Australian Government
Australian Transport Safety Bureau

Safe Transport

MARINE SAFETY INVESTIGATION
No. 193

Independent investigation into the equipment failure aboard the Australian flag roll-on/roll-off vessel

Searoad Mersey

in Bass Strait
21 March 2003

Australian Government

Australian Transport Safety Bureau

MARINE SAFETY INVESTIGATION
No. 193

Independent investigation into the equipment failure aboard the Australian flag roll-on/roll-off cargo vessel *Searoad Mersey* in Bass Strait on 21 March 2003

Released under the provisions of the *Navigation (Marine Casualty) Regulations* under the *Navigation Act 1912.*

Issn 1447-087X
ISBN 1 877071 87 0 December 2004

This report was produced by the Australian Transport Safety Bureau (ATSB), PO Box 967, Civic Square ACT 2608.

Readers are advised that the ATSB investigates for the sole purpose of enhancing safety. Consequently, reports are confined to matters of safety significance and may be misleading if used for any other purpose.

CONTENTS

Australian Government
Australian Transport Safety Bureau

Media Release

December 2004
2004/40

ATSB REPORT ON SHIP DISABLED IN BASS STRAIT

The ATSB has released its final report into the catastrophic failure of the port main engine of the Australian cargo ship *Searoad Mersey* which left the vessel disabled in Bass Strait.

At 1612 on 21 March 2003, the roll-on/roll-off cargo vessel *Searoad Mersey* departed from Melbourne on a scheduled service to Devonport in Tasmania. By 1924 the ship had cleared Point Lonsdale and was heading in a south-easterly direction in Bass Strait.

At about 2118, the duty engineer received an engine room alarm and made his way to the engine room. During his subsequent inspection of the engine room, he found a main engine connecting rod lying on the deck on the inboard side of the port main engine. The port main engine had stopped and it was evident that there had been a catastrophic failure of one of the engine's piston assemblies.

A short time later the running main generator overheated and shutdown which caused the ship to black out. The generator had stopped as a result of the damage to the main engine which had caused a large loss of cooling water from the common cooling system.

By 2230, the ship's systems had been stabilised and the starboard main engine had been restarted. *Searoad Mersey* then proceeded back to Melbourne under its own power to arrive at Webb Dock in the morning of 22 March 2003.

The ATSB's report makes conclusions relating to the failure of *Searoad Mersey's* port main engine including:

- A casting flaw found in the piston skirt which failed initiated a fatigue crack which eventually caused the piston to fail in service.
- The vessel's maintenance system did not include a system for tracking the total operating hours of the main engine piston assemblies.
- The vessel's maintenance system did not include a procedure for crack testing the piston skirts in the areas stipulated by the manufacturer in a service bulletin.
- There was evidence to suggest that the engine type have had a history of piston skirt failures similar to that which occurred on *Searoad Mersey*.

The report also makes recommendations to the operators of Wartsila Vasa 32 engines and to Wartsila NSD in relation to the servicing of piston assemblies and the distribution of engine service bulletins.

Copies of the report may be downloaded from the internet site at www.atsb.gov.au or obtained from the ATSB by telephoning (02) 6274 6478 or 1800 020 616.

Media contact: Peter Saint B: (02) 6274 6590; M: 0408 497 016
15 Mort Street, Canberra City ACT 2601 • PO Box 967, Civic Square ACT 2608 Australia
Telephone: 02 6274 6590 • Facsimile: 02 6274 6474
24 hours: 1800 621 372 • www.atsb.gov.au
ABN 86 267 354 017

1 SUMMARY

At 1612 on 21 March 2003, the Australian flag roll-on/roll-off cargo vessel *Searoad Mersey* departed from Melbourne on a scheduled service to Devonport in Tasmania. By 1924 the vessel had cleared Point Lonsdale, at the entrance to Port Phillip and was en route to Devonport.

At 2118:50 the engine room alarm sounded in the duty engineer's cabin, followed shortly after by the fire alarm. During his subsequent inspection of the engine room the duty engineer found a main engine connecting rod lying on the deck on the inboard side of the port main engine. The port main engine had stopped. There was oil lying all over the floor plates, on and around the engine, and on the deck head above the engine. It was apparent that there had been a catastrophic failure of the number one piston assembly, cylinder liner and cylinder cover.

A short time later the port main generator overheated and shut down which caused the ship to black out. The port generator had stopped as a result of the damage to the port main engine which had caused a large loss of cooling water from the common cooling system.

By about 2215 the various engine room systems had been stabilised and checked by the engineers. The decision was made to return the ship to Melbourne and by 2230 the starboard main engine had been started and the vessel was proceeding under its own power. *Searoad Mersey* arrived alongside Webb Dock in Melbourne at 0715 on 22 March 2003 where repairs to the damaged port main engine commenced.

The report makes the following conclusions relating to the failure of *Searoad Mersey*'s port main engine:

- A casting flaw found in the piston skirt fitted to number one unit initiated a fatigue crack which eventually caused the piston to fail in service.
- The vessel's maintenance system did not include a system for tracking the total operating hours of the main engine piston assemblies.
- The vessel's maintenance system did not include a procedure for crack testing the piston skirts in the areas stipulated by the manufacturer in their service bulletin *Piston overhaul of VASA 32 engines after 24 000 running hours and later overhauls*.
- The critical manufacturer's *Main Components maintenance intervals for VASA 32, 32LN and 32GD* bulletin had not been provided to the vessel or its technical manager.
- The evidence strongly suggests that Wartsila Vasa 32 engines have had a history of piston skirt failures similar to that experienced by *Searoad Mersey*.

The report makes recommendations to the operators of Wartsila Vasa 32 engines and to Wartsila NSD in relation to the servicing of piston assemblies and the distribution of engine service bulletins.

2 SOURCES OF INFORMATION

The master and crew of *Searoad Mersey*

Patrick Shipping, Melbourne

Wartsila NSD, Sydney

Australian Maritime Safety Authority

Acknowledgements

The assistance of ETRS, Melbourne, is gratefully acknowledged.

FIGURE 1:
Searoad Mersey at Webb Dock, Melbourne

3 NARRATIVE

Searoad Mersey

Searoad Mersey (figure 1), is an Australian flag, roll-on/roll-off cargo vessel of 4 824 deadweight tonnes at its summer draught of 5.512 m. The vessel is managed by Patrick Shipping, Melbourne and is classed ✠1A1, General Cargo Carrier Container RO/RO, with an E0[1] notation, with Det Norske Veritas.

Searoad Mersey operates on a scheduled trade between Devonport in northern Tasmania and Melbourne on the mainland. A single call is made at the King Island port of Grassy each week. Cargo is worked during daylight hours with the vessel sailing each afternoon to cross Bass Strait overnight.

Built in 1990 by Singapore Slipway and Engineering Company, Singapore, *Searoad Mersey* has an overall length of 119.30 m, a moulded breadth of 18.50 m and a moulded depth of 13.60 m. The accommodation superstructure is at the forward end of the vessel with the main cargo deck, accessed by a stern ramp, located aft of it. The main vehicle deck is under the accommodation and cargo deck with access for roll-on cargo via a stern door. The ship carries containerised and general cargo on lo-loader cassettes on its main vehicle deck and cargo on trailers on its open main deck.

The engine room is located under the vehicle deck at the aft end of the vessel. Crew normally access the engine room from the accommodation via a raised catwalk on the starboard side of the vehicle deck which leads aft to a doorway in the engine room fiddley.

At the time of the incident, *Searoad Mersey* had a crew of 15 comprising a master and three mates, chief and two engineers, chief and four integrated ratings, two catering staff and a trainee. All of the crew were Australian nationals.

The mates on *Searoad Mersey* maintain a four hours on, eight hours off watchkeeping system. The engineers operate a 24 hour duty roster system with the engine room unmanned outside of normal daytime working hours, which are between 0800 and 1700 each day.

Searoad Mersey's master at the time of the incident held a master class one certificate of competency issued by the Australian Maritime Safety Authority and had 33 years experience at sea, the last four of which were in command. He had been master on the vessel since 2001. The chief engineer had been at sea for over 30 years an held a class one (motorship) certificate of competency issued by the Australian Maritime Safety Authority and had been chief engineer on *Searoad Mersey* for the previous four years but had also served on the vessel as first engineer for a period between 1992 and 1995.

The main engines

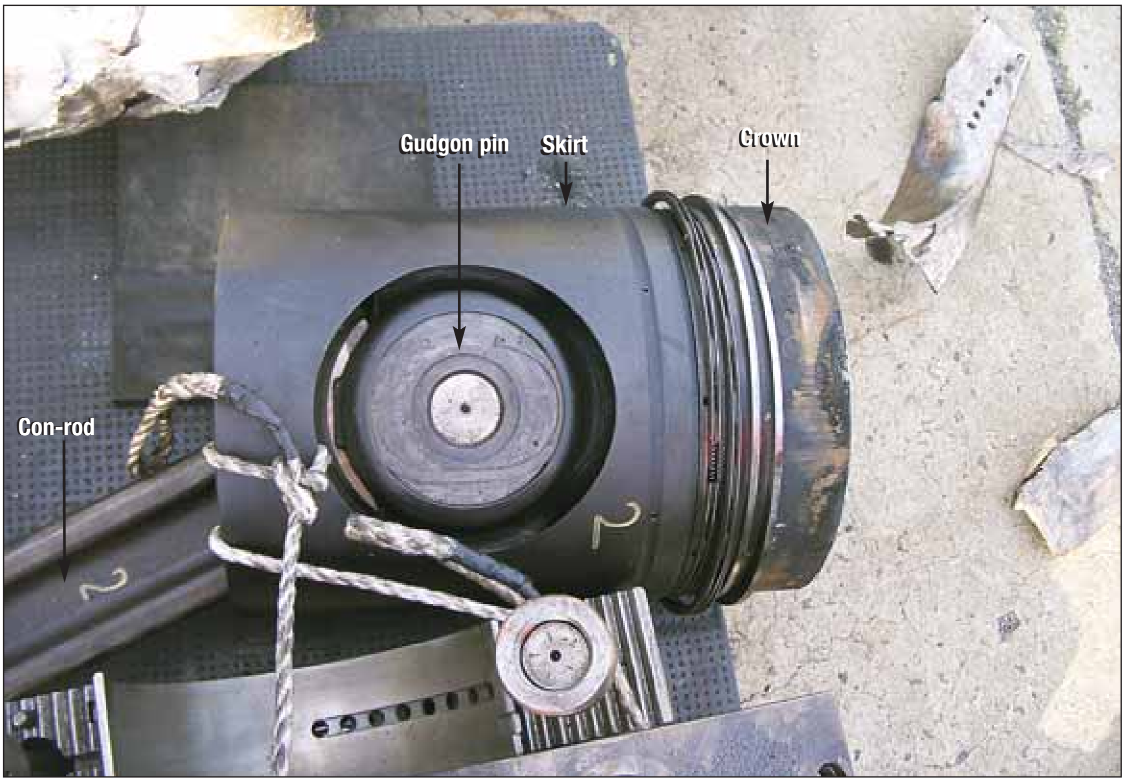
Searoad Mersey is fitted with two four-stroke, single-acting, Wartsila 8R32E main engines each with a maximum continuous rating of 3 280 kW at 750 rpm. Each engine has eight cylinders in line, with each cylinder having a bore of 320 mm, and a stroke of 350 mm. The engines are clutched into individual reduction gearboxes which in turn drive a pair of contra-rotating controllable pitch propellers to give the ship a service speed of 16 knots.

---

1 Engine room may be operated un-manned, equivalent to un-manned space (UMS) notation.

The pistons fitted to each main engine cylinder (or unit) are comprised of two parts, a forged steel crown which is bolted onto a nodular cast iron skirt. The gudgeon pin, which attaches the connecting rod (con-rod) to the piston assembly, is housed in a 'socket' which is cast into the piston skirt (figure 2).

FIGURE 2:
Piston assembly on pallet



Searoad Mersey's main engines and generators are cooled by a common jacket water system. The system is divided at each main engine and main generator into low and high temperature circuits. The charge air, lube oil, and alternator coolers are supplied with low temperature water and the engine and turbocharger jackets are supplied with higher temperature water. Thermostatic valves control the temperatures of the cooling water circuits on the engines by admitting varying quantities of water to the common, seawater cooled, plate heat exchangers. Two head tanks are fitted in the system with a combined capacity of 0.52 m^3 to provide immediate make up water in the event of a leak. The head tanks are designated 'generator' and 'main engine' but, as the cooling water system is cross connected, when a leak occurs both tanks will drain.

The incident

At 1612 on 21 March 2003, *Searoad Mersey* departed from Melbourne on a scheduled service to Devonport in Tasmania. By 1924 the vessel had cleared Point Lonsdale at the entrance to Port Phillip. The chief engineer, who was in the engine control room for the departure stand-by, made a final inspection of the engine room including the main engines, switched the alarms over to the second engineer (duty engineer for the day) and then left the machinery space unmanned.

At 2118:50 the engine room alarm sounded in the second engineer's cabin. He attempted to accept the alarm three times but was unsucessful. He then left his cabin. At this time the fire alarm started to sound in the accommodation.

As he approached the entrance to the engine room at the after end of the vehicle deck, the second engineer could smell oily smoke and suspected that there was something seriously wrong. When he entered the engine room he could see the top third of the engine room had filled with an oily mist but there was no smell of combustion. He made his way to the control room where he found that the alarm monitor was showing a full page of alarms. The analogue gauges for the critical parameters on both main engines on the console were showing zero. He was joined in the control room at this time by the mate who had come to investigate the fire alarm.

At approximately 2122, the second engineer telephoned the bridge and spoke to the first engineer (who had made his way to the bridge on hearing the alarms in the accommodation). He told the first engineer that there was no apparent fire but that there was 'something else very wrong'. The first engineer said that he'd come to the engine room immediately. The second engineer then left the control room to inspect the engine room. As he was leaving the control room he noticed that both propeller shafts were turning (the port main engine had stopped but its shaft was 'trailing') and it occurred to him that he should reduce the load on the main engines as a precaution. He again telephoned the bridge to request a propeller pitch reduction before leaving the control room to inspect the engine room.

During his inspection, the second engineer found a main engine connecting rod lying on the deck on the inboard side of the port main engine. The port main engine had stopped. There was oil lying all over the floor plates, on and around the engine, and on the deck head above the engine. He also found a solitary inlet valve lying on the floor plates. He returned to the control room to report the situation to the bridge. On finding the bridge telephone engaged, he used his hand held radio to report that he thought that the port main engine had experienced a crankcase explosion.

At this point the second engineer concluded that the inlet valve lying on the plates meant that one of the cylinder heads on the port main engine must also have been severely damaged. He knew from past experience that this meant that the engine would have a serious cooling water leak and that it needed to be isolated quickly from the common cooling water system to prevent the other running engines, including the port generator, from overheating. He had started to isolate the engine from the cooling water system when the first engineer and the trainee engineer arrived in the engine room. They quickly assessed the situation and then helped the second engineer to isolate the services to the port main engine.

During this time the chief engineer, alerted by the fire alarm, was making his way to the engine room. At approximately 2126, when he was halfway down the vehicle deck catwalk, the port main generator stopped and the ship blacked out. The emergency generator started a short time later, followed by the starboard main generator which had been set to start automatically as the 'stand-by' generator.

When the chief engineer arrived in the engine room the other engineers were still in the process of isolating the cooling water, air, lubricating oil and fuel to the port main engine. He inspected the engine and confirmed that there had been a catastrophic failure of the number one piston assembly, cylinder liner and cylinder cover. He was concerned about the loss of cooling water from the common system and rang the master on the bridge to appraise him of the situation. He also asked if it was safe to stop the starboard main engine while the cooling water was replenished. The ship was 30 miles south-south-east of Point Lonsdale and in no danger. The weather was reasonably good (winds force 4–5) and there were no other ships in the immediate vicinity. With the master's agreement, the chief engineer took 'engine room control' and stopped the starboard main engine.

After speaking with the chief engineer the master telephoned the ship's manager in Melbourne to notify him of the main engine breakdown. The master and ship manager discussed the various alternatives and a short time later the decision was made to return the ship to Melbourne when circumstances permitted.

By about 2215 the various engine room systems had been stabilised and checked by the engineers. At 2220 the starboard main engine was restarted and by 2230 the vessel was underway en route to Melbourne. *Searoad Mersey* arrived alongside Webb Dock in Melbourne at 0715 on 22 March 2003 where work started on repairing the port main engine.

Repair of the port main engine eventually involved the replacement of the crankshaft and entablature and various other ancilliary running gear.

FIGURE 3:
No.1 unit PME water jacket space

FIGURE 4:
Debris in crankcase

FIGURE 5:
Con-rod lying on floor plates as found

FIGURE 6:
Pieces of piston skirt

4 COMMENT AND ANALYSIS

Evidence

An investigator from the Australian Transport Safety Bureau (ATSB) attended *Searoad Mersey* at Webb Dock on 1 April 2003. The damaged engine and components were inspected and various documentary evidence was obtained from the ship including copies of log books, engine room data logs, maintenance records and procedures. The master, chief engineer, duty engineer and technical manager from Patrick Shipping were interviewed and provided accounts of the incident.

After the incident the ship's managers commissioned an independent technical report by ETRS into the cause of the piston failure. A copy of the ETRS report was subsequently provided to the ATSB.

The incident

The engine room alarm logger accurately recorded the sequence of events from the time of the first alarm until the main generator stopped and power was lost. The relevant section of the alarm log is reproduced below:

Alarm	*Time*	*Alarm*	*Time*
F.W Low Press Gen 2	2118:50	Mechanical Overload ME2	2120:11
HT Water Press ME1	2118:51	F.O Leakage Aft High Level ME1	2120:27
Oil Mist Density High ME1	2118:54	Aux Cooling Press Low	2120:38
LT Water Pressure ME1	2118:55	L.O High Temp Gen 2	2120:50
Gear L.O Low Press CPP P	2118:56	Mechanical Overload ME1	2121:31
Fire Alarm	2118:58	L.O Low Press ME1 Trip	2121:34
Gen FW Cooling P/P St By Start	2118:59	**Port Main Engine Stops**	
Oil Mist Detector Failure ME1	2119:00	Servo Oil Low Pressure CPP P	2121:52
Cooling Water Pressure G2	2119:01	Gear Port L.O St By Start	2122:01
Gen FW Cooling Exp TK Low Level	2119:12	F.W High Temp Gen 2	2122:34
ME Cooling FW Exp TK Low Level	2119:13	L.O Purifier 2 Fail	2125:55
Lub Oil Pressure ME1	2119:15	Cooling Water Temp Outlet G2 (85°)	2126:05
Temp Cyl.7 ME1 (505°)	2119:17	**Port Generator Stops/Ship Blacks Out**	
PME L/O Auto Filter Diff Press	2120:28		

The critical times for the event are:

- The first alarm at 2118:50, a jacket water low pressure alarm on the running generator. This indicates that the number one piston in the port main engine had failed at this time and had holed the cylinder liner or cylinder cover. This led to a large cooling water loss from the common system into the engine's crankcase. The low cooling system pressures, stand-by pump start and expansion tank level alarms which followed, all resulted from the cooling water leak.

- The port main engine oil mist density alarm at 2118:54 probably resulted from the cooling water entering the crankcase. The subsequent oil mist detector failure alarm at 2119:00 supports this proposition.
- The fire alarm at 2118:58 was probably initiated by the liberation of the gas inside the port main engine crankcase when the connecting rod punched a hole through one or both crankcase doors.
- The low lube oil pressure alarm at 2119:15 indicates either progressive bottom end bearing damage on number one unit and/or the gudgeon pin detaching from the con-rod. In each case the lube oil system pressure would have decreased as the flow of oil through the damaged bearing and/or con-rod increased.
- The lube oil high temperature alarm at 2120:50 on the running generator indicates that it was starting to overheat due to the lack of cooling water in the system.
- The low lube oil pressure trip on the port main engine operated at 2121:34 which was probably when the con-rod became fully detached from the crankshaft. This resulted in the free flow of lube oil from the bottom end bearing journal and consequently a further decrease in the engine's lube oil pressure and when combined with the increasing filter pressure differential (as a result of water and/or debris contamination) was sufficient to trip the main engine stop.

The port main engine had probably stopped before the second engineer arrived in the engine room allowing that his estimate of the time it took him to walk from the accommodation after the first alarm is reasonable. In all, from the time that the number one piston had failed sufficiently to cause the cooling water leak, until the time that the engine stopped, the port main engine ran for 2 minutes and 44 seconds. At a speed of 750 rpm, this amounts to approximately 2000 revolutions.

The cooling water high temperature shut down on the port generator operated some seven minutes and 15 seconds after the first jacket water low pressure alarm. By this time, the cooling water in the common system had probably drained almost entirely into the port main engine crankcase and the generator had been running for some period without any cooling water flow.

Failure analysis

The failure analysis performed by ETRS included an examination of the remains of the piston, liner, connecting rod, bottom end bolts and bottom end bearing shells. ETRS concluded from their initial visual inspection that the majority of the piston fragments were the result of single event failures. However their report noted:

> …sections of the piston where the piston skirt attaches to the gudgeon pin socket via two webs did show evidence of progressive failure, ie fatigue crack growth.
>
> Well developed fatigue growth fronts were observed on the web section of one gudgeon socket (see Figures 7 & 8) while less well defined fatigue crack growth fronts were observed at a similar location in the second gudgeon of the piston. In both instances, the cracking was associated with the central region of the two webs at the casting 'flash' at the web/gudgeon socket transition.

These areas of the piston skirt were then examined under a microscope with the ETRS report noting:

> Examination near the surface, which coincided with the casting flash region, revealed the presence of a large casting defect in the form of entrapped dross/shrinkage…

ETRS examined the failed bottom end bolts and ascertained that the fracture surfaces on the bolts indicated that they had failed over a relatively short time and their report concludes:

> It is therefore concluded that the piston fractured first and that during the secondary failures that resulted in bending of the piston rod and damage to the counter weights etc, the out of balance and uneven loading has resulted in the impacting of the nuts, fatigue of one stud and then subsequent failure of the second stud by overload, separating the piston rod from the crankshaft.

FIGURE 7:
Section of piston skirt showing fatigue crack on gudgeon pin socket web section

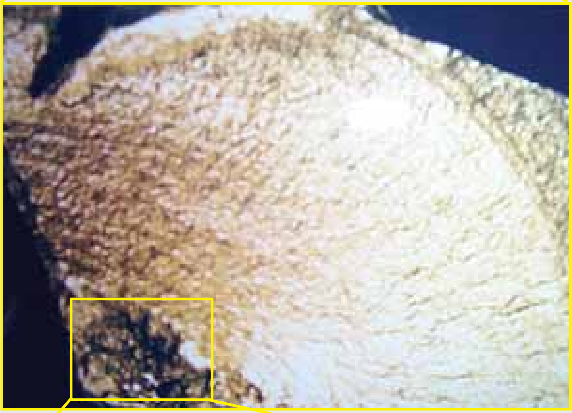


FIGURE 8:
Fatigue crack in detail showing casting defect

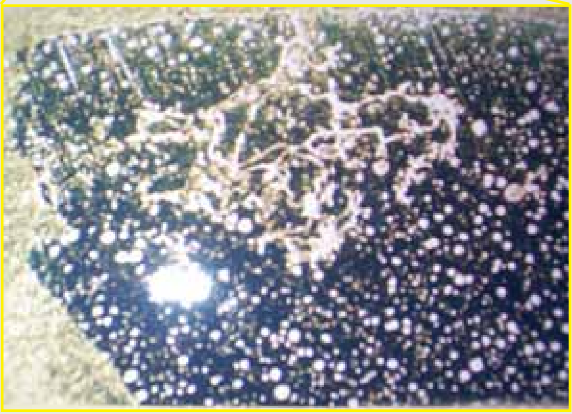


FIGURE 9:
Fatigue crack magnified 25X showing area of dross (black)

ETRS also non-destructively tested two of the ship's spare piston assemblies. In particular, the piston skirts were tested to ascertain if they were showing any signs of cracking in the same area as the piston skirt which failed. Their examination did not reveal anything of significance.

Piston maintenance

Searoad Mersey's port main engine failed catastrophically when the piston assembly fitted to number one unit failed. It is likely that the casting inclusion found by ETRS in the piston skirt initiated the formation of the fatigue crack adjacent to the gudgeon pin socket with the evidence suggesting that the crack had grown over a period of time.

Searoad Mersey's maintenance records indicated that the number one unit on the port main engine had been last overhauled on 20 August 2001 at 53 901 engine hours, a scheduled 24 000 hour service. At the time, a new cylinder liner was fitted in addition to the work normally performed at 12 000 hour intervals. The work included the fitment of a reconditioned piston, cylinder head and new bottom end bolts and bottom end bearing shells. The engine hours at the time of the failure were approximately 61 900, which meant that the reconditioned piston assembly had run for approximately 8 000 hours since the previous overhaul.

The total hours for the piston assembly cannot be accurately determined as, at the time of the incident, the vessel did not have a system to track specific piston assemblies through the two main engines. The practice on the vessel had been to exchange piston assemblies every 12 000 hours with overhauled spares which had been in service previously. From time to time throughout the life of the vessel new piston assemblies had been purchased and put into service. The piston assembly which failed was an overhauled spare when fitted at 53 901 hours which means that its minimum total running hours may have been as low as 20 000 hours (one overhaul period of 12 000 hours in addition to the 8 000 hours before the failure). For this to have been the case, the piston assembly would had to have been purchased after the vessel had commenced service.

It is more likely that the piston assembly which failed had been supplied as an original engine part rather than an in service replacement purchase. In this case the piston assembly may have been running in one of the vessel's main engines for as many as three overhaul periods before the overhaul at 53 901 hours. This would mean that the piston assembly may have run for as many as 36 000 hours in addition to the 8 000 hours before the failure, a total of 44 000 running hours.

An inspection of the ship's main engine maintenance procedures revealed a service letter from the engine manufacturer, Wartsila, entitled *Piston overhaul of VASA 32 engines after 24 000 running hours and later overhauls*, (service letter 3211S025GB, dated 23/06/1994), which makes recommendations relating to piston overhaul procedures after 24 000 running hours. The service letter states under the heading 'Piston Skirt':

> Crack detection test of the entire piston skirt with use of liquid penetrant must be made. Special attention must in this regard be given to the upper part of the piston skirt and to the gudgeon pin bore with its supports to the upper part and to the circumferential part of the skirt…

Searoad Mersey's piston assembly overhaul procedure prior to the failure included the inspection and crack testing of parts of the piston skirt and crown. It did not include the crack testing of the areas of the skirt adjacent to the gudgeon pin stipulated in the Wartsila service letter. If the running hours of the failed piston assembly had been tracked, and exceeded 24 000 at the time of the previous overhaul, a crack test as per the service letter may have prevented the failure. However, given that the piston ran a further 8 000 hours before it failed, it is impossible to conclude whether or not a crack in the skirt would have been detectable at the time of the previous overhaul.

On 25 November 1997, Wartsila released a ‘Data and Specifications’ bulletin to their service network entitled *Main Components maintenance intervals for VASA 32, 32LN and 32GD* (3204N026GB). This bulletin stipulates overhaul and replacement intervals for various engine components for differing engines operated under various conditions. For *Searoad Mersey*’s engines, the bulletin recommends a replacement interval of 36 000 hours for piston skirts and crowns. It is possible that the piston assembly which failed had exceeded 36 000 hours and should have been discarded at the time of the previous overhaul.

The *Main Components maintenance intervals for VASA 32, 32LN and 32GD* bulletin was not evident onboard *Searoad Mersey*. Both the chief engineer (who had spent a total of seven years on the vessel) and ship manager (who had managed the vessel for the ten years prior to the incident) had no knowledge of it. It appears that this bulletin had not been promulgated from the service agent to the vessel or the vessel’s management. Had the vessel’s management received the bulletin in 1997, it is likely that a regime for tracking the hours on the various engine components would have been instituted to ensure that they were renewed at the recommended intervals.

In their submission Wartsila NSD stated:

> Data & Spec 3204N026GB is an internal guideline for estimating exchange intervals when making offers etc. Please note that on page1 it is clearly stated that “Recommended replace interval” is the average replace interval of the component in question. Which is not the same as the max lifetime.

Past incidents

In August 2001, the ATSB investigated an incident on board the Antigua and Barbuda registered general cargo vessel *ANL Purpose*. The vessel was fitted with a Wartsila Vasa 32 main engine which had failed catastrophically in a similar manner to *Searoad Mersey*’s. The subsequent investigation concluded that the failure was probably initiated by the incorrect fitment of bottom end bearing shells. However, the examination of the failed piston assembly revealed pre-existing fatigue cracks in the gudgeon pin support webs in the piston skirt which had contributed the catastrophic failure of the piston. Other piston assemblies in the engine were examined which also exhibited cracks in the same area of the piston skirts.

ANL Purpose’s pistons were different in design from *Searoad Mersey*’s. The similarity of the incidents, however, and the manufacturer’s service bulletins referring to crack testing and replacement after relatively modest running hours points to the probability of latent on-going problems with the piston skirts fitted to Wartsila Vasa 32 main engines.

In their submission Wartsila NSD stated:

> True that we have had some cases, however if service letters and instructions manual followed, (catastrophic) failures can in most cases be avoided.

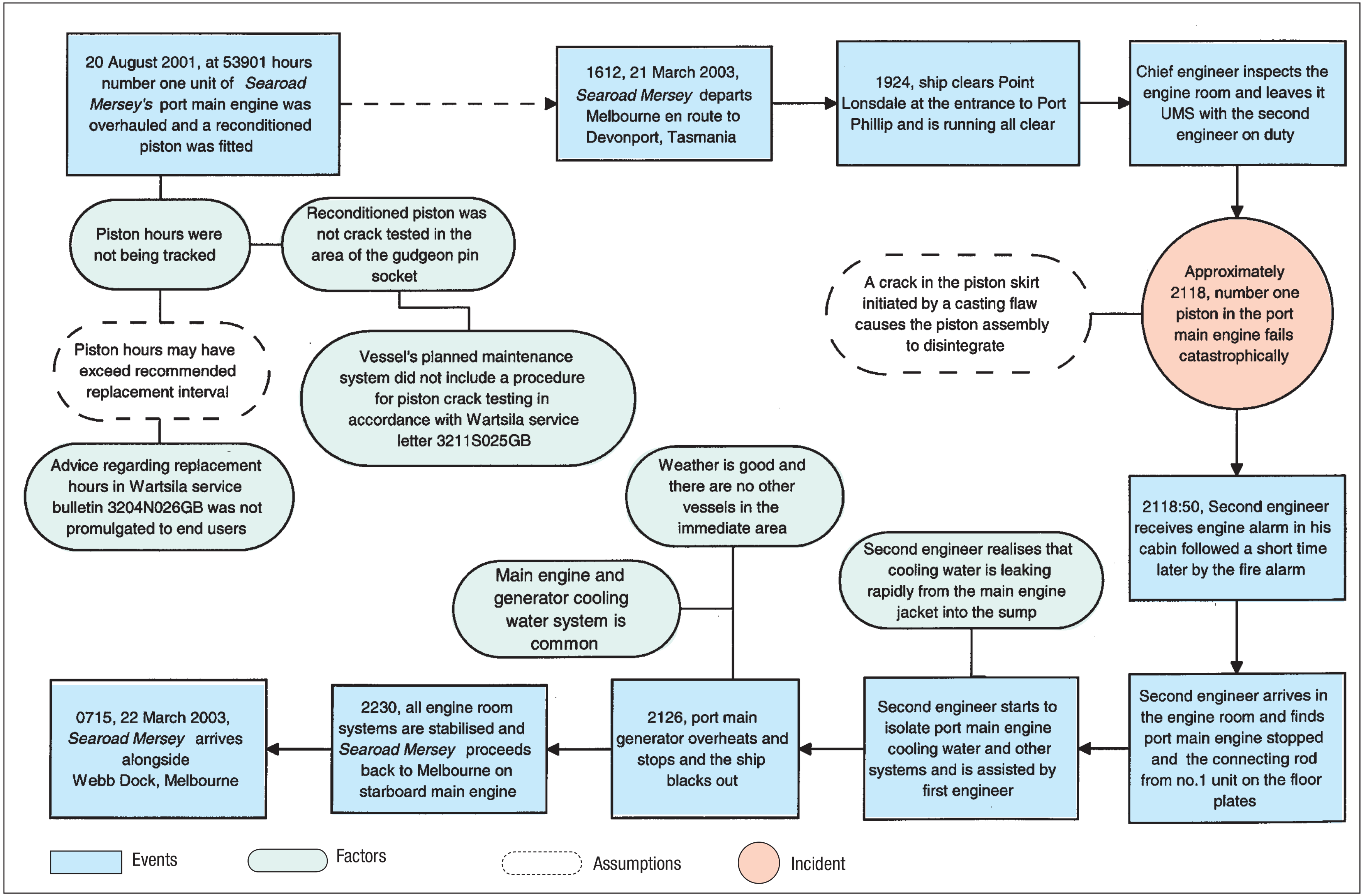
5 CONCLUSIONS

These conclusions identify the different factors contributing to the incident and should not be read as apportioning blame or liability to any particular organisation or individual.

The following factors are considered to have contributed to the failure of *Searoad Mersey*'s port main engine on 21 March 2003:

1. The casting flaw found in the piston skirt fitted to number one unit initiated a fatigue crack which eventually caused the piston to fail in service.
2. The vessel's maintenance system did not include a system for tracking the total operating hours of the main engine piston assemblies.
3. The vessel's maintenance system did not include a procedure for crack testing the piston skirts in the areas stipulated by the manufacturer in their service bulletin *Piston overhaul of VASA 32 engines after 24 000 running hours and later overhauls*.
4. The critical manufacturer's *Main Components maintenance intervals for VASA 32, 32LN and 32GD* bulletin had not been provided to the vessel or its technical manager.
5. The evidence strongly suggests that Wartsila Vasa 32 engines have had a history of piston skirt failures similar to that experienced by *Searoad Mersey*.

FIGURE 10:
***Searoad Mersey*: Events and causal factors chart**



6 RECOMMENDATIONS

MR 20040035

Operators of Wartsila Vasa 32 engines ensure that they comply with the manufacturer's recommendations in respect of the overhaul and replacement of piston assemblies at the operating hours stipulated.

MR 20040036

Wartsila NSD review their system for distributing technical bulletins to ensure that all owners and operators of their engines are provided with appropriate advice and warnings in a timely manner.

7 SUBMISSIONS

Under sub-regulation 16(3) of the Navigation (Marine Casualty) Regulations, if a report, or part of a report, relates to a person's affairs to a material extent, the Inspector must, if it is reasonable to do so, give that person a copy of the report or the relevant part of the report. Sub-regulation 16(4) provides that such a person may provide written comments or information relating to the report.

Copies of the draft report were sent to *Searoad Mersey*'s master, chief engineer and second engineer, the Australian Maritime Safety Authority, Wartsila NSD, Patrick Shipping and ETRS Melbourne.

Submissions were received from Wartsila NSD and have been included in the final report where appropriate.

8 SEAROAD MERSEY

Name	*Searoad Mersey*
IMO No.	853962
Flag	Australia
Classification Society	Det Norske Veritas
Vessel type	Roll-on/roll-off container vessel
Owner	Canzon
Ship manager	Patrick Shipping, Melbourne
Year of build	1990
Builder	Singapore Slipway and Engineering Company, Singapore
Summer deadweight	4 824 tonnes
Length overall	119.30 m
Breadth, moulded	18.50 m
Depth	13.60 m
Draught (summer)	5.512 m
Engine	2 x Wartsila Vasa 8R32E, 8-cylinder, single acting, 4-stroke
Engine power	2 x 3 280 kW @ 750 rpm
Service speed	16 knots
Crew	15 Australians

Independent investigation into the equipment failure aboard the Australian flag roll-on/roll-off vessel Searoad Mersey, in Bass Strait on 21 March 2003

ISSN 1447-087X
ISBN 1 877071 87 0

1800 621 372
www.atsb.gov.au

Searoad Mersey 11.04