

MA2011-10

**MARINE ACCIDENT
INVESTIGATION REPORT**

October 28, 2011

Japan Transport Safety Board

The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board is to determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. It is not the purpose of the investigation to apportion blame or liability.

Norihiro Goto
Chairman,
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

MARINE ACCIDENT INVESTIGATION REPORT

Vessel type and Name: Cargo ship MARINE STAR
IMO number: 9228629
Gross tonnage: 7,382 tons

Vessel type and Name: Container ship TAKASAGO
Vessel number: 135973
Gross tonnage: 499 tons

Accident type: Collision
Date and time: About 0615 hrs, February 20, 2009 (Local time, UTC+9)
Location: On the Bisan Seto East Traffic Route (off Sakaide Port, Sakaide City, Kagawa Prefecture)
Around 062° true, 2,300 m from Koseijima lighthouse, Sakaide City, Kagawa Prefecture
(Approximately 34°23.1'N, 133°52.5'E)

October 6, 2011

Adopted by the Japan Transport Safety Board

Chairman Norihiro Goto

Member Tetsuo Yokoyama

Member Kuniaki Shoji

Member Toshiyuki Ishikawa

1 PROCESS OF ACCIDENT INVESTIGATION

1.1 Summary of the Accident

On February 20, 2009, the cargo ship MARINE STAR, with a master and sixteen crew members on board, was proceeding northward off Sakaide Port, Kagawa Prefecture, while the container ship TAKASAGO, with a master and four crew members on board, was proceeding eastward by the Bisan Seto East Traffic Route. The ships collided with each other at about 0615 hrs.

MARINE STAR sustained damage in the form of dents on the port stern shell plate. TAKASAGO sustained damage in the form of dents to the bow. There were no casualties on either ship.

1.2 Outline of the Accident Investigation

1.2.1 Set up of Investigators

On February 20, 2009, the Japan Transport Safety Board appointed an investigator-in-charge and another investigator from local office to investigate this accident. Later, the board designated a marine accident investigator as an investigator-in-charge and also designated another investigator.

1.2.2 Collection of Evidence

February 23, 24 and March 6, 2009: on-site investigation and interview

March 5, 16, 17 and 31, 2009: interview

March 27, April 10 and August 11, 2009: collection of written replies to questionnaires

1.2.3 Comments of Parties Relevant to the Cause

Comments on the draft report were invited from the parties relevant to the cause of the accident.

1.2.4 Comments from Flag States

Comments on the report were invited from the flag state, Owner and Management Company of the Marine Star.

2 FACTUAL INFORMATION

2.1 Events Leading to the Accident

2.1.1 Events Leading to the Accident according to the Records of AIS Information and the Records of Radar Tracking

According to the records of AIS¹ information (hereinafter referred to as “AIS records”) of MARINE STAR (hereinafter referred to as “Ship A” except for chapter 5) received by the Bisan Seto Vessel Traffic Service Center (hereinafter referred to as “BISAB MARTIS”), the records of radar tracking by TAKASAGO (hereinafter referred to as “Ship B” except for chapter 5) and the bell book of Ship A,² the events leading to the accident were as follows.

(1) Ship A

{1} At about 0602.00 hrs, Ship A put the main engine to half ahead.

{2} At about 0610.01 hrs, Ship A was proceeding with a heading of 017° (true bearing, the same shall apply hereinafter, for COG (Course over the Ground) as well), COG of 016.7° and speed of 8.8 kn.

{3} At about 0610.05 hrs, Ship A put the main engine to slow ahead.

{4} At about 0610.09 hrs, Ship A was proceeding with a heading of 015°, COG of 019.2° and speed of

¹ An “Automatic Identification System (AIS)” is a system that enables ships to automatically exchange navigation information, such as call sign, type, name, position, and course, with other ships or with shore facilities. The position is the position of the GPS antenna.

² A “bell book” is a notebook for keeping records of engine orders via telegraph from the bridge, such as speed (full, half, slow and so forth) with the time of the order, while entering or leaving a port and so on.

8.7 kn.

{5} At about 0611.01 hrs, Ship A was proceeding with a heading of 337°, COG of 356° and speed of 7.1 kn. At about 0611.50 hrs, Ship A was proceeding with a heading of 325°, COG of 332° and speed of 6.6 kn.

{6} At about 0612.10 hrs, Ship A put the main engine to dead slow ahead, and then at about 0612.12 hrs to harbor full ahead.

{7} At about 0612.20 hrs, Ship A was proceeding with a heading of 319°, COG of 320° and speed of 7.1 kn. At about 0613.00 hrs, Ship A was proceeding with a heading of 317°, COG of 313° and speed of 7.9 kn.

{8} At about 0613.20 hrs, Ship A put the main engine to slow ahead.

{9} At about 0613.29 hrs, Ship A was proceeding with a heading of 319°, COG of 311° and speed of 8.3 kn.

{10} At about 0614.40 hrs, Ship A put the main engine to harbor full ahead.

{11} At about 0615.10 hrs, Ship A was proceeding with a heading of 319°, COG of 288° and speed of 7.9 kn.

(2) Movements of Ship B

{1} At about 0608.00 hrs, Ship B was proceeding with a COG of 055° and speed of 12.1 kn.

{2} At about 0610.30 hrs, Ship B was proceeding with a COG of 060° and speed of 12.7 kn.

{3} At about 0612.00 hrs, Ship B was proceeding with a COG of 067° and speed of 12.7 kn.

{4} At about 0614.00 hrs, Ship B was proceeding with a COG of 070° and speed of 12.7 kn.

{5} At about 0615.12 hrs, Ship B was proceeding with a COG of 070° and speed of 12.7 kn.

2.1.2 Events leading to the Accident According to Oral Statements from the Crews and others

According to the oral statements from the master of Ship A (hereinafter referred to as “Master A”), the chief officer of Ship A (hereinafter referred to as “Officer A”), the ordinary seaman of Ship A (hereinafter referred to as “OS A”), the chief engineer of Ship A (hereinafter referred to as “C/E A”), the master of Ship B (hereinafter referred to as “Master B”) and the chief officer of Ship B (hereinafter referred to as “Officer B”), and according to the logbook of Ship A and the logbook of Ship B, the events leading to the accident were as follows.

(1) Ship A

At about 1648 hrs, February 19, 2009, Ship A departed Senboku District, Hanshin Port. When it entered the east entrance of the Bisan Seto East Traffic Route (hereinafter referred to as “East Route”) at about 2132 hrs, Ship A, via VHF radiotelephone (hereinafter referred to as “VHF”), reported to the BISAN MARTIS of having passed the EE line.³ After entering the “Quarantine Anchorage off Sakaide Port” (hereinafter referred to as “Quarantine Anchorage”), Ship A anchored at about 2318 hrs, and then reported to the BISAN MARTIS via VHF that it had anchored. Although Master A had much experience in navigating through Seto Naikai and the East Route, it was the first time for Master A to anchor in the Quarantine Anchorage.

At about 0550 hrs, February 20, Master A reported to the BISAN MARTIS of leaving the Quarantine Anchorage for Marugame Port.

³ “EE line” is set by the 6th Regional Coast Guard Headquarters for safe navigation. The Headquarters requests the ships of specified size to report to the BISAN MARTIS once they have crossed any of the position report Lines. The “EE line” referred to here is one of such lines, and runs from Jizo Saki, Shodoshima and Okushi Saki.

Master A was in command of heaving-up the anchor. Officer A via radio had been relaying the orders from Master A to the third officer at the forecastle deck, where the third officer, the boatswain and an apprentice were working on heaving-up the anchor.

The second officer was resting in his room after having handed-over the anchor watch on which he had served between 0000 and 0400 hrs to Officer A, the next duty officer.

The course plan of Ship A for after heaving-up the anchor was as follows: proceeding with a COG of 017° to approach the East Route, changing to a COG of 339°, and crossing the center line of the East Route at almost a right angle.

Ship A finished heaving-up the anchor at about 0600 hrs, and, with the main engine set to half ahead, headed to Marugame Port along the planned route drawn on the chart.

Master A set up the No. 1 Radar, which was fitted with ARPA,⁴ on the 3 NM range scale and the No. 2 Radar on the 1.5 NM range scale, took the con including lookout, radar monitoring, telegraph operations and VHF communications, and assigned OS A to manual steering, being close to the repeater compass placed at almost the center of the forepart of the bridge.

Although Master A had assigned Officer A to ship's position monitoring, which Master A thought was significant, Master A thought of assigning Officer A to lookout and to monitor the radar in addition to the duty that Officer A already had.

Since Ship A heaved up anchor, Officer A, in the chart room separated with a curtain, had been plotting the positions and times of the ship read out from the GPS on the chart for the ship's navigation on the planned course.

Officer A plotted the ship's position on the chart and then reported that the planned course was a COG of 017°.

Upon the receipt of the report from Officer A, Master A ordered to set the heading to 017°.

Officer A plotted the next waypoint on the chart, and reported that the next planned course would be a COG of 339°.

At about 0610 hrs, Master A sighted the two masthead lights and the starboard side light of Ship B at 9 to 10 o'clock in direction. After knowing through investigating by binoculars that Ship B was proceeding on the East Route, Master A thought that Ship A would not make the way, ordered the main engine to slow ahead, and kept Ship A proceeding.

Master A did not reconfirm the range and bearing of Ship B with radar.

Before recognizing Ship B, Master A had seen the lights of another ship, which passed without problems, and since then he saw no ships or fishing vessels other than Ship B around Ship A.

Master A shuttled between the bridge and the left wing one or two times. Just before the collision, Master A was on the left wing, letting OS A steer and operate the telegraph by the order of Master A.

Master A ordered OS A to put the helm to port in order to change the heading to 339°, with the intention of passing Ship B, starboard to starboard. However, Master A did not blow a whistle signaling that Ship A had altered her course to port. Master A was not thinking of contacting Ship B via VHF.

Master A had been expecting Ship B to notice Ship A and reduce its speed following good

⁴ ARPA (Automatic Radar Plotting Aids) is an apparatus that displays on the radar screen the course, the speed, CPA (the closest point of approach), etc. of a radar-detected ship; it is also capable of warning against possible collision with another ship.

seamanship⁵ (the ordinary practice of seamen).

Officer A found that Ship A was off the planned course as much as 350 m to the east and felt that something was amiss. However, Officer A did not report this fact to Master A, because such deviations off course are not so rare. Furthermore, Officer A did not assess the situation of the surrounding area.

Master A, at about 0612 hrs, ordered dead slow ahead in order to let Ship B go first. OS A replied "Dead Slow, Sir." Then, Master A changed the heading from 339° to 330° in order to pass by the stern of Ship B.

Master A, at about 0612 to 13 hrs, changed the heading to 315°.

Master A, at about 0613 hrs, on the receipt of the information provided by the BISAN MARTIS that a ship was approaching to Ship A, responded, "Will proceed slowly."

Master A, at about 0614 hrs, became upset when he saw the sidelights of Ship B, which was approaching with a higher speed than expected, and noticed that she had altered her course to starboard. Master A, in order to turn to starboard, ordered the main engine to harbor full ahead to increase the rudder effectiveness, and ordered the rudder hard to starboard. Master A thought that if Ship A was going by dead slow ahead, Ship B would pass by the bow.

Master A, upon feeling a collision shock, instructed OS A to read the clock and received a report at 0615 hrs. The angle of collision was 20° to 30°.

The collision caused the generator to stop with smoke coming out, which led to a blackout.⁶ As a result, all the communication to the outside of the ship became unavailable.

C/E A thought about explosions and stopped the main engine, because oil spilled out into the engine room from the fuel pipes damaged by the shock of the collision. Some of the spilled oil in the engine room flowed into the sea.

Master A, in order to anchor, ordered to drop the anchor, which was relayed by Officer A via radio to the third officer stationed at the forecandle deck.

Master A noticed by looking into the GPS plots on the chart that Ship A had been proceeding off the planned course, on the right. Master A thought that the current caused the deviation.

(2) Ship B

At about 1625 hrs, February 19, 2009, Ship B departed Tanoura District, Kanmon Port, bound for Kobe District, Hanshin Port with the main engine running at 680 revolutions per minute (rpm) and a speed of about 13 kn. The watchkeeping arrangement of Ship B was a single-man watch as follows: Master B from 0800 to 1200 and 2000 to 2400 hrs, Officer B from 0400 to 0800 and 1600 to 2000 hrs, and a second officer from 0000 to 0400 and 1200 to 1600 hrs.

The visibility was bad due to rain for a while after Ship B departed Kanmon Port, and at about 0510 hrs, February 20, when Ship B entered the East Route after passing the Bisan Seto South Traffic Route, the rain stopped and the visibility improved.

Officer B changed the heading to 058° when Ship B was passing under the Minami Bisan Seto Ohashi Bridge and confirmed that the speed was 12 kn by the GPS plotter. In ordinary situations the speed is 13 kn, but Officer B thought the speed was reasonable because the current was against Ship B.

⁵ "Good seamanship" refers to the knowledge, experience or common practice that ordinary seamen are supposed to have. For example, a cruising ship will avoid an anchored ship. It is also called "the ordinary practice of seamen."

⁶ "Blackout" refers to loss of electric power. .

Officer B, 7 to 8 minutes before the collision, off Kosei Shima Lighthouse, Sakaide City, Kagawa Prefecture, changed the steering from automatic to manual to alter the heading to 068°. Then Officer B changed the steering back to automatic.

Officer B, just before altering the heading to 068°, sighted the two masthead lights and the port side light of Ship A in the direction of Kosei Shima. Officer B measured the range with radar. The range was about 1.7 M and Ship A seemed to be proceeding north-eastward. Because Ship A was proceeding very close to the coast, Officer B thought that she would enter the route to proceed eastward and that as she was moving faster than Ship B she would enter the route ahead of Ship B.

Ship B had set up the No. 1 radar to the 1.5 M range (off-centered to provide about 2M view ahead). The No. 2 radar was in operation on the 3 M range scale.

Although the radars were fitted with functions such as displaying the closest point of approach (CPA) from the plots of the target images or sounding an alarm when other ships came within a predefined range, Officer B did not use those functions, instead he was referring to the chart and the GPS plotter one after the other for comparison.

Officer B thought that there were no ships or fishing vessels around Ship B except a westbound cargo ship the same size as Ship B, in addition, no ships were proceeding in the same direction. Officer B turned around to the GPS plotter to begin operations to confirm the next way point.

Officer B was not so familiar with the GPS plotter because it had not been long since he first boarded Ship B. For several minutes, Officer B operated the GPS plotter in order to confirm the next way point and become familiar with the GPS plotter operation. When Officer B saw toward the bow, he noticed that a ship which was crossing the route had come as close as 70 to 80 m away. Officer B saw, directly in front of him, a part of the right side of the bridge of Ship A and a light directly under the bridge.

Officer B changed the steering from auto pilot to manual, put the helm hard to starboard and the main engine to stop. When Ship B began to turn to starboard, its bow collided with the port stern of Ship A.

Approximately at the time of the collision, Officer B put the main engine to astern. At the time of the collision, the heading of Ship B did not turn to heading of 90° while the helm was held to starboard.

The time of the collision was about 0615 hrs, and the location was about 0.4 M southwest of the center buoy of the East Route.

Officer B, although he had set the VHF volume loud, had not heard the voices of the BISAN MARTIS or other voices in English. Officer B usually paid attention to the VHF because there are many ships coming out of the Mizushima Traffic Route into the East Route. As for the day of the collision, channel 16 had been quiet. Officer B thought that it was because fewer ships than usual were navigating. Officer B had not heard the VHF or the whistles of Ship A.

It was after the collision that Officer B for the first time heard English voices, which were communicated between Ship A and the Japan Coast Guard. After that, Ship B was called by the Japan Coast Guard via VHF and communication was exchanged.

Master B, after the collision, made emergency calls via mobile phone to the Japan Coast Guard at 118 and the ship operator. It was not the first time for Officer B to notice that his ship was being called when the BISAN MARTIS called it in such a way as, "The ship proceeding east at the offing of somewhere," rather than by Ship B's name.

The time and date of the accident was about 0615 hrs, February 20, 2009. The location was

about 062°, 2,300 m from the Kosei Shima Lighthouse.

(Refer to Figure 1 to 3: Plots of estimated ship Positions, Figure 4: Chart used by Ship A, Attached Table 1: AIS records of Ship A, Table 2: Records Ship B's Radar Displays, and Table 3: Variation of Ship A's Speed)

2.1.3 VHF Communications by the BISAN MARTIS

According to the oral statements from the officer then on duty, the VHF communication by the BISAN MARTIS was as follows:

(1) The VTS operator at the control console had kept track of Ship A on the radar screen and also on the AIS screen. As for Ship B, although the operator had kept track of it as a radar image on the screen, the operator had not identified the name or the destination of Ship B, because Ship B was not equipped with AIS.

Between the time of Ship A's heaving-up anchor and 0613 hrs, the VTS operator, after having decided that there was no need for frequent dedicated communications with Ship A based on the judgment that Ship A had noticed Ship B because Ship A was at a position providing a wide view of the East Route and Ship A had reduced its speed, kept monitoring Ship A's movements but mainly concentrated on watching the Sakaide Port area, the Mizushima Traffic Route, the routes inside Mizushima Port and the intersection of the Mizushima Traffic Route and the Bisan Seto Traffic Routes.

At about 0613 hrs, the VTS operator judged from the radar information of both the ships that there is risk of collision. In order to prevent such collision, the VTS operator provided information to Ship A to be careful of the ship approaching on the port side. The VTS operator judged that Ship A would give way to Ship B, because Ship A replied that it would proceed slowly. The records of communications providing situational information between the VTS operator and each of the ships are as listed in (2).

(2) Radio Communication Recording of the BISAN MARTIS

Time	Operator	Content	Radio CH
0550 hrs	From Ship A to the BISAN MARTIS	Leaving the Quarantine Anchorage for Marugame Port.	16, 22
	From the BISAN MARTIS to Ship A	Roger, watch the movements of other ships when entering the route.	16, 22
0613 hrs	From the BISAN MARTIS to Ship A	Be careful of the ship approaching on the port side.	16
	From Ship A to the BISAN MARTIS	Roger, will proceed slowly.	16

0614 hrs	From the BISAN MARTIS to the unidentified ship going east (estimated as Ship B)	The ship proceeding eastward off Sakaide, be careful of the crossing vessel. (No reply received) .	16
0618 hrs	From Ship A to the BISAN MARTIS	Tried to clear starboard to starboard by reducing speed. Failed and collided.	16,22

2.2 Injuries or Deaths

There were no injuries or deaths.

2.3 Damage to Vessels

(1) Ship A

Breakage of the port side stern shell plate and the fuel pipes in the engine room
(Refer to Photos 1 to 3: Condition of Ship A)

(2) Ship B

Dents on the bow fashion plate and to the bulbous bow
(Refer to photo 4: Damage to Ship B)

2.4 Events Leading to the Accident

(1) Ship A

According to the information from Japan Coast Guard, the events after the collision on Ship A was as follows

Ship A was towed by two tug boats to the berth of Sakaide Port to dock there.

The fuel oil spilled from Ship A disappeared thanks to the removal action by patrol boats.

(2) Ship B

According to the oral statements from Officer B, Ship B followed the instructions of the Japan Coast Guard (Sakaide Coast Guard Station) to anchor off the route. Ship B received, via VHF CH 16, an instruction from a coast guard patrol boat that had come close to, "Wait for a while for the officer in charge, who is coming in another patrol boat."

2.5 Crew Information

(1) Gender, Age, and Certificate of Competence

{1} Master A, Nationality of Republic of the Philippines, Male, 61 years old

Endorsement attesting the recognition of certificate under STCW regulation I /10 of a certificate, Master (issued by Republic of Panama)

Date of Issue: November 7, 2008

Date of Expiry: March 4, 2013

{2} Officer A, Nationality of Republic of the Philippines, Male, 60 years old

Endorsement attesting the recognition of certificate under STCW regulation I /10 of a certificate unknown

{3} Officer B, Male, 59 years old

Fourth Grade Maritime Officer (navigation)

Date of Issue: September 1, 1972

Date of Revalidation: October 8, 2004

Date of Expiry: November 15, 2009

Second Grade Technical Marine Radio Operator for Special Service

Date of Issue: March 7, 2001

(2) Sea-going Experience

{1} Master A

According to the oral statement from Master A, his experience was as follows:

Master A served as an apprentice between 1965 and 1967, third officer in 1967, second officer in 1969 and chief officer in 1971. Master A obtained a master's license in 1974 and boarded a timber carrier of gross tonnage 3,846 tons as a master in 1975 and in August, 2008, he first boarded Ship A as a master.

Master A had a slight hearing difficulty in his left ear, which did not influence his capability of ship handling.

{2} Officer A

According to the oral statement from Officer A, his experience was as follows:

Officer A obtained a master's license in December 2001, and first boarded Ship A in November 2007. Since August 2008, Officer A served as a trainee master.

{3} Officer B

According to the oral statement from Officer B, his experience was as follows:

Officer B served as an ordinary seaman on 300 gross-ton class tuna-fishing vessels for 7 years since 1968, as master on 200 to 300 gross-ton class pusher barges from 1991 to 2005, and as a chief or second officer on 499 to 800 gross-ton class cargo ships since 2005. Since February 12, 2009, Officer B had served as the chief officer of Ship B. Officer B had conducted the watchkeeping 20 to 30 times on the East Route.

Officer B never drinks alcohol on voyages, and his health conditions were good.

2.6 Vessel Information

2.6.1 Particulars of Vessel

(1) Ship A

IMO number: 9228629

Port of registry: Panama City, Republic of Panama

Owner: ASIA SHIPPING NAVIGATION S.A. (Republic of the Philippines)

Management company: BLUE MARINE MANAGEMENT CORP. (Republic of the Philippines)

Classification society : Nippon Kaiji Kyokai (NK)

Gross tonnage: 7,382 tons

L × B × D: 108.50 m × 20.00 m × 13.50 m

Hull material: Steel

Engine: One diesel

Output: 3,900 kW (Maximum and Continuous)

Propulsion: Single 4-blade fixed pitch propeller
Date of launch: June 2000
Use: Cargo ship
Number of persons on board: 17 (Nationality: Republic of the Philippines)

(2) Ship B

Vessel number: 135973
Port of registry: Kobe City, Hyogo Prefecture, Japan
Owner: Kotani Kaiun Co. Ltd. and Imoto Lines, Ltd.
Operator: Imoto Lines, Ltd.
Gross tonnage: 499 tons
L × B × D: 77.08 m × 13.00 m × 6.62 m
Hull material: Steel
Engine: One diesel
Output: 1,765 kW (Maximum and Continuous)
Propulsion: Single 4-blade fixed pitch propeller
Date of launch: November 2000
Use: Container ship
Capacity of persons on board: 5 crews and two persons, 7 in total

(Refer to Figure 6: General Arrangement Plan of Ship A and Figure 7: General Arrangement Plan of Ship B)

2.6.2 Loading Conditions

(1) Ship A

According to the oral statements from Master A, Ship A was loaded with 47,441 m³ of timber for plywood. The draft was 6.18 m bow and 6.64 m aft.

(2) Ship B

According to the oral statements from Officer B, Ship B was loaded with six 20-foot containers weighing 65 tons in total. The draft was 2.80 m bow and 3.40 m aft.

2.6.3 Navigation Equipment

(1) Ship A

According to the oral statements from Master A, Ship A was equipped with two radars, a GPS plotter, VDR, AIS and VHF.

There were no defects in the hull or the engine.

(2) Ship B

According to the oral statements from Officer B, Ship B was equipped with two radars, a GPS plotter and VHF. There were no defects in the hull or the engine.

The GPS plotter was installed adjacent to the chart table. Because the display of the GPS plotter was facing toward the bow, Officer B was operating while facing toward the stern.

Voices on VHF could be made well audible by adjusting the volume or squelch (a switch for suppressing noise).

Ship B was not equipped with AIS because Ship B belonged to the category of ships less than 500 gross tonnage, which are not obligated to be equipped with AIS.

2.6.4 Chart used in Ship A

According to the oral statements from Officer A, he plotted four positions on chart W1122 after the anchors were weighed up.

The times and positions plotted by Officer A are estimated, by overlapping the AIS records on the chart, as follows:

The 1st position is about 34°21.97'N 133°52.65'E, at 0604 hrs;

The 2nd position is about 34°22.50'N 133°52.90'E at 0609 hrs;

The 3rd position is about 34°22.80'N 133°52.95'E at 0611 hrs; and

The 4th position is about 34°22.98'N 133°52.87'E at 0613 hrs.

(Refer to Figure 5: Plots of estimated ship Positions (Close-up Part 3))

2.6.5 Data on Maneuverability characteristics of the vessels

(1) Ship A

According to the characteristics table of Ship A, the speed particular plate in the bridge and the oral statements from Master A, the maneuvering characteristics of Ship A were as follows:

{1} Speed

Dead Slow: 5.1 kn, Slow: 7.3 kn, Half: 9.9 kn, Harbor Full: 10.8 kn, and Navigation Full: 13.0 kn

{2} Turning ability at the speed of 9.4 kn

(a) At port turn (hard to port), the transfer: 0.10 M,⁷ the advance: 0.21 M,⁸ and the time taken to turn 90°: 1.4 minutes.

(b) At starboard turn (hard to starboard), the transfer: 0.09 M, the advance: 0.21 M and the time taken to turn 90°: 1.3 minutes.

{3} The time it takes to stop when the main engine: changed from half ahead to astern is 4.6 minutes, the distance: 0.38 M, and when the main engine: changed from slow ahead to astern, 2.6 minutes and 0.24 M, respectively.

{4} The minimum effective steerage: about 3 kn.

{5} The maximum rudder angle is 35°.

(2) Ship B

According to the results of sea trial, the speed of Ship B was as follows: 10.13 kn at 472 rpm, 12.59 kn at 595 rpm, 13.80 kn at 681 rpm and 14.18 kn at 710 rpm.

⁷ "Transfer" refers to the traversal distance of the center of gravity from the original course when the bow has accomplished a 90° turn away from the original course.

⁸ "Advance" refers to the forward distance of the center of gravity from the original position on the original course when the bow has accomplished a 90° turn away from the original course.

2.7 Weather and Sea Conditions

2.7.1 Weather Data

The data observed from 0500 hrs to 0700 hrs by the Tadotsu Regional Observation Post located at about 10 M south-west from the site of the accident was as follows:

At 0500 hrs, the weather was rain, the wind was 2.0 m/sec north, and the visibility: 4.13 km;

At 0600 hrs, the weather: rain, the wind: 1.6 m/sec west-north-west, and the visibility: 13.4 km;

At 0700 hrs, the weather: rain showers, the wind: 2.2 m/sec south-west, and the visibility: 21.4 km.

2.7.2 Observation by the Crew

(1) Ship A

According to the oral statements from Master A, it was raining slightly, the visibility was good, and the tidal current was flowing westward.

(2) Ship B

According to the oral statements from Officer B, it was cloudy, the visibility was over 6 M, the wind was 7 m/sec west, wave height was about 0.5 m, and tidal current was 1 kn against.

2.7.3 Time of Sunset and Sunrise

According to the nautical almanac published by the Japan Coast Guard, the times of the sunrise around Sakaide Port on February 20, 2009, were as follows: 0646 hrs at Mizushima Port, Okayama Prefecture; and 0644 hrs at the Takamatsu Port, Kagawa Prefecture.

2.7.4 Tidal Current

The tidal current at Bisan Seto on February 20, 2009 was as follows: at 0353 hrs, westward 1.3 kn; at 0721 hrs, the turned tide was turning, and at 0952 hrs, eastward 0.7 kn.

2.8 Characteristics of the Area

According to the Sailing Directions for the Seto Naikai by the Japan Coast Guard, the characteristics of the area where the accident occurred are as follows:

In Seto Naikai are dotted various small and large islands, sunken rocks and many narrow channels with swift tidal current, further fogs frequently occur. In such circumstances, many vessels sail both for coastal and international shipping and fishery and marine leisure activities are also busy, therefore there are many casualties of vessels (collision and grounding etc.) in Seto Naikai compared to Tokyo Bay, Ise Bay and other sea areas. According to statistics for between 1998 and 2002, every year, the number of collisions or groundings in Seto Naikai reported to the Japan Coast Guard accounted for 30 % of the total number of the marine accidents in Japan. During the five years, about 440 ships on average were involved in such accidents annually.

2.9 Safety Guidance for Crew

2.91. Ship A

According to the oral statements from the representative of the agent office in charge of cargos to Marugame Port, the representative provided safety information as follows:

{1} Ship A, while scheduled to arrive 0630 hrs, February 20, was advised in an e-mail by the representative to temporary anchor in the Quarantine Anchorage or to enter the port later than the scheduled time, because it was the first time for Ship A to enter the port, and entering in the dark is not safe. Following the advice, Ship A anchored at the Quarantine Anchorage at about 2310 hrs

February 19.

{2} The representative, in order to guide the course from the Quarantine Anchorage to Marugame Port, sent an e-mail showing an approximate course from the Quarantine Anchorage to the East Route and a course from the East Route to Marugame Port that crosses the East Route center line, runs westward by the East Route, then runs southward with the Ushi Shima island on the port side, and enters Marugame Port. The email was attached with a copy of the chart on which the course was plotted.

{3} The representative also informed that ships should inform the BISAN MARTIS three hours prior to entering the East Route.

{4} The agent office handles, every month, about five ships entering Marugame Port. Two to three of them temporary anchored the Quarantine Anchorage.

2.9.2 Ship B

(1) Guidance from the Operator

According to the oral statements from Officer B, the operator had given an instruction to inform the BISAN MARTIS before entering the routes, when the Ship was scheduled to do so.

(2) The relevant articles and terms in Ship B's safety codes

Ship B's safety management manual are as follows:

Chapter 12 Inspection and Management of Transport facilities

Article 36 Confirmation of the Ship Inspection Results

The operator and the owner of a ship should confirm that the ship has received and passed the ship inspections obligated by laws and regulations and that the ship has no defects in operations.

Article 37 Inspection and Management of Ship

The ship master should keep a record book of engine checks, ship facilities and apparatuses, and inspect those at least once a day in line with the book. The ship master may skip the items checked before departure on the same day.

2 When abnormalities are found in an inspection, the ship master should immediately report a summary of the abnormalities to the operator and the owner, and take actions for repair.

3 The owner, upon receiving the report described in the previous paragraph, should inform the parties concerned of the situation, and request comments on the repairs taken by the crew or on the recovery and maintenance actions. The operator should supervise the comments and actions.

2.10 Situations in the BISAN MARTIS

The situations at the time of the accident are described below in 2.10.1 and 2.10.2. The present situations are different from those described below, as a result of modifications made on July 1, 2010, following the enforcement of the amended Act on Port Regulations and the amended Maritime Traffic Safety Act (refer to 6.2 and 6.4).

2.10.1 Services and Operations

The Vessel Traffic Service Centers are organizations of the Japan Coast Guard and

provides 24-hour services of traffic control and navigation information. They locate throughout Japan, in Tokyo Bay, Ise Bay, Nagoya Port, Osaka Bay, Bisan Seto, Kurushima Strait and Kanmon Strait. It is called MARTIS, which is an abbreviation for Marine Traffic Information Service.

At the time of the accident, the BISAN MARTIS was classified by the Radio Act as a ground station for radio navigation, where the services via VHF were limited to providing information on movements of ships. The BISAN MARTIS was prohibited from giving instructions for navigation.

The BISAN MARTIS had prepared leaflets in Japanese and English to publicly announce to the ships navigating through the Bisan Seto Sea Area that the MARTIS is in charge of traffic control of ships belonging to the category of large vessel in the Maritime Traffic Safety Act, and in addition provides navigation information by radio broadcasting, VHF, AIS messaging, signals by electronic signboard, telephone, fax and the internet. In the leaflet, the BISAN MARTIS announced that it provides, as Information Service, information such as navigation rules, movement of other vessels and advice for safety navigation, and as Navigational Control, it handles pre-entry reports and position reports from ships.

Refer to Figure 8 for radar service area and position report lines of BISAN MARTIS.

2.10.2 Situations of Operations

According to the operator in charge of the BISAN MARTIS, the situations of operations were as follows:

(1) Traffic Monitoring

{1} Eight VTS operators are serving. Of the eight, six operators are on watch duty on a steady basis. The watch area is divided up and a section is assigned to each operator. When risk of collision exists, the operators exchange necessary information with vessels.

{2} Whether there is risk of collision or not is judged from the courses and the speed vectors attached to the ship images on the radar screen.

{3} The watch duty of 0900 to 1700 hrs is handed over at 0840 hrs from the previous duty and at 1640 hrs to the next duty.

{4} When ships heave up anchors at the Quarantine Anchorage, they generally inform the MARTIS that they have done so.

(2) Operation volume of VTS operators

According to the statistics of vessels going through Bisan Seto in FY 2007, 845 ships passed through the east area and 653 ships through the west area of Bisan Seto.

The number of the passing vessels which submitted information to the MARTIS in FY 2008 was 138 per day on average, and about 50,000 annually.

(3) English conversation capability

The BISAN MARTIS has prepared book of English terms for VTS operation, and has been using them as a training material for new operators. In addition, all the officers are required to attend an English conversation training course once a week (about 60 minutes per lecture, held regularly from the start of September to the end of January). Regarding regular conversation and provision of information, there are no problems in English capability.

2.11 Relevant Information

2.11.1 The Maritime Traffic Safety Act

(1) The Maritime Traffic Safety Act stipulates the general rules for navigation in traffic routes as follows:

Article 3 When a vessel is entering into a traffic route, going out of a traffic route, crossing a traffic route or not navigating along a traffic route (except a vessel engaged in fishing and a vessel restricted in her ability to maneuver), so as to involve risk of collision with a vessel navigating along the traffic route, the former vessel shall keep out of the way of the latter. In this case, the provisions of paragraph 2 of article 9, paragraph 1 of article 12, paragraph 1 of article 13, paragraph 1 of article 14, the first sentence of paragraph 1 of article 15 and paragraph 1 (limited to item 4) of article 18 of the Act on Preventing Collisions at Sea are not applied to that latter vessel.

Paragraph 2 and 3 (omitted)

(2) According to Appended Table 2 of the Maritime Traffic Safety Act Ordinance for Enforcement, vessels leaving the Sakaide Port Area and then entering the East Route to proceed westward along the route shall, by day, raise the first substitute of the international maritime signal flags with letter flag C attached below, and, by night, sound four prolonged blasts.

2.11.2 Sailing Directions for Seto Naikai

The Sailing Directions for Seto Naikai, published by the Japan Coast Guard, provide navigation guidance as follows:

Part 2 Traffic Route

Chapter 2 Harima Nada Sea to Kurushima Strait

Guidance for Safe Navigation

1 to 8, omitted

9 Communications with the Bisan Seto Traffic Advisory Service Center

(1) and (2), omitted

(3) Vessels equipped with VHF should keep a watch on CH16 (156.8MHz) while navigating within the radar service area, as information may be provided by the Bisan Seto Traffic Advisory Service Center.

And in case of confused communication, vessels which equipped with CH13, as well as CH16, providing for need of call from Center.

10 Marine Traffic Information: All vessels navigating are recommended to make use of the following traffic information, and taking early action to avoid dangerous situation.

(1) Information service by the Bisan Seto Traffic Advisory Service Center

(a) to (f), omitted

(g) Warning

Contents: The Bisan Seto Traffic Advisory Service Center will call up a vessel by VHF or telephone when she is in the course of collision with another vessels or some danger is expected.

11, omitted

12 Navigation of foreign flag vessel: Foreign flag vessels should obey and grasp the following items when navigating in Seto Naikai.

(1) Enforcement of the basic items such as proper watch, confirmation of vessel position and watch on VHF.

(2) to (4), omitted

2.11.3 International Trends in VTS

The international trends in VTS are shown below, of which a part related to the use of message markers has been reflected in the amendment of the amended Act on Port Regulations and the Maritime Traffic Safety Act enforced on July 1, 2010. Chapter 6 of this report, entitled Actions Taken, will describe such items.

(1) The International Convention for the Safety of Life at Sea 1974,⁹ states the following in Regulation 12, entitled Vessel Traffic Services, of Annex Chapter V (Safety of Navigation):

Regulation 12 Vessel Traffic Services

1. *Vessel traffic services (VTS) contribute to safety of life at sea, safety and efficiency of navigation and protection of the marine environment, adjacent shore areas, work sites and offshore installations from possible adverse effects of maritime traffic.*
2. *Contracting Governments undertake arrangements for the establishment of VTS where, in their opinion, the volume of traffic or the degree of risk justifies such services.*
3. *Contracting Governments planning and implementing VTS shall, wherever possible, follow the guidelines¹⁰ developed by the Organization. The use of VTS may only be made mandatory in sea areas within the territorial seas of a coastal State.*

4 and 5 are omitted

(2) Guidelines for VTS provided in the IMO Assembly Resolution A.857 (20)

IMO Resolution A.857(20), Annex 1 provides guidelines as follows:

{1} A VTS authority should take into account the legal implications in the event of a shipping accident where VTS operators may have failed to carry out their duty competently.

{2} When the VTS is authorized to issue instructions to vessels, these instructions should be result-oriented only, leaving the details of execution, such as course to be steered or engine maneuvers to be executed, to the master on board the vessel. Care should be taken that VTS operations do not encroach upon the master's responsibility for safe navigation, or disturb the traditional relationship between master and pilot.

{3} Decisions concerning the actual navigation and the maneuvering of the vessel remain with the master.

{4} In conjunction with the IALA/VTS Manual,¹¹ IMO Standard Marine Communication Phrases should be used where practicable.

{5} Details of the VTS service should be published in the "World VTS Guide."¹²

⁹ "SOLAS Convention" is the abbreviation for "The International Convention for the Safety of Life at Sea." The Convention states technical standard requirements for hull structures, life-saving appliances, radio communications, safe navigation, carriage of special cargoes, carriage of dangerous goods, management for the safe operation of ship and measures for maritime security. The first version of the Convention was adopted in 1914 in response to the sinking of the RMS Titanic on April 14, 1912. After several amendments, the current version is SOLAS 1974, which was adopted on November 1, 1974, and took effect on May 25, 1980.

¹⁰ An explanatory note, "Refer to the 'Guidelines for Vessel Traffic Services' adopted by the organization (IMO) in resolution A. 857(20)," is attached.

¹¹ "IALA/VTS Manual" refers to the VTS manual published by the International Association of Marine Aids to Navigation and Lighthouse Authorities.

¹² "World VTS Guide" is material publicized by IALA that introduces VTS services and operations around the world.

(3) IALA/VTS Manual

The objective of the manual is to recommend the concrete operational procedures derived from IMO Assembly Resolution A.857(20), “Guidelines for Vessel Traffic Services,” mentioned above, and is aimed at the persons who are in any way involved with the policy for provision, operation and effectiveness of VTS.

As for the operational procedures of VTS, the manual describes as follows:

{1} The fundamental principle of VTS communications should be result-oriented. The execution, such as courses to be steered or engine maneuvers to be ordered, remain the responsibility of the person on board accountable for navigational decision making at that time.

{2} Messages to be transmitted should include one of the Message Markers. It is at the discretion of the shore personnel or the ship's officer whether to use one of the message markers and, if so, which marker is applicable to the situation. If used, the message marker is to be spoken preceding the message. The messages directed to a vessel should be clear; IMO Standard Marine Communication Phrases should be used.

(4) IMO Standard Marine Communication Phrases

The IMO Standard Marine Communication Phrases was adopted as resolution A.918 (22), based on the concept that the standardized words and terms in communication assist in the greater safety of navigation and of the conduct of the ship.

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978 (as amended) (STCW Convention) requires officers in charge of a navigational watch to be capable of understanding and using the IMO Standard Marine Communication Phrases, as the minimum standard of competence for English capability.

The message markers such as “INSTRUCTION,” “ADVICE,” “WARNING,” and “INFORMATION,” are defined as standard communication phrases used in VTS operations to guide participating vessels, as follows.

(a) INSTRUCTION

This indicates that the following message implies the intention of the sender to influence others by a Regulation.

Comments: This means that the sender, e.g. a VTS Station or a naval vessel, must have full authority to send such a message. The recipient has to follow this legally binding message unless he/she has contradictory safety reasons which then have to be reported to the sender.

Example: “INSTRUCTION. Do not cross the fairway.”

(b) ADVICE

This indicates that the following message implies the intention of the sender to influence others by a Recommendation.

Comments: The decision whether to follow the ADVICE still stays with the recipient. ADVICE does not have to be followed but should be considered very carefully.

Example: “ADVICE. (Advise you to) stand by on VHF Channel six nine.”

(c) WARNING

This indicates that the following message implies of the sender to inform others about

danger.

Comments: This means that any recipient of a WARNING may pay immediate attention to the danger mentioned. Consequences of a WARNING will be up to the recipient.

Example: "WARNING. Obstruction in the fairway."

(d) INFORMATION

This indicates that the following message is restricted to observed facts, situations, etc.

Comments: This marker is preferably used for navigational and traffic information, etc. Consequences of INFORMATION will be up to the recipient.

Example: "INFORMATION. MV No name will overtake to the west of you."

Beside those mentioned above, "QUESTION," "ANSWER," "REQUEST" and "INTENTION" are included in the Message Markers.

Around the time of the accident, the BISAN MARTIS had not adopted the IMO Standard Marine Communication Phrases, and had not been providing information services using message markers preceding the message. The World VTS Guide provides the latest information because those services are used by vessels around the world. The guide book stated that the BISAN MARTIS provided an "Information Service."

3 ANALYSIS

3.1 Situations of the Accident Occurrence

3.1.1 Time Line of the Accident

According to 2.1, it is considered probable as follows:

(1) Ship A

{1} At about 0600 hrs, February 20, Ship A heaved up anchor at the Quarantine Anchorage and left there for Marugame Port. At about 0602.00 hrs, Ship A put the main engine to half ahead. At about 0610.01 hrs, Ship A was proceeding with a heading of 017°, COG of 016.7° and speed of 8.8 kn.

{2} At about 0610.05 hrs, Ship A put the main engine to slow ahead. At about 0610.09 hrs, Ship A was proceeding with a heading of 015°, COG of 019.2°, and speed of 8.7 kn.

{3} At about 0611.01 hrs, Ship A was proceeding with a heading of 337°, COG of 356° and speed of 7.1 kn. At about 0611.50 hrs, Ship A was proceeding with a heading of 325°, COG of 332° and speed of 6.6 kn.

{4} At about 0612.10 hrs, Ship A put the main engine to dead slow ahead and then at 0612.12 hrs to harbor full ahead. At about 0612.20 hrs, Ship A was proceeding with a heading of 319°, COG of 320° and speed of 7.1 kn. At about 0613.00 hrs, Ship A was proceeding with a heading of 317°, COG of 313° and speed of 7.9 kn.

{5} At about 0613.20 hrs, Ship A put the main engine to slow ahead. At about 0613.29, Ship A was proceeding with a heading of 319°, COG of 311° and speed of 8.3 kn.

{6} At about 0614.40 hrs, Ship A put the main engine to harbor full ahead. At about 0615.10 hrs, with a heading of 319°, COG of 288 and speed of 7.9 kn, Ship A collided with Ship B.

(2) Ship B

{1} At about 0608 hrs, Ship B was proceeding with a COG of 055° and speed of 12.1 kn.

{2} At about 0610 hrs, Ship B altered her course along the route, and then changed to autopilot. At about 0612 hrs, Ship B was proceeding on autopilot with a COG of 067° and speed of 12.7 kn.

{3} At about 0615 hrs, with a COG of 070° and speed of 12.7 kn, Ship B collided with Ship A.

(3) Situations of Closing

According to 2.1, between 0608 hrs and 0610 hrs, the relative compass bearing from each of the ships showed no significant changes, and between 0610 hrs and 0613 hrs showed a change of about 5°. Between 0613 hrs and 0614 hrs, when both the ships came close to each other, the relative bearing changed by 4°. Because Ship A was approaching toward the bow of Ship B, taking into consideration the sizes of the ships and that it was in the dark of night, both the ships were in a situation where risk of collision existed.

3.1.2 Time, Date and Location of the Occurrence of the Accident

According to 2.1, it is considered probable that the accident occurred at about 0615 hrs based on the AIS record of Ship A, when the heading had changed from 309° to 319° and the speed had been reduced.

It is considered probable that the time of the occurrence was about 0615 hrs, February 20, 2009, and based on the AIS record at the time, the location was 34°23.1"N 133°52.5"E (around 062° 2,300 m from the Kosei Shima Lighthouse).

3.1.3 Situation of Collision

It is considered probable that, because according to 2.1, 2.3 and 3.1.2 the heading of Ship A was 319° and the COG of Ship B was 070° at the time of the collision, the port stern of Ship A and the bow of Ship B collided at an angle of about 70° from the port of Ship B.

3.2 Causal Factors of the Accident

3.2.1 Crew

According to 2.5 (1), Master A and Officer B had legal and valid an Endorsement attesting the issue of a certificate under STCW regulation I /10 and a certificates of competency, respectively.

3.2.2 Ship Condition

According to 2.6.3, it is considered probable that the hulls, main engines and equipment of both the ships had no defects or malfunctions.

3.2.3 Weather and Sea Condition

According to 2.7, it is considered probable that the weather was cloudy or raining, the wind was west to west-north-west, wind force 2 to 4 and the visibility was about 6 M.

3.2.4 Lookout and Ship Maneuvering

Judging from 2.1, 2.6.4, 2.11 and 3.1.1, it is considered probable that the following occurred:

(1) At about 0608 hrs

Officer B, sighted the two masthead lights and the port side light of Ship A on the starboard bow, and confirmed by radar that Ship A was proceeding North-Eastward along the coast line and was at a distance of about 3,000 m away. Officer B, thought that Ship A was going faster than Ship B and assumed that it would enter the East Route ahead of Ship B and proceed eastward.

(2) At about 0609 hrs

{1} Officer A plotted the second position on the chart, and then reported to Master A that the next planned course was 339°.

{2} Master A did not alter the course to 339°, instead, he held the main engine at half ahead and let the ship proceed with a heading of 017° and speed of 8.7 kn.

(3) At about 0610 hrs

Master A sighted the two masthead lights and the starboard side light of Ship B on the port about 2.600m and noticed that Ship B was proceeding by the East Route. Master A thought that Ship A would not make the way, and in order to reduce the speed, ordered the main engine to slow ahead. Then, intending to pass Ship B starboard to starboard, he began a port turn to change the course to 339°, and Ship A proceeded at speed of 8.1 to 8.8 kn.

(4) At about 0611 hrs

{1} Officer A plotted the third position on the chart and noticed that Ship A was off the planned course by about 350 m to the east. Officer A did not report this fact to Master A. Furthermore, Officer A did not assess the situation of the surrounding area.

{2} Master A let the ship proceed with a heading between 325° and 337° and a speed of 6.5 to 7.1 kn.

(5) At about 0612 hrs

{1} Officer B, assumed that Ship A would enter the East Route ahead of Ship B and proceed eastward, so he operated the GPS plotter to confirm the next way point and also to become familiar with how to operate it, while facing toward the stern. Officer B continued these operations until just before the collision.

{2} Master A ordered the main engine to dead slow ahead in order to let Ship B pass ahead of Ship A, but two seconds later, intending to pass by the stern of Ship B, ordered the main engine to harbor full ahead, and changed the course to about 330° and then to about 315°.

{3} Both the ships came close to each other, reaching a distance of less than 1,840 m. Ship A was

proceeding with a course of 317° to 319° and speed of 7.1 to 7.7 kn. Ship B was proceeding on autopilot, maintaining a course of about 067° and speed of about 12.7 kn until the time of the collision.

(6) At about 0613 hrs

{1} Master A kept proceeding with a course of 315° and speed of about 8 kn, intending to pass by the stern of Ship B. However, the compass bearing of Ship B from Ship A was changing to the left, which meant that Ship A was approaching toward the bow of Ship B.

{2} Ship A responded to information provided by the BISAN MARTIS, “Will proceed slowly,” and put the main engine to slow ahead in order to reduce the speed. However, the speed of Ship A actually showed no decrease and continued at about 8 kn until the collision. At about the same time that the reply was made, Officer A plotted the fourth position of the ship positions on the chart.

(7) At about 0614 hrs

Both the ships came close to each other, reaching a distance of about 770 m. The speeds of Ship A and of Ship B were about 8 kn and 12.7 kn, respectively.

(8) At about 0615 hrs

The distance between the ships decreased to about 200 m. Master A, concerned because Ship B was approaching and turned to starboard, ordered the main engine to harbor full ahead, intending to increase the rudder effectiveness, and ordered the rudder hard to starboard, in order to clear Ship B. On the other hand, Officer B, when he turned toward the bow and looked out, noticed that Ship A was approaching. Officer B put the helm hard to starboard and stopped the main engine, but the ships collided with each other.

3.2.5 Analysis of Actions to Avoid Collision

According to 2.1, 2.6.4 and 3.1.1, it is considered probable as follows;

(1) Ship A, sighting Ship B and in order to avoid a collision, turned to port and raised or decreased the speed while navigating, first intending to pass starboard to starboard, and then intending to pass by the stern of Ship B.

(2) Master A, until about 2 minutes before the collision, was maneuvering the ship while keeping a lookout and operating the engine telegraph. Since about 2 minutes before the collision, Master A was conning the ship on the left wing. Therefore, Master A did not confirm by the radar or other available means the changes in the compass bearing of Ship B and that Ship B was approaching. As a consequence, Master A had let Ship A proceed without noticing that the relative compass bearing of Ship B from Ship A had changed to the left before the collision, that Ship A was approaching toward the bow of Ship B, and that as a result Ship A was in such a situation as to involve risk of collision. Therefore, Ship A did not take action to keep out of the way of Ship B.

(3) Ship B sighted Ship A on the starboard bow, observed Ship A with radar and thought that Ship A was proceeding north-eastward along the coast line at a speed faster than that of Ship B; assumed that Ship A would enter the East Route ahead of Ship B and proceed eastward along the route; while facing the stern, continued to operate the GPS plotter to confirm the way points or become familiar with how to operate it; and held the course and the speed by autopilot without keeping lookout, until just before the collision.

3.2.6 Navigational Rule

According to 2.1, 2.11.1 and 3.2.4, the following is considered probable:

- (1) It is considered probable that Ship A, which was navigating to enter the East Route from the south of the route, was approaching toward the bow of Ship B, which was proceeding eastward along the East Route, so as to involve risk of collision. Therefore, it is also considered probable that, as both the ships were in an area in which the Marine Traffic Safety Act is applied, Ship A was obligated to keep out of the way of Ship B according to Article 3, Paragraph 1 of the Act. It is considered probable that both the ships were in sight of one another.
- (2) It is considered probable that although Ship A, intending to pass by the stern of Ship B, turned to port and decreased or increased the speed, Ship A did not take action to keep out of the way of Ship B, because, as mentioned in 3.2.5, Master A had not noticed that Ship A was proceeding so as to involve risk of collision with Ship B.
- (3) It is considered possible that, if Ship A, which was entering the East Route, had taken a course to cross the route at a right angle, Ship B would not have assumed that Ship A was a vessel entering the East Route to proceed along the route.
- (4) It is considered possible that the fact that no route signals required by the Marine Traffic Safety Act Ordinance of Enforcement were blasted on Ship A, which was entering the East Route from the south due to Ship A's intention to proceed westward, was involved in the fact that Officer B thought that Ship A was entering the East Route to proceed eastward.
- (5) It is considered probable that, although Ship B was obligated to take actions of stand-on vessel under Article 17 of the Act on Preventing Collision at Sea pursuant to Article 40 of the same Act, Officer B did not take such action as would best aid to avoid the collision while facing the stern and operating the GPS plotter until just before the collision.

3.2.7 Communications between the BISAN MARTIS and Ships

According to 2.1.3, 2.10, 2.11.3, 3.2.4 and 3.2.5, the following is considered probable:

- (1) The BISAN MARTIS and Ship A
 - {1} The VTS operator of the BISAN MARTIS had kept track of Ship A anchored off Sakaide Port, both on the radar display and on the AIS display.
 - {2} At about 0550 hrs, the BISAN MARTIS received a report from Ship A via VHF that it had heaved up anchor at the Quarantine Anchorage to leave there for Marugame Port, and was informed that Ship A planned to enter the East Route. The BISAN MARTIS sent a message to Ship A to advise her to be careful of the movement of other ships when entering the route.
 - {3} At about 0613 hrs, the Bisan MARTIS judged that there was risk of collision between Ship A, entering the East Route, and Ship B, proceeding eastward along the route, and sent a message via VHF to Ship A that she should be careful of the ship approaching from the port side.
 - {4} On the receipt of the message, Master A understood that a ship was approaching Ship A, and then knew that it was Ship B, whose stern Ship A was passing. Then, Master A took actions to

reduce speed.

{5} The BISAN MARTIS, upon receiving the reply, “Will proceed slowly,” concluded that Ship A would avoid Ship B, which was proceeding on the route.

(2) The BISAN MARTIS and Ship B

{1} The VTS operator of the BISAN MARTIS, while capturing Ship B on the radar display, was not able to confirm the name or destination because Ship B was not equipped with AIS.

{2} Officer B did not hear the communications between the BISAN MARTIS and Ship A of about 0550 hrs and about 0613 hrs. In addition, Officer B did not hear the message in Japanese sent by the BISAN MARTIS at about 0614 to Ship B that the ship proceeding eastward off Sakaide should be careful of the crossing vessel. Although it is considered probable that Officer B did not hear the VHF communication because Officer B had been paying attention to the GPS plotter, the volume of the VHF was too low, the squelch was too strong, or the Officer was too far from the VHF, the reason has not been clarified.

{3} It was at about 0618 hrs, after the collision, when Officer B first heard the VHF communications and intercepted the English communications between the Japan Coast Guard and Ship A.

{4} Ship B was anchored off the route after the collision, following the direction via VHF of the Japan Coast Guard. Then, a Coast Guard patrol boat, which came close to Ship B, transmitted a message via VHF to Ship B stating, “Wait for a while for the officer in charge, who is coming in another patrol boat.”

Based on what is described above, it is considered probable that the BISAN MARTIS judged that Ship A and Ship B would involve risk of collision, and made communications to provide information.

Around the time of the accident, the BISAN MARTIS had not provided services following the international standards for VTS in compliance with the SOLAS Convention. It is considered possible that, if the communications such as those shown below had been executed in compliance with the international standards, Ship A would have taken actions to avoid collision. Therefore, it is desirable for the BISAN MARTIS to consider the adoption of the appropriate communication services for foreign-flag ships.

The desired communication would have been executed in the following manner:

{1} At about 0550 hrs (25 minutes before the collision), send a message via VHF as “INFORMATION” including the specific navigational rule for Ship A to follow, e.g. “INFORMATION, ships proceeding along a traffic route have priority. Sound four prolonged blasts prior to entering the route.”

{2} At about 0613 hrs, send a message via VHF to recommend Ship A to give way, in the form of “WARNING,” “ADVICE” or “INSTRUCTION.”

Ship B did not hear the VHF information. It is considered probable that, if Ship B had been prepared to monitor the information provided by the BISAN MARTIS via VHF within its radar service area, Ship B would have possibly taken actions to avoid the collision. Therefore, it is desirable for the BISAN MARTIS to consider effective way for VHF-equipped vessels to monitor

VTS information.

3.2.8 Watchkeeping Arrangement

Judging from 2.1, the watchkeeping on the bridges was as follows:

{1} Master A had assigned Officer A to ship's position fixing based on the consideration that the position fixing was critical because it was the first time for Master A to navigate from Sakaide Port to Marugame Port on the planned course, which enters the East Route, runs westward along the route, passes the intersection of the Bisan Seto North Traffic Route and the Mizushima Route, turns south off Ushi Shima Island and then crosses the Bisan Seto South Traffic Route. Therefore, it is considered probable that Ship A was short of persons who could engage in forward lookout by sight or monitoring radar.

As a result, it is considered probable that Master A was working alone on the whole of the navigational command, including lookout, VHF communication and telegraph operations, and proceeded without confirming the compass bearing or distance of Ship B.

It is considered possible that, if Master A had arranged the watchkeeping properly, such as to have the second officer, who was taking a rest, board the bridge and be assigned to lookout or radar monitoring, Ship A would have noticed the risk of collision with Ship B to avoid the accident. Therefore, it is considered somewhat likely that the fact that Master A did not arrange the watchkeeping properly such as by assigning persons dedicated to lookout or radar monitoring contributed to the occurrence of the accident.

{2} It is considered probable that, after the heaving-up of the anchor, Officer A went to the chart room separated by a curtain, plotted on the chart the ship's positions obtained from GPS, and reported them to Master A.

{3} Officer B, on bridge watchkeeping duty alone, sighted Ship A on the starboard bow at about 0608 hrs, observed by radar to ascertain the distance to Ship A and the course, and after that, operated the GPS plotter and let the ship proceed without keeping lookout. It is considered possible that, if the functions of the radar in use, such as to display the CPA or sound an alarm when a ship comes into a predefined range, had been effectively used, Officer B would have noticed that Ship A was getting close and would have avoided the collision.

According to what is described above, it is desirable to take actions for reinforcing the watchkeeping arrangement on the bridge, such as assigning persons to exclusively keep lookout or radar monitoring, in the case of navigating in a congested sea area, especially when master or duty officer is expected to have a heavy workload because he/she is navigating the ship on an unfamiliar course or is entering traffic routes.

As for the ships where such reinforcements of watchkeeping arrangement would be difficult, it is desirable to fully utilize the functions provided by radars or other available means.

3.2.9 Safety Management

According to 2.9, the following is considered probable:

(1) Ship A

{1} Ship A was scheduled to wait in the Quarantine Anchorage and enter Marugame Port the next

morning, because it was the first voyage in which Ship A would go from the Quarantine Anchorage to Marugame Port. Also, it was the first time to enter Marugame Port.

{2} Ship A's agent had informed Ship A of the course from the Quarantine Anchorage to Marugame Port using a chart on which the course was drawn.

{3} Ship A's agent had also informed Ship A that it was required to report to the BISAN MARTIS, three hours before entering the East Route.

(2) Ship B

{1} Although the operator had given an instruction that it is required to report to the BISAN MARTIS prior to entering the East Route, Ship B did not follow the instruction.

{2} The alignment of the GPS plotter in Ship B influenced the lookout, because it was placed on the left of the chart table in the port-back area of the bridge with the display facing the bow, hence forcing the operator to face away from the bow for operation.

According to Ship B's safety management manual, the operator and the owner should make sure that the ship has passed the ship safety inspection required by laws and regulations and that the ship is in a good condition for navigation, and the master should immediately inform the operator and the owner of any problems found in the inspection and take actions for rectifying the problems. The GPS plotter, which forced the operator to turn away from the bow as mentioned above, was not treated as a problem that interferes with navigation because, while it was an installation problem and could interfere with lookout, it was not a malfunction in itself.

According to what is mentioned above, it is desirable for the operator to find such facilities that can interfere with lookout, by, for example, inviting comments during a safety guidance visit to ships, and take actions to remove problems.

3.2.10 Occurrence of Accident

According to 2.1, 3.1.1 and 3.2.4 to 3.2.9, the situation leading to the accident was as follows:

(1) It is considered probable that Ship A, under the command of Master A, with Officer A and OS A assigned on the bridge, was proceeding northward to enter the East Route on the way from the Quarantine Anchorage to Marugame Port, that Ship B, with Officer B on bridge watchkeeping duty alone, was proceeding eastward along the East Route, and that both the ships collided with each other in the East Route.

(2) It is considered probable that, while Ship A was proceeding in the area south of the East Route, upon sighting Ship B on the port bow, Ship A changed the course to port and at the same time decreased or increased the speed, first intending to pass starboard to starboard, and then intending to pass by the stern of Ship B.

(3) Because it was Master A's first time to navigate from the Quarantine Anchorage to Marugame Port, and because Ship A's navigation plan was to enter the East Route, proceed westward along the route, turn to the south off Ushijima Island after passing the intersection of the Bisan Seto North Route and the Mizushima Traffic Route, and cross the Bisan Seto South Route, it is considered probable that Master A judged that it was critical to keep on monitoring the ship's position, and

therefore assigned Officer A to ship's position fixing, and OS A to the steering.

(4) It is considered probable that Master A, who, until about two minutes before the collision, was maneuvering the ship while keeping lookout and operating the telegraph, and who, since about two minutes before the collision, was maneuvering the ship on the left wing, was letting the ship proceed so as to involve risk of collision with Ship B without noticing that Ship A was approaching toward the bow of Ship B, because, although the compass bearing of Ship B from Ship A had shown changes to the left, Master A did not confirm by radar or other available means the changes in the compass bearing of Ship B, or the situation of approaching.

(5) It is considered probable that although Ship A, which was entering the East Route from outside so as to involve risk of collision with Ship B proceeding eastward along the route was obligated to keep out of the way of Ship B, Ship A kept proceeding as mentioned above in (4) and Ship A did not take actions to keep out of the way of Ship B. In addition, it is considered probable that Ship A did not blast the route signal although ships entering the East Route to navigate westward are obligated to do so.

(6) It is considered probable that, although, on the receipt of the message by the BISAN MARTIS two minutes before the collision that Ship A should be careful of the ship approaching on the port side, Ship A replied that he would proceed slowly and performed the engine operation for reducing speed, Ship A continued to proceed at a speed of about 8 kn until the collision without showing any reduction in speed.

(7) It is considered probable that, although Master A, concerned by Ship B's turning to starboard at such a short distance away, increased the speed in order to increase the rudder effectiveness, and then ordered the rudder hard to starboard, Ship A collided with Ship B.

(8) It is considered somewhat likely that the fact that Master A did not arrange the watchkeeping on the bridge properly in such a way as to assign dedicated persons to lookout or radar monitoring contributed to the occurrence of the accident.

(9) It is considered somewhat likely that the fact that Master A, while navigating Ship A to enter the East Route from the south and proceed westward along the route, did not blast the route signal was involved in the judgment of Ship B that Ship A was entering the East Route to proceed eastward along the route.

(10) It is considered probable that Ship B, proceeding eastward along the East Route, assumed that Ship A would enter the East Route ahead of Ship B and proceed eastward, because Officer B, after sighting Ship A on the starboard bow, noticed by radar observation that Ship A was 3,000 m away and proceeding north-eastward along the coast line, and in addition, assumed that Ship A was moving faster than Ship B.

(11) It is considered probable that, until just before the collision, Officer B was navigating on autopilot while holding the speed and course but not keeping lookout, and operating the GPS plotter while facing the stern in order to confirm the next way point and also to become familiar

with how to operate the GPS plotter.

(12) It is considered probable that, although the BISAN MARTIS, about one minute before the collision, sent a message via VHF that the ship proceeding eastward off Sakaide Port should be careful of the crossing vessel, Officer B did not hear the message, and it was not until after the occurrence of the accident that Officer B intercepted the VHF communications between the Japan Coast Guard and Ship A. The reason that Officer B did not hear the VHF communications has been unidentified.

(13) It is considered probable that, although Officer B put the helm hard to starboard and stopped the engine when he turned toward the bow and saw Ship A approaching, Ship B collided with Ship A.

(14) It is considered somewhat likely that if the radar functions fitted with Ship B, such as those to show the CPA or sound alarm when other ships come within a predefined range, had been effectively utilized, Ship B would have detected Ship A approaching, and the accident would have been avoided.

(15) It is considered probable that the BISAN MARTIS, upon judging that Ship A and Ship B would involve risk of collision, made VHF communications as information provision. It is considered somewhat likely that, if the BISAN MARTIS had made communications according to the International Standard for VTS in compliance with the SOLAS Convention, which had not been adopted by the BISAN MARTIS at the time, Ship A would have taken actions to avoid collision.

In addition, it is considered somewhat likely that, although Ship B did not hear the information via VHF, if Ship B had been prepared to monitor VHF to receive the information provided by the BISAN MARTIS while navigating in its radar service area, Ship B would have taken actions to avoid collision.

4 CONCLUSIONS

4.1 Findings

(1) It is considered probable that Ship A, proceeding from the Quarantine Anchorage to enter the East Route, sighted Ship B proceeding eastward along the route, took maneuvering actions including turning to port and decreasing or increasing speed with the intention of passing by the stern of Ship B, and did not keep out of the way of Ship B because Master A had not noticed that Ship A was proceeding in a situation where it was approaching the bow of Ship B so as to involve risk of collision with Ship B. In addition, it is considered probable that Ship A, while entering the East Route, blasted no route signals.

(2) It is considered probable that Ship B, proceeding eastward along the East Route, officer B

sighted Ship A on the starboard bow and assumed that Ship A would enter the East Route ahead of Ship B and proceed eastward along the route because Officer B thought that Ship A was proceeding north-eastward along the coast line at a higher speed than that of Ship B, and continued GPS plotter operations while facing the stern and proceeded on autopilot without keeping lookout but held the speed and course until just before the collision.

(3) It is considered probable that Ship A was proceeding with arrangements on the bridge whereby Master A was commanding the ship while also keeping lookout and telegraph operation, Officer A was confirming the ship's positions in the chart room separated with a curtain and reporting the planned course to Master A, OS A was assigned to the steering, and no persons were assigned to exclusively carry out lookout or radar monitoring, and that Master A let the ship proceed so as to involve risk of collision with Ship B because he had been in command while also keeping lookout and telegraph operations until about two minutes before the collision and then had been in command on the left wing without confirming the change of ship's compass bearing by radar or other available means.

(4) It is considered probable that Ship A received, two minutes before the collision, a message from the BISAN MARTIS informing that Ship A should be careful of the ship approaching from the port side, and that Master A, who had been maneuvering with the intention of passing by the stern of Ship B, replied that he would proceed slowly, and in order to reduce the speed ordered the main engine from harbor full ahead to slow ahead; however, the Ship continued proceeding at a speed of about 8 kn without showing any decrease in the speed.

(5) It is considered somewhat likely that the fact that Ship A did not make proper watchkeeping arrangements on the bridge, such as the assignment of persons dedicated to lookout or radar monitoring, contributed to the occurrence of the accident.

(6) Officer B did not hear the message via VHF from the BISAN MARTIS one minute before the collision informing that the ship proceeding eastward off Sakaide Port should be careful of the crossing ship. Although Officer B heard the message via VHF after the collision, the reason that he did not hear the message before the collision has not been identified.

(7) It is considered probable that the BISAN MARTIS judged that the ships would involve risk of collision and sent messages as information just before the accident. It is considered somewhat likely that if the BISAN MARTIS had sent messages following the international Standard Communication for VTS in compliance with the SOLAS Convention, which had not been adopted by the BISAN MARTIS, Ship A would have taken actions to avoid collision. It is considered somewhat likely that if Ship B, which was equipped with VHF, had been prepared to monitor information provided by the BISAN MARTIS via VHF while navigating in its radar service area, Ship B would have taken actions to avoid collision.

4.2 Probable Causes

It is considered probable that the accident, whereby Ship A, proceeding northward, and Ship B, proceeding eastward along the East Route, collided, occurred at night off Sakaide Port because Ship A was proceeding with the intention of passing by the stern of Ship B in a situation

where there was risk of collision with Ship B without noticing that Ship A was approaching ahead of Ship B, while Ship B was proceeding without keeping lookout.

It is considered probable that Ship A was proceeding without noticing that Ship A was approaching ahead of Ship B because Master A did not confirm the changes in the compass bearing of Ship B or not assess the situation where both the ships were approaching by radar or other available means.

It is considered somewhat likely that the fact that Ship A did not make proper watchkeeping arrangements on the bridge, such as the assignment of persons dedicated to lookout or radar monitoring, contributed to the occurrence of the accident.

It is considered probable that Ship B was proceeding without keeping lookout because Officer B continued operations of the GPS plotter assuming that Ship A was proceeding north-eastward along the coast line at a faster speed than that of Ship B and would enter the East Route ahead of Ship B.

5 SAFETY RECOMMENDATIONS

The accident occurred at night in the East Route off Sakaide Port, where MARINE STAR (hereinafter referred to as “Ship A”) was proceeding northward and TAKASAGO (hereinafter referred to as “Ship B”) was proceeding eastward along the East Route, when Ship A, although obligated to keep out of the way of Ship B proceeding along the route, was proceeding with the intention of passing by the stern of Ship B in a situation where there was risk of collision with Ship B, without noticing that Ship A was approaching ahead of Ship B. It is fortunate that the accident caused no severe pollution although the site of the collision is located in a key area for the transportation and fishing industries and is always congested with heavy vessel traffic.

The Japan Transport Safety Board, in view of the results of this accident investigation, recommends the Panama Maritime Authority, the ASIA SHIPPING NAVIGATION S.A. as the owner of Ship A and the BLUE MARINE MANAGEMENT CORP. as the management company of Ship A to take the following actions.

The Panama Maritime Authority should guide the ASIA SHIPPING NAVIGATION S.A. to have the BLUE MARINE MANAGEMENT CORP. execute proper ship management to secure safe operation.

The ASIA SHIPPING NAVIGATION S.A. should instruct the BLUE MARINE MANAGEMENT CORP. to follow the navigation rules of the state where vessel call, prepare a proper watchkeeping arrangement and ensure the safety of navigation.

The BLUE MARINE MANAGEMENT CORP. should provide clear and specific instructions on the rules that must be obeyed to the ships that navigate in this sea area, and at the same time guide the ships to ensure safety by reinforcing watchkeeping arrangements on the bridge through the measures including the increase of the number of crew on bridge watchkeeping duty.

6 ACTIONS TAKEN

6.1 Actions Taken after the Accident

(1) Actions taken by the BLUE MARINE MANAGEMENT CORP.

The BLUE MARINE MANAGEMENT CORP., further to the marine accident investigation report, accepted sufficiently and adhered to the safety recommendations, and as part of commitment of the company to facilitating the safe navigation and operation of their respective vessels within its management, have developed a Navigation Safety Policy:

{1} Develop and maintain an effective Safety Management System enabling to undertake and regulate marine operations in a way to safeguard all managed vessels operations and the environment.

{2} Provide the necessary training to ensure that bridge personnel are competent within the roles they are required to perform, and ensure sufficient resources are available to implement correct navigational procedures effectively.

{3} Disseminate any relevant navigational safety information to all managed vessels.

{4} Evaluate the safety performance through reporting systems contained within the Safety Management System, by constant visiting of ships by a superintendent to check and monitor the safety operations of the vessel. Ensuring that all respective vessel's Master are well disciplined and proficient for the task they are bound to perform when vessel in navigation.

{5} Constant reminders on Yearly Campaign on Major Incidents that includes collision and stranding accidents.

(2) Actions taken by Ship B

Ship B altered the GPS plotter installation to the front position so that the operator has a view toward the bow during the plotter operation.

6.2 The Act for Partial Revision of the Act on Port Regulations and the Marine Traffic Safety Act (Law No. 69, 2009), including provisions that advice may be provided to a vessel to obey navigation rules or to avoid dangerous situation, was promulgated on July 3, 2009, and has been enforced since July 1, 2010. According to the amendment, the BISAN MARTIS altered the information provision services in such a way that messages to vessels via VHF or telephone sent by the BISAN MARTIS, regardless of whether they are in Japanese or in English, use a message marker preceding the message (Public notice No. 168 of the Japan Coast Guard, July 1, 2010, "Public notice on the Aonoyama Vessel Traffic Signal Station operated by the Bisan Seto Traffic Advisory Service Center and the information service provided by the Center").

As for the message markers, IMO Standard Maritime Communication Phrases should be used in such a way that one of the following words is spoken preceding the message: {1} "INFORMATION," for providing information as to observed facts or situations; {2} "WARNING," for providing information related to any dangerous situation that may impede safe navigation of vessels; {3} "ADVICE," for providing advice to obey navigation rules or to avoid the dangerous situation; or {4} "INSTRUCTION," for instructing vessels to stand by outside the traffic route.

6.3 According to the amended Marine Traffic Safety Act, ships of 50 m and upwards in length are

required to monitor the messages provided by the MARTIS while navigating in specified traffic routes; Ship B, which is 77 m long, is required to monitor such messages.

6.4 For the successful enforcement of the amended Marine Traffic Safety Act, in April 2010, the Japan Coast Guard promoted public understanding of new maritime traffic rules and system by the utilization of its website, the brochure titled” New Rules for Maritime Traffic Safety” and others.

In addition, the BISAN MARTIS also promoted public understanding of the use of the message markers, obligation to monitor the messages provided by the MARTIS and others by measures such as provision of the USER MANUAL.

Figure 1: Plots of estimated Ship Positions (General View)

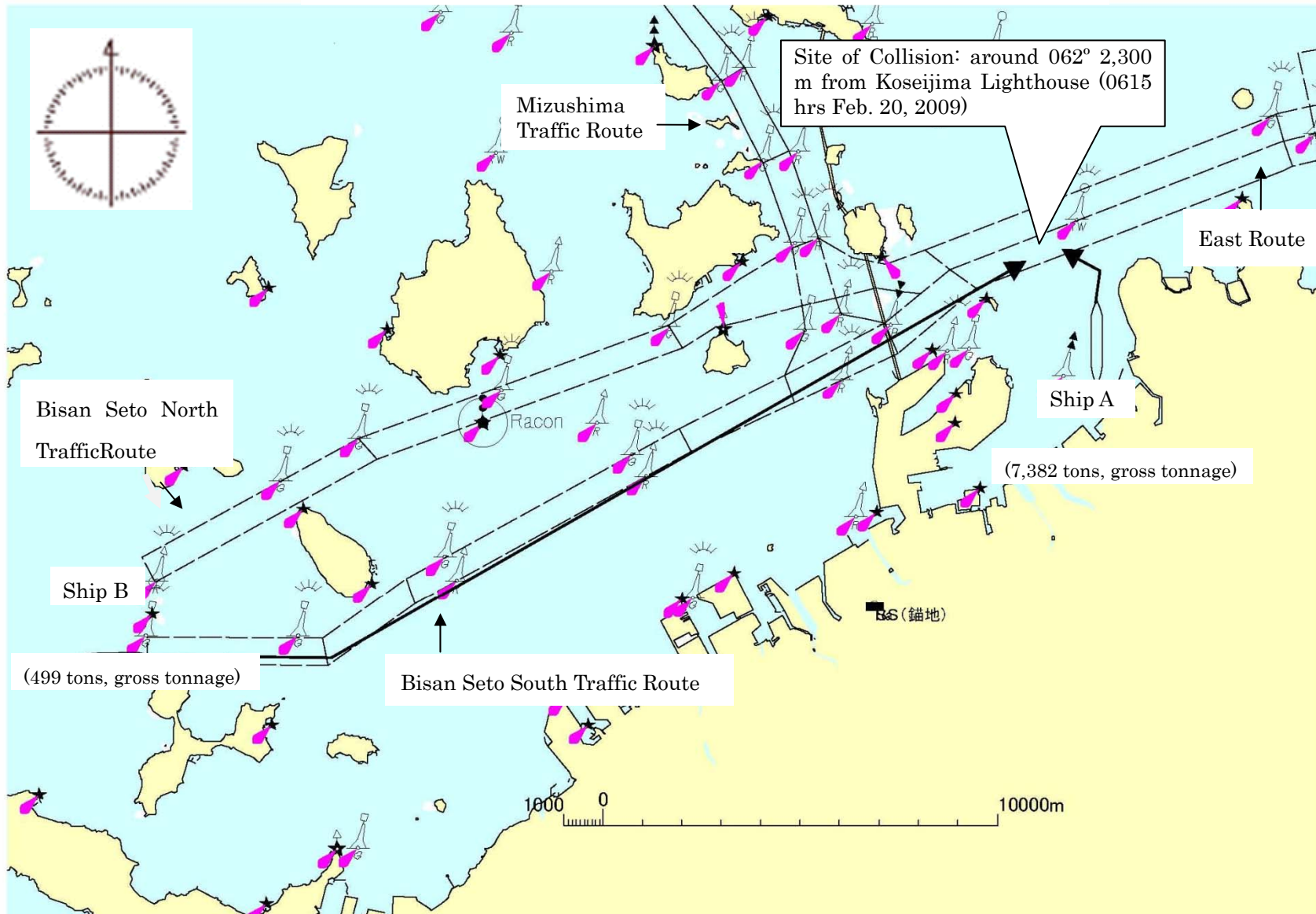


Figure 2: Plots of estimated Ship Positions (Close up Part 1)

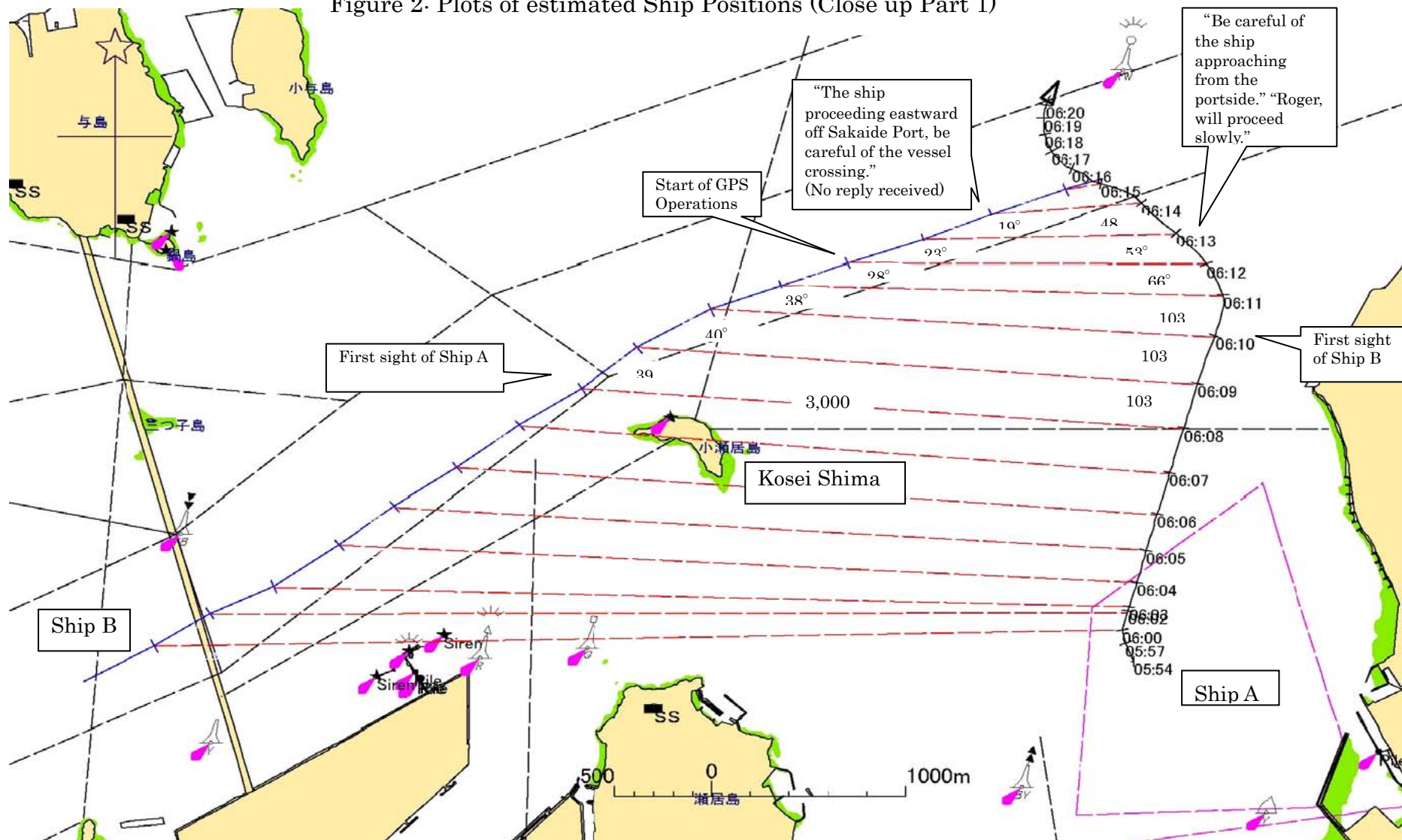


Figure 3: Plots of estimated Ship Positions (Close up Part 2)

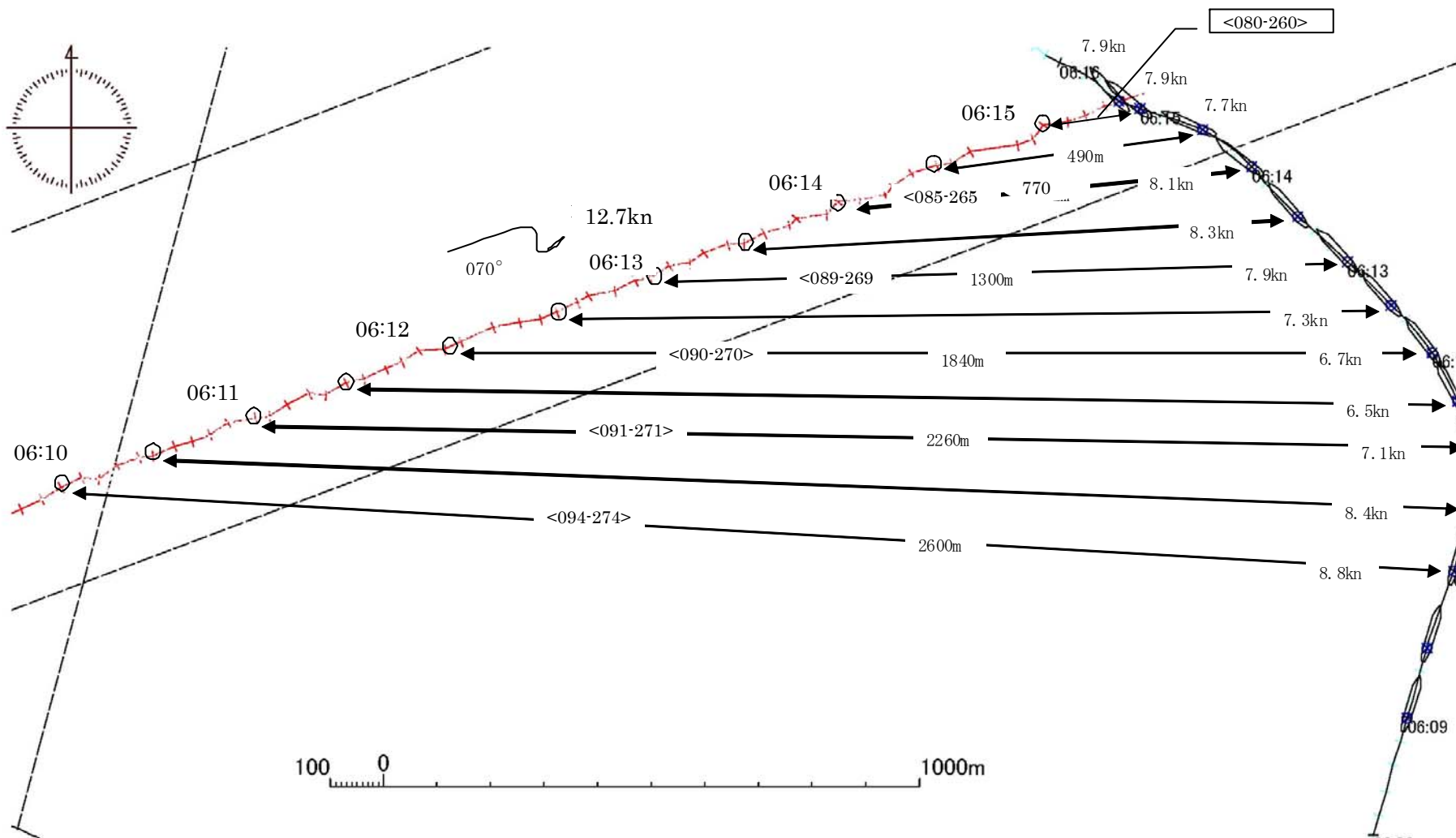


Figure 4: Chart used by Ship A

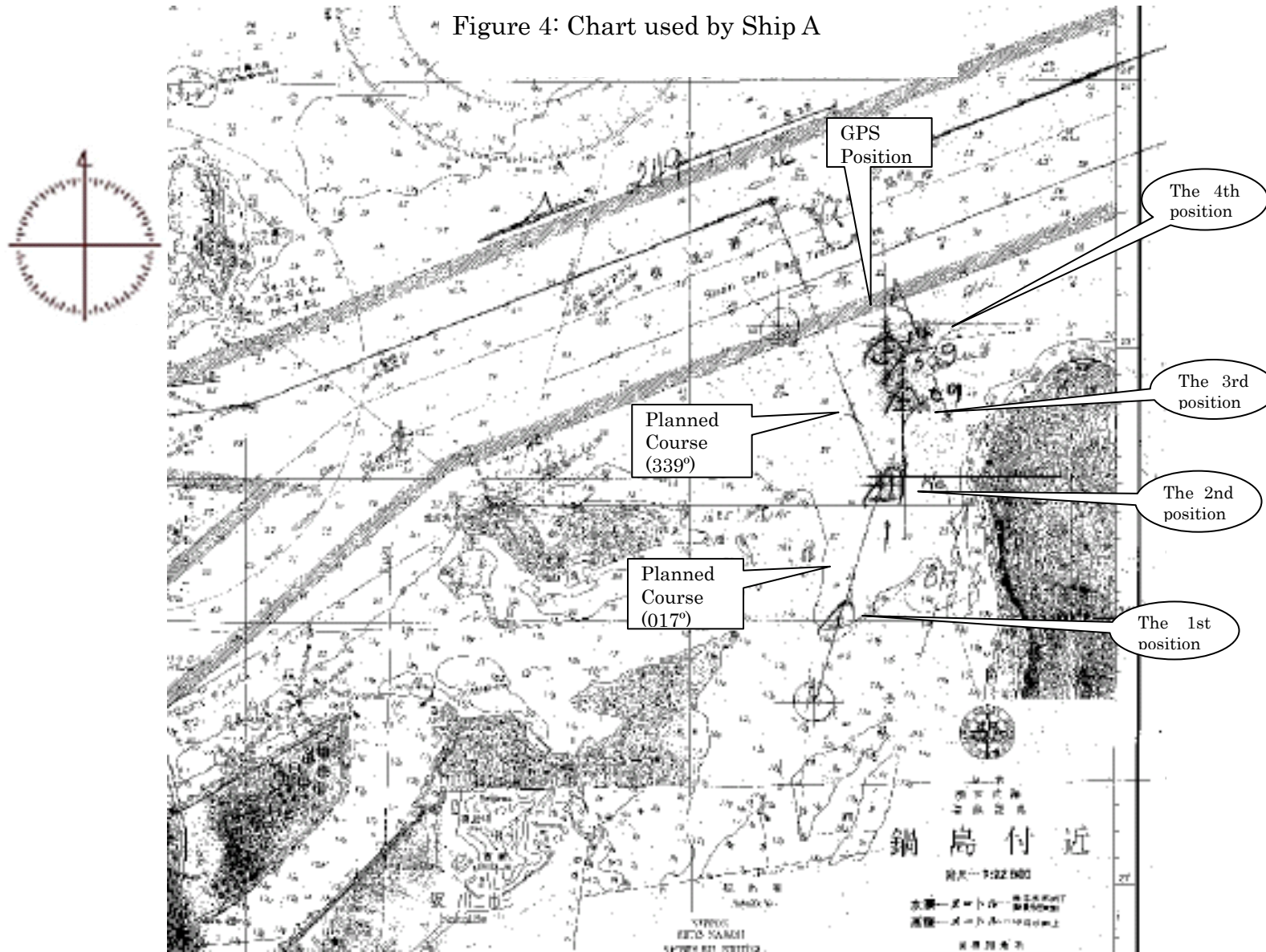


Figure 5: Plots of estimated Ship Positions (Close up Part 3)

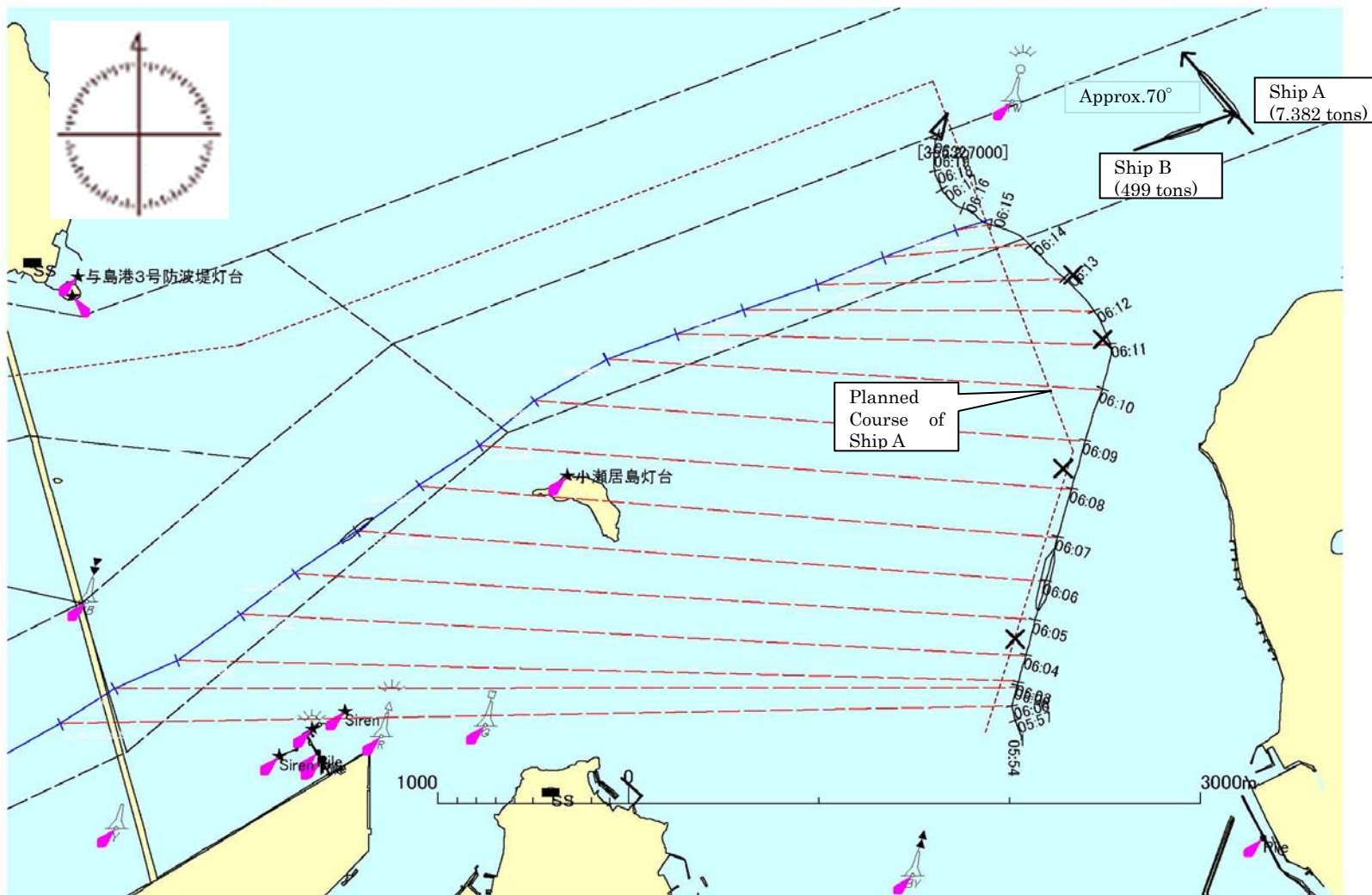


Figure 6: General Arrangement Plan of Ship A

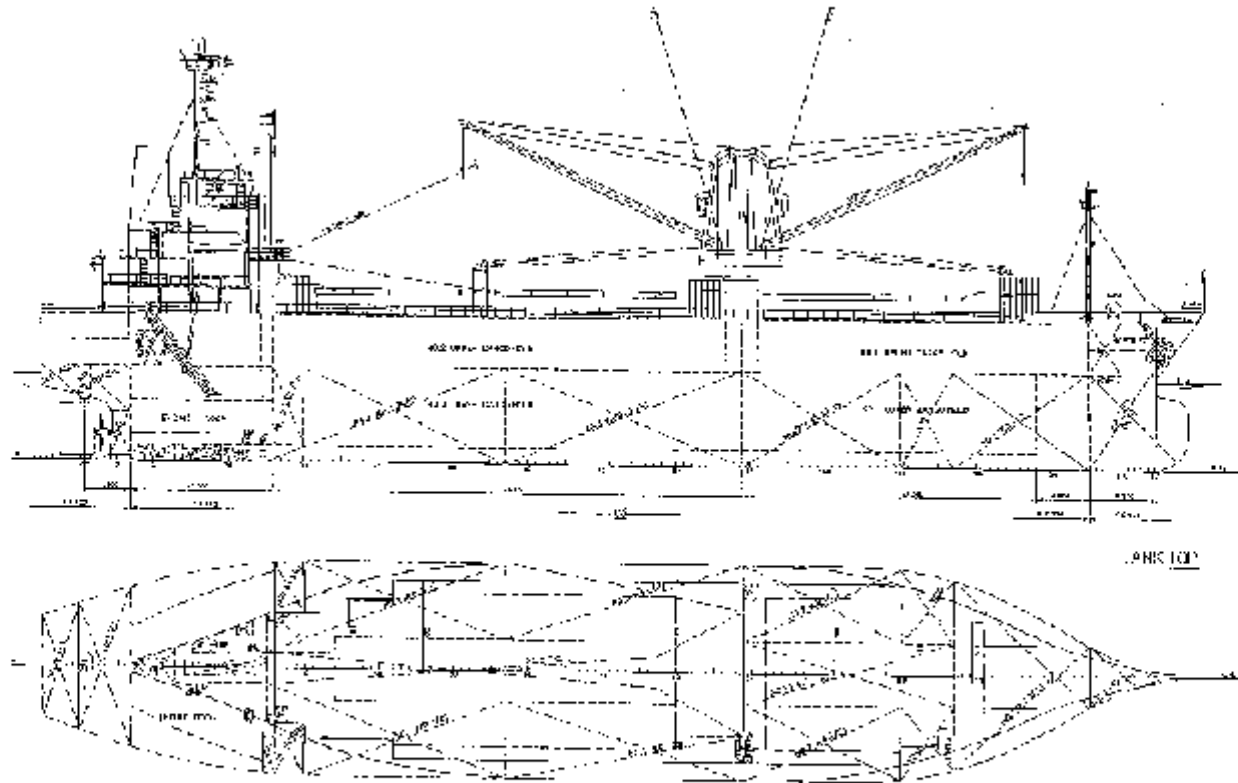


Figure 8: Radar Service Area and Position Report Line of BISAN MARTIS



Attached Table 1: AIS Records of Ship A

Time (hh:mm:ss)	Speed (kn)	LAT N (degree-minute-second)	LNG E (degree-minute-second)	COG (°)	Heading (°)
05:57:28	1.1	34-21-44.1	133-52-39.1	334	347
06:00:25	0.5	34-21-46.5	133-52-38.3	7.4	16
06:03:01	3.4	34-21-50.7	133-52-39.7	15	17
06:04:01	5.2	34-21-55.3	133-52-41.3	14	16
06:07:01	7.9	34-22-15.4	133-52-47.9	15	17
06:08:01	8.4	34-22-23.6	133-52-50.7	14	17
06:09:01	8.7	34-22-31.8	133-52-53.5	15	17
06:10:01	8.8	34-22-40.7	133-52-56.9	16.7	17
06:10:09	8.7	34-22-41.8	133-52-57.3	19.2	15
06:10:20	8.4	34-22-43.3	133-52-58.0	19.7	10
06:10:41	8.1	34-22-45.8	133-52-58.6	15	351
06:11:01	7.1	34-22-48.2	133-52-58.6	356	337
06:11:20	6.5	34-22-50.2	133-52-57.7	339	334
06:11:40	6.6	34-22-52.1	133-52-56.5	334	329
06:11:50	6.6	34-22-53.1	133-52-55.9	332	325
06:12:00	6.7	34-22-53.9	133-52-55.3	330	323
06:12:20	7.1	34-22-55.9	133-52-53.4	320	319
06:12:29	7.3	34-22-56.8	133-52-52.4	317	319
06:12:41	7.5	34-22-57.5	133-52-51.4	315	318
06:12:50	7.7	34-22-58.4	133-52-50.3	315	317
06:13:00	7.9	34-22-59.3	133-52-49.2	313	317
06:13:29	8.3	34-23-02.1	133-52-45.5	311	319
06:13:41	8.4	34-23-03.1	133-52-44.3	312	319
06:13:50	8.3	34-23-04.1	133-52-43.2	315	315
06:14:00	8.1	34-23-05.1	133-52-42.2	317	308
06:14:20	7.9	34-23-06.7	133-52-39.9	308	296
06:14:41	7.6	34-23-07.9	133-52-36.9	294	296
06:14:50	7.6	34-23-08.2	133-52-35.5	290	301
06:15:00	7.9	34-23-08.6	133-52-34.0	288	309
06:15:10	7.9	34-23-09.0	133-52-32.5	288	319
06:15:20	6.5	34-23-09.6	133-52-31.5	301	315
06:16:00	5.4	34-23-11.4	133-52-28.1	297	324
06:18:01	3.4	34-23-17.8	133-52-22.6	342	11
06:20:02	2.4	34-23-23.1	133-52-22.9	10	27

Attached Table 2: Records of Ship B's Radar Display

Time (hh:mm:ss)	Speed (kn)	LAT N (degree-minute- second)	LNG E (degree-minute- second)	COG (°)
06:00:00	10.6	34-21-37.0	133-49-08.8	64
06:01:18	11.7	34-21-45.0	133-49-26.7	62
06:01:24	11.5	34-21-45.6	133-49-27.9	54
06:04:00	12.3	34-22-02.1	133-50-00.1	56
06:07:00	12.7	34-22-24.2	133-50-36.7	55
06:08:00	12.1	34-22-30.9	133-50-49.1	55
06:09:00	12.7	34-22-38.6	133-51-00.4	54
06:10:30	12.7	34-22-47.6	133-51-22.0	60
06:11:00	12.7	34-22-49.9	133-51-29.5	63
06:11:24	12.7	34-22-51.3	133-51-34.6	66
06:11:42	12.7	34-22-52.9	133-51-39.0	67
06:12:00	12.7	34-22-54.1	133-51-43.3	67
06:13:00	12.7	34-22-58.4	133-51-58.3	70
06:14:00	12.7	34-23-03.0	133-52-12.0	70
06:15:00	12.7	34-23-07.6	133-52-27.0	70
06:15:06	12.7	34-23-07.8	133-52-28.8	70
06:15:12	12.7	34-23-08.2	133-52-30.1	70
06:15:18	12.7	34-23-08.7	133-52-31.5	70
06:15:24	12.7	34-23-09.1	133-52-32.9	70
06:15:30	12.7	34-23-09.5	133-52-34.3	70

Attached Table 3: Variation of Ship A's Speed

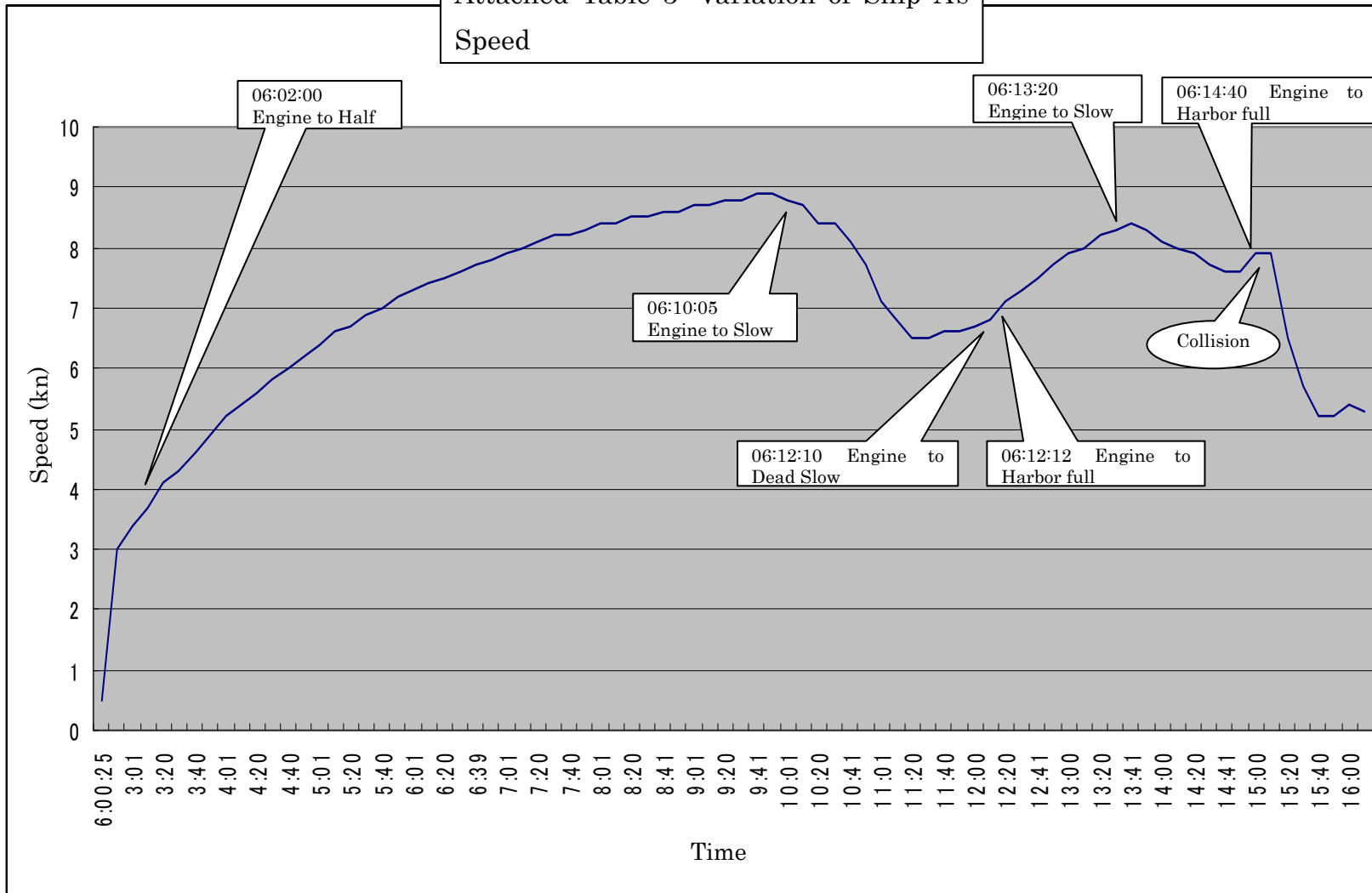


Photo 1: Condition of Ship A



Photo 2: Damage to Ship A (Port Stern)



Photo 3: Damage to Ship A (Engine Room)



Photo 4: Damage to Ship B

