

MARINE OCCURRENCE REPORT

GROUNDING

OF THE BULK CARRIER "JADE FOREST"
OFF SNAKE ISLAND, BRITISH COLUMBIA
12 NOVEMBER 1996

REPORT NUMBER M96W0243

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

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Summary

The "JADE FOREST" was en route from Harmac, a loading berth south of Nanaimo, B.C., to Chemainus, B.C., under the conduct of a B.C. Coast pilot when the vessel ran aground approximately three cables south-south-east of Snake Island. The vessel sustained extensive damage to her bottom shell plating. Neither injury nor pollution was reported as a result of this occurrence. The vessel was refloated four and a half hours later, on the rising tide.

Ce rapport est également disponible en français.

Other Factual Information

Particulars of the Vessel

Name	“JADE FOREST”
Port of Registry	Bridgetown, Barbados
Flag	Barbados
Official Number	725400
Type	Bulk carrier
Gross Tonnage	30,767
Crew	22
Length	207 m
Built	1983, Kanasashi, Japan
Propulsion	Diesel engine, 11,656 BHP at 120 RPM, driving a fixed-pitch propeller
Owners	Canadian Transport Company Ltd., Barbados

The "JADE FOREST" is a bulk carrier with seven hatches and two moveable gantry cranes. The wheel-house, machinery and accommodation are all housed in one superstructure located at the after end of the vessel. Two radar scanners are located above the wheel-house.

The wheel-house has an open layout, with the steering console in the middle and the chart table behind the steering console. Radar No. 1 is to the right of the steering console, and radar No. 2 is recessed and mounted to the right of the chart table. An automatic radar plotting aid (ARPA) unit interfaced with one radar is located to the left of the steering console.

The clock, and the vessel speed, rudder angle and revolutions per minute (RPM) indicators are mounted on the forward bulkhead in front of the steering console. Additional rudder indicators are located on both bridge wings and on the deckhead in the wheel-house, so that at least one of them is easily visible from any location inside or outside the wheel-house.

The propulsion machinery of the “JADE FOREST” consists of one reversible main engine driving one right-handed, fixed-pitch propeller. It is fully controlled from the wheel-house by means of one lever governing both the direction and RPM of the propeller.

The manoeuvring characteristics of the “JADE FOREST” in a loaded condition are as follows:

Advance and tactical diameter of the turning circle, each approximately 0.32 mile; the crash stop distance from “full ahead”, 0.66 mile and from “full sea speed”, 1.46 miles.

The master reported that the normal sea speed of the vessel as she was loaded at the time of the occurrence would be approximately 14 knots.

On 12 November 1996, at 2200, after a cargo of forest products had been loaded at Harmac wharf, the master and crew of the "JADE FOREST" began preparations for departure and transit to Chemainus. All relevant equipment and machinery was tested by the crew and found to be in good working order. A passage plan with courses and distances between the waypoints was prepared by the officer of the watch (OOW). At approximately 2245, a B.C. Coast pilot came on board and three tugboats arrived at the vessel's side.

The pilot looked at the vessel's chart and saw the courses plotted by the OOW. The courses in Northumberland Channel, leading to Fairview Channel were not to his liking; he was planning to pass Malaspina Point further off than the plotted lines, however he did not communicate his plan to the master.

The "JADE FOREST" departed from the Harmac West wharf at 2312 and proceeded through Northumberland Channel in a general north-westerly direction toward Fairview Channel. Once there, the vessel would have to make a turn of approximately 90 degrees to starboard to enter Fairview Channel and pass between Gabriola Island and Snake Island, leaving on the port side buoy P2 which marks the south end of the Snake Reef. The pilot, the master, the OOW and the helmsman were in the wheel-house. Both radars and the ARPA were in use; the pilot used radar No. 1, the master observed the ARPA screen, and the OOW used radar No. 2.

After initial "dead slow", "slow" and "half ahead", at 2319, when the vessel was approximately four cables from the Harmac West wharf, the pilot ordered "full ahead", and at 2330 when the vessel was off Duke Point, "full sea speed". Both orders were logged and executed. While the "JADE FOREST" was gaining speed and proceeding in the middle of Northumberland Channel, the pilot kept turning the vessel to starboard until he ordered the course 350° (T and G) to be steered. The vessel's progress was monitored by the master and OOW. The latter plotted two positions on the chart, at 2343 and 2347. According to these positions, the "JADE FOREST" passed 5.5 cables off Malaspina Point at approximately 2346 at a speed of about 11.5 knots. The pilot reported that he passed Malaspina Point further to the west, at a distance of approximately 6.5 cables.

After passing Malaspina Point, the pilot gave the order for five degrees starboard rudder, which was promptly executed by the helmsman and observed on the rudder indicator. Neither the time nor the vessel's exact position was recorded when this order was given. After giving the order, the pilot waited to hear the gyro clicking, a characteristic sound made by the gyro-repeater when the vessel is swinging. About 20 seconds later, as he had not heard any gyro movement, the pilot checked the vessel's head, which was still 350°(G), and he ordered 10 degrees starboard rudder.

The master remembered that, when this order was given, buoy P2 was observed on the radar at a distance of five cables on the starboard bow. The pilot recalls that the distance from the buoy was variously, eight cables, nine cables or about one mile at this time.

A few seconds later, the pilot ordered 20 degrees starboard rudder and noticed the vessel slowly turning to starboard. Judging the rate of turn as very slow, he ordered the rudder hard-to-starboard. None of these orders

¹ All times are PST (Coordinated Universal Time (UTC) minus eight hours) unless otherwise stated.

was timed or logged. The course recorder on this vessel does not record rudder positions.

After that last order, the vessel's rate of turn increased. However, the vessel did not reach Fairview Channel. Buoy P2 was observed on the vessel's starboard side throughout. At approximately 2353, the "JADE FOREST" swung rapidly to starboard, shuddered and stopped hard aground on a heading of 118°(T). After the grounding, the master stopped the engines. Buoy P2 was observed amidship, approximately 25 m off the starboard side.

Immediately after the grounding, the pilot notified Vancouver Marine Communications and Traffic Services and called the tugboats to approach and stand by the "JADE FOREST". The master ordered the sounding of the tanks, bilges and the seabed around the vessel. It was found that a double-bottom fuel tank was ruptured and water was ingressing. Some fuel spilled on deck through a vent pipe. The spill was contained on deck and cleaned by the crew.

The Canadian Coast Guard, Environmental Response, Harbour Master, and a cleaning company were notified. No oil spillage into the water was observed. The "JADE FOREST" was refloated at 0425 on 13 November, on the rising tide and, assisted by the tugs, moved to anchorage C off Nanaimo. An oil boom was placed around the hull and an underwater survey was conducted by divers throughout that day.

No one in the wheel-house reported that a malfunction of either the propulsion or steering mechanism was the cause of the grounding. Similarly, there was no indication by either the pilot or the bridge crew that language, communication or fatigue were factors in the accident.

Before boarding the "JADE FOREST", the pilot had a 48-hour break after his previous assignment, and reportedly had a normal, uneventful day on 12 November, including an afternoon nap. The master, although occupied with the usual ship's business and paperwork through the day, had managed to take some rest between dinner time, at 1800, and departure time. The OOW did not report that he was tired. During the passage from the Harmac West wharf to the grounding position, he monitored the pilot's orders and helmsman's actions and he remembered noting that the rudder indicator needle always moved to the angle ordered by the pilot.

After the initial damage assessment was completed, the "JADE FOREST" berthed at Duke Point, south of Nanaimo where all the cargo was discharged. On 20 November, the vessel proceeded to Vancouver for dry-docking and repairs.

It was ascertained during diving operations, and subsequently after dry-docking, that the "JADE FOREST" had a five-metre wide longitudinal indentation and scrape marks on either side. The affected area was approximately 61 m long between frames 95 and 171 on the starboard side, and 88 m long between frames 65 and 175 on the port side. Four ballast tanks were holed, and fuel oil tank No. 4 was split open between frames 76 and 91 on the port side. A small rock was embedded into the plating at frame 91 on the starboard side.

The master of the "JADE FOREST" holds a Master Foreign Going Certificate of Competency issued in the United Kingdom in 1977. He had accumulated approximately 30 years of sea service on various cargo vessels in worldwide trade. He had served on the "JADE FOREST" for approximately three months before the accident. He had been in the Nanaimo area on three previous occasions and remembered the passage.

The OOW, employed on the "JADE FOREST" as a second mate, holds a Second Mate Certificate of Competency issued in the Philippines in 1990.

The pilot holds a Master Home Trade, Unlimited Certificate of Competency issued in Canada in 1977 and also a Pilot's Licence, issued in May 1988. He attended all the required upgrading courses: Automatic Radar Plotting Aid, Simulated Electronic Navigation, Marine Emergency Duties, and ship handling. His total sea time is 19 years, from 1969 to 1988, on various Canadian home-trade vessels, including buoy tenders, Search and Rescue craft, fisheries patrol vessels and icebreakers. Of this time, approximately 11 years were as a deck officer and 1 year was as a relieving master. He had not sailed on cargo vessels comparable in size to the "JADE FOREST". Since 1988, he has worked as a B.C. Coast pilot.

The "JADE FOREST" was issued a Cargo Ship Safety Certificate on 08 February 1996, which was due to expire on 07 February 1997.

The weather was described as overcast with rain, light wind, rippled sea surface and good visibility. The tide was approaching its low water level. Low water in Nanaimo was predicted to be at 0026 on 13 November 1996. According to the Canadian Hydrographic Service (CHS) Institute of Ocean Sciences, the predicted surface current at about the time of the grounding was negligible.

The grounding occurred some 30 minutes before low water and the refloating took place on the rising tide.

Immediately after refloating, a test of the steering mechanism was conducted. It was found that it took 13 seconds to move the rudder from amidship to the hard-over position, and 25 seconds to move from the hard-to-port to the hard-to-starboard position, when two steering pumps were working.

During an inspection by TSB investigators in dry-dock, the steering system was tested again. It was successfully operated in five-degree increments as well as from amidship to hard-over without stopping. The rudder movements, all executed without problem, were observed from the steering flat and from the dock.

The pilot reported that after ordering the rudder hard-to-starboard, he observed that the vessel was sluggish and turning slowly. He made a comment to the master about his observations. He reportedly heard the master assuring him in response that the rate of turn would increase, and he relaxed.

Both the master and OOW categorically denied that the pilot had made such a remark before the grounding. The OOW reported that the only communication from the pilot were helm orders directed to the helmsman.

The master also reported that he had not heard the first order, for five degrees starboard rudder, given by the pilot. He stated that if he had heard the pilot's first order, he would have changed it and increased the rudder angle.

The Fleet Regulations manual provided by the managers of the "JADE FOREST", in the section entitled "Responsibility", state:

The Master is always in full command of the vessel and ultimately responsible for the navigation of the vessel. The Pilot, whether compulsory or optional, only takes an advisory role in the navigation of the vessel, and his advice must only be taken as a guidance and not an order.

Section 26(2) of the Canadian *Pilotage Act* requires the master to file a written report with the pilotage authority whenever the master takes the conduct of the vessel from a licensed pilot.

Bridge Resource Management advances the principles that members of the bridge team, including the pilot, should: divide tasks to share the workload according to individual expertise; share information to ensure that, as far as is possible, all relevant factors are taken into account in decision making; create an environment to allow members of the team to challenge an action perceived, by any member of the team, as unsafe; and enable the primary decision-maker or, collectively, the team, to make safe decisions on the basis of *all* the information available.

In its Report Number SM9501, *A Safety Study of the Operational Relationship Between Ship Masters/Watchkeeping Officers and Marine Pilots*, the Board recommended that the principles outlined above should be applied.

Analysis

The “JADE FOREST” grounded while negotiating a 90 degree turn to starboard to pass between two islands, with an extensive shoal area to the north of the channel marked by a buoy.

The slow rate of turn initiated by the pilot and the fact that “full sea speed” had been executed resulted in the vessel advancing further and decreasing the distance to the shallow water before any remedial action could be taken.

As is the usual practice, the pilot had the con of the vessel from the moment the vessel left the berth. The master and the OOW, although present in the wheel-house and monitoring the vessel's progress, did not interfere with, or otherwise override the pilot's orders. The sequence of manoeuvres ordered by the pilot accumulated and resulted in the grounding.

By ordering “full sea speed” shortly after leaving the berth, when the vessel was still in confined waters and before a sharp bend in the channel, the pilot exhausted one possible remedy that could have been used to increase the rate of turn or to stop the “JADE FOREST”. A large vessel usually approaches a bend at slow speed, moves the rudder over and increases the RPM of the propeller if it is necessary to increase the rate of turn. Such a sequence of manoeuvres gives the vessel a good turning moment without a significant increase in speed. Conversely, if the rate of turn is still insufficient, it is possible to stop the vessel in a shorter distance. The “JADE FOREST” was negotiating the turn at a speed of approximately 11 knots. Although she did not reach her normal sea speed of 14 knots, it was at that moment her maximum possible speed.

The first order, for five degrees starboard rudder, intended to start the turn, did not yield the expected result. The rudder deflection was too small to turn a vessel of this size at an appreciable rate within a short distance. It must also be noted that a vessel with a right-handed propeller has a natural tendency to turn to port when the rudder is at the 0° (zero) position because of the side effect of the turning propeller. To compensate for this side effect, the rudder's real amidship position is offset to approximately two to three degrees to starboard. Thus, the practical effect of the order for five degrees starboard rudder on the "JADE FOREST" was decreased by the offset, making it even less significant.

While the pilot was waiting for the long period of 20 seconds to hear the gyro clicking, the "JADE FOREST" covered a distance of approximately 120 metres ahead. When the pilot ordered 10 degrees starboard rudder, the distance to buoy P2 was only five cables. Several more seconds elapsed before the pilot increased to 20 degrees starboard rudder and thence to hard-to-starboard. Additionally, it took approximately 10 seconds before the rudder moved to the hard-over position.

From the turning circle data established during sea trials, it is known that the advance of the "JADE FOREST" is approximately 3.2 cables from the time the rudder is in the full hard-over position. The vessel's length is about 1.2 cables. These two figures indicate that, to successfully negotiate a 90-degree turn, the "JADE FOREST" needs a minimum distance ahead of 4.4 cables from the wheel-house if the rudder is already in the hard-over position. Therefore, the remaining five cables from the radar scanner to buoy P2 was barely sufficient to accomplish the 90 degree turn, even if the hard-to-starboard order had been given at that time.

All three navigators in the wheel-house were monitoring the vessel's progress and were aware of the distance to the shoal. The fact that the pilot ordered the rudder deflection in steps and the master did not increase it at any stage of the turn indicates that the bridge team did not evaluate the situation by comparing the vessel's manoeuvring characteristic data with the remaining distance ahead.

Similarly, although there had been no discussion of variations from the courses laid down on the chart by the OOW, the bridge team did not question the vessel's courses as ordered by the pilot in Northumberland Channel which did not follow the courses plotted by the OOW.

Findings

1. The propulsion machinery and steering equipment of the "JADE FOREST" were in good working order.
2. No detailed discussion of the voyage plan took place before departure.
3. The pilot requested "full sea speed" shortly after the vessel left the berth, when the vessel was in confined waters and before a sharp bend in the channel.
4. The "JADE FOREST" was closing the distance to the shallow water at her maximum possible speed.
5. The initial angle of the rudder, five degrees to starboard, was too small to start the turn at a sufficient rate.
6. Subsequent rudder orders were delayed, so that the helm orders given in steps (10 degrees, 20 degrees and hard-to-starboard) were insufficient in the developing circumstances.
7. The master did not take over the con from the pilot when the rate of turn was too slow.
8. The vessel could not be stopped nor the rate of turn increased after the rudder was moved to the hard-over position prior to the grounding.
9. All actions following the grounding, up to and including the refloating, by the master, crew and port authorities, were timely and appropriate in the circumstances.
- . The "JADE FOREST" sustained extensive damage to her bottom shell plating.

Causes and Contributing Factors

The "JADE FOREST" grounded because of the "full sea speed" combined with the insufficient rudder deflection ordered by the pilot when the vessel was approaching a sharp bend in the channel, and of the lack of input by the master or the OOW.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release of this report on 30 September 1997.