MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

ACCIDENT REPORT

SERIOUS MARINE CASUALTY | REPORT NO 6/2017 | APRIL 2017

Passenger ferry *Uriah Heep* contact with Hythe Pier near Southampton, United Kingdom 13 May 2016

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SUMMARY

On 13 May 2016 the passenger ferry *Uriah Heep*, with 15 passengers and three crew on board, ran into Hythe Pier while it was attempting to berth. The ferry became wedged under the pier and its wheelhouse was demolished, but there were no serious injuries and there was no pollution. The MAIB investigation identified that:

- The confined nature of the ferry's normal berth at Hythe afforded little space in which to safely abort an approach in the event of a mechanical malfunction.
- The collision resulted from a loss of control of the ferry's water jet propulsion.
- The cause of the loss of propulsion control could not be identified but it was almost certainly due to a mechanical failure within the system's hydraulic circuit.
- The potential for similar mechanical failures to occur in the future cannot be discounted.
- Injuries to passengers were avoided by them being seated and warned of the impending impact.

Following the accident, the Maritime and Coastguard Agency (MCA) withdrew *Uriah Heep*'s passenger safety certificate and the ferry was sold by its operator, White Horse Ferries Ltd. In view of the action taken, no recommendations have been made.

Uriah Heep

FACTUAL INFORMATION

Narrative

At 2100[1] on 13 May 2016, the water jet propelled trimaran *Uriah Heep* departed Town Quay, Southampton, for passage along Southampton Water to Hythe, 1.4nm to the south-south-east **(Figure 1)**. On board were the skipper, mate, deckhand and 15 passengers, who were briefed by the mate to remain

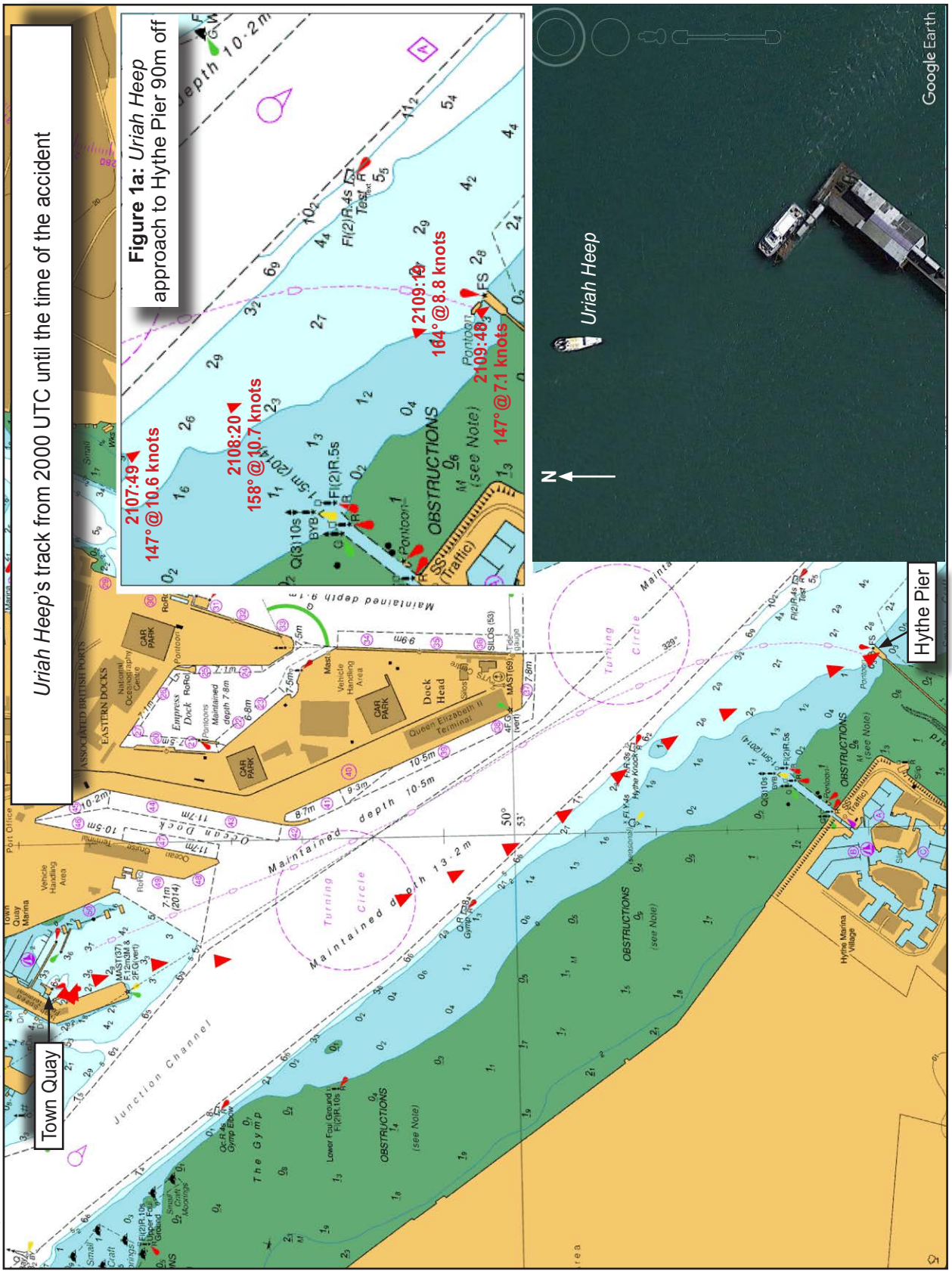

Figure 1: *Uriah Heep* track from Town Quay to Hythe Pier

[1] All times in this report are UTC+1.

seated during the short passage. By 2105, the ferry was heading 157° at a speed of 10.7kts[2]. The wind was north-westerly at between 10 and 15kts and the predicted tidal stream was ebbing to the south-east at a rate of 1kt.

At about 2109, *Uriah Heep*'s skipper reduced the ferry's engine speed from approximately 1800rpm to 1500rpm. The vessel was about 90m from its intended berth located on the inner side of a pontoon attached to the north-west side of Hythe Pier **(Figures 1** and **2)**. The skipper used his left hand to move the morse lever on the forward console to control engine speed and his right hand to move the joystick controller on the starboard console to alter the vessel's heading **(Figure 3)**. Both the mate and the deckhand had donned lifejackets ahead of the planned berthing operation. The mate was at the disembarkation point aft of the wheelhouse while the deckhand was seated in the passenger cabin.

As *Uriah Heep* neared the western end of the pontoon, the skipper moved the starboard joystick backwards in order to set the water jet propulsion to drive astern. The ferry's speed did not reduce. The skipper increased the engine speed but, instead of slowing and stopping off the pontoon as the skipper expected, the ferry accelerated ahead. The skipper immediately alerted the crew by shouting "*no control*". In response, the mate told the passengers to "*brace*".

Seconds later *Uriah Heep*'s wheelhouse struck the underside of Hythe Pier. The impact shattered the wheelhouse's glass windows and pushed its roof and canopy on to the top of the passenger cabin. The ferry came to rest wedged under the pier **(Figure 4)**. The mate checked the wellbeing of the passengers, none of whom were injured, and then helped the skipper, who had suffered minor cuts and abrasions and was crawling out from beneath the wheelhouse debris. He then told the deckhand to use a hand-held VHF radio to inform Southampton VTS of the accident. The mate also told the passengers to don lifejackets and to remain seated until assistance arrived.

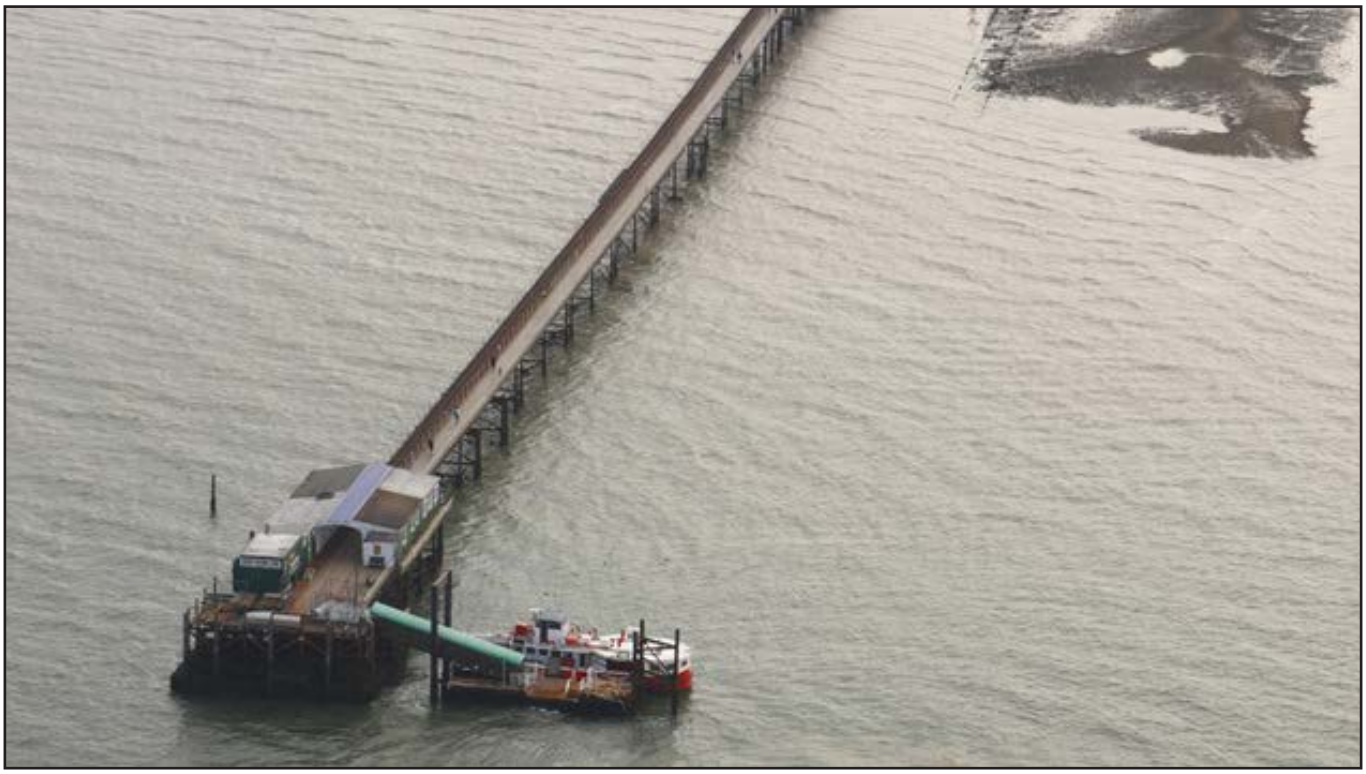

Figure 2: Arrangement of Hythe Pier showing *Hotspur IV* at the inner berth

[2] All vessel speeds in this report are speed over the ground.

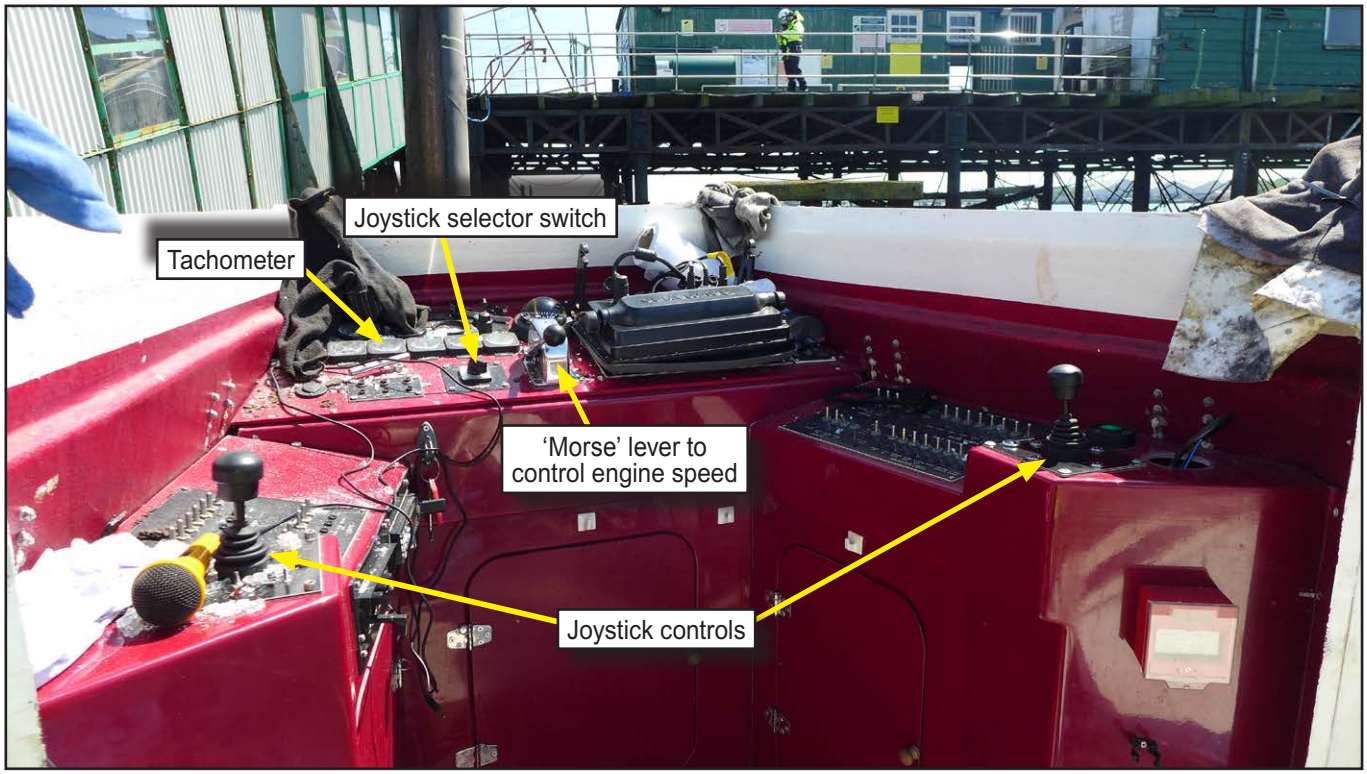

Figure 3: Wheelhouse console

Figure 4: *Uriah Heep* under Hythe pier

The port services launch, *Joker,* was first on the scene and was used to transfer the passengers and crew to the pontoon. *Uriah Heep*'s engine, which had been left running to provide lighting, was then stopped and the ferry was towed from under the pier and secured alongside the pontoon **(Figure 5)**. It is reported that the position in which the starboard joystick control was found corresponded to a position that usually provided astern drive.

Figure 5: *Uriah Heep* showing damage

During the morning of 14 May, *Uriah Heep*'s engine was re-started and the ferry's water jet propulsion system was tested. The water jet nozzle and the thrust deflector operated as expected in response to the movement of both the port and starboard joystick controllers. The ferry was subsequently towed to Hamble Point Marina, where it was taken out of the water.

Vessel history

Uriah Heep was built in 1999 and was one of six vessels designed specifically for commuter services on the River Thames. The vessels operated to dedicated V-shaped berths that helped keep the craft steady as the passengers embarked and disembarked **(Figure 6)**. In 2001, the vessels' operator, White Horse Ferries Ltd, ceased its services on the Thames and *Uriah Heep* was taken out of the water and laid up in Gravesend **(Figure 7)**.

In April 2015, *Uriah Heep* was put back in the water and towed to Southampton where it was intended to replace the aging ferry *Hotspur IV* on the service between Southampton and Hythe, a service White Horse Ferries Ltd had operated through Hythe Ferry Ltd since 1991. Sea trials were conducted in Southampton Water and the ferry's intended skippers were trained in the operation of its water jet propulsion system and handling characteristics. It was evident during the trials, which included berthing alongside the pontoons at Hythe Pier and Town Quay, that *Uriah Heep* was prone to 'rolling' in moderate sea states, particularly when travelling at slow speed or when stationary.

The MCA issued a passenger safety certificate for *Uriah Heep* on 22 May 2015, and the vessel commenced operating on the Hythe-Southampton route a few days later.

Propulsion and steering

Uriah Heep was fitted with a single water jet **(Figure 7)** powered by a 388kW diesel engine. The amount of thrust generated by the water jet was directly proportional to the speed of the impeller driven by the engine. Engine speed was regulated by a morse control lever and indicated by a tachometer, both of which were sited on the wheelhouse's forward console **(Figure 3)**. The minimum engine speed generally used when manoeuvring was approximately 1500rpm.

Directional control (steering) was achieved by lateral movement of the jet nozzle. The average time taken to move the jet nozzle from fully angled to port to fully angled to starboard, and vice versa, was 2 seconds, irrespective of engine speed. Ahead and astern thrust was determined by the position of a deflector **(Figure 7)**. The time taken to move the deflector and change the direction of thrust from ahead to astern was between 4 seconds (engine speed 1200rpm-1800rpm) and 7 seconds (engine speed 800rpm).

Figure 6: V-berth arrangement on River Thames

Figure 7: *Uriah Heep* laid up at Gravesend

The lateral movement of the water jet nozzle and the position of the thrust deflector were controlled by joysticks located on the port and starboard consoles. The joysticks were integral to independent control systems with the control system in use (port or starboard) being selected via a switch on the forward console.

Forward movement of a joystick moved the deflector clear of the water jet nozzle to produce 'ahead' drive; backward movement of a joystick lowered the deflector to produce 'astern' drive. The sideways movement of a joystick moved the water jet nozzle to port or to starboard. The joystick controls were not self-centring and remained in the last position they were set. Neither the position of the water jet nozzle nor the position of the deflector were indicated in the wheelhouse. 'Zero' or 'neutral' thrust could be achieved by moving the joystick controls to balance the nozzle direction and deflector position, but this relied on the judgment and skill of the operator.

The movement of the selected joystick in the wheelhouse was translated into electrical signals that acted, via an electronic logic controller, onto directional control valves that operated hydraulic rams connected to the water jet nozzle and the deflector **(Figure 8)**. The hydraulic circuit included load-sensing valves that prioritised hydraulic power to the water jet nozzle over the deflector. The hydraulic pump had no back-up in the event of failure, and there was no means of moving the water jet nozzle or the deflector in the event of the total loss of hydraulic power.

Hydraulic system tests

On 26 September 2016, the hydraulic circuit that moved *Uriah Heep*'s water jet nozzle and deflector was inspected and tested by Mechanical Services Ltd on behalf of the MAIB. As the ferry was out of the water, the main engine could not be run, so a portable electric motor was used to drive the hydraulic pump. The inspection report concluded that the system appeared to be working as intended. However, it also noted that the hydraulic system temperatures achieved during the tests were substantially cooler than if the vessel had been operating on the water.

Survey and certification

Uriah Heep was surveyed by an MCA surveyor on 10 May 2015 prior to entering service on the Hythe - Southampton route. The survey report identified 18 deficiencies that had to be addressed before the ferry could be issued with a passenger safety certificate in accordance with the requirements of Merchant Shipping Notice (MSN) 1823(M) *Safety Code for Passenger Ships Operating Solely in UK Categorised Waters*. Included in the deficiencies was that there was no method of emergency steering available in the event of a hydraulic circuit failure.

Following representations by White Horse Ferries Ltd, the MCA accepted that the duplicated electronic steering control system was sufficient to meet the requirements of an auxiliary steering system. The MCA took into account the sheltered nature of the ferry's intended route and the proximity of support in the event of a steering failure.

The passenger ship safety certificate issued by the MCA allowed the ferry to carry 42 passengers, all seated inside the cabin. Other operational limitations detailed on the certificate included:

> *Vessel to be operated in fair weather, where fair weather is defined as clear, fine settled weather with a sea state such as to cause only moderate pitching and rolling.*

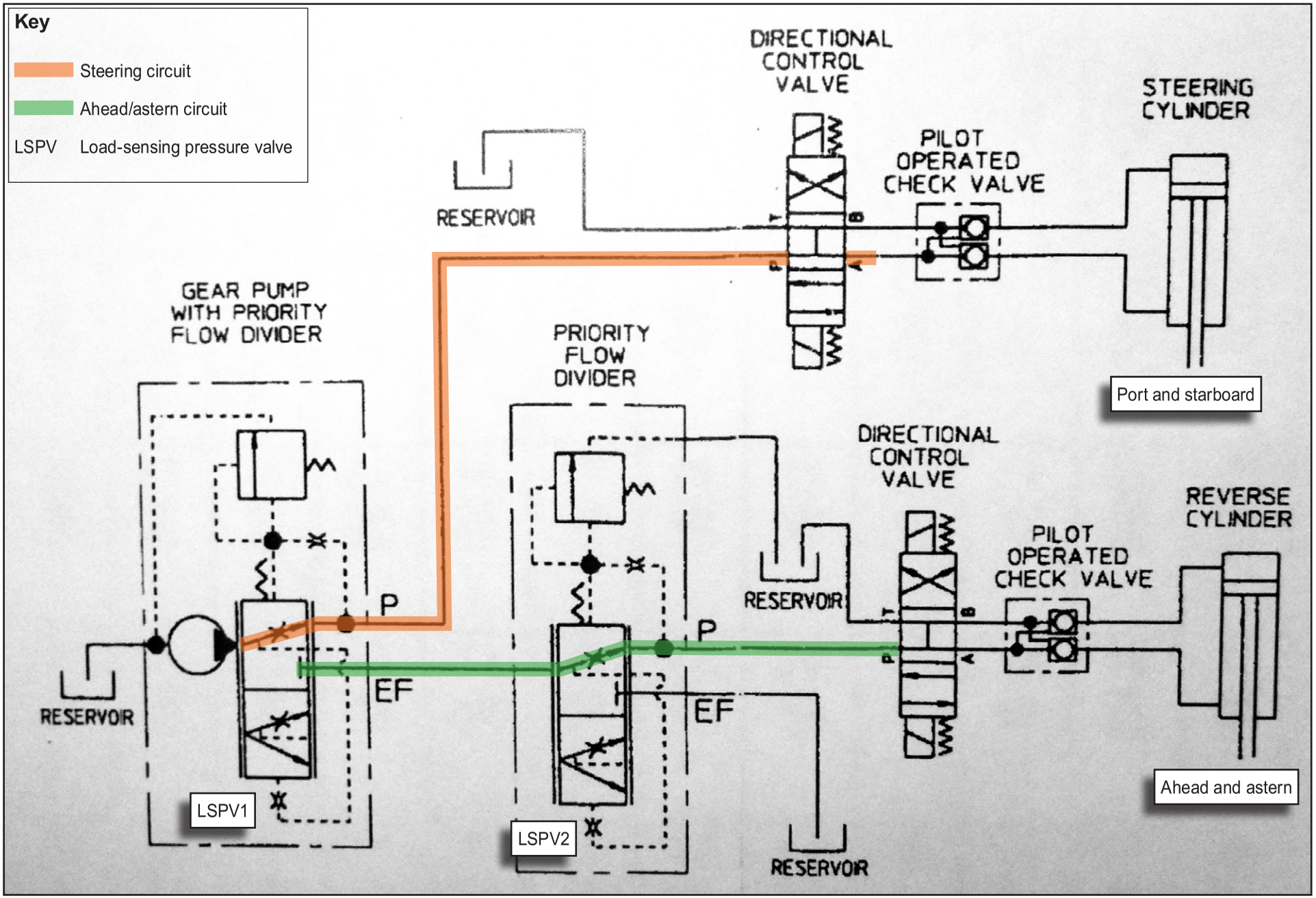

Figure 8: Hydraulic circuit diagram

Crew

Uriah Heep's skipper (age 54) had worked for Hythe Ferry Ltd for over 30 years. He had been a skipper for 25 years and had been a skipper on board *Uriah Heep* since the ferry re-entered service. He held a Tier 2 Category D Boatmasters' Licence and also had a pilotage exemption certificate for Southampton. The mate (age 63) had been employed by Hythe Ferry Ltd for 6 years and regularly worked with the skipper. The mate held no maritime qualifications. The deckhand (age 26) was a postgraduate engineer and had worked for Hythe Ferry Ltd for approximately 1 month on a casual basis. On 13 May 2016, the skipper and crew started their shift at 1305, but the ferry service was suspended for 2 hours from 1800 due to adverse sea and weather conditions.

Hythe Pier

The inner side of the pontoon attached to the north-west side of Hythe Pier's seaward end was *Uriah Heep*'s usual berth. The outer side of the pontoon was used by *Great Expectations*, a conventional twin hulled ferry also operated by Hythe Ferry Ltd. The fendering on each side of the pontoon was arranged to accommodate the differing hull forms of the two ferries. As a result, *Uriah Heep* normally embarked and disembarked passengers at the inner side of the pontoon.

Previous accidents and incidents

In 1999, *Uriah Heep* made heavy contact with a 'V' berth on the Thames following the loss of propulsion control. Investigation by the hydraulic system's manufacturer identified that the failure of a load sensing valve had prevented the actuation of the power ram connected to the thrust deflector. Consequently, the deflector had remained in the 'ahead' position.

On 27 May 2015, *Uriah Heep* made heavy contact with Town Quay, Southampton. As the ferry approached its intended berth the skipper moved the joystick controller to initiate astern drive, but *Uriah Heep* did not decelerate. To achieve a quicker response from the propulsion system, the skipper increased the engine speed, but this resulted in the ferry accelerating ahead. The skipper immediately reduced the engine speed and selected the auxiliary steering system. However, he was still unable to initiate astern drive so he steered the ferry away from its berth. In doing so, it struck an adjacent quay. The skipper was able to warn the passengers and crew before the contact and there were no injuries. During subsequent tests, the propulsion system operated as designed. However, as a precaution, a number of the hydraulic circuit's components were replaced and a hydraulic oil cooler was fitted.

On 10 May 2016, *Uriah Heep* was anchored soon after leaving Hythe when its skipper noticed that the propulsion system was not responding as expected. Inspection identified that the delayed response was caused by a hydraulic oil leak.

During the morning of 13 May 2016, the same day as this accident, *Uriah Heep*'s skipper reported that the starboard joystick controller had been stiff to move. However, the problem was no longer evident after a shore engineer had dismantled and re-assembled the controller mechanism.

ANALYSIS

Loss of control

There is strong evidence to support the conclusion that during *Uriah Heep*'s approach to the pontoon on Hythe Pier the ferry's water jet propulsion system did not operate as expected by its skipper. Consequently, the ferry's wheelhouse struck the pier at a speed of about 7kts. That the ferry accelerated ahead after the starboard joystick controller had reportedly been moved backwards and the engine speed had been increased, indicates that the thrust deflector did not respond, or was very slow to respond, to the joystick commands. However, no defects with the propulsion control or hydraulic systems were found during tests at Hythe following the accident or during the later tests commissioned by the MAIB.

Without propulsion control records, it is not possible to discount that the continued and unintended ahead thrust was caused by the skipper's actions, particularly in view of *Uriah Heep*'s manoeuvring characteristics, which required a high degree of anticipation and hand-eye co-ordination, and the lack of indication in the wheelhouse of the actual positions of the jet nozzle and the deflector. However, the skipper was very familiar and practised with the water jet propulsion system. In addition, that he adjusted the ferry's heading and speed during the crossing **(Figure 1)**, and had the presence of mind to alert the crew before the ferry ran under Hythe Pier, indicates that he had a good level of situational awareness throughout. Therefore, given that the circumstances of the accident were also identical to those experienced at Town Quay in Southampton 1 year earlier, it is more likely that the loss of propulsion control was due to mechanical malfunction rather than to human error.

Berth approach

Uriah Heep's normal berths on Hythe Pier and at Town Quay afforded little margin for error. Both were confined with limited options available in the event of an approach having to be aborted. In addition, the berth at Hythe Pier was exposed to the effects of the wind and the tidal stream. Further, even when the tide was ebbing, the easiest approach to the inner berth was down-tide. Although the ferry's water jet propulsion arguably made it more manoeuvrable than similar sized vessels fitted with a propeller and rudder, high engine speeds were required when manoeuvring to ensure that sufficient thrust was generated and that the response time of the deflector was minimised. At Hythe Pier, the ferry's susceptibility to rolling was also a consideration with respect to the speed of approach. In such circumstances, any loss of directional control or of 'ahead' or 'astern' drive had the potential to be difficult to correct in the limited sea room available.

Failure mode

Although *Uriah Heep* was equipped with two independent means of controlling its water jet propulsion from the wheelhouse, the mechanical rams that moved the water jet nozzle and the deflector were driven by the same hydraulic system. Consequently, the malfunction of a single hydraulic component had the potential to result in the prioritisation of nozzle movement over deflector movement or, worse, render both the water jet nozzle and the deflector inoperative.

A common factor in the three accidents in which *Uriah Heep* has struck fixed objects while attempting to berth (1999, May 2015 and May 2016) was that the skippers were unable to stop the vessel due to the lack of 'astern drive'. As no problems were reported or found with the ferry's main engine, the absence or insufficiency of astern drive on all of these occasions must have been caused by the water jet deflector not moving into the required position.

In 1999, the failure of the deflector to operate was due to the malfunction of a load sensing valve within the hydraulic circuit. However, the technical investigations of the most recent occurrences have been inconclusive. Nonetheless, it is almost certain that the causes of the deflector failure on these occasions were again associated with the propulsion system's hydraulics.

It is frequently the case that intermittent faults only become identifiable when the conditions of failure are reproduced. In the case of hydraulic systems, the variabilities of temperature and hydraulic pressure frequently make this difficult to achieve. Therefore, while the failure modes that led to the accidents at Town Quay and Hythe Pier could not be identified or repeated, that does not mean that they did not exist or will not re-occur in the future.

The MCA's acceptance that *Uriah Heep* lacked an auxiliary steering arrangement before the vessel re-entered service in 2015 was based largely on the ferry's duplicated control system, the sheltered waters in which the ferry was operating and the close proximity of assistance. In hindsight, the circumstances of this case indicate that the potential for a loss of control close to the ferry's intended berths also warranted consideration.

Passenger safety

That no passengers were injured during *Uriah Heep*'s collision with Hythe Pier, or at Town Quay a year earlier, supports the onboard requirement for passengers to remain seated while the ferry was underway. It also reflects positively on the crews' quick thinking to warn the passengers prior to the impacts.

CONCLUSIONS

- *Uriah Heep*'s collision with Hythe Pier resulted from a loss of propulsion control.
- The confined nature of the ferry's berth at Hythe afforded little space within which to abort an approach in the event of a mechanical malfunction.
- The loss of propulsion control almost certainly resulted from a mechanical failure within the hydraulic circuit that powered the thrust deflector.
- The cause of the mechanical failure could not be identified and the potential for similar mechanical failures to occur in the future cannot be discounted.
- The safety of the passengers was assured by them being seated and warned prior to the ferry's impact with the pier.

ACTION TAKEN

The **Maritime and Coastguard Agency** has withdrawn *Uriah Heep*'s passenger safety certificate and will take the findings of its own investigation into this accident into account should an application to certify the vessel as a passenger ship be received in the future. **White Horse Ferries Ltd** has sold the vessel.

RECOMMENDATIONS

In view of the actions taken following the accident, no recommendations have been made.

SHIP PARTICULARS	
Vessel's name	*Uriah Heep*
Flag	United Kingdom
Classification society	Not applicable
IMO number/fishing numbers	902817
Type	Passenger ferry
Registered owner	White Horse Ferries Ltd
Manager(s)	Hythe Ferry Ltd
Year of build	1999
Construction	Glass Reinforced Plastic
Length overall	17.64
Registered length	17.64
Gross tonnage	13.57
Minimum safe manning	2
Authorised cargo	Not applicable
VOYAGE PARTICULARS	
Port of departure	Southampton
Port of arrival	Hythe
Type of voyage	Domestic passenger
Cargo information	Not applicable
Manning	3
MARINE CASUALTY INFORMATION	
Date and time	13 May 2016 at 2110
Type of marine casualty or incident	Serious Marine Casualty
Location of incident	Hythe Pier, Hythe, Hampshire, UK
Place on board	Wheelhouse and superstructure
Injuries/fatalities	None
Damage	Wheelhouse demolished
Ship operation	On passage/berthing
Voyage segment	Arrival
External environment	Semi-darkness. The wind was north-westerly at between 10 and 15kts and the tidal stream was ebbing to the south-east at a rate of 1kt.
Persons on board	18