



Marine Accident Inquiry Agency

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Message for the Prevention of Marine Accidents in Fog

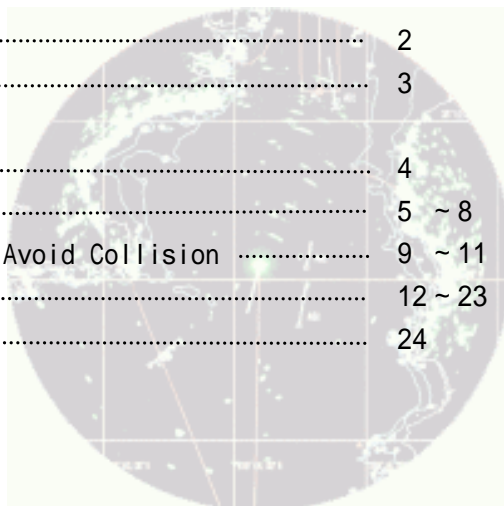
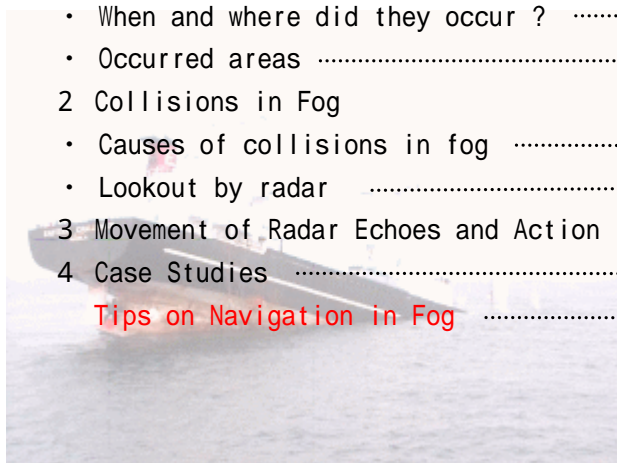
“Why Did the Ship Make a Port Turn ? ”
- clearing the mystery of accidents in fog -

From spring to summer, the Japanese archipelago is often enveloped by dense fog. Many collisions and groundings occur every year during this time along the Pacific Coast and in the Seto Inland Sea (Seto Naikai) due to restricted visibility. In July 2005, a series of collisions occurred in fog in the wide area of the Pacific Coast, from Kumano Nada, east of the Kii Peninsula, to offshore of Inubo Saki, Boso Peninsula, that killed 15 people in total.

This issue of “MAIA DIGEST,” “Marine Accidents in Fog,” features in-depth analyses of recent significant casualties caused by fog, and lessons learned from these cases. We hope this booklet would be a good reference for those navigating around Japan in the foggy situations, and contribute to the prevention of similar casualties in future.

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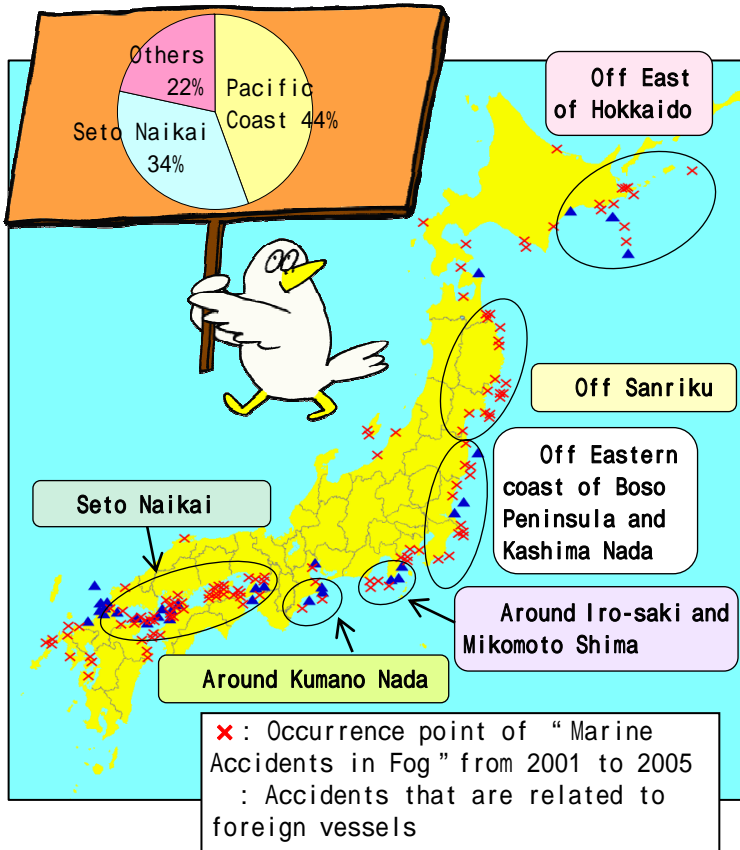


1 Marine Accidents in Fog

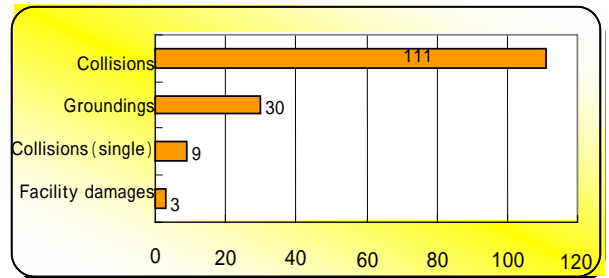
Foreign vessels are involved in 20% of casualties in fog

We pronounced 3,890 judgments related to 5,673 vessels in five years from 2001 to 2005. 153 collisions or groundings occurred in fog, in which 264 vessels were involved. These cases account for 4% of the total number of marine accidents that occurred in the same period, and 5% of the number of vessels involved. In other words, about 30 accidents occur due to fog every year around Japan. One fifth of these cases involve foreign vessels, and 37 foreign vessels were involved in accidents in fog in the vicinity of the Japanese archipelago.

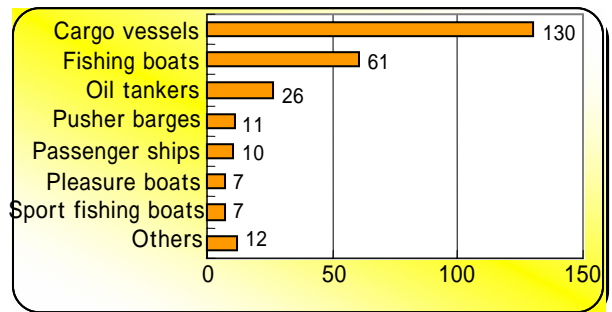
When and where did they occur ?



Occurrence of marine accidents classified by category of accidents (2001 ~ 2005) (Cases)

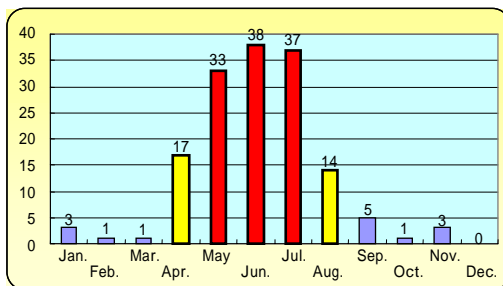


Occurrence of marine accidents classified by type of vessels (2001 ~ 2005) (Vessels)

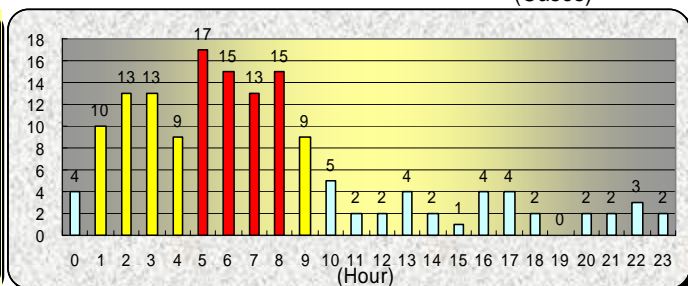


Others; tug boat, transport boat for fishing etc.

Occurrence of marine accidents classified by month (2001 ~ 2005) (Cases)



Occurrence of marine accidents classified by hour (2001 ~ 2005) (Cases)

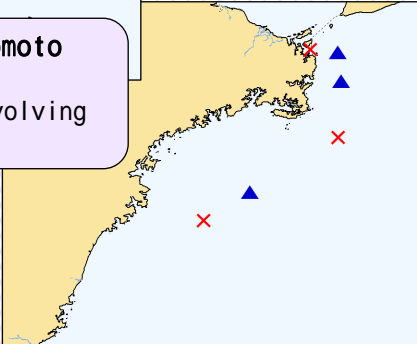
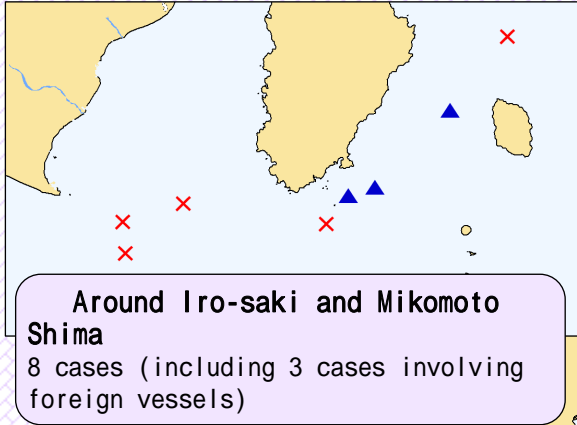
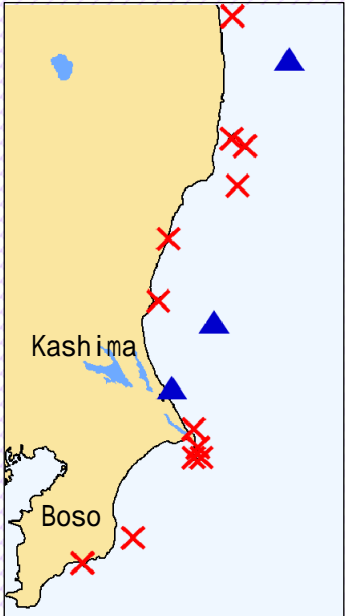
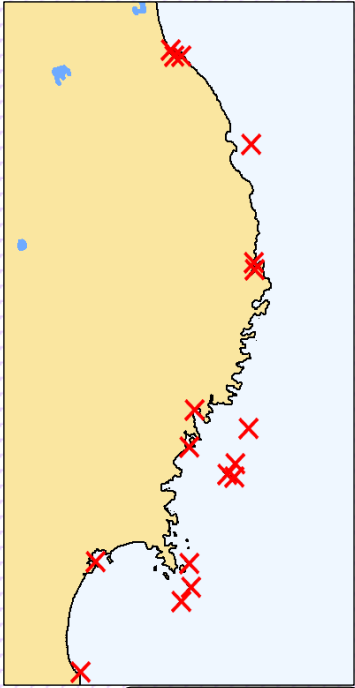
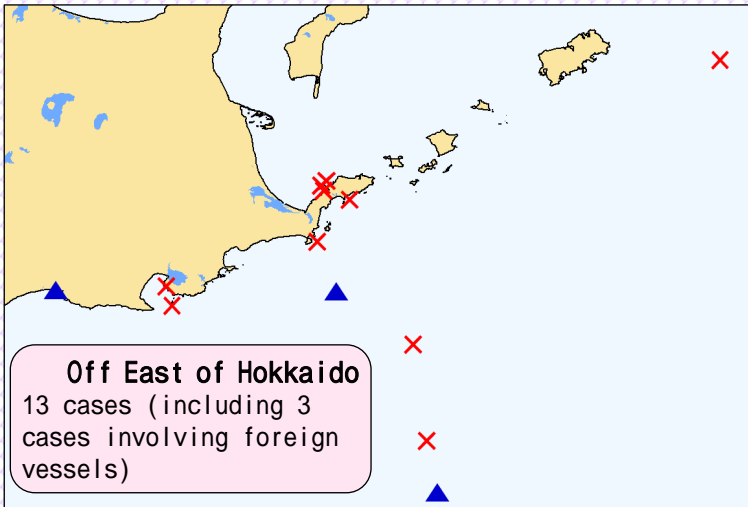


As we see in the monthly data, most of accidents related to fog occurred in spring and summer. It is remarkable that 71% (108 cases) of casualties in fog occurred in the three months between May and July.

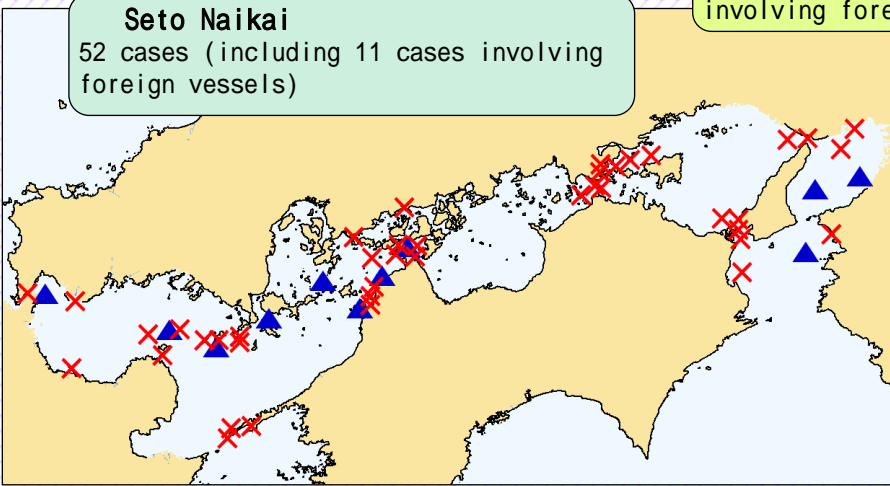
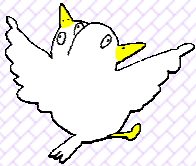
The above hourly data shows that the occurrence of fog-related accidents is concentrated in the hours between 01:00 and 10:00. This is because the fog came on in the chilled air around midnight and dispersed in the morning. The peak time of fog-related accidents, 05:00 to 09:00, coincides with the time period when the fogs were thickest.

Occurred areas

× : Occurrence point between 2001 and 2005
 (△ : Accidents that are related to foreign vessels)



Off Eastern coast of Boso Peninsula and Kashima Nada
 15 cases (including 3 cases involving foreign vessels)



Around Kumano Nada
 6 cases (including 3 cases involving foreign vessels)

2 Collisions in Fog

Causes of collisions in fog

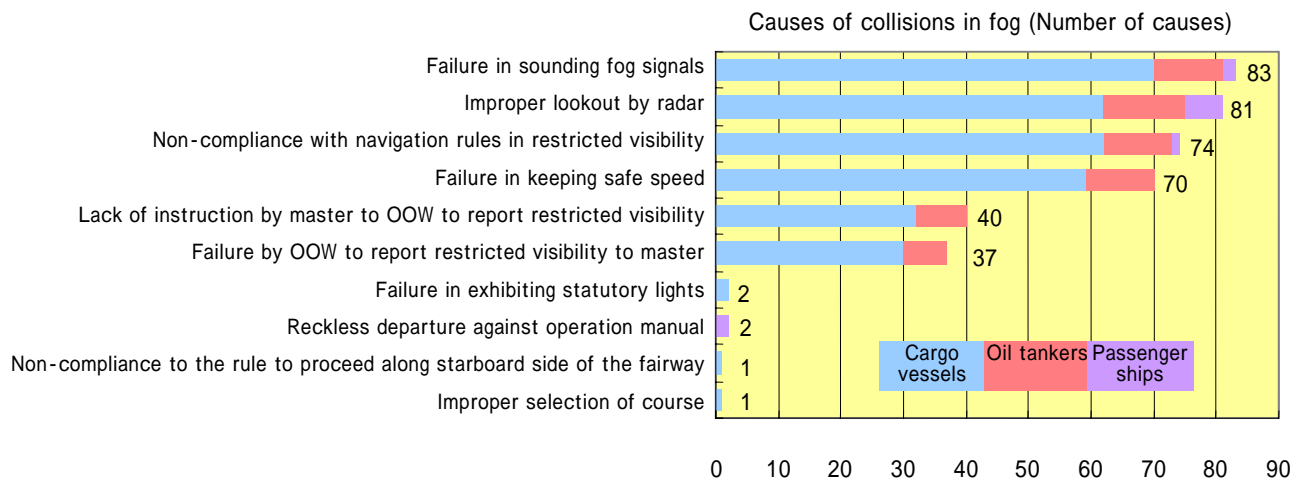
**Half of the vessels failed to sound fog signals !
Half of the vessels failed to keep proper lookout by radar !**

We analyzed 91 cases (157 vessels; cargo vessels, oil tankers and passenger ships) of 111 collision cases in fog which were pronounced from 2001 to 2005. The causes of collisions are as follows (plural causes can be detected for each vessel.);

Failure in sounding fog signals ··· 83 vessels (53%)

Improper lookout by radar ··· 81 vessels (52%)

Non-compliance with navigation rules in fog (Rule 19 of International Regulations for Preventing Collision at Sea (COLREGS)) ··· 74 vessels (47%)



In the present situation, most vessels are now equipped with radars, and the role of fog signals is diminishing. However, it is important to note that more than half of the vessels that collided failed to keep proper lookout by radar. Therefore, sound signals are indispensable in fog to announce the

vessel's location to other vessels and to avoid collision.



Lookout by radar

80% recognized the other vessel's echoes on the radar screen, but...

Out of 157 vessels that were involved in collisions;

5 vessels (3%) did not recognize the echoes of the other vessel on the radar screen;

28 vessels (18%) did not recognize the echoes of the other vessel until the approach was too late to be avoided;

48 vessels (31%) had once recognized the echoes in a remote zone, but failed to keep watch on it;

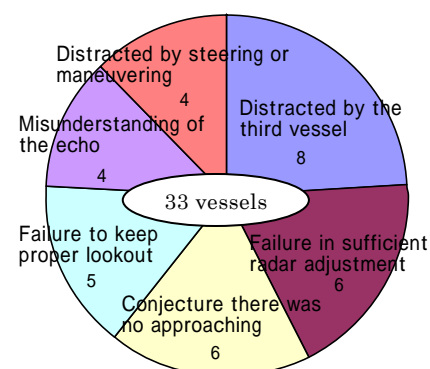
74 vessels (47%) kept watching the vessel on the radar screen, but did not reduce speed;

2 vessels (1%) took proper action, but collided due to improper operation of the other vessel.

Why didn't the vessel recognize the other vessel while being equipped with radar ?

In cases of and , 33 vessels (21%) didn't recognize the other vessels until immediately before collision. The reasons are as follows:

- Among 8 vessels, they were concentrating on watching the echo of a third vessel that was close to them;
- Among 6 vessels, the radar was not used effectively. In some cases, they used only long-distance range and could not detect the echo. In others, they used only short-distance range in a narrow passage and could not recognize the other vessel until they came into close vicinity. Some vessels failed to adjust the sensitivity or surface reflection properly.
- Among 6 vessels, they conjectured that there were no other vessels around them, judging from the location, time, or the weather, and neglected to keep proper lookout.
- Among 5 vessels, they did not watch the screen at all for such reasons as sudden aggravation of the weather, etc.
- Some vessels mistook the other vessel's echoes as that of a small island, or misread the speed or direction of the vessel.

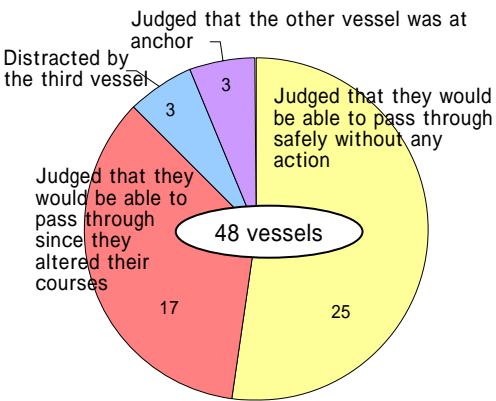


The reasons why the vessel didn't recognize the other vessel (and)

The other vessel had been once recognized, but after that...

48 vessels had once recognized the echo in a remote zone (case), but collided due to the following reasons :

- More than half of them, 25 vessels, presumed carelessly that there was little possibility of collision and discontinued watching the vessel. Accordingly, they did not recognize the other vessel's change of course.
- 17 vessels altered their course after recognizing the other vessel, and presumed carelessly that the risk of collision had been totally avoided. They did not recognize that the other vessel had also changed the course, and that the two vessels were approaching.

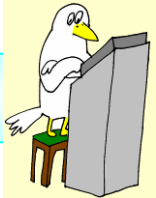


The reasons why the vessel didn't keep watching the other vessel after once recognizing it.

In some cases, disarray of the echo after the alternation of the course, or the change of the mode to short distance range also caused the misjudgments.

- Among 3 vessels, the existence of the other vessel slipped out of their mind while paying more attention to other vessels that were closer to them or approaching them.
- 3 vessels presumed erroneously that the other vessel was at anchor, and that she would not weigh the anchor in the restricted visibility.

Keep watching the movement of the other vessel until passing has been safely completed !



74 vessels kept watching the vessel on the radar screen (case), but finally collided for such reasons as:

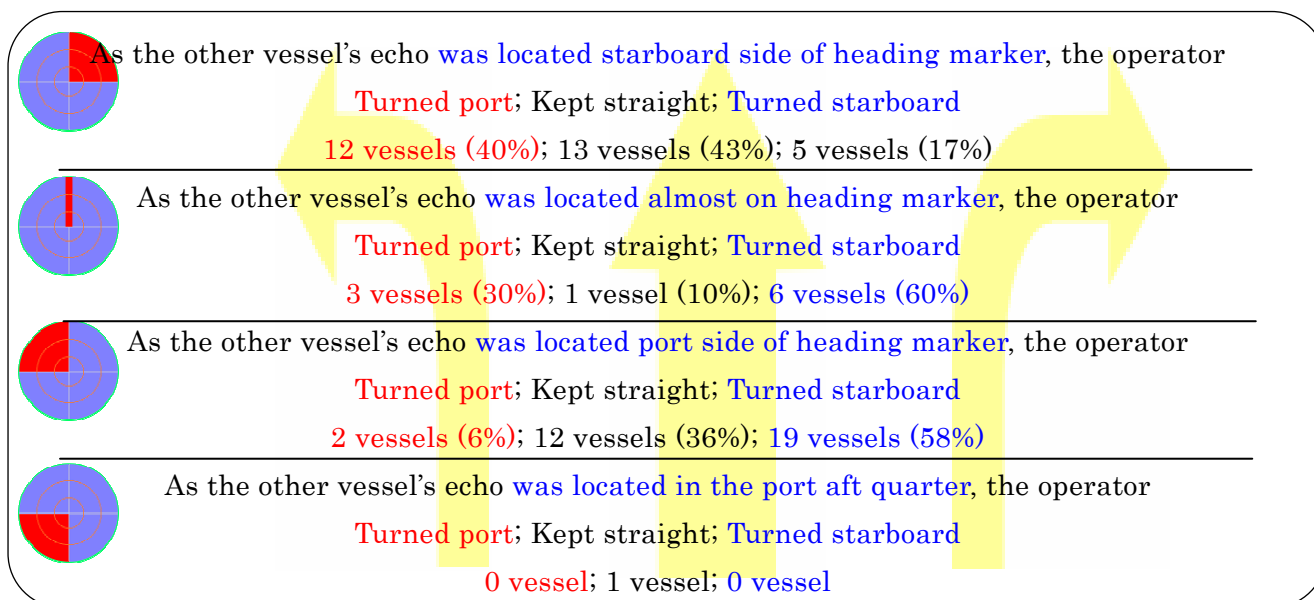
- The operator presumed that the vessel would be able to pass through without taking any action although CPA (Closest Point of Approach) was close;
- The operator presumed that the vessel would be able to avoid collision by altering her course at a small angle or by taking action after catching sight of the other vessel;
- The other vessel took an unexpected action. Collisions are frequently attributed to the gap between the expectation on one hand and the actual movement of the other.

In some cases, the vessel repeated alternation of her course at a small angle in order to avoid the other vessel. It should be noted that alternation at a small angle makes it difficult for the other vessel to recognize the change of course.

Turn port : Straight : Turn starboard = 23% : 36% : 41%

Out of the 74 vessels that didn't reduce their speed, 17 vessels (23%) turned port after recognizing that they would not be able to avoid a close quarters situation. 27 vessels (36%) maintained the same course, and 30 vessels (41%) turned starboard.

The following figure shows the relation between the other vessel's location on the radar screen and the action taken by the operator of the vessel:



Decision on alternation of the course depends on the location of the other vessel on the radar screen

Out of the 17 vessels (23% of all) that **turned port**, 12 vessels (71%) had observed the other vessel's echo on the starboard side of heading marker, and only 2 vessels (12%) had observed it on the port side of heading marker. The reasons for the port turn are explained on the next page.

Out of 26 vessels (36% of all) which **proceeded straight**, 13 vessels had observed the other vessel's echo on the starboard side of heading marker, 12 vessels on the port side, and 1 vessel had observed it almost on her heading marker.

The reason why the operator decided to proceed straight was that he judged that the vessel would be able to pass through safely without taking any action.

Out of 30 vessels (41% of all) which **turned starboard**, 19 vessels (63%) had observed the other vessel's echo on the port side of heading marker, and only 5 vessels (17%) had observed it on the starboard side of heading marker.

The reasons why the operator decided to turn starboard was that he judged he would be able to pass through the port side of the other vessel, or he just wanted to increase distance from the other vessel.

Why did vessels turn port ?

Rule 19 of International Regulations for Preventing Collision at Sea (COLREGS) prescribes that a vessel which detects by radar alone the presence of another vessel shall determine if a close quarters situation is developing and/or risk of collision exists. If so, she shall take avoiding action in ample time, provided that when such action consists of an alteration of course, so far as possible the following **shall be avoided**:

- (i) **an alternation of course to port** for a vessel forward of the beam, other than for a vessel being overtaken;
- (ii) an alternation of course towards a vessel abeam or abaft the beam.

Why did many vessels alter the course to port despite the COLREGS rule ? The reasons are as follows:

- 6 vessels; the third vessels were on the starboard side;
- 5 vessels; the operator judged it was the appropriate action to avoid the other in ample time.
- 2 vessels; the seashore was close to the starboard side.
- 2 vessels; the other vessel's echo was on the starboard side of heading marker.
- 1 vessel; the operator carelessly expected that the other vessel would also alter the course to port.



Are you aware of the risk of port turn in fog ?

You turn port, and the other vessel turns starboard, then...

12 vessels out of 17 which turned port steered port at less than 10 degrees each time. In 16 cases out of the 17 collisions due to port turn, the other vessels turned starboard.

Many vessels collided after repeating port turns at small angles. This is because the relative direction on the radar screen to the other vessel did not change as had been expected due to the starboard turn of the other, so the operator tried again to increase the distance by port turn at a small angle.

Accordingly, in many cases, the vessel collides at a great angle with another which was putting the helm on the opposite side. This is the reason why collisions in fog tend to be serious casualties, in which the vessels are totally lost.

I should not have turned port.



3 Movement of Radar Echoes and Action to Avoid Collision

Reading Radar Echoes

Difference between the Actual Course and the Movement of Echoes

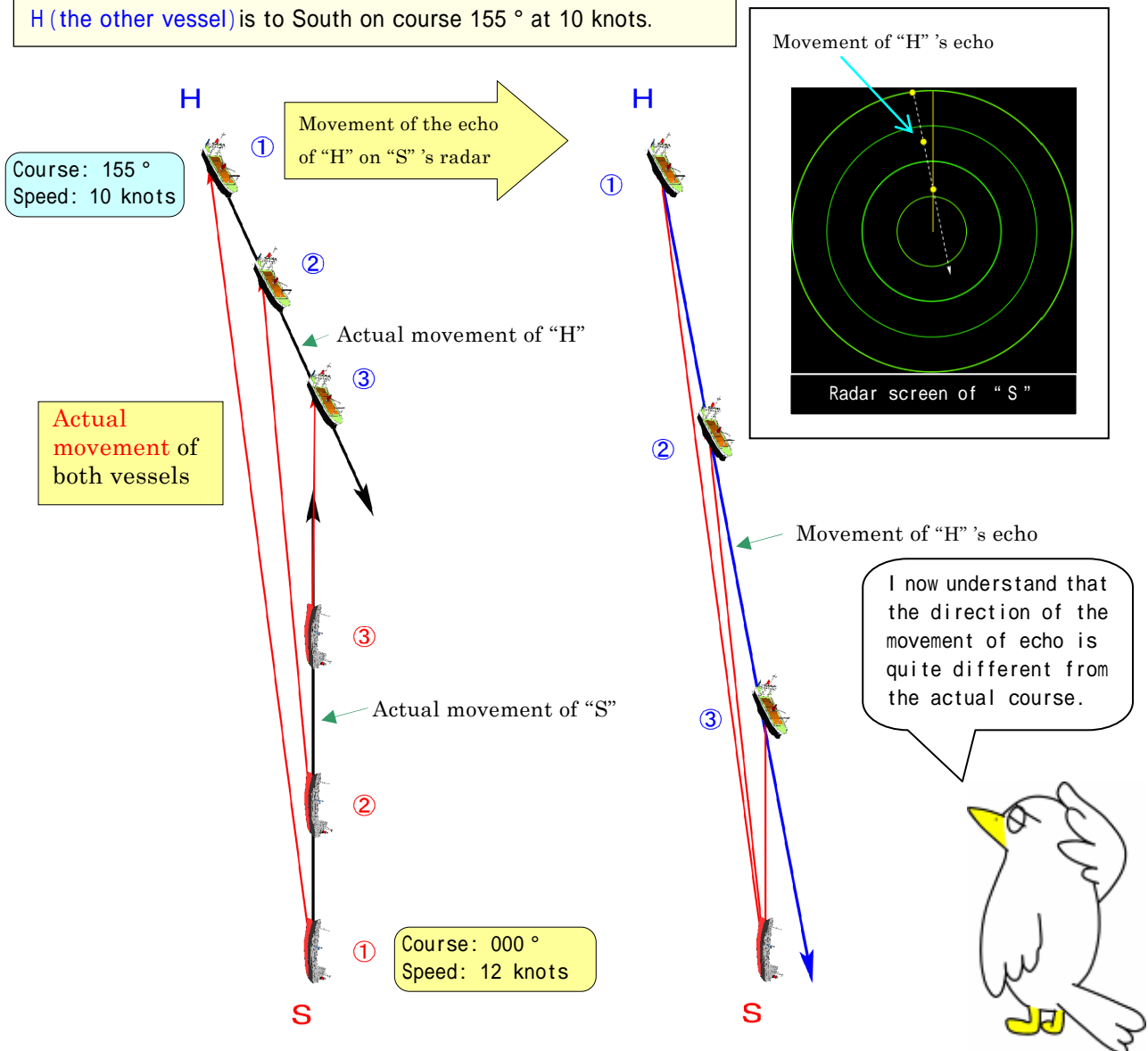
In restricted visibility in fog, OOW (Officer Of the Watch) totally relies on the radar screen to watch the movement of other vessels. Therefore, it is very important to master the operation of radar devices, and to be practiced in judging the course, speed, CPA (Closest Point of Approach) and TCPA (Time to CPA) of other vessels by radar plotting and other skills needed for systematic observation.

In order to clarify basic matters concerning reading radar echoes, let's see the difference between the actual movement of vessels and its movement on the radar screen. In the following example, you are on board "S." "S" and another vessel "H" are approaching.

Case:

S (own vessel) is proceeding to North on course 000 ° at 12 knots.

H (the other vessel) is to South on course 155 ° at 10 knots.



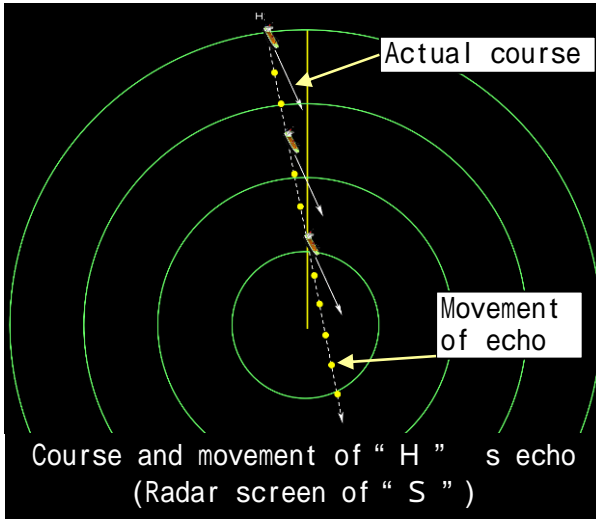


Actual course differs from the movement of its radar echo

The vessel is actually pointing closer to the heading marker than her movement on the radar screen!

Echoes approaching from the port bow

Other vessels' positions observed from your own vessel and their moving direction can be recognized on your radar screen. However, all OOW should pay attention to the fact that the movement of radar echoes is a relative one, and they are different from the actual course or speed.

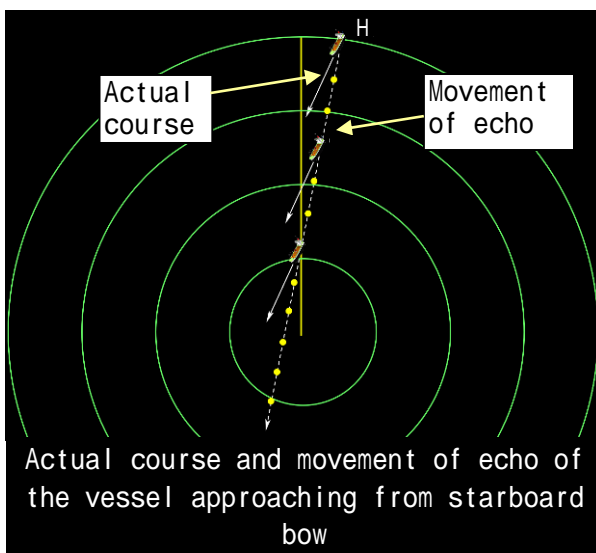


- 1 You are in the most vulnerable position to collision, when the echo is approaching toward the center of your radar screen with no bearing change.
- 2 When the echo is approaching toward the center of your radar screen while changing its bearing (as shown in the left figure), the other vessel will cross ahead or stern of your own vessel.
- 3 Where the echo is moving almost parallel to your heading marker, the other vessel will pass through your port side.

In case of 1 and 2, you should note that the other vessel is actually pointing closer to the heading marker than it appears on the radar screen. What you must do in these cases is to turn starboard substantially at greater angle than what seems to be needed judging from the radar screen. At the same time, you should bear in mind that, in these situations, the other vessel is prone to make a port turn despite the COLREGS rule, because the other vessel can possibly judge that she can pass on the starboard side of your vessel whose echo on her radar screen is on the starboard side.

In case of 3, most vessels will change their course to starboard even when CPA is insufficient intending to pass on your port side, because echo of your vessel is observed at port bow. However, in restricted visibility by fog, you should keep sufficient CPA in order not to cause undue alarm with other vessels.

Echoes approaching from the starboard bow



1 Also in cases where the echoes of other vessels are approaching from the starboard bow, the vessel is actually pointing closer to the heading marker than her movement on the radar screen.

In such a case, you may be inclined to make a port turn, because the echo is on your starboard side. Especially when the echo is remote from the heading marker, you may judge that you will be able to pass through the starboard side of the vessel safely.

But you should note that the other vessel will most probably make a starboard turn, because your echo on their radar screen is located on their port side, and they know that your port turn would be against the COLREGS rule. **You should always bear in mind that turning port in fog multiplies your risk.**

2 When an echo is moving almost parallel to your heading marker, the vessel will pass through your starboard side safely. However, when the CPA is not sufficient, the other vessel may take action and try to make a starboard turn in order to pass through your port side.

Even for small vessels, CPA should always be more than 0.5 miles, and should be 0.75 to 1.0 miles in the open sea. It is hard to predict what happens in fog. It is essential to turn starboard as early and substantially as possible to secure ample CPA when you detect the risk of collision.

Even with a small vessel, CPA should be kept 0.5 miles minimum !

Now we suppose the situation where two vessels are heading straight to each other at the speed of 12 knots each, and one vessel alters her course to starboard at the distance of 2 miles. If the alteration of course is 10°, the CPA will be no more than 0.17 miles (310m), and if the alteration of course is 30°, the CPA will be 0.5 miles.

A CPA of around 0.3 miles is not a safe distance. There are some cases in which two vessels collide, although the CPA was 0.3 miles, due to unnecessary alternation of course by one or both of them, driven by anxiety or confusion. Taking account of the maneuverability of ships and the unusual state of mind of the crew members in emergency, **CPA should always be more than 0.5 miles for all vessels including small ones, and should be 0.75 to 1.0 miles in the open sea.**

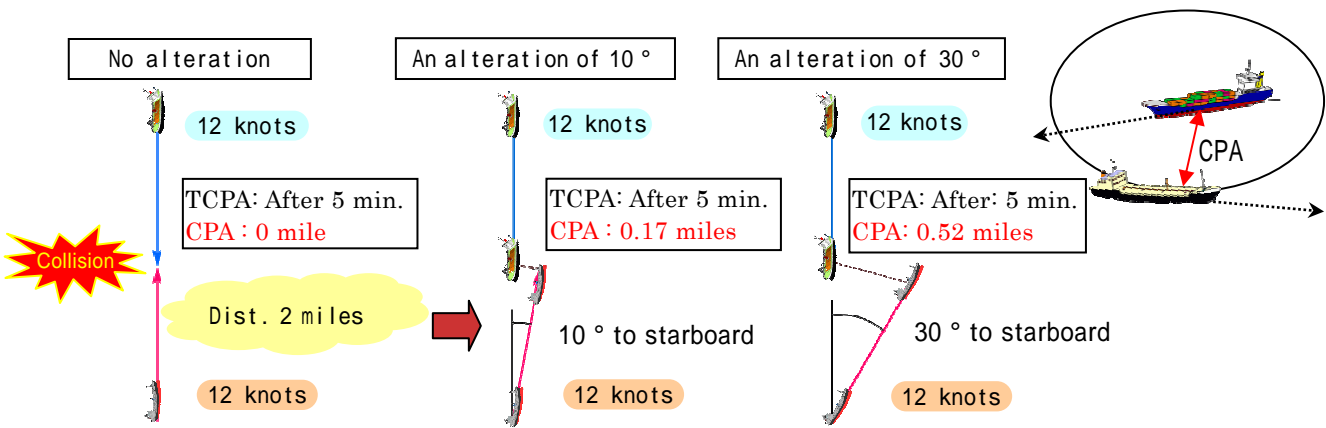
CPA in case of an alteration to starboard at 12knots

Course change	12 knots					
	3 miles		2 miles		1 mile	
	TCPA	CPA	TCPA	CPA	TCPA	CPA
0°	After 7.5 minutes	0 m (Collision)	After 5 minutes	0 m (Collision)	After 2.5 minutes	0 m (Collision)
10°	After 7.5 minutes	0.26 miles	After 5 minutes	0.17 miles	After 2.5 minutes	0.09 miles
20°	After 7.5 minutes	0.52 miles	After 5 minutes	0.35 miles	After 2.5 minutes	0.17 miles
30°	After 7.5 minutes	0.78 miles	After 5 minutes	0.52 miles	After 2.5 minutes	0.26 miles
40°	After 7.5 minutes	1.03 miles	After 5 minutes	0.68 miles	After 2.5 minutes	0.34 miles
45°	After 7.5 minutes	1.15 miles	After 5 minutes	0.77 miles	After 2.5 minutes	0.38 miles

At least 0.5 miles should be kept for small vessels !
In the wide area, 1 mile may be kept !



Drawing the comparison between an alteration 10° and 30° at distance of 2 miles in situation of both vessel meeting reciprocal at 12knots

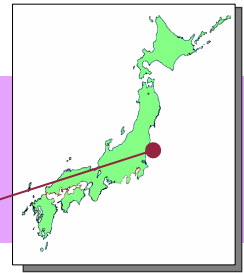


4 Case Studies

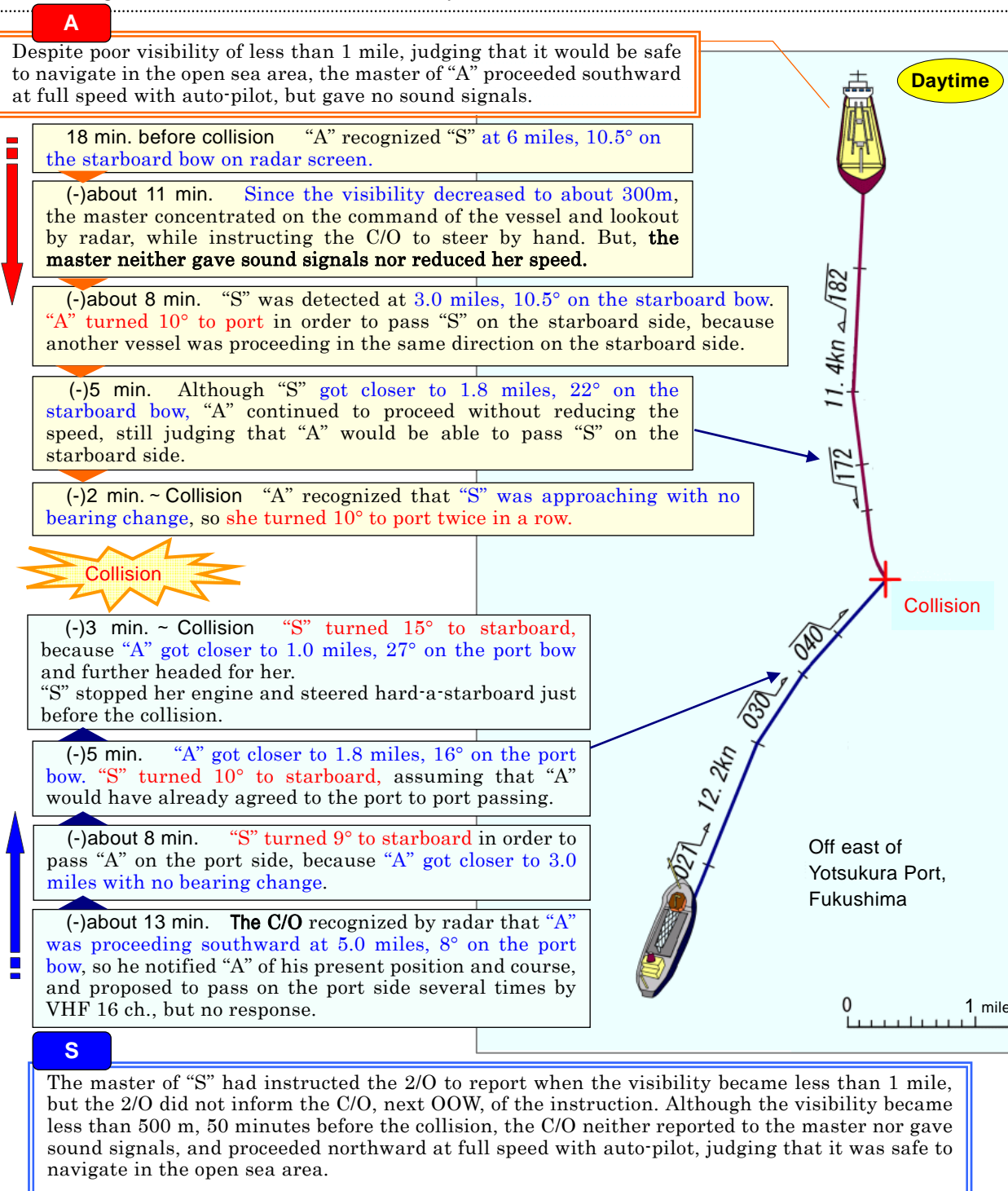
Case 1

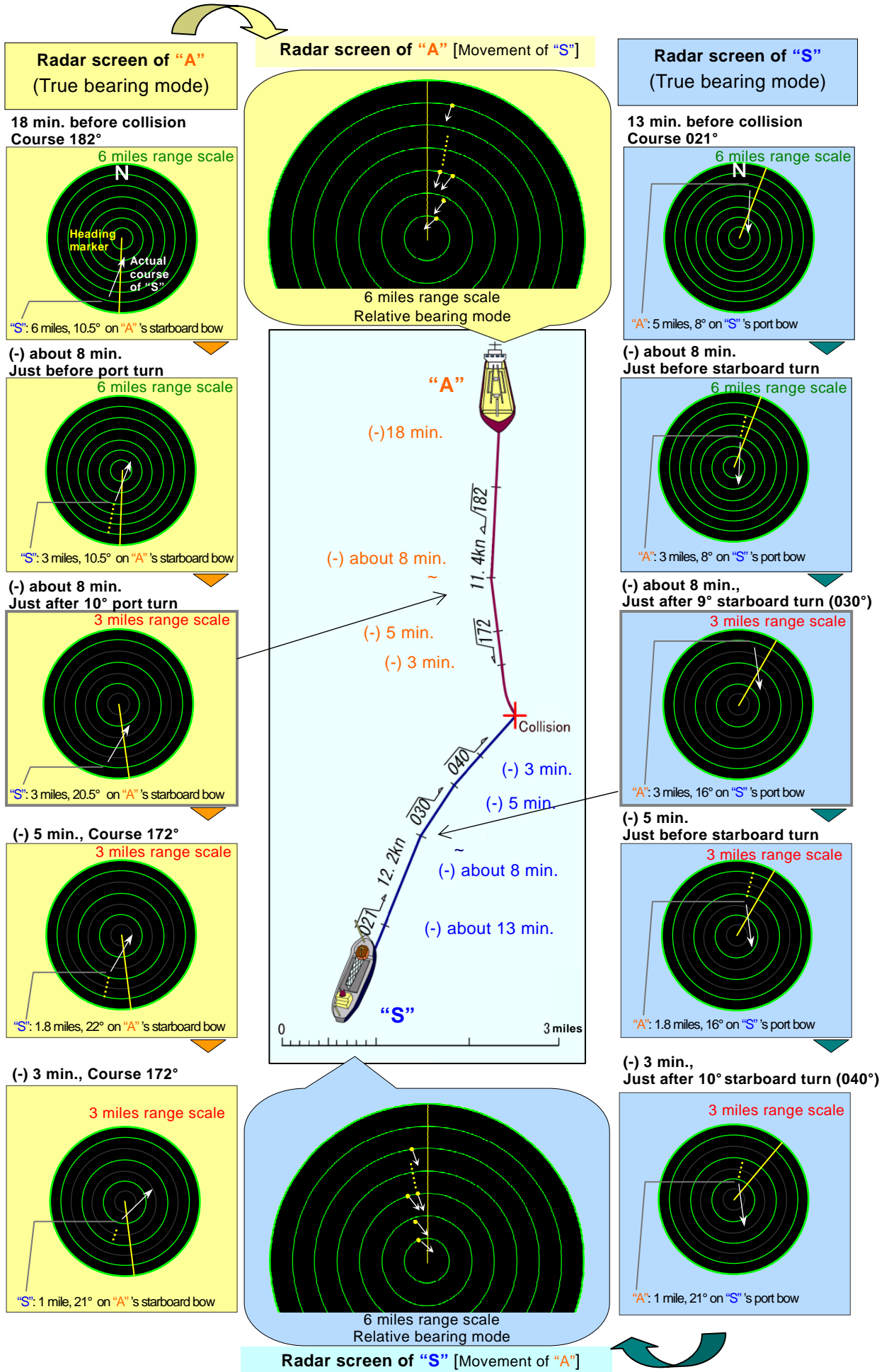
Collision between Cargo vessel "S" and Oil tanker "A"

Off east of Yotsukura Port, Fukushima Pref.
Under visibility of about 120m



Cargo vessel "S" G/T: 682 t Crew: 7 Cargo: Water dredges (1,600 t) Kisarazu Port, Chiba Kamaishi Port, Iwate
Master Age: 49 License: Second class (Deck) Experience at sea: 30 years
C/O (OOV) Age: 51 Experience at sea: 32 years License: Third class (Deck) (18 years after acquisition)
Oil tanker "A" G/T: 499 t Crew: 5 No cargo Ishinomaki Port → Keihin Port
Master (OOV) Age: 54 Experience at sea: 32 years License: Fourth class (Deck) (31 years after acquisition)
Time and date: At 17:46 (UTC+9h) on July 27, 2004
Weather: Fog, South wind with force 1 Visibility: About 120m

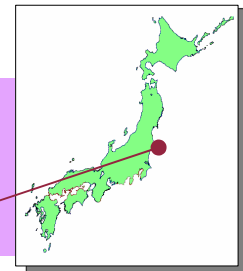




Case 2

Collision between Cargo vessel "T" and Cargo vessel "S"

Off NE of Shioya Saki, Fukushima Pref.
Under visibility of about 100m



Cargo vessel "T" G/T: 498 t Crew: 5 Cargo: Aggregate (1,530 t) Omoto Port, Iwate → Chiba Port
Master Age: 70 License: Fifth class(Deck) (35 years after acquisition)
C/O (OOW): Age 55 License: Fifth class (Deck) (35 years after acquisition)
Experience at sea: 35 years

Cargo vessel "S" Register: Panama G/T: 6,530 t Crew: 15 Cargo: Plywood (2,227 t)
Kashima Port → Tomakomai Port, Hokkaido
Master Japanese
2/O (OOW) Age: 36 Experience at sea: 8 years

Time and date: At 02:15 (UTC+9h) on Sep. 10, 2003
Weather: Fog No wind Visibility: 100m

T

Under the visibility of about 2 miles, at the watch relief, the master left the bridge after giving instruction to the C/O, who had a long experience as a master, to report without reserve if the visibility decreased extremely. But, even after the visibility got worse, the C/O **neither reported to the master nor gave sound signals**, and proceeded southward at full speed with auto-pilot.

33 min. before collision The C/O **recognized "S" at 12 miles, 7° on the starboard bow** on radar screen. **Some northbound vessels were also displayed on the west side of "S" on her radar.**

(-)15 min. "S" was at **5.0 miles, 4.5° on the starboard bow**. "A" turned 7° to port in order to ensure ample passing distance on the starboard side.

(-)10 min. "S" was at **3.1 miles, 11° on the starboard bow**. "A" proceeded without slow-down **with repeated small port turns**, so that the echo of "S" on the radar screen came to starboard side from heading marker.

(-)7 min. ~ Collision "S" got closer to **2.0 miles, 26° on the starboard bow**. "T" continued to proceed **with repeated small port turns** in order to pass "S" on the starboard side. The C/O became anxious about "S" 's approach with no bearing change, so he used searchlight. After recognizing the lights of "S", he took hard-a-starboard and full astern just before the collision.

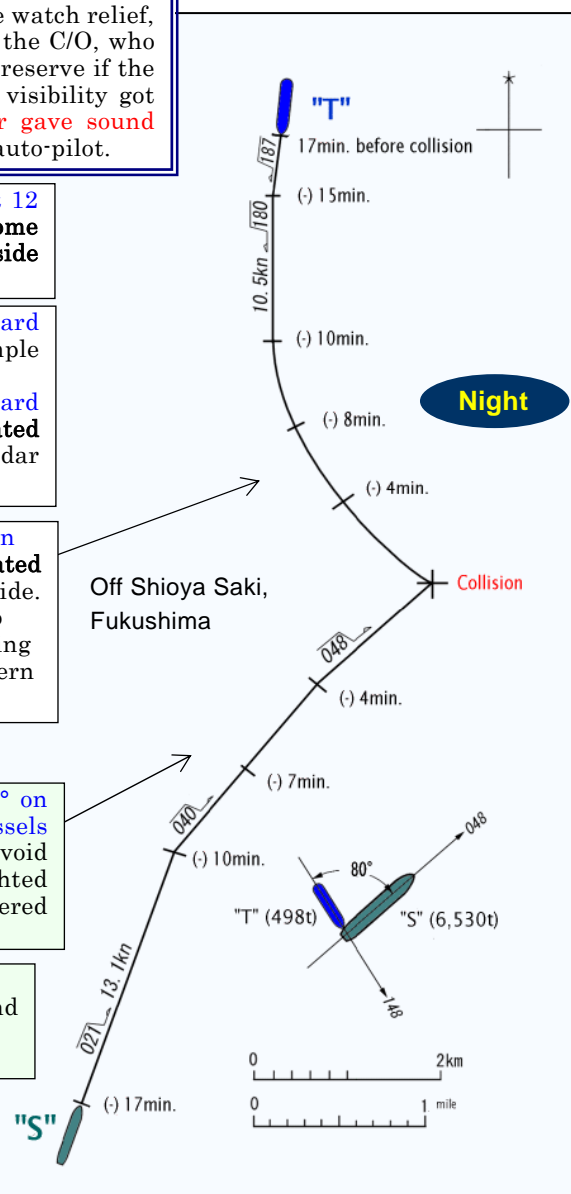
(-)7 min. ~ Collision "T" got closer to **2.0 miles, 31° on the port bow**. **When the distance between the vessels became 1 mile, "S" turned 8° to starboard** in order to avoid "T", but did not reduce the speed sufficiently. "S" sighted the side light of "T" on the port side and steered hard-a-starboard just before the collision.

(-)10 min. "T" got closer to **3.1 miles, 10° on the port bow**. The 2/O ordered the Q/M to steer by hand and to **put the helm at starboard 10°** to secure passing distance on the port side. "S" **turned 19° to starboard**.

(-)17 min. **The 2/O recognized on radar screen that "T" was at 6 miles, 9° on the port bow** and was proceeding southward. Although **the visibility became less than 300m**, he **neither reported to the master nor gave sound signals** and proceeded northward at full speed with auto-pilot, instructing a Q/M to lookout.

S

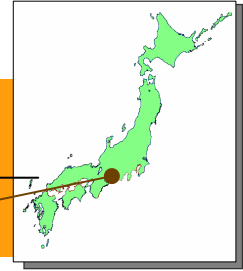
The master did not give OOW the concrete instruction to report decreased visibility.



Case 3

Collision between Oil tanker "K" and Cargo vessel "S"

West Passage, Nagoya Port
Under visibility of about 200m



Oil tanker "K" G/T: 494 t Crew: 5 No-cargo Nagoya Port → Yokkaichi Port
Master Age 38 License: Fifth class (Deck) (12 years after acquisition)
Experience at sea: 15 years
2/O (OOV) Age: 57 License: Forth class (Deck) (32 years after acquisition)
Cargo vessel "S" Register: China G/T: 6,734 t Crew: 21(Chinese) Cargo: Container (3,260 t)
Outer harbor of Nagoya Port (Anchoring for cargo waiting) → Nagoya Port **No pilot on board**
Master (OOV) Chinese Age: 47 Experience at sea: 30years
Time and date: At 06:54(UTC+9h) on May 17, 2004
Weather: Fog No wind Visibility: about 200m During dense-fog warning

K 13 min. before collision Although the master of "K" knew dense-fog warning was issued after leaving berth, he expected that the situation would not be very serious because the visibility was about 2 miles at that time. He left the bridge for breakfast assigning the 2/O to operate the vessel. After that, despite deterioration of the visibility, the 2/O neither reported to the master nor gave sound signals, and proceeded at full speed with auto-pilot on the starboard side of the West Passage.

(-6 min. The 2/O recognized "S" at 1.3 miles, 33° on the port bow on the radar screen (3 miles range scale). After that, assuming that "K" would be able to pass "S" on the port side if "K" proceeded on the starboard side of the passage, the 2/O started hand steering and prepared for course change, but did not keep proper lookout of radar.

(-4 min. "K" turned to port along the passage and proceeded on the starboard side of the passage.

(-3 min. The visibility decreased to 200m. The 2/O reduced her speed to dead slow ahead, but gave no sound signals. He was not monitoring the radar screen because he was steering by hand. So he did not notice "S" approaching her through the center of the passage.

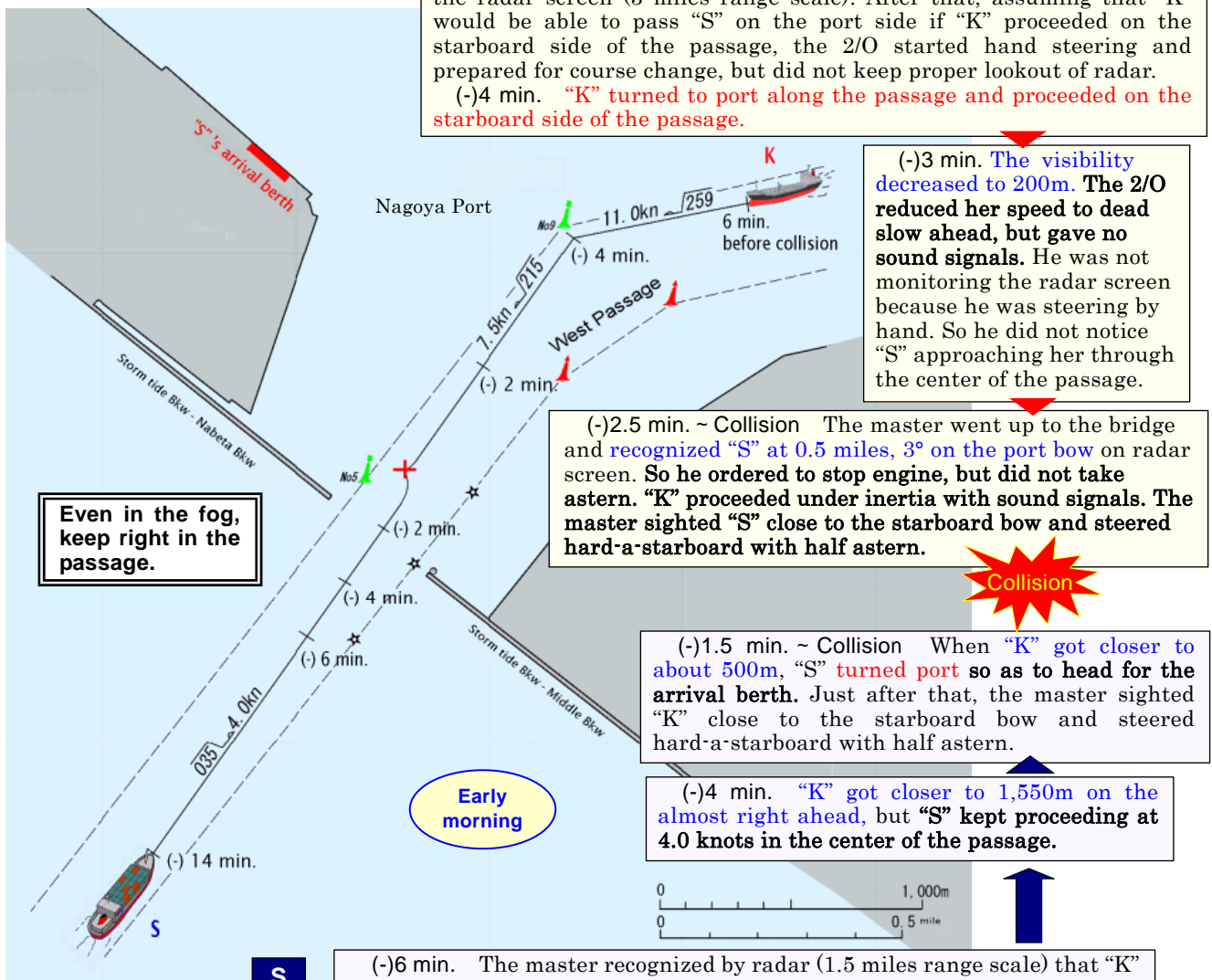
(-2.5 min. ~ Collision The master went up to the bridge and recognized "S" at 0.5 miles, 3° on the port bow on radar screen. So he ordered to stop engine, but did not take astern. "K" proceeded under inertia with sound signals. The master sighted "S" close to the starboard bow and steered hard-a-starboard with half astern.

(-1.5 min. ~ Collision When "K" got closer to about 500m, "S" turned port so as to head for the arrival berth. Just after that, the master sighted "K" close to the starboard bow and steered hard-a-starboard with half astern.

(-4 min. "K" got closer to 1,550m on the almost right ahead, but "S" kept proceeding at 4.0 knots in the center of the passage.

S (-6 min. The master recognized by radar (1.5 miles range scale) that "K" was at 1.3 miles, 11° on the starboard bow and was leaving the port.

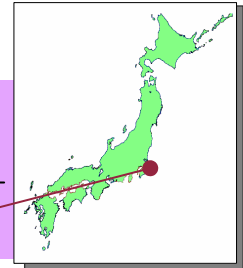
14 min. before collision The master assigned the 3/O to lookout and an able seaman to hand steering respectively and proceeded at dead slow ahead toward the center, not along the starboard side of the passage, with sound signals.



Case 4

Collision between Chemical tanker "K" and Cargo vessel "H"

Off SSE of Inubo Saki, Chiba pref.
Under visibility of about 200m



Chemical tanker "K" G/T: 749 t Crew: 6 No cargo
Shimizu Port, Shizuoka pref. → Onahama Port, Fukushima pref.
Master: Age 50 License: Third class (Deck)
C/O (OOW) Age 47 License: Forth class (Deck) Experience at sea: 28 years
Cargo vessel "H" G/T: 498 t Crew: 5 Cargo: Plaster (1,500 t) Soma Port, Fukushima pref. → Chiba Port
Master: Age: 50 License: Forth class (Deck)
C/O (OOW) Age: 44 License: Forth class (Deck) Experience at sea: 29 years
Time and date: At 05:55(UTC+9h) on May 9, 2001
Weather: Fog NW wind with force 2 Visibility: 200m

H

(-)55 min. **Visibility: About 1 mile**
Judging that the fog would clear away soon, the C/O neither reported to the master nor gave sound signals and continued to proceed at full speed with auto-pilot.

(-)17 min. The C/O recognized "K" at 6 miles, 12° on the port bow by radar (6 miles range scale). After 1 min., "K" got closer to 5.6 miles, 13° on the port bow (CPA: 1.1 miles) and the C/O judged that "H" would pass "K" on the port side safely. So he did not report to the master in spite of rapid deterioration of the visibility.

(-)15 min. The C/O recognized "K" at 6 miles, 12° on the port bow by radar. Since another preceding vessel on "H" 's starboard bow turned port, "H" also turned 38° to port following the vessel so as to cross ahead of "K" and to pass on the starboard side.

(-)5 min. "K" got closer to 1.5 miles, 23° on the starboard bow, so "H" turned 20° to port.

(-)1 min. ~ collision "K" got closer to 0.3 miles on the radar. The C/O sighted "K" at close range just after it became difficult to distinguish the echo of "K" on the screen with the center of the radar. Stopped engine

Collision

(-)25 min. ~ Collision The distance further decreased to 0.7 miles with no bearing change. The C/O stopped engine, but, did not take astern. "K" proceeded under inertia with sound signals, and then sighted "H" at close range. Full astern and Hard-a-starboard

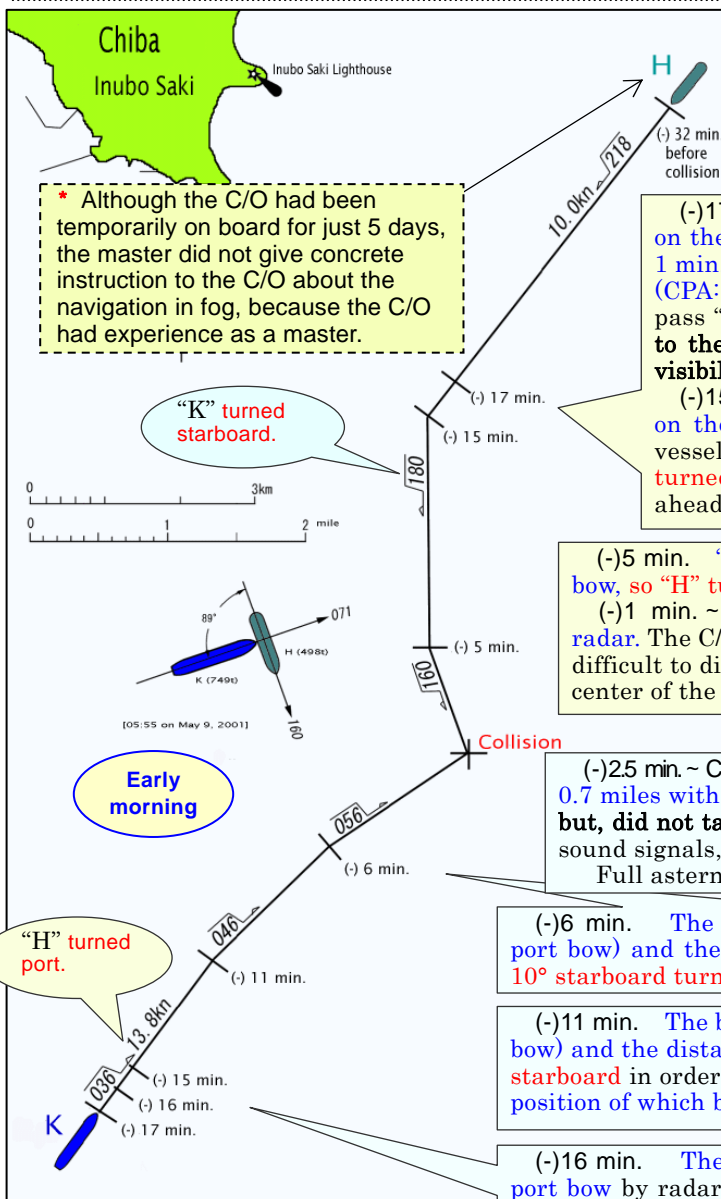
(-)6 min. The bearing to "H" did not change (21° on the port bow) and the distance decreased to 1.8 miles. "K" added 10° starboard turn.

(-)11 min. The bearing to "H" did not change (11° on the port bow) and the distance decreased to 3.7 miles. "K" turned 10° to starboard in order to secure the passing distance with "H", the position of which became at 3.7 miles, 21° on the port bow.

(-)16 min. The C/O recognized "H" at 5.6 miles, 11° on the port bow by radar (6 miles range scale). He judged from echo trails of "H" that "K" would be able to pass on the port side, and kept proceeding at full speed.

(-)about 25 min. Despite rapid deterioration of the visibility, judging easily that the fog would clear away soon, The C/O of "K" neither reported to the master nor gave sound signals, and continued to proceed at full speed with auto-pilot.

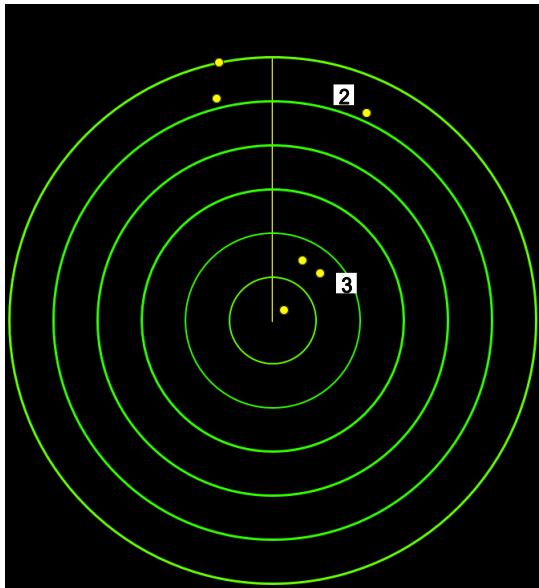
K



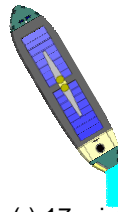
* The master of "K" had repeatedly reminded the crew at meetings of the importance of reporting poor visibility and other actions on board.

Movement of radar echo

Radar screen of "H"



6 miles range scale
Relative bearing mode



"H" turned port

How did the echo of "K" move on "H" 's radar screen?

(-) 17 min.: "H" first recognized "K" at 6.0 miles, 12° on the port bow.

(-) 15 min. (before changing course): "K" was at 5.2 miles, 14° on the port bow. ("H" turned 38° to port in order to pass starboard to starboard with "K", following the port turn of the other preceding vessel on the starboard bow.)

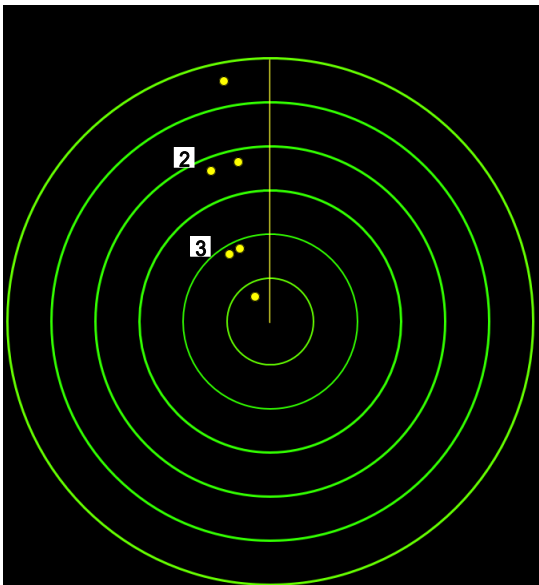
2 (-) 15 min. (just after changing course): "K" was at 5.2 miles, 24° on the starboard bow.

(-) 5 min. (before changing course): "K" was at 1.5 miles, 23° on the starboard bow. ("H" turned 20° to port to avoid "K".)

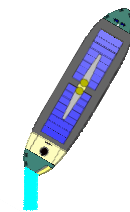
3 (-) 5 min. (just after changing course): "K" was at 1.5 miles, 43° on the starboard bow.

(-) 1 min.: "K" was at 0.3 miles on the starboard bow. (The echo of "K" was too close to the center of the radar to be distinguished from it.)

Radar screen of "K"



6 miles range scale
Relative bearing mode



"K" turned starboard

How did the echo of "H" move on "K" 's radar screen?

(-) 16 min.: "K" first recognized "H" at 5.6 miles, 11° on the port bow. ("K" judged from "H" 's track that "K" would be able to pass "H" on the port side.)

(-) 11 min. (before changing course): "H" was at 3.7 miles, 11° on the port bow. ("K" turned 10° to starboard, considering that the passing distance would not be enough.)

2 (-) 11 min. (just after changing course): "H" was at 3.7 miles, 21° on the port bow.

(-) 6 min (before changing course): "H" was at 1.8 miles, 21° on the port bow. ("K" turned 10° to starboard to avoid "H".)

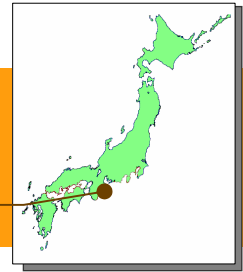
3 (-) 6 min. (just after changing course): "H" was at 1.8 miles, 31° on the port bow.

(-) 2.5 min.: "H" was at 0.7 miles, 31° on the port bow. (The echo of "H" approached with no bearing change.)

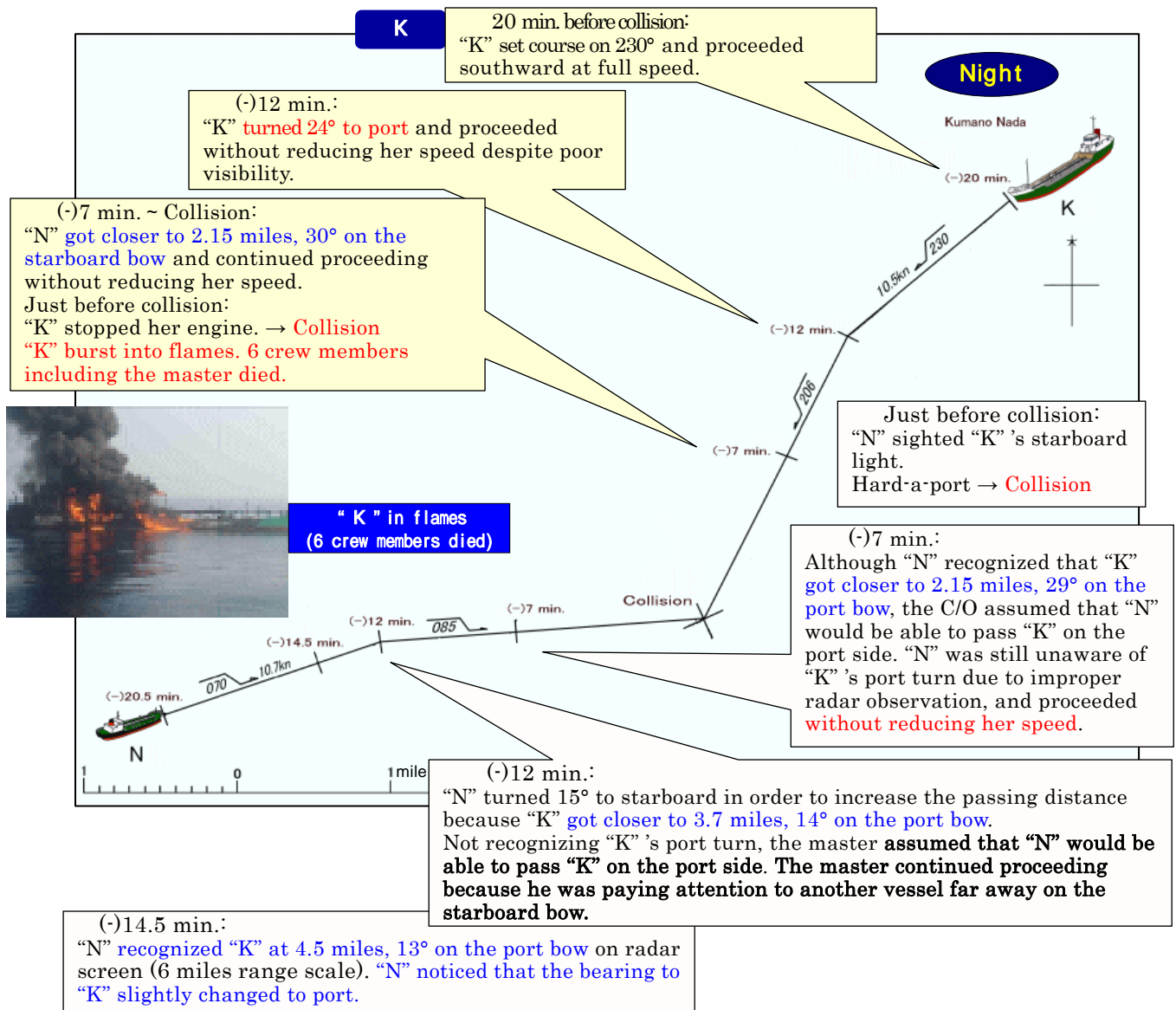
Case 5

Collision between Oil tanker “K” and Chemical tanker “N”

Kumano Nada under visibility of 250m



Oil tanker “K” G/T: 697 t Crew: 7 Cargo: DM Reformate (2,000kl) Yokkaichi Port → Matsuyama Port
 Master Age: 56 (OOW is not identified)
 Chemical tanker “N” G/T: 499 t Crew: 5 Cargo: Deoxidized naphthalin (203 t) and Creosote oil (805 t)
 Mizushima Port→ Chiba Port
 Master Age: 60 License: Fifth class (Deck) (36 years after acquisition) Experience at sea: 36 years
 C/O (OOW) Age: 53 License: Third class (Deck) (16 years after acquisition) Experience at sea: 38 years
 Time and date : At 04:05 JST (UTC+9h) on July 15, 2005 Place of accident: Kumano Nada
 Weather: Fog No wind Visibility: About 250m During dense-fog warning

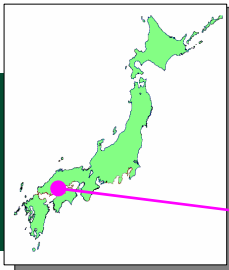


20 minutes before collision:
 The 2/O informed the C/O, next OOW, of the course, the condition of the fog and the existence of another vessel on the opposite course on the starboard bow, and left the bridge. The visibility became less than 5 miles, but the C/O did not report it to the master.
 The vessel continued proceeding at full speed without giving sound signals nor reducing her speed.

N

Because dense-fog warning had been issued off north of Shikoku, the master predicted that visibility would be poor. He told the 2/O, next OOW, to be careful of dense fog before leaving bridge: He gave instruction to avoid at large angle and report to him when the 2/O felt any risk of collision.
 When the vessel reached Kajitori Saki in Kumano Nada, the visibility became 1 mile, but the 2/O did not report it to the master. The 2/O set course on 070° and proceeded northbound at full speed.

Collision between Cargo vessel "M" and Cargo vessel "L"



Kurushima Kaikyo Traffic Route under the visibility of about 40m

Cargo vessel "M" Register: Belize G/T: 1,205 t Crew: 8
 Cargo: Scrap(1,135 t) Osaka Port → Haimen Port, China No pilot on board
 Master (He went up to bridge just before collision) Chinese Age: 38
 Experience at sea: 23 years
 2/O (OOV) Chinese Age: 27 Experience at sea: 6 years
 Cargo vessel "L" Register: Mongol G/T: 952 t Crew: 11 Cargo: Stone(1,600t)
 Baiquan, China → Katakami Port, Okayama No pilot on board
 Master Chinese Age: 45 Experience at sea: 21 years
 2/O (OOV) Chinese Age: 30 Experience at sea: 12 years
 Time and date : At 04:25 JST (UTC+9h) on May 14, 2004
 Place of accident: Kurusima Kaikyo Traffic Route
 Weather: Fog SE wind with force 1
 Visibility: About 40m Current: 1 knot to east (the fastest current of the day)

What is the "Sail Naka Suido with the tidal current, Sail Nishi Suido against the tidal current" rule?

Maritime Traffic Safety Law (Art.20.1 (1))
 Vessels shall navigate the Kurushima Kaikyo Naka Suido with the tidal current and to navigate the Kurushima Kaikyo Nishi Suido against the tidal current.

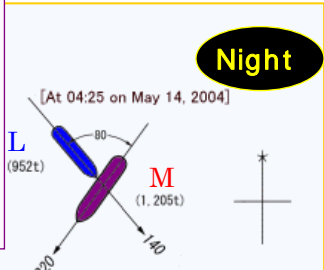
Maritime Traffic Safety Law (Art.20.1 (2))
 Vessel shall navigate as close as possible to O Shima and Oge Shima, when navigating via Naka Suido



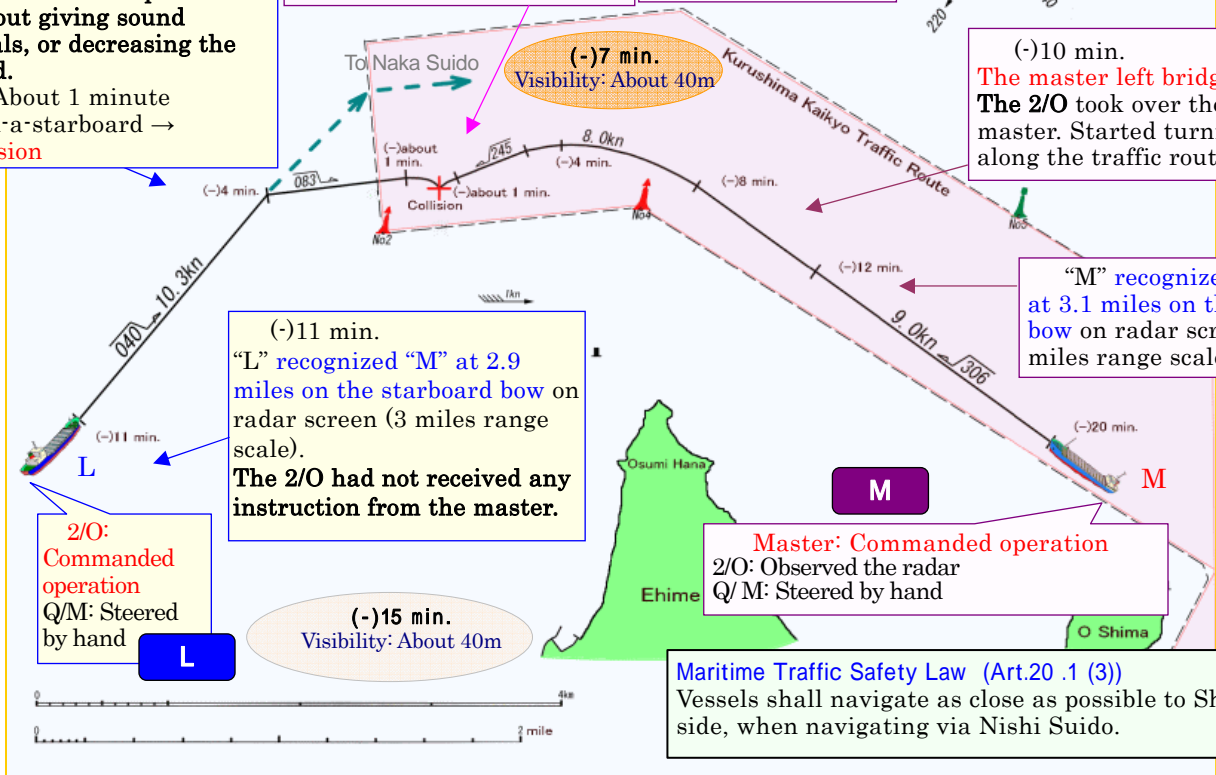
(-)4 min.
 "L" turned 43° to starboard and headed for traffic route.
 "L" recognized "M" at 1.2 miles on the right ahead on radar screen. "L" proceeded without giving sound signals, or decreasing the speed.
 (-)About 1 minute
 Hard-a-starboard → Collision

The master went up to bridge noticing poor visibility. He recognized "L" on radar screen.
 Hard-a-port → Collision → Sinking

(-)4 min.
 The 2/O failed to report to the master that visibility worsened rapidly. The 2/O recognized "L" at 1.2 miles on the port bow on radar screen while "M" turned port gradually. "M" proceeded without giving sound signals, or reducing the speed.



(-)10 min.
 The master left bridge. The 2/O took over the port. Started turning port along the traffic route.



(-)11 min.
 "L" recognized "M" at 2.9 miles on the starboard bow on radar screen (3 miles range scale).
 The 2/O had not received any instruction from the master.

"M" recognized "L" at 3.1 miles on the port bow on radar screen (3 miles range scale).

2/O: Commanded operation
 Q/M: Steered by hand

Master: Commanded operation
 2/O: Observed the radar
 Q/M: Steered by hand

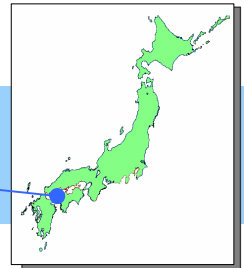
Maritime Traffic Safety Law (Art.20.1 (3))
 Vessels shall navigate as close as possible to Shikoku side, when navigating via Nishi Suido.

Even in the fog, the Art.20 of the Maritime Traffic Safety Law shall be followed !!
 When visibility is poor in the Kurushima Kaikyo, many vessels suspend the passing through the channel until visibility recovers. But sometimes the visibility worsens rapidly during passing.
 In such cases, you must follow the rule of "Sail Naka Suido with the tidal current, Sail Nishi Suido against the tidal current", and navigate as close as possible to O Shima and Oge Shima, when navigating via Naka Suido and navigate as close as possible to Shikoku side, when navigating via Nishi Suido.

Case 7

Collision between Cargo vessel "T" and Cargo vessel "K"

Iyo Nada under the visibility of about 100m



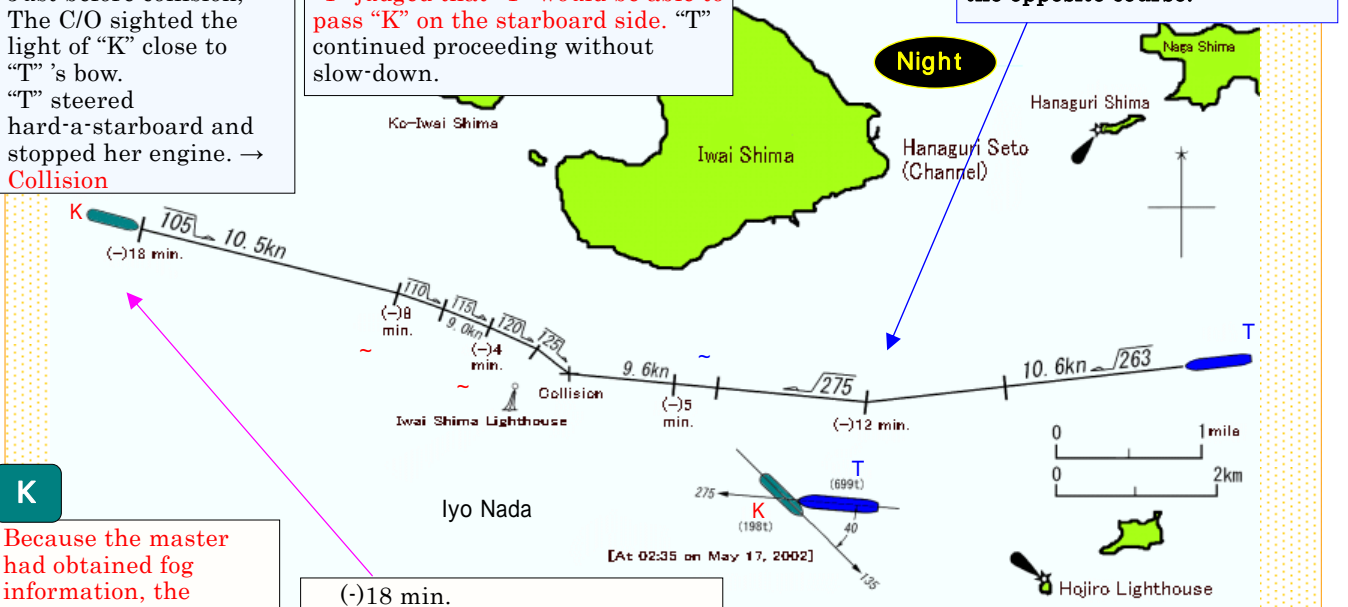
Cargo vessel "T" G/T: 699 t Crew: 5 Cargo: Cement (1,086 t) Higashi Harima Port, Hyogo → Kanda Port, Fukuoka
 Master Age: 54 License: Forth class (Deck) (29 years after acquisition) Experience at sea: 36 years
 C/O (OOV) Age: 73 License: Fifth class (Deck) (35 years after acquisition) Experience at sea: 60 years
 Cargo vessel "K" G/T: 198 t Crew: 2 Cargo: Stainless steel(364t) Kanmon Port → Kinuura Port, Aichi
 Master (OOV) Age: 42 License: Fifth class(Deck) (16 years after getting license) Experience at sea: 19 years
 Time and date : At 02:35JST (UTC+9h) on May 17, 2002 Place of accident: Iyo Nada
 Weather: Fog, no wind Visibility: About 100m

(-)5 min. ~ Collision
 "T" reduced her speed to half ahead of 9.6 knots due to dense fog. The C/O of "T" concentrated on watching ahead, assuming that he would sight "K" 's light shortly, and paid no attention to the radar. Just before collision, The C/O sighted the light of "K" close to "T" 's bow. "T" steered hard-a-starboard and stopped her engine. → Collision

(-)7 min. Visibility: About 500m
 The C/O did not report the visibility to the master. He did not give sound signals nor reduced her speed. "T" proceeded at full speed with auto-pilot.
 (-)6.5 min.
 "T" recognized "K" at 2.0 miles, 11° on the starboard bow. Because the echo of "K" was in starboard side of heading marker on radar screen, "T" judged that "T" would be able to pass "K" on the starboard side. "T" continued proceeding without slow-down.

(-)10 min.
 The C/O recognized the fog emerging ahead of "T" because he could not sight the "K" 's light, 3.2 miles from "T".

The master had relied on the well-experienced C/O, and had not instructed him to report poor visibility to the master.
 (-)12 min.
 After "T" changed course to 275°, "T" recognized "K" at 4.0 mile, 8° on the starboard bow on radar screen (12 miles range scale and Off center). "T" recognized that "K" was on the opposite course.



Because the master had obtained fog information, the master had ordered the C/E (OOV) to report to the master when visibility became poor.
 (-)About 1 hour
 The C/E reported to the master that visibility became poor about 100m. The master went up to the bridge and commanded operation.

(-)18 min.
 The master recognized "T" at 6.0 miles on the right ahead on radar screen (6 miles range scale). He recognized that "T" was on the opposite course. He turned 5° to starboard in order to pass "T" on the port side, so that the echo of "T" is located on the port side of heading marker on the radar. "K" proceeded at full speed using auto-pilot without giving sound signals.

(-)8 min.
 Because "T" got closer to 2.6 miles on the almost right ahead, "K" changed course to 110°.
 (-)6.5 min.
 Because "T" got closer to 2.0 miles, 4° on the port bow, "K" assumed that "T" would turn starboard and pass "K" on the port side. "K" did not reduce her speed.
 (-)6 min.
 Because "T" got closer to 1.8 miles, 4° on the port bow with no bearing change, "K" changed course to 115°.

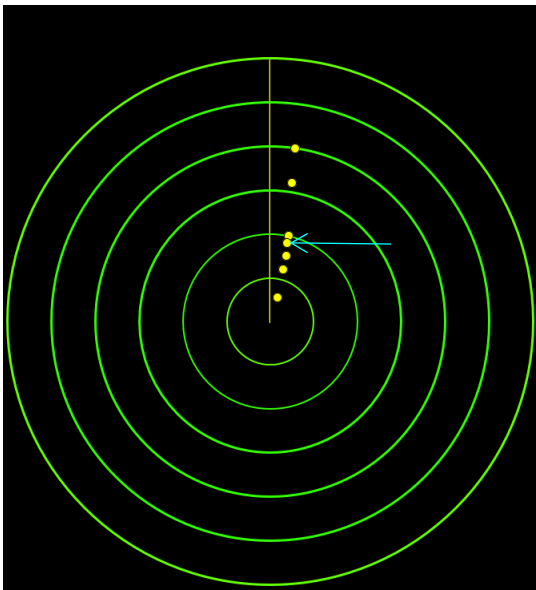
(-)5 min.
 "T" got closer to 1.5 miles, 8° on the port bow.
 "K" reduced her speed to half ahead of 9.0 knots.
 (-)4 minutes
 Because "T" got closer to 1.2 miles, 8° on the port bow with no bearing change, "K" changed course to 120°.

(-)2 min.
 Because "T" got closer to 1,050m, "K" changed course to 125°. ("K" expected that "T" would enter port side on radar screen.)

(-)1 min. ~ Collision
 Because "T" got closer to 500m, "K" felt danger and stopped her engine. The master engaged in steering by hand and paid attention to port bow with the C/E. Just before collision, "K" sighted the light of "T" close to her bow. Starboard 10° and Half astern → Collision

Movement of radar echo

Radar screen of "T"



【6 miles range scale】
(Relative bearing mode)

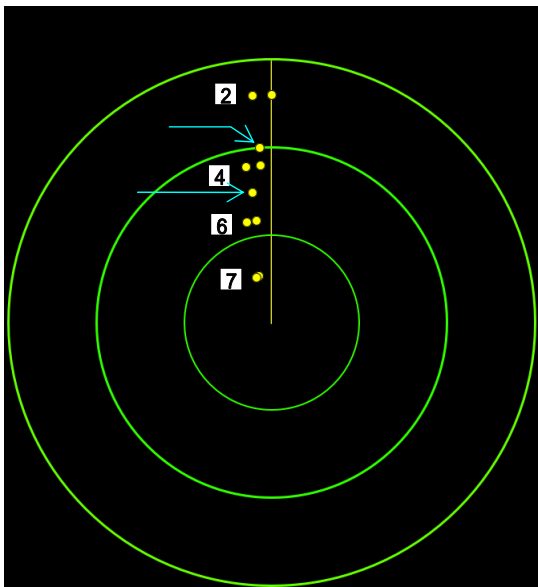


"T" went straight

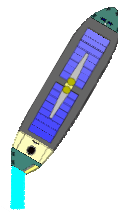
How did the echo of "K" move on "T" 's radar screen?

- (-)12 min.: "T" recognized "K" at 4.0 miles, 8° on the starboard bow.
- (-)10 min.: "T" recognized "K" at 3.2 miles, 9° on the starboard bow. ((-)8 min.: "K" altered 5° to starboard.)
- (-)6.5 min.: "T" recognized "K" at 2.0 miles, 11° on the starboard bow. CPA was 0.12 miles.
- ("T" judged that "T" would be able to pass "K" on the starboard side because "K" was in the starboard side of heading marker.)
- (-)6 min.: "T" recognized "K" at 1.8 miles, 11° on the starboard bow. ("K" altered 5° to starboard.)
- (-)5 min.: "T" recognized "K" at 1.5 miles, 13° on the starboard bow.
- ("T" reduced her speed to half ahead of 9.6 knots.)
- (-)4 min.: "T" recognized "K" at 1.2 miles, 13° on the starboard bow. ("K" altered 5° to starboard.)
- (-)2 min.: "T" recognized "K" at 1,050m, 13° on the starboard bow. ("K" altered 5° to starboard.)

Radar screen of "K"



【3 miles range scale】
(Relative bearing mode)



"K" turned starboard

How did the echo of "T" move on "K" 's radar screen?

- (-)18 min. (before changing course): "K" recognized "T" at 6.0 miles on the almost right ahead.
- ("K" intended to pass "T" on the port side. And "K" altered 5° to starboard expecting that "T" would enter port side of the heading marker.)
- 1** (-)18 min. (just after changing course): "K" recognized "T" at 6.0 miles, 5° on the port bow.
- (-)8 min. (before changing course): "K" recognized "T" at 2.6 miles on the almost right ahead. ("K" altered 5° to starboard.)
- 2** (-)8 min. (just after changing course): "K" recognized "T" at 2.6 miles, 5° on the port bow.
- (-)6.5 min.: "K" recognized "T" at 2.0 miles, 4° on the port bow. CPA was 0.12 miles.
- ("K" judged that "T" would turn starboard and "K" would be able to pass "T" on the port side.)
- (-)6 min. (before changing course): "K" recognized "T" at 1.8 miles, 4° on the port bow. ("K" altered 5° to starboard.)
- 4** (-)6 min. (just after changing course): "K" recognized "T" at 1.8 miles, 9° on the port bow.
- (-)5 min.: "K" recognized "T" at 1.5 miles, 8° on the port bow. ("K" reduced her speed to 9.0 knots.)
- (-)4 min. (before changing course): "K" recognized "T" at 1.2 miles, 8° on the port bow. ("K" altered 5° to starboard.)
- 6** (-)4 min. (just after changing course): "K" recognized "T" at 1.2 miles, 13° on the port bow.
- (-)2 min. (before changing course): "K" recognized "T" at 1,050m, 13° on the port bow. ("K" altered 5° to starboard.)
- 7** (-)2 min. (just after changing course): "K" recognized "T" at 1,050m, 18° on the port bow.

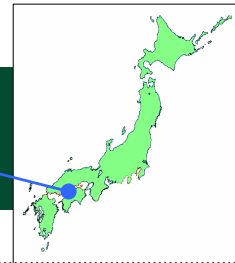
Modest slow-down or alternation of course at a small angle of 5° is hard to be recognized by other vessels.



Case 8

Collision between Cargo vessel "C" and Cargo vessel "A"

Aki Nada under the visibility of about 100m



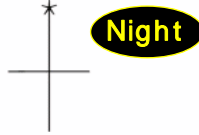
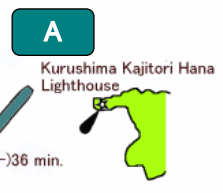
Cargo vessel "C" G/T: 199 t Crew: 3 Chip(450 t) Aburatsu Port, Miyazaki → Mishima Kawanoe Port, Ehime
 Master (in the bridge) Age: 60 License: Fifth class (Deck)
 C/O (OOW) Age: 61 Forth class (Deck) Experience at sea: 18 years
 Cargo vessel "A" Register: Panama G/T: 1,478 t Crew: 8 Cargo: Steel (990 t)
 Himeji Port, Hyogo → Pusan Port, South Korea **No pilot on board**
 Master (OOW) Filipino Age: 54
 3/O (Lookout) Filipino
 Time and date : At 02:53 JST (UTC+9h) on July 13, 2001 Place of accident: Aki Nada
 Weather: Fog SW wind with force 1 Visibility: About 100m



Radar of "A"

The master commanded operation and assigned the 3/O to lookout. "A" proceeded southward with sound signals along the recommended course line, sighting light buoy on the starboard side, at full speed using auto-pilot.

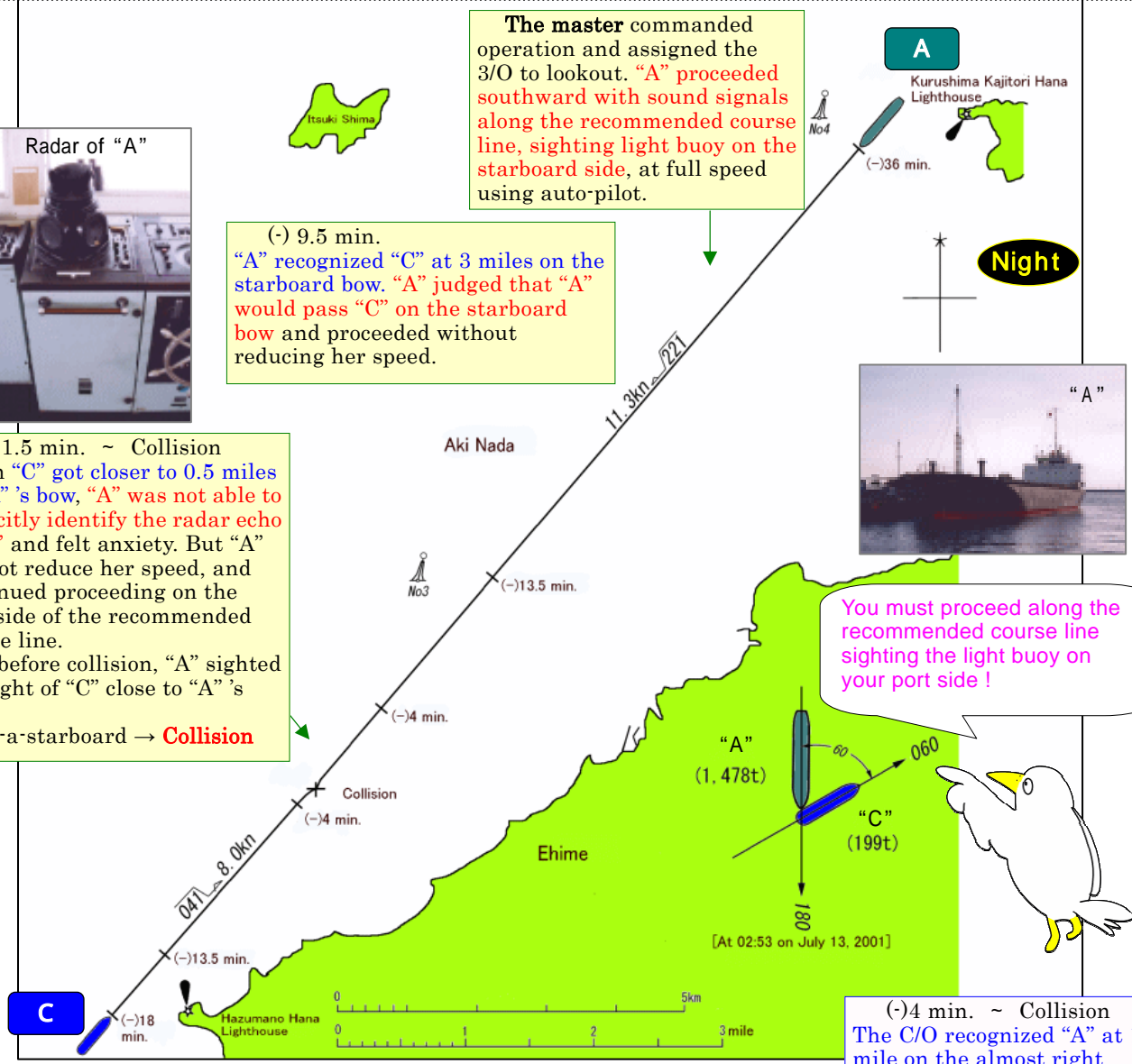
(-) 9.5 min.
 "A" recognized "C" at 3 miles on the starboard bow. "A" judged that "A" would pass "C" on the starboard bow and proceeded without reducing her speed.



Night

(-)1.5 min. ~ Collision
 When "C" got closer to 0.5 miles on "A" 's bow, "A" was not able to explicitly identify the radar echo of "C" and felt anxiety. But "A" did not reduce her speed, and continued proceeding on the port side of the recommended course line.
 Just before collision, "A" sighted the light of "C" close to "A" 's bow.
 Hard-a-starboard → **Collision**

You must proceed along the recommended course line sighting the light buoy on your port side !



(-)1.5 hours
 The master of "C" went up to bridge after hearing sound signals, but the master continued to have the C/O to watch, and the master himself did not command the operation. He looked into the radar screen or engaged in lookout in port wing from time to time.

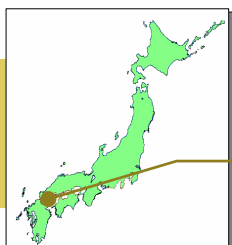
(-)18 min.
 Visibility: 100m
 The C/O of "C" set her course on the south (starboard) side of the recommended course line and proceeded using auto-pilot with sound signals manually.
 (-) 13.5 min.
 The C/O recognized "A" at 4 miles on her bow on radar screen.

(-)9.5 min.
 The C/O recognized "A" at 3 miles on her bow on radar screen.
 The C/O worried that "A" was proceeding southward on the port side of recommended course line. But, "C" assumed that "A" would turn starboard, and continued proceeding without reducing her speed.

(-)4 min. ~ Collision
 The C/O recognized "A" at 1 mile on the almost right ahead on radar screen. Assuming that "C" would pass "A" on the port side, the C/O of "C" altered 20° to starboard, reduced her speed to dead slow ahead and gave a long blast. Just before collision, "C" sighted the light of "A" on the port bow.
 Full ahead → **Collision**
 → "C" sank.

Collision between Cargo vessel "P" and Chemical tanker "S"

Off north of Mutsure Shima, Yamaguchi Pref.
under the visibility of about 400m



Cargo vessel "P" Register: Panama G/T: 7,433 t Crew: 18 No cargo

Dalian Port, China → Mizushima Port, Okayama

Master (Commanding operation) Filipino Age: 61 **No pilot on board**

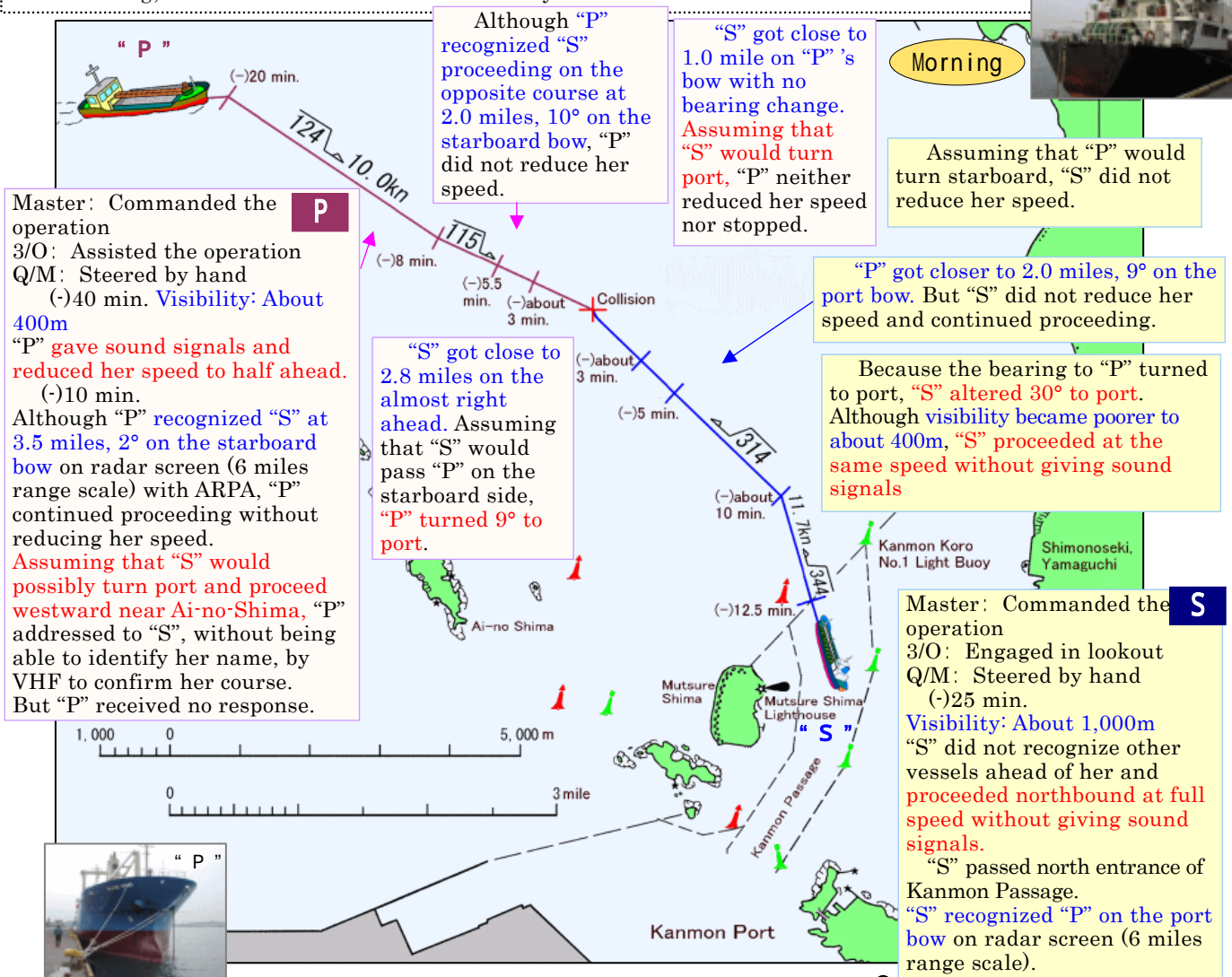
Chemical tanker "S" Register: South Korea G/T: 1,592 t Crew: 13 No cargo Keihin Port → Onsan Port, South Korea

Master (Commanding operation) South Korean Age: 44 **No pilot on board**

Time and date: At 09:10 JST (UTC+9h) on April 12, 2003

Place of accident: Off North of Mutsure Shima, Yamaguchi

Weather: Fog, WNW wind with force 3 Visibility: About 400m



Lessons for the navigation under poor visibility
Slow down to a safe speed!
Avoid a close quarters situation in ample time!

What is "a safe speed"? (COLREGS Rule 6)

A safe speed means that she can;

- () take proper and effective action to avoid collision and
- () be stopped within a distance appropriate to the prevailing circumstances and conditions.

Don't turn port to avoid a close quarters situation!

Don't hesitate to reduce your speed substantially or stop!

- Don't count on the action of other vessels. YOU must take definite actions to avoid a close quarters situation in ample time. But remember not to turn port!
- Take apparent actions that can be easily recognized by other vessels! Turn starboard largely (at least 30°) before approaching other vessels!
- Don't hesitate to reduce your speed largely or stop when you are in a close quarters situation!

Is your speed safe in the fog?



Tips on Navigation in Fog

Command by the master in fog (ISM code, Mariners Law (Art.10))

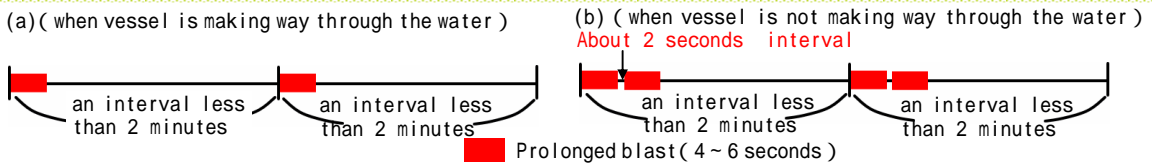
The master himself must command in the bridge when the vessel enters port, passes through narrow channel, or faces any other vulnerable situations.

Lights and shapes (COLREGS Rule 20(c))



In restricted visibility, the lights prescribed by the rules in COLREGS shall also be exhibited from sunrise to sunset.

Sound signals in restricted visibility (COLREGS Rule 35(a) and (b))



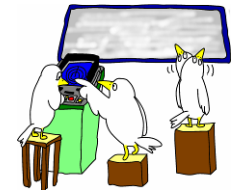
Safe speed (COLREGS Rule 6)

Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.

Conduct of vessels in restricted visibility (COLREGS Rule 19)

First, prepare the engine !

(b) A power-driven vessel shall have her engines ready for immediate maneuver.

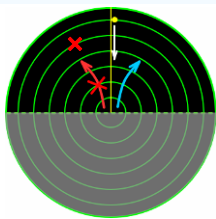


Take large action in ample time when you recognize other vessels !

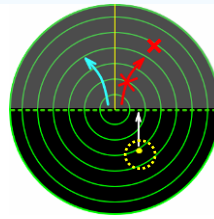
(d) A vessel which detects by radar alone the presence of another vessel shall determine if a close-quarters situation is developing and / or risk of collision exists. If so, she shall take avoiding action in ample time.

Don't turn port in fog !

(d) Provided that when such action consists of an alteration of course, so far as possible the following shall be avoided:



() an alteration of course to port for a vessel forward of the beam, other than for a vessel being overtaken



() an alteration of course towards a vessel abeam or abaft the beam

Don't hesitate to go astern when you are in a close quarters situation !

(e) Except where it has been determined that a risk of collision does not exist, every vessel which hears apparently forward of her beam the fog signal of another vessel, or which cannot avoid a close quarters situation with another vessel forward of her beam, shall reduce her speed to the minimum at which she can be kept on her course. She shall if necessary take all her way off and in any event navigate with extreme caution until danger of collision is over.

Reduce your speed to the minimum or stop when you hear sound signals from ahead !

