Report on the investigation of

the collision between

Sea Express 1

and

Alaska Rainbow

on the River Mersey

3 February 2007

Marine Accident Investigation Branch
Carlton House
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Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2005 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

<u>NOTE</u>

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AIS	-	Automatic Identification System
ARPA	-	Automatic Radar Plotting Aid
CCTV	-	Closed Circuit Television
CHA	-	Competent Harbour Authority
COLREGS	-	The International Regulations for Preventing Collisions at Sea 1972, as amended
CSO	-	Customer Service Officer
EBL	-	Electronic Bearing Line
ETA	-	Estimated Time of Arrival
GPS	-	Global Positioning System
HSC 1994 Code	-	International Code of Safety for High Speed Craft, 1994
IALA	-	International Association of Marine Aids to Navigation and Lighthouse Authorities
IMO	-	International Maritime Organization
IOMSPC	-	Isle of Man Steam Packet Company
m	-	metre
MCA	-	Maritime and Coastguard Agency
MDHC	-	Mersey Docks and Harbour Company
MGN	-	Marine Guidance Note
MKD	-	Minimum Keyboard Display
MoU	-	Memorandum of Understanding
MPTE	-	Merseyside Passenger Transport Executive
MSC	-	Maritime Safety Committee of IMO
MSN	-	Merchant Shipping Notice
OOW	-	Officer of the Watch
PEC	-	Pilotage Exemption Certificate

PMSC	-	Port Marine Safety Code
RNLI	-	Royal National Lifeboat Institution
Ro-Ro	-	Roll on - Roll off
SAR	-	Search And Rescue
SOLAS	-	Safety of Life At Sea Convention
STCW95	-	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended
t	-	tonne
TRC	-	Type Rating Certificate
TRE	-	Type Rating Examiner
TRI	-	Type Rating Instructor
UTC	-	Universal Time Co-ordinated
VDR	-	Voyage Data Recorder
VHF	-	Very High Frequency
VRM	-	Variable Range Marker
VTS	-	Vessel Traffic Services
VTSO	-	Vessel Traffic Services Operator

SYNOPSIS

At 1138 (UTC) on 3 February 2007, the high speed ferry *Sea Express 1* and the general cargo vessel *Alaska Rainbow* collided on the River Mersey in thick fog. The collision holed the starboard hull of the ferry, causing her to list and trim significantly within seconds. However, there were only minor injuries to passengers and the vessel remained afloat. There were no injuries on board *Alaska Rainbow*, and the damage to this vessel was minor.

Alaska Rainbow had anchored in the vicinity of the Bar Light Buoy at 0030 on 3 February, and had remained at anchor until 0830. She was bound for Birkenhead Docks, which required her to transit the Alfred Lock. The pilot boarded once the vessel was off the Bar Light Buoy, at 0918. Two tugs were attached before the vessel arrived off the lock. Here, the pilot turned the vessel to stem the tide and await the scheduled docking time, and for the visibility to clear enough for a safe approach to be made.

Sea Express 1 left Douglas, Isle of Man, at 0850, bound for Liverpool Landing Stage in the vicinity of Alfred Lock. On board were 274 passengers, 20 crew and 58 cars. This included a trainee captain who was to berth *Sea Express 1* in Liverpool as part of his assessment for type rating examination. At 1033, as *Sea Express 1* approached the Bar Light Buoy, the trainee captain made contact with Mersey Radio (VTS), who passed the positions of other traffic and advice that visibility in the river was poor. No mention was made of *Alaska Rainbow*.

Sea Express 1 proceeded inwards, reducing her speed over the ground to about 7 knots. At 1138, in the vicinity of Alfred Lock, *Sea Express 1* took action to avoid *Alaska Rainbow*'s forward tug, which had suddenly appeared out of the fog directly ahead. Seconds later *Alaska Rainbow* appeared, and *Sea Express 1* took further avoiding action. However, this was too late, and *Sea Express 1'*s starboard quarter and *Alaska Rainbow'*s bow collided. The collision tore a large hole in the starboard hull of *Sea Express 1,* immediately flooding the engine room and jet pump room. This caused an electrical blackout and the loss of both starboard engines, effectively disabling the vessel. The captain of *Sea Express 1* notified Mersey Radio 40 seconds after the collision and, following a subsequent request for tug assistance, *Sea Express 1* was towed to the Liverpool Landing Stage, where the passengers were disembarked.

Mersey Docks and Harbour Company and Isle of Man Steam Packet Company Limited have taken a number of actions following the accident, particularly with respect to VTS operations, pilotage training and the allocation of bridge team duties in preparation for type rating examinations. Additionally, as a result of its analysis of the accident and the ascertainment of its causes and circumstances, the MAIB has made recommendations as follows:

- Isle of Man Steam Packet Company Limited is recommended to:
  - Review its safety management system with particular respect to its instructions on the use of radar and bridge team procedures for conducting external communications in the event of an emergency.
  - Ensure that its passenger safety instruction card is appropriate for the type of lifejacket to be found under each passenger seat for which the card is provided.

- J.G. Goumas (Shipping) Co. S.A. is recommended to ensure that its masters are given clear guidelines which detail the importance of effective dialogue with pilots and identify the need for the ship's bridge team to be proactive in providing support to pilots and to challenge decisions taken by pilots at an early stage so that, when required, effective corrective action can be taken to prevent accidents.

- Mersey Docks and Harbour Company (MDHC) is recommended:

  - To complete its review of compliance with the requirements of the Port Marine Safety Code (PMSC) with particular reference to VTS operations, pilotage best practice and emergency procedures.

  - Following satisfactory completion of its review into PMSC compliance, invite the Maritime and Coastguard Agency (MCA) to conduct a PMSC verification visit to the Port of Liverpool.

  - Review the Mersey Channel Collision Rules with respect to sound signals required by vessels manoeuvring in close proximity during periods of restricted visibility.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *SEA EXPRESS 1, ALASKA RAINBOW* AND ACCIDENT

Vessel details		***Sea Express 1* (Figure 1)**
Registered owner	:	MIOM 1 Ltd
Manager	:	Isle of Man Steam Packet Company Limited
Port of registry	:	Newhaven
Flag	:	UK
Type	:	Ro-Ro Cargo/Passenger Ferry, Twin Hull HSC Code Category B craft
Built	:	1991 – Incat – Tasmania
Classification society	:	Det Norske Veritas
Construction	:	Aluminium
Length overall	:	74m
Gross tonnage	:	3003
Engine type	:	4 x Rushton 16R K270
Service speed	:	36 knots
Other relevant info	:	Two engines in each hull each drive a jet pump. Control of the four jets can be provided independently or through a combined control system

Vessel details		***Alaska Rainbow* (Figure 2)**
Registered owner	:	Sea Echo ENE
Manager	:	J.G. Goumas (Shipping) Co. S.A.
Port of registry	:	Piraeus
Flag	:	Greece
Type	:	Geared Bulk Carrier
Built	:	1985 – Japan
Classification society	:	Nippon Kaiji Kyokai
Construction	:	Steel
Length overall	:	157.26 m
Gross tonnage	:	13,898
Engine type	:	Mitsubishi 6UEC 52L
Service speed	:	13.7 knots
Other relevant info	:	Single screw, conventional rudder. No bow thruster. Four holds with one crane per hold

Accident details

Time and date	:	3 February 2007 – 1138 (UTC)
Location of incident	:	Lat 53º 24.625'N Long 003º 00.617'W River Mersey – off Alfred Lock **(Figure 3)**
Persons on board	:	*Sea Express 1*- 274 passengers, 20 crew *Alaska Rainbow* – 21 crew, 2 pilots
Injuries/fatalities	:	*Sea Express 1* - minor injuries to 13 passengers
Damage	:	*Sea Express 1* - large hole in starboard engine room, split hull at No 4 void, starboard bridge wing crushed *Alaska Rainbow* – minor damage.

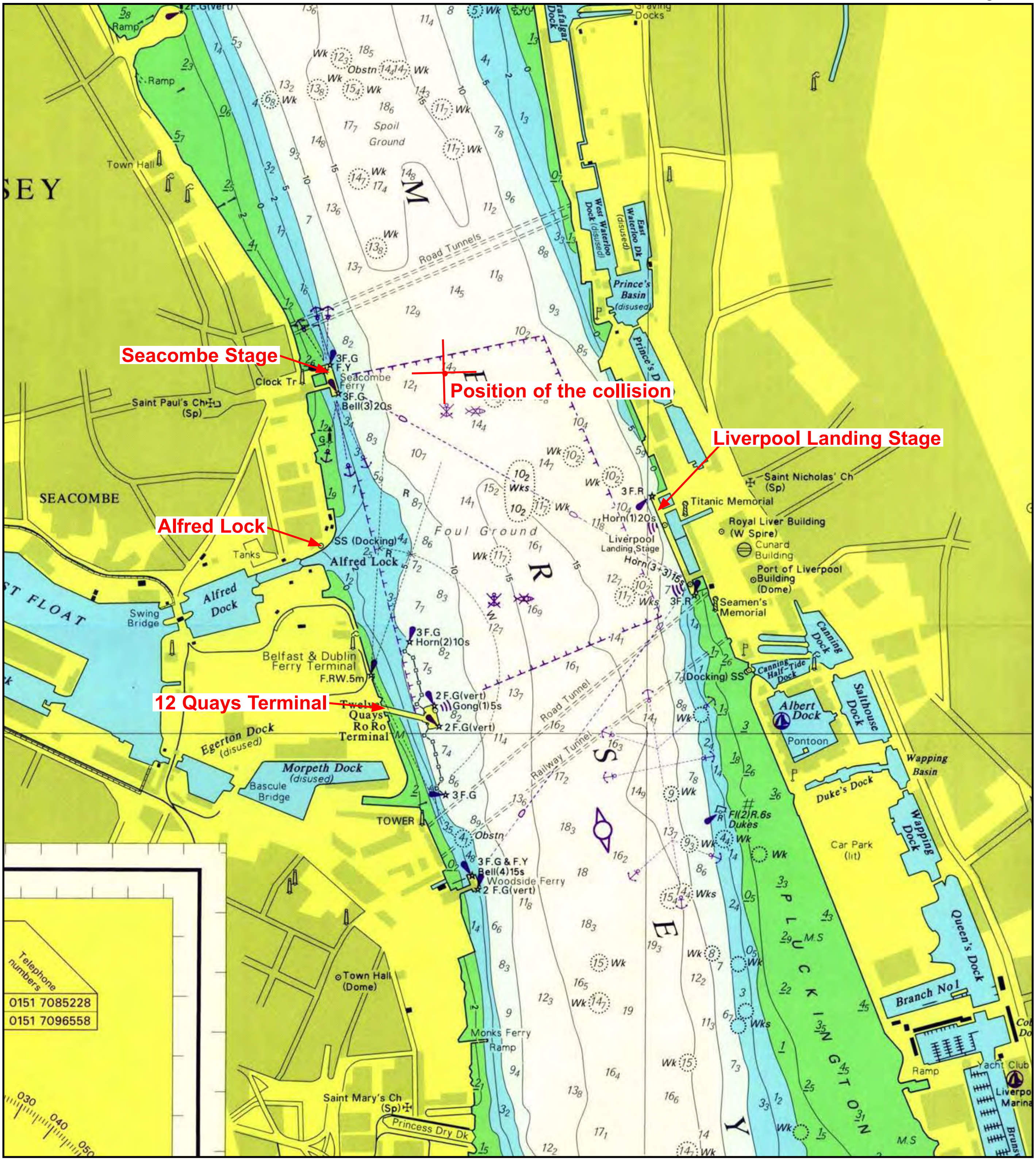
Figure 1

Sea Express 1

Figure 2

Alaska Rainbow

Figure 3



River Mersey and location of the collision

1.2 BACKGROUND

1.2.1 *Sea Express 1*

a) Vessel

Built in Tasmania, *Sea Express 1* had been operated in the Irish Sea with several companies on different routes and under a number of different names. The ship had been operated by Isle of Man Steam Packet Company Limited (IOMSPC) in the past, but had been replaced by a more modern vessel. She was brought back into service by the IOMSPC in mid September 2006 to replace another of the fleet's vessels during refit and repair of that vessel.

Built of aluminium, *Sea Express 1* had a catamaran hull form, with each hull designed for wave piercing. This optimised the top speed of the vessel while providing a stable platform for passenger comfort. Each of the two hulls was sub-divided into eight compartments. The forward space was the forepeak, and the next five were void spaces numbered from forward to aft, with number four void of both hulls being available for use as a bunker tank for long range voyages. At the time of the accident, these voids were clean and gas free, and had not been used for bunkers since the ship's delivery voyage from Tasmania in 1992. Spaces 7 and 8 were the engine and jet pump rooms respectively. Although they were identified as separate spaces with no access between them, the bulkhead between the two was not watertight, and they were therefore considered to be a single space for damage stability purposes.

The vessel operated different timetables for the winter and summer seasons. Operating on the winter timetable at the time of the accident, there were sailings only on Friday, Saturday and Sunday, consisting of a single round trip from Douglas to Liverpool and return to Douglas.

While the winter service was operating, the ship's staff continued to work a week-on, week-off rota, with the changeover day of Wednesday. On the days with no sailing, the ship's staff carried out general maintenance and training duties on the vessel. The cabin staff, however, had transferred to a winter contract, requiring them to be available only on sailing days, i.e. on Fridays, Saturdays and Sundays.

b) Bridge Layout and Equipment

The navigation, engine control and alarm equipment were mounted in a desk at the forward side of the bridge arranged on the centreline **(Figure 4)**. Three chairs were fitted for the operators. The left-hand chair was the engineer's position. In front of the engineer were the alarm panels and remote operating panels for the equipment in the engine room. The monitor for the CCTV cameras in the engine room was set to the left of the seat, with the fire alarm and engine alarm panels directly in front of the seat. The middle seat was positioned on the centreline of the ship, and was the position used for steering. The wheel was situated directly in front of the chair, with the controls for the steering motors and automatic whistle mounted above the wheel. To the left of this chair was a microphone for internal communications, the ship's mobile phone and a VHF radio handset. To the right of the chair were the four engine controls. These consisted of four levers set in two mounts, one mount for the port engines and one for the starboard engines. Ahead of the engine controls and mounted in the vertical face of the desk was a Kelvin Hughes Nucleus

3 radar. This radar was not directly in front of the person steering, but was easily visible from that position. The control panel for this radar was in easy reach of the chair, so the radar could be operated by the person steering. The right-hand chair had a Kelvin Hughes Nucleus 2 6000A ARPA radar directly in front of the operator. To the left was a handset for internal communications, the Voyage Data Recorder (VDR) control box and an echo-sounder repeater. To the right were the Global Positioning System (GPS) receiver, the Automatic Identification System (AIS) receiver, and the screens for the onboard computer.

In the deckhead above the centreline window **(Figure 5)** was a series of repeaters for the speed log, wind speed indicator, time clock and the periscope arrangement for viewing the magnetic compass. Behind the centreline seat on the after bulkhead of the bridge were the controls for the ship's audio-visual system for passenger safety announcements. On each bridge wing was a control panel for manoeuvring the vessel alongside a berth.

c) Bridge Manning and Management

IOMSPC required that the bridge was manned by the captain, first officer, chief engineer and a lookout at all times. The chief engineer sat in the left-hand seat, which was the control and monitoring station for the engines. The captain and first officer occupied the centreline and right-hand seats. The centreline seat was designated for steering and controlling the engines. The right-hand seat was designated for maintaining the radar watch and operating the communications equipment. The decision concerning whether the captain or first officer should sit in which seat was determined by the captain.

In general, the captain took the wheel on entering port, with the first officer providing navigational and collision avoidance support, and external communications, with the roles reversed at sea. However, this was not a fixed arrangement and was reversed from time to time. The bosun and two able seamen on board split the lookout requirement with the additional requirement for a presence on the car deck, organised such that 30 minutes as lookout was followed by 30 minutes on the car deck, then 30 minutes standby in the mess room. If necessary, owing to restricted visibility, a second lookout was stationed on the bridge.

On 3 February 2007, the bridge manning complement was increased by the inclusion of a trainee captain who was to berth *Sea Express 1* in Liverpool as part of his type rating examination. The trainee captain already held a type rating certificate for the vessel as first officer, and this was to be a final check of his capability in manoeuvring *Sea Express 1* alongside the Liverpool Landing Stage. The captain was one of the company's designated type rating examiners (TRE) for this vessel. The captain, trainee captain and first officer all held Pilotage Exemption Certificates (PEC) for Liverpool, and had worked on this route for a number of years.

The trainee captain took charge of the navigational watch with the captain in close proximity. On passing the Bar Light Buoy, the first officer was sitting in the centreline seat and the trainee captain was sitting in the right-hand seat, with the captain standing to one side of the trainee captain. Actions to avoid collision and maintain the planned track were discussed between the trainee captain and the captain, before the order to adjust course or speed was passed by the trainee captain to the first officer.

Figure 4

Sea Express 1 - bridge

Figure 5

Sea Express 1 - deckhead instruments

1.2.2 *Alaska Rainbow*

a) Vessel

Alaska Rainbow was a four hatch ship with a single electro-hydraulic crane at the forward end of each hatch. The four cranes were positioned on the centreline of the ship, and could operate through an arc of 360º, allowing two cranes to service holds 1, 2 and 3.

Alaska Rainbow traded worldwide. At the time of the collision, she was carrying a part cargo of steel products. This gave her a draught of 5.8m forward and 6.8m aft. This was only slightly deeper than the ballast condition, and considerably less than the vessel's maximum loaded draught of 9.91m.

The vessel was operated with a crew of 21, who were a mix of Greek and Filipino nationals. The working language on board was English, although Greek and Filipino were used extensively. The eight Greeks on board were employed on a 7 month contract, and the remaining 13 Filipino crewmen had signed 12 month contracts. Most of the crew had worked on the vessel for a number of contracts, with the Greek master having served on the vessel for 29 months in total.

The vessel operated a 3 watch system of 4 on 8 off watches, with bridge watches kept by the Greek chief officer and the Filipino second and third officers. At the time of the accident, the third officer was on watch, with the chief and second officers in charge of the forecastle and poop mooring crews respectively.

b) Bridge Layout and Equipment

The bridge of *Alaska Rainbow* occupied approximately one third of the breadth of the ship, with large open bridge wings to either side. The wheel and telemotor unit were mounted on the centreline in the middle of the wheelhouse **(Figure 6)**. To port of the telemotor unit was a fixed chair, and to starboard were the two radars, positioned next to each other. Forward of the radars was the engine telegraph, positioned close to the bridge front. To starboard, and aft of the wheelhouse was the chart room. The ship's two GPS receivers and the AIS receiver were all fitted in the chart room, in such a position that the data could also be read from the wheelhouse. The view directly ahead from a position on the centreline was restricted by the presence of the ship's cranes.

The port radar was a JRC JMA 9900 series ARPA, and the starboard radar was a Kelvin Hughes Nucleus 2 6000A, which was also an ARPA. The scanners for both radars were near the top of the main mast, and neither radar showed blind sectors.

c) Bridge Manning and Management

The bridge was manned by the master, third officer, helmsman and lookout, plus the pilot and a junior pilot. The roles were assigned such that the master and pilot discussed the navigation, the third officer stood by the engine telegraph following the orders of the master and completing the bell-book, and the helmsman and lookout kept to their respective tasks of steering and keeping a lookout. The pilot was left to carry out the navigation and radar watch, with the master offering assistance as necessary to adjust the radar display.

The junior pilot was on board as part of his training programme to advance from class 4 to class 3. This programme required that he witness a number of trips in and out of the various locks, particularly with regard to the use of the tugs. As the junior pilot, he had taken control of navigation for the initial stages of the pilotage, with the more senior pilot taking over as the vessel approached the tugs. From that point on, the junior pilot took an observing role, and had no part in the decisions concerning the navigation of the vessel. This was entirely in the hands of the more senior pilot and the master.

Figure 6

Alaska Rainbow - bridge

1.2.3 Vessel Traffic Services (VTS)

The VTS station was manned for 24 hour operation with two VTS operators (VTSOs) on duty at all times. Each VTSO manned a desk with specific responsibilities for either organising pilots or for the VTS information service. They monitored separate VHF radio channels and responded with different call signs. The information service was provided on VHF radio Channel 12 and utilised the call sign “Mersey Radio”. The pilotage desk utilised the call sign “Liverpool Pilots” and monitored Channel 9 as well as Channels 11 and 16.

Shipping movements within the port were mainly tidal, with the majority of these being undertaken during the period from 2 hours before to 1 hour after high water when the locks were accessible. Each VTSO stood a 12 hour watch.

Both operators had available at their respective desks a screen with a composite radar picture from the two radar sites covering the river and approaches superimposed on a chart of the area. The radar picture from Point Lynas in Anglesey, also superimposed on an appropriate chart, could also be accessed to monitor pilot boarding operations in the area and the traffic approaching the port along the North Wales coast. Each VTSO used his screen as required to monitor the shipping movements, either to advise on traffic movements or to monitor the progress and positioning of pilots.

1.3 NARRATIVE

(All times UTC)

Alaska Rainbow arrived at the anchorage in the vicinity of Liverpool Bar Light Buoy at 0030 on 3 February, and went to anchor to await the next high water, the predicted time of which was 1202. She was bound for Birkenhead Docks, which required her to transit Alfred Lock at a scheduled time of 1 hour before high water. The anchor was weighed at 0830 and the vessel proceeded towards the pilot boarding station. The pilot boarded at 0918. He was a class 2 pilot, and on this occasion was accompanied by a junior pilot.

The master and pilot discussed the passage into the port, and the pilot's intention of turning to stem the tide and wait for the approach of high water. The prevailing visibility in the river was poor due to fog; however, the pilot and master agreed that there was a good chance that the fog would have cleared by the time *Alaska Rainbow* reached Alfred Lock. The passage began in good visibility, with the junior pilot having control of the navigation. However, the visibility reduced as the vessel proceeded inwards, and the senior pilot took over before the vessel made the tugs fast. Two tugs were made fast at 1050, *Svitzer Bidston* forward and *Thorngarth* aft. By this time, the visibility in the river had substantially reduced to about 100m. At 1101, the pilot called "Mersey Radio" to inform VTS that *Alaska Rainbow* was starting to swing to starboard to stem the tide off Alfred Lock. By 1116, *Alaska Rainbow* was heading north, stemming the tide and awaiting sufficient visibility for entering the lock.

Sea Express 1 left Douglas at 0850, which was 10 minutes ahead of schedule. On departure, the sea was calm, with clear visibility and a cloudless sky. The routine VHF radio call to Liverpool Coastguard was made at 0852, giving numbers of passengers and crew on board and the vessel's ETA at the Liverpool Landing Stage. The passage then continued without incident. As the vessel approached the entrance to the River Mersey approach channel, the broadcasts by "Mersey Radio" became clearer, and it became apparent to all three deck officers that, once in the River Mersey, visibility would be reduced by fog.

At 1032, the trainee captain contacted "Mersey Radio" and informed the responding VTSO that *Sea Express 1* was 10 minutes from the Bar Light Buoy, and gave his PEC number for the entry. The VTSO acknowledged the information and passed the positions of the other traffic in the River Mersey ahead of *Sea Express 1*. The VTSO was then asked for an update on the state of visibility in the river. The VTSO replied that there were "patches of dense fog". No mention was made of the presence of *Alaska Rainbow.*

Sea Express 1 continued her passage inwards, and, at 1111, the trainee captain made radio contact with a tanker, *Keewhit*, which was proceeding inbound ahead of *Sea Express 1.* This was to confirm to the tanker that, because of the visibility, *Sea Express 1* would remain 0.5 mile astern of *Keewhit*. Visibility had reduced substantially and

Sea Express 1 had decreased speed to about 10 knots. At 1117, the pilot of *Alaska Rainbow* called "Mersey Radio" to inform VTS that *Alaska Rainbow* was stemming the tide by Twelve Quays Terminal. At 1118, the dredger *WD Medway II* asked "Mersey Radio" to confirm the name of the vessel stemming the tide, and was told that it was *Alaska Rainbow* and that she had two tugs in attendance. Although received on board *Sea Express 1,* these conversations on VHF radio Channel 12 were not noted by the bridge team. At the time, the captain, trainee captain and first officer were discussing the state of visibility and the course to steer. A second lookout was arranged, and positioned initially on the bridge wing and subsequently on the forecastle.

On *Alaska Rainbow,* the pilot was trying to maintain the vessel's position between Twelve Quays Terminal and Seacombe Stage. This task was made more difficult owing to the restricted visibility and the lack of visual clues, such as transits, to estimate changes of heading, speed over the ground, and distance off the lock. While the pilot was trying to maintain *Alaska Rainbow* in position between the two stages, the vessel moved laterally from close to the west bank of the river to almost mid-river. At 1126, "Mersey Radio" informed *Keewhit* that *Alaska Rainbow* was stemming the tide, deciding whether or not to enter Alfred Lock. This VHF radio exchange was missed by *Sea Express 1*'s captain and trainee captain, who then proceeded to discuss the approach to Liverpool Landing Stage. At 1130, *Keewhit* called the pilot of *Alaska Rainbow* on VHF radio Channel 12 and, having changed to VHF radio Channel 6, agreed to pass "green to green". The initial VHF radio exchange on Channel 12 was again missed by the captain and trainee captain on *Sea Express 1* as they and the first officer were discussing the traffic movements and a need to change course to maintain track mid-river.

At 1131, the trainee captain identified the radar echoes of the tugs *Svitzer Bidston* and *Thorngarth* using AIS, and the first officer suggested that the vessel stemming the tide was *Alaska Rainbow.* At 1134, with *Keewhit* now passing, the pilot of *Alaska Rainbow* was involved in discussions with *Alaska Rainbow's* master and the junior pilot about their options. The pilot decided that there was insufficient time to enter the lock before high water even if the fog lifted, and so decided to abort the manoeuvre and take *Alaska Rainbow* back to the anchorage. The junior pilot went to the bridge wing to use his mobile phone to arrange for the pilot boat to take him off *Alaska Rainbow* while the vessel was still in the river. *Alaska Rainbow,* in the meantime, was moving towards the west bank of the river, and ahead towards Seacombe Stage. The pilot ordered the head tug to pull the vessel to starboard, the stern tug to pull astern, and also ordered an astern movement on the engines.

At 1135, *Sea Express 1*'s captain made an announcement to his passengers and then ordered the fog signal to be started. The vessel's speed was now about 7 knots over the ground. At 1136, "Mersey Radio" informed *Sea Express 1* that *Leistein,* a vessel ahead of *Sea Express 1,* had turned around and was now outbound. At 1137, the captain informed "Mersey Radio" that *Sea Express 1* was off Seacombe Stage and would be turning to port in 2 or 3 minutes time, to which "Mersey Radio" replied that *Leistein* was the only outbound vessel to the south of *Sea Express 1.*

Once clear of Seacombe Stage, *Alaska Rainbow*'s pilot gave orders to let the tugs go. The tug *Svitzer Bidston* was acting as the forward tug for *Alaska Rainbow*. The tug controls were arranged such that when the tug skipper was in the driving seat, he faced aft monitoring the tow. On being told that the tug was going to be let go, he stood up and turned to face forward, which was the intended direction of travel. As he turned to look ahead, he was confronted by *Sea Express 1* appearing out of the fog at a distance of about 20m. He could see directly between the two hulls of the catamaran.

It was 1138, and the following events occurred simultaneously:

1. The tug skipper immediately altered course to port.
2. *Alaska Rainbow*'s pilot called *Sea Express 1* by VHF radio, saying, "Is that you just off Seacombe? We are just about to let the tug go now, we are just aborting and heading out shortly."
3. The lookout on the forecastle of *Sea Express 1* called the bridge using his hand-held VHF radio, reporting that he could see a tug fine to starboard. He also pointed towards it.

Sea Express 1's captain replied to *Alaska Rainbow*'s pilot, saying "Yes, we see you there okay, thank you." At the same time, the trainee captain ordered that the wheel be put "hard-a-port". The first officer put the wheel over, and then stated "I'll get some speed on". *Sea Express 1* began to alter course to port and increase speed. The captain and the trainee captain moved to the starboard bridge wing to monitor clearance from the tug, which passed at about 10m range. As they were moving across the bridge, *Alaska Rainbow* appeared out of the fog, and the trainee captain told the first officer to "bring her to starboard", followed by the captain ordering "hard-to starboard" in an attempt to kick the stern away from the bow of *Alaska Rainbow.* The trainee captain then ordered "full ahead", to attempt to pull away from *Alaska Rainbow*'s bow. While this was happening, the pilot of *Alaska Rainbow* again called *Sea Express 1,* on VHF radio, saying, "Have you got us there *Sea Express 1?"* This call went unanswered.

The aft part of the starboard hull of *Sea Express 1* and the bulbous bow of *Alaska Rainbow* collided, ripping a hole 2.5m by 6.5m in the engine room and jet pump room. This caused rapid flooding of the space, stopping the starboard engines and the two generators. The electrical load then transferred to the generator in the port engine room which overloaded and tripped out, leaving *Sea Express 1* temporarily on emergency electrical power only. The impact turned *Sea Express 1* to starboard, and a second impact was made with the hulls of the two ships parallel to each other **(Figures 7, 8 and 9)**. *Sea Express 1* continued to slide down the starboard side of *Alaska Rainbow*, and the starboard bridge wing then made contact with *Alaska Rainbow*'s accommodation ladder stowed outboard of the ship's side railings near the accommodation. This impact ripped away *Sea Express 1*'s starboard bridge wing roof and windows, and damaged adjacent liferaft stowage arrangements.

By now, *Sea Express 1* was listing to starboard and was trimmed by the stern **(Figure 8)**. The trainee captain had sounded the emergency alarm shortly after the first impact, and the cabin crew were taking charge of the passengers, getting them to sit down and don lifejackets. With main electrical power restored but only the engines in the port hull available, the vessel was not manoeuvrable, and she drifted upstream with the tide. The small amount of thrust from the port engines, combined with the extra drag from the starboard hull, caused a slow turn to starboard.

Figure 7

Passenger photograph of the collision

Figure 8

Sea Express 1 parallel to *Alaska Rainbow* 20 seconds after the collision - note trim and list

Debris from *Sea Express 1* on the deck of *Alaska Rainbow*

Alaska Rainbow's pilot and the captain of *Sea Express 1* called "Mersey Radio" within 40 seconds of the collision, the latter saying, "I'm afraid we've made contact with the vessel outbound from Alfred Lock. We're just stopped here for the moment". The pilot of *Alaska Rainbow* then again called "Mersey Radio", saying "Just had a collision with *Sea Express 1*". The VTSO responded to this call by saying "That's noted in the logbook."

The captain of *Sea Express 1* then told the first officer to request "Mersey Radio" to arrange tug assistance. "Mersey Radio" then made a general call on VHF radio Channel 12 to "any tugs in the River Mersey", informing them that *Sea Express 1* required assistance. Tugs *Adsteam Waterloo* and *Oakgarth,* which were close to the scene of the collision, made their way towards *Sea Express 1*, and then made fast, with *Adsteam Waterloo* forward and *Oakgarth* aft. The deck crew were instructed to start checking the void spaces, starting with number 5, which was just forward of the engine room, and then progressing forward. The keys to the padlocks attached to the void space tank lids for reasons of security had to be sent from the bridge to the car deck. However, the access lids were opened quickly, and the fact that the voids were dry was reported to the bridge **(Figure 10)**.

Meanwhile, on board *Alaska Rainbow*, the tugs had been released and the pilot had ordered the starboard anchor to be let go. The master ordered the chief officer to check the forward spaces for damage, and to sound the forward tanks. As soon as reports were received on the bridge that there was no water ingress, and no visible damage, the pilot asked for the anchor to be weighed, and confirmed to "Mersey Radio" his intention to return to the anchorage in the vicinity of the Bar Light Buoy. The pilot later spoke to Liverpool Coastguard to confirm that his intention was to return to anchor off the Bar Light Buoy, and that the extent of damage to *Alaska Rainbow* had been confirmed by the pilot boat as scrapes to the hull paintwork and a small dent in the bulbous bow.

Figure 10

Sea Express 1 - access to void space

Once the tugs *Svitzer Bidston* and *Thorngarth* had been released from *Alaska Rainbow* they made their way towards *Sea Express 1* to assist. At the request of the trainee captain, with four tugs in attendance, two of which were made fast, *Sea Express 1* was towed slowly across the river towards the Liverpool Landing Stage **(Figure 11)**. Following the collision, the captain and trainee captain made a number of announcements to the passengers, telling them what had happened and asking them to follow the crew's instructions.

At 1154, the VTSO informed Liverpool Coastguard of the collision by telephone, and gave an update of the actions taken so far. Liverpool Coastguard then tasked the RNLI lifeboats at New Brighton and at Hoylake, the marine fire craft based at the Liverpool Landing Stage, and the coastguard rescue teams at Hoylake and Crosby. At 1202, the coastguard contacted Merseyside police, and attendance at the Landing Stage was arranged. Fire and ambulance services were also activated, and by 1221, police, fire and ambulance units were reported to the coastguard as being in attendance.

As *Sea Express 1* approached the stage, the captain spoke to "Mersey Radio" by VHF radio to update the VTSO of the vessel's situation. At the same time, the trainee captain spoke to the two tugs made fast and suggested that the vessel berth port side to the stage, keeping the damage offshore, and allowing the use of the port mooring deck, the starboard one being underwater. This was agreed, and the tug skippers arranged between themselves that a starboard turn would be the best manoeuvre. The skipper of *Svitzer Bidston,* which was standing by the tow, suggested that he move his tug to the offshore side in order to push on if required. The captain then spoke to the terminal by VHF radio to arrange for a gangway to disembark the passengers. The usual gangway was a fixed structure sited for the normal starboard-side-to docking. Fortunately, there was another, mobile, gangway available on the jetty, and this was manoeuvred into position. The first lines from *Sea Express 1* went ashore at 1210, and the passengers started to disembark at 1214. The lifejackets were collected from the passengers at the top of the gangway. Once it was thought that all of the passengers

Figure 11

Sea Express 1 under tow

were off the vessel, the cabin staff swept through the cabin to make sure that no-one had been left on board. At 1226, with the sweep completed, the vessel's Customer Service Officer (CSO) reported to the captain that all the passengers were off the vessel. The captain then ordered all non-essential staff off the ship.

Fire brigade units from Mersey Fire and Rescue Service that attended the vessel included two fire appliances, a specialist search and rescue team and the marine fire and rescue team. Once the passengers were clear of the vessel, the fire brigade units also made a sweep of the vessel to confirm who was left on board, and to discuss with the ship's officers how they could assist in stabilising the vessel. It was decided to place pumps on board to try and pump out the engine room and jet pump space. However, before this could start, the captain wanted to turn the vessel around so that she would be stern-to the loading ramp in order that an attempt could be made to discharge the passengers' cars. It was decided that since the water ingress did not seem to be getting any worse, the vessel would be turned on the berth before the pumps were placed on board. Turning the vessel would also bring the damaged hull next to the quay, making access easier. The lines were cast off at 1253, and the ship was re-secured starboard side to at 1322.

Fire brigade pumps were then put on board, and an attempt started to pump out the engine room. This had little effect because the spaces were open to the river, and larger pumps were engaged from the Port of Liverpool's level 2 pollution response team. A diver survey was arranged for 1900 during the low water slack period, and additional lighting for the scene was obtained from the coastguard coast rescue team. However, the underwater visibility was very poor, and the situation did not permit the diver to access the damaged area, and so the diver survey was postponed. With the pumps running, the situation was now stable, and the lifeboat and coast rescue teams stood down at 2050. Salvors were appointed, and at 1100 the following day they took charge of the vessel.

1.4 THE DAMAGE TO *SEA EXPRESS 1* AND DAMAGE STABILITY

The damage to *Sea Express 1* was not conclusively assessed until an underwater survey was completed the day after the collision. This identified the main damage as a hole with a maximum extent of 6.5m by 2.5m stretching from the aft end of the jet pump room, forward into the engine room **(Figure 12a)**. A 1.5m vertical split was found in number 4 void, starting 10cm above the damaged waterline **(Figures 12b)**. Substantial damage was also received to the starboard bridge wing **(Figures 12c and 12d)**. Water ingress into the engine room was sudden and, due to the size of the hole, unstoppable.

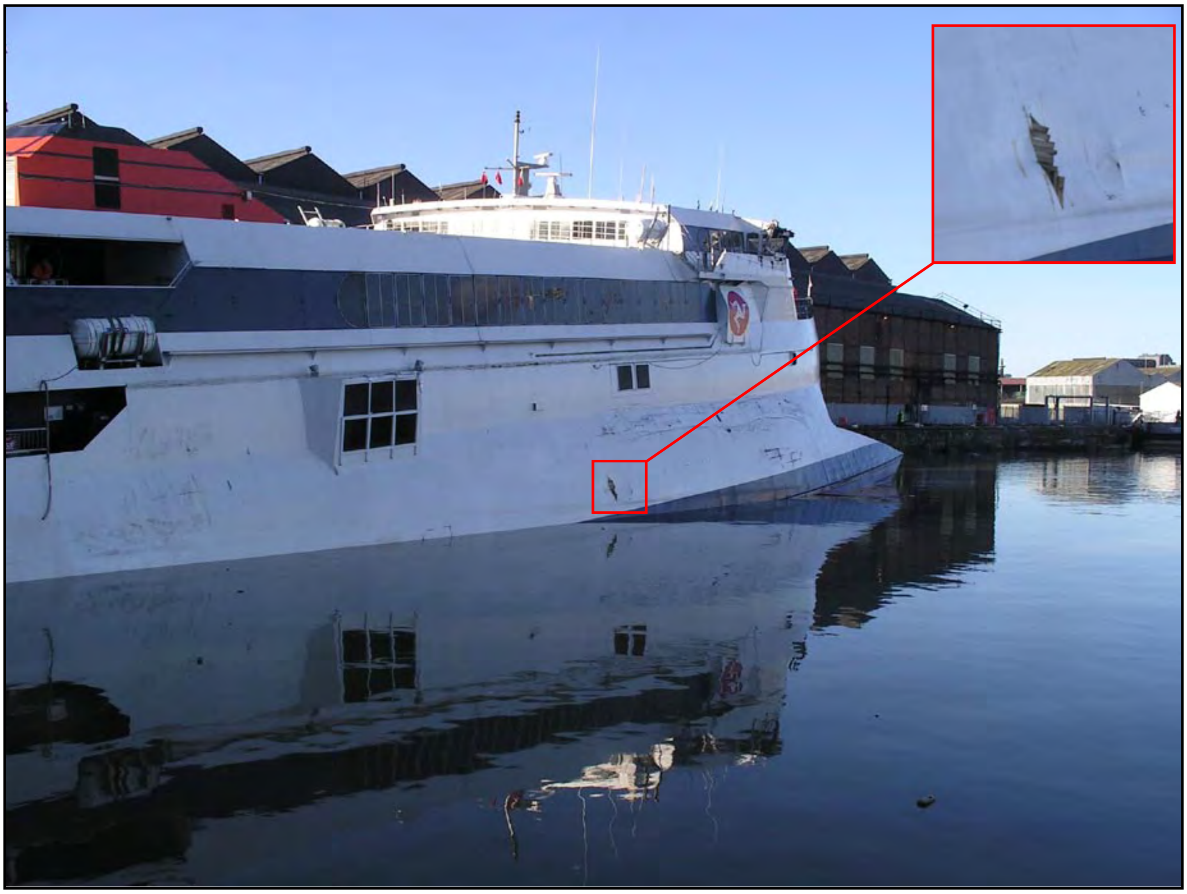
A decision support system for emergency management was provided on board. The damage cases included in the emergency plans represented those which just survive in ideal conditions, i.e. those that retained positive buoyancy and GZ in flat calm conditions with no passenger, car, or wind heeling moment. Any increase in damage would result in the vessel foundering. The notes attached to the plans also stated that:

> *in a real flooding situation, the reserves of stability and freeboard would be less due to passenger and vehicle movement, wave action, increased free surface during intermediate flooding etc. Therefore this information is provided for guidance only. The master must still exercise his judgement.*

Figure 12a

Still from underwater damage survey showing part of the shell plating damage

Figure 12b



Damage to *Sea Express 1*'s starboard side

Figure 12c

Damage to *Sea Express 1*'s starboard bridge wing

Figure 12d

Showing damage to starboard hull of *Sea express 1* once vessel dry-docked

Damage case 11.30 **(see Figure 13)** of the decision support system referred to flooding in the starboard engine room, starboard jet room and void number 5 starboard. Since the jet room and engine room were separated by a non-watertight bulkhead, these two spaces were considered as one for the purposes of damage stability. Therefore, the vessel could have survived damage in the two aftermost watertight spaces.

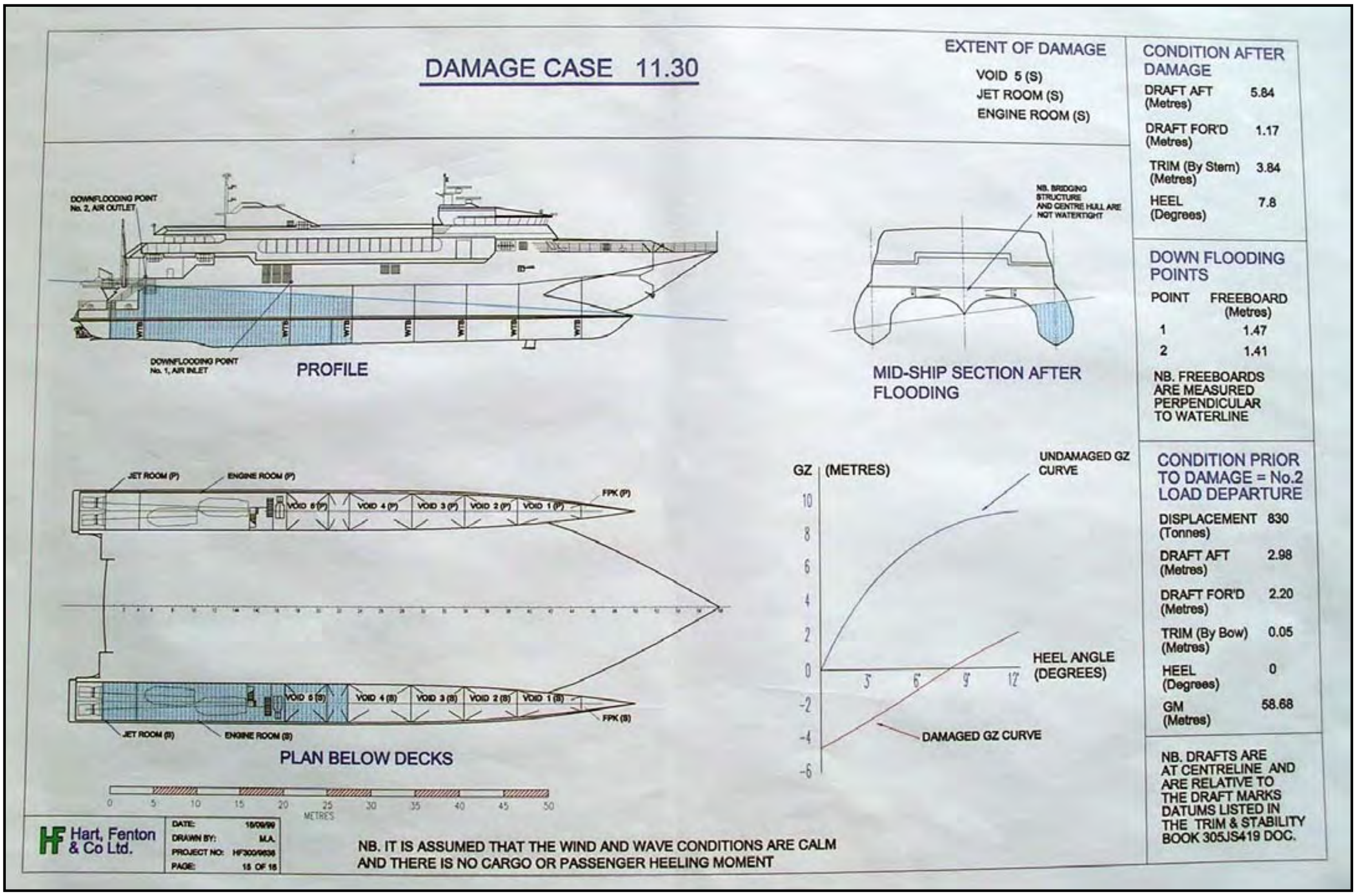
The statement that the vessel could have survived flooding in the two aftermost spaces had been often repeated by the crew(s) of *Sea Express 1*, and, without referral to the damage control decision support system, had come to be accepted as meaning the jet pump room and engine room. Therefore, when the jet pump room and engine room flooded, great concern was raised that the vessel was at the limit of damage survivability, when in fact number 5 void could also have sustained damage.

1.5 TRAINING FOR *SEA EXPRESS 1*

The HSC 1994 Code provides for the fact that the safety regime and training requirements for officers serving on such vessels differ from those of a conventional ship. Section 18.3 of the Code provides guidelines for the additional training and competences required for service on high speed craft. It also establishes the requirement for type rating certification to be adopted by Administrations to evidence competence in the operation of these craft. See **Annex 1** (Chapter 18 of the Code).

Merchant Shipping Notice (MSN) 1740(M) *Training and Certification of officers and crew of high speed craft* implements in the UK the requirements of Chapter 18 of the Code.

Figure 13



Damage case 11.30

1.5.1 Type rating

The type rating programme implemented by IOMSPC identified 41 individual competencies which would be required for a type rating qualification. These 41 competencies were divided into 14 units, which are in direct relation to the 12 elements of training detailed in the HSC Code, plus a further 2 relating to the company's Safety Management System. The type rating programme for deck officers covered three levels of training, namely the training of new first officers, the training of current officers wishing to add new routes or craft to their type rating, and, thirdly, the additional training required for the role of captain. A similar arrangement was in place for engineer officers. Each officer was issued with a Type Rating Programme record book, in which were detailed the individual competencies required for each of the 14 units. Extracts of this programme are shown at **Annex 2**. The competencies were described in detail in the booklet, at the end of which were spaces for the candidate to indicate that they felt ready for examination; for the Type Rating Instructor (TRI) to indicate that the candidate was thought to be ready for examination; and for the Type Rating Examiner (TRE) to sign the competence as completed. Additionally, a space was available to show for which craft, route and rank the competency had been completed. Once all the competencies were signed off, a Type Rating Certificate was issued by the company.

This training scheme was approved by the Maritime and Coastguard Agency (MCA), and remained valid on the condition that:

1. *Records were maintained such that the authenticity of any certificate issued could be verified.*

2. *Any change in the course content, facilities equipment, or other matter that may affect the delivery of the programme was reported to the inspecting Marine Office without delay.*
3. *Monitoring of the training programme by the MCA proved to be satisfactory*.

Full approval for this system was granted by the MCA on 30 April 2004.

The examination for type rating consisted of two parts, the completion of the record book, and the assessment of practical ability. For *Sea Express 1* there were two company appointed TREs, and three TRIs. The roles of TRE and TRI were separate, with none of the instructors appointed as examiners, and vice versa.

All three deck officers on board *Sea Express 1* held the appropriate Type Rating Certificates, with the trainee captain undergoing part of his examination for type rating as captain for this class of vessel. The first officer was also due to start the process of examination for a type rating certificate as captain, having recently completed the PEC examination for Liverpool.

1.5.2 Emergency procedures

MSN 1740(M) requires that deck and engine ratings and other personnel employed on high speed craft (HSC) must undergo a training programme appropriate to their duties on board. This training should include the familiarisation and appropriate STCW95 training programmes required by The Merchant Shipping (Training and Certification) Regulations 1997 (SI 1997/348). For cabin staff, additional minimum training requirements are advised, as they are nominated to assist passengers in emergency situations. This additional requirement is promulgated in the UK by MSN 1579, which reflects the content of IMO Resolution A770(18) *Recommendation on Minimum Training Requirements for Personnel nominated to assist Passengers in Emergency Situations on Passenger Ships*.

There were two types of safety training programmes provided for cabin staff. The first was for new staff or those staff re-joining a company vessel after an absence of 6 months or more, and the second was for staff transferring to a different vessel in the fleet. The training was carried out by a company-appointed instructor, who was also a serving officer in the fleet. For each stage, there was a safety training record book, which led the candidate through the required competencies. Each competency was required to be initialled, to show that the candidate had been instructed in it and a further initial to show that the candidate was considered competent. The front cover of the booklet was then signed by the candidate, instructor and assessor.

The company also carried out the following in-house training courses for cabin staff:

Fire Prevention and Fire-Fighting

Personal Safety and Social Responsibility

Crisis Management and Human Behaviour.

These were as required by MSN 1740, and followed the requirements of STCW95 with respect to the format and content of the training.

The ship's staff carried out at least one drill/training exercise per week. All crew members took part in these drills, under the direction of the first officer. The company issued a planned drills matrix for use by the vessel to ensure that the different drills were all practised, and the crew did not conduct the same drill every week. On the day before the accident, the crew had been mustered at general emergency stations and exercised in vehicle deck fire and full abandonment procedures. These procedures changed slightly depending on the number of passengers carried, which in turn determined the number of crew required. Table 1 shows the number of crew required for different numbers of passengers. Each level of manning is described as a mode, and the different modes determine the positioning of the cabin staff during an emergency. Each crew member was identified with a number on the crew list. It was this number which then identified where that person should muster during an emergency. Key players, such as the master, customer service officer, and chief engineer, always had the same muster list number, and so always mustered in the same place and carried out the same tasks. Other crew members mustered as their number on the crew list dictated, and performed the duties required for that position.

Table 1 – Crew modes and passenger numbers

Mode	Passengers	Crew (supernumeraries)	Total
22	501	22(+9)	532
20	443	20(+11)	474
18	360	18(+13)	391
16	284	16	300

The crew were regularly drilled in their actions under the different modes, with question and answer sessions included in the drill to ensure a thorough understanding of where all of the other "numbers" mustered, and what their duties were. Any supernumeraries carried mustered with the customer service officer, and acted as a pool of manpower.

1.6 PILOT TRAINING AND QUALIFICATION

The Mersey Docks and Harbour Company (MDHC) is the Competent Harbour Authority (CHA) for the Port of Liverpool, and therefore has responsibility for authorising pilots working in the Port of Liverpool. The CHA does not directly employ the pilots; instead the pilots are self-employed, offering their services through Liverpool Pilotage Services Limited. This company organises the rotas and leave arrangements for the pilots.

The training programme for a Liverpool pilot is expected to take at least 5½ years before the pilot qualifies at first class level. It begins with a 6 month period of initial training, during which time the trainee pilot is expected to accompany duly authorised pilots on at least 78 trips, half inward and half outward, half in daylight and half at night. Having completed these "leadsman" trips, the candidate is examined and successful completion of the examination qualifies the candidate as a class 4 pilot. To advance to the next class, a pilot has to carry out leadsman trips with a pilot qualified at least to the next class. Advancement to a class 1 pilot is therefore through a series of leadsman trips gaining experience as well as by examination. Table 2 shows the training programme as a whole.

Table 2 - Liverpool Pilot training programme			
Class of pilot	Expected time in class	Restriction	Trips to advance
Trainee	6 months	Not qualified	78
4th	1 year	Up to 95 metres	14
3rd	1 year	Up to 130 metres	15
2nd	3 years	2 years up to 160 m 1 year up to 180 m	8
1st		Unlimited	N/A

In addition to the training detailed in Table 2, the MDHC had also introduced training agreements for the pilots, and these were administered by Liverpool Pilotage Services Limited. Each pilot was expected to undertake a period of simulator training at Lairdside Simulation Centre. However, the MDHC had recently been purchased by Peel Ports Group, and the training budget for the current year had yet to be finalised.

1.7 PORT OF LIVERPOOL VTS

1.7.1 Background

The purpose of VTS is to improve safety and efficiency of navigation, safety of life at sea and the protection of the marine environment and/or the adjacent shore area, worksites and offshore installations from possible adverse effects of maritime traffic[1].

VTS is defined by the International Maritime Organization (IMO) as *shore side systems which range from the provision of simple information messages to ships, such as position of other traffic or meteorological hazard warnings, to extensive management of traffic within a port or waterway.* IMO Resolution A857(20) and the IALA VTS Manual 2002 describe three categories of service (Information Service, Navigational Assistance Service and Traffic Organisation Service) by reference to their functionality. The references also specify a standard for training, leading to a certificate (V103). The term VTS is therefore used to describe a system operated by personnel trained to the V103 standard.

[1] Taken from section 7.3.11 of "A guide to good practice on port marine operations", prepared in conjunction with the Port Marine Safety Code and published by the Department for Transport in 2002.

Regulation 2(1) of The Merchant Shipping (Vessel Traffic Monitoring and Reporting Requirements) Regulations 2004, defines a vessel traffic service as a service:

a) which is designed to improve the safety and efficiency of vessel traffic and to protect the environment and which is capable of interacting with that traffic and responding to traffic situations developing in the VTS area; and

b) which, in relation to a service operated by the United Kingdom, either alone or in conjunction with one or more states, is a service provided from within the United Kingdom which has been designated by the MCA in writing and is specified in a Merchant Shipping Notice.

In the UK, a formal assessment of navigational risk is required under the Port Marine Safety Code (PMSC), and this determines what management of navigation is required in the port. This risk assessment also determines whether, and to what degree, monitoring and traffic organisation needs to play a role in mitigating risk. The risk assessment at the Port of Liverpool determined that the level of service required was an "Information Service". This level of service is defined by IMO as:

a service to ensure that essential information becomes available in time for on-board navigational decision making.

Formal identification of UK VTS within UK waters is provided in MSN 1796 (M+F). In this document, the Port of Liverpool is listed as providing an Information Service.

The Port of Liverpool inaugurated the world's first harbour surveillance radar in 1948. The system in operation at the time of the collision combined radar and CCTV surveillance of the port and approaches, with radio and telephone communication. The service was based around a Norcontrol VTS5060 system, which had been updated in 2006. This recorded the radar, AIS and VHF radio transmissions, which were replayed as part of the MAIB investigation **(Figure 14)**.

1.7.2 Operator training and qualification

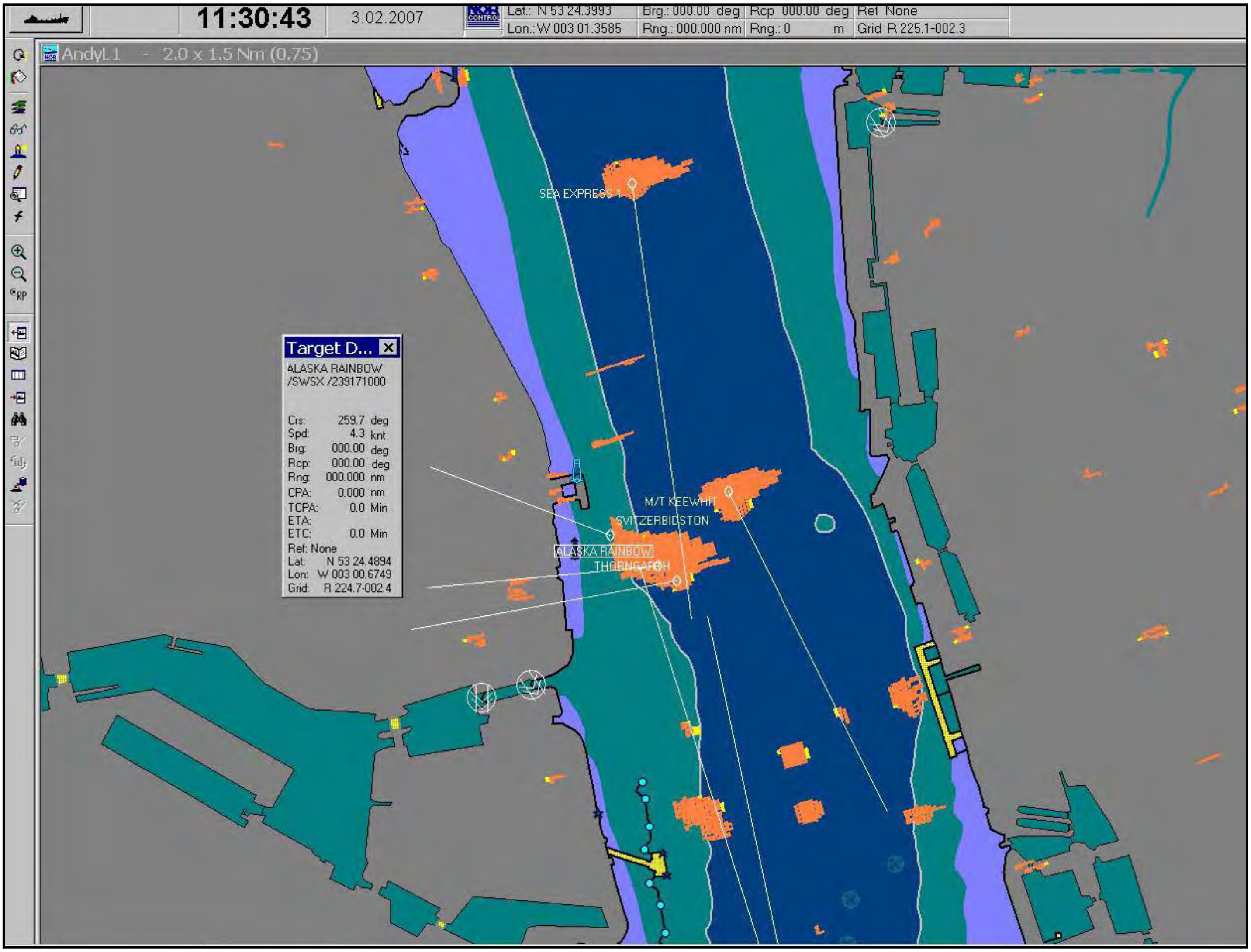
In May 1998, The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) issued recommendation V103 to its national members. This provided the standard for training and certification of VTS operators. Qualification required satisfactory completion of a training course at an approved training establishment, plus completion of a VTS Certification Log used to record specific on-the-job training at a specified VTS centre. This log also recorded the VTS operator certificate number and any on-the-job training completed to allow work at a different VTS centre, as well as any further qualifications to advance to VTS supervisor or Instructor.

All VTSOs employed at the Port of Liverpool VTS station had attained the qualification detailed by the IALA V103 recommendation. This was a requirement for the port to provide an Information Service.

1.7.3 Manning and workload

During the working week, two clerks were available to take the bookings for pilotage. Under the port charges regime, any booking made out of hours was subject to increased fees, so the vast majority of bookings were made during office hours. It is of note that these hours also included Saturday and Sunday mornings (0800-1000), so bookings could be made at this time without financial penalty. Since there was no clerical support at the weekends, the VTSO manning the pilotage desk was required

Figure 14



VTS replay

to take the pilotage bookings as well as carry out the normal business of the pilotage desk. To assist the pilotage desk VTSO at such times, the information service VTSO occasionally answered the phone or operated the VHF radio for him.

1.7.4 Actions in restricted visibility

The additional threat to the safety of shipping on the River Mersey when restricted visibility was reported was dealt with by the VTSOs with reference to an Initial Response Card for Restricted Visibility. This defined the meaning of restricted visibility, and gave the following five actions for the VTSOs to take:

1. *Advise shipping of restricted visibility conditions and obtain regular visibility assessment reports from vessels across the VTS area.*
2. *Call Gladstone Dockmaster to activate the C22 red can boat beacon fog signal.*
3. *Call Alfred Dockmaster to activate fog signals at Liverpool landing stage.*
4. *Call Merseyside Passenger Transport Executive MPTE to activate fog signals at Woodside and Seacombe ferry landing stages.*
5. *Call Tranmere Oil Terminal to activate fog signals at north and south Tranmere oil stages.*

No further actions were required of the VTSOs.

1.7.5 Standing orders for VTSOs

The standing orders for VTSOs issued by the MDHC were in the process of being reviewed and re-written at the time of the accident. Reference was made in the original document to job titles that no longer existed, and gave no clear direction to the tasks expected of the VTSOs when on duty. The 11 orders re-iterated the MDHC directions for navigation, but did not include the actions expected of the VTSOs in each case.

1.8 EMERGENCY RESPONSE

1.8.1 Civil Contingencies Act

The Civil Contingencies Act 2004 received Royal Assent on 18 November 2004 and was designed to deliver a single framework for civil protection in the UK. The Act is in two substantive parts.

Part 1 deals with local arrangements for civil protection, and establishes a framework of roles and responsibilities for local responders.

Part 2 focuses on emergency powers, and establishes a framework for the use of special legislative measures that might be necessary to deal with the most serious emergencies.

The Act also updates the definition of what constitutes an emergency, which has been defined in Civil Defence legislation dating from 1948, and in the Emergency Powers Act 1920. The 2004 Act defines an emergency as:

- An event or situation which threatens serious damage to human welfare;
- An event or situation which threatens serious damage to the environment; or
- War, terrorism, which threatens serious damage to security.

For Part 1 of the Act the definition sets out the range of possible incidents for which local responders must prepare when fulfilling their civil protection duties. For planning purposes in the maritime environment, this includes a rapid accidental sinking of a passenger vessel, and a blockage of access to a waterway (as a result of a maritime accident or deliberate act). To facilitate co-operation at the local level, multi-agency resilience fora were established to review the community risk register and the responses required. Based around the police force areas, incidents on the River Mersey are either within the area of the Merseyside Police Force or the Cheshire Police Force. The community risk registers for both areas had assessed passenger ship operations. Cheshire, Halton and Warrington Community risk register looked at the straightforward rapid sinking of a passenger vessel, and identified the risk rating as medium, and referred to MCA major incident plans as the capability and barriers already in place to effectively manage this risk. Merseyside community risk register identified three maritime transport hazards. These were a major passenger ship flooding, a major passenger ship stranding, and a collision between a passenger ship and a ship carrying hazardous material. Passenger ship stranding was assessed as high risk, with the other two as medium risk. Again, the capability relied on MCA major incident plans and those of Category 1 responders (ie fire, police and ambulance services), with the barrier of national and international regulation of shipping, and port state control to ensure compliance with the regulations.

1.8.2 Port Marine Safety Code

Paragraph 2.1.12 of the PMSC establishes a requirement for emergency planning within a port, and states:

> *A safety management system should include preparations for emergencies – and these should be identified as far as practicable from the formal risk assessment. Emergency plans need to be published and exercised.*

The accompanying publication to the PMSC is *A guide to good practice on port marine operations*, and this explains that planning is an effective response to all emergencies since it will secure the following:

- A pre-designed structure to work
- A swift reaction
- Measured decisions
- Prioritisation
- Co-ordination between other agencies.

Those preparing harbour authority emergency plans are advised by the guide to consult other agencies from the start. The other agencies may have statutory obligations to meet in their own right, and the consultation process would ensure that the co-ordination between agencies is effective and avoids duplication of effort. The harbourmaster should give every reasonable assistance to the fire, police, ambulance and other emergency services for dealing with, alleviating or preventing any emergency.

The responsibility for search and rescue in harbour limits is also discussed in the guide. HM Coastguard is responsible for co-ordinating the search and rescue phase of any distress within harbour limits, with the harbour authority providing support. This support can be in many forms, an example of which is the use of pilot boats. HM Coastguard will also assist the harbour authority, and provide co-ordination in the search and rescue phase of any incident which is being carried out under the Port Emergency Plan. The harbour authority will remain responsible for managing the overall response to a port emergency. The guide goes on to explain that some port authorities have a Memorandum of Understanding (MoU) with HM Coastguard on lines of responsibility and communication in the event of a port incident. No such MoU existed for the Port of Liverpool.

The PMSC requires that marine operations within the port are discharged in accordance with a safety management system. This system should be informed by a formal risk assessment, covering all marine operations in the port, designed to ensure that the risks are tolerable and as low as reasonably practicable. Paragraph 2.2.10 of the PMSC additionally requires that the safety management system should include provision for systematic review of performance based on information from monitoring and from independent audits of the whole system. In the case of the Port of Liverpool risk assessment, the carriage of passengers had not been separately assessed. Furthermore, the safety management system had not been subject to an independent audit.

1.8.3 Operation SEAVAC

Operation SEAVAC was a Merseyside police emergency plan for dealing with survivors following a major maritime incident. The examples of the type of incident considered included an aircraft crash in the sea, and a passenger ship sinking. The plan dealt with the requirements for the police to provide casualty reception facilities, and nominated seven landing sites in the Merseyside area for survivors to be brought ashore. It also acknowledged that it was unlikely for there to be a police presence at the scene of the incident, and that the search and rescue phase would be co-ordinated by HM Coastguard. The plan listed the seven sites in turn, reviewed the facilities available nearby, and how the police would establish traffic control, survivor reception, temporary mortuary facilities, and ambulance marshalling at each site. It also detailed the manpower resources necessary to carry out the plan.

The plan also noted that the informant for any sea-based emergency was usually the HM Coastguard, and emphasised that in the event that this was not the case, then the coastguard should be informed immediately.

The plan, therefore, listed the police force's reaction to a major maritime incident, and looked at how the police force would deal with large numbers of survivors coming ashore.

1.9 ON BOARD INFORMATION FOR PASSENGERS

The HSC 1994 Code requires illustrations and instructions in appropriate languages to be posted in public spaces and be conspicuously displayed at muster stations, at other passenger spaces and near each seat to inform passengers of their muster station, the essential actions they must take in an emergency, and the method of donning lifejackets.

Available at each passenger seat on board *Sea Express 1* was a card containing safety instructions **(Annex 3)**. This detailed the emergency alarm signal and actions to take following the alarm, instructions for donning a lifejacket, and a children's lifejacket and, on the reverse, a plan of the cabin area showing the evacuation route. The instructions were in English and French and supported by a safety video shown shortly after departure from port. This safety video included demonstrations of how to don both types of lifejacket carried **(Figures 15a and 15b)**, and a demonstration of the evacuation routes and action to be taken following the emergency alarm. The safety instruction card, however, illustrated only one type of lifejacket.

1.10 PASSENGER QUESTIONNAIRES

After an incident involving a passenger vessel, the MAIB normally issues a copy of a passenger questionnaire to all those passengers for whom it has a postal address. The object of this questionnaire is to provide MAIB Inspectors with a description of the incident as seen by passengers located in various parts of the vessel, and to provide an enhanced insight into the events both before and after the incident.

The MAIB sent 175 questionnaires to passengers' addresses provided by IOMSPC. The MAIB received 100 replies, which were reviewed as part of the investigation. A summary of the passenger comments is at **Annex 4**.

Figure 15a

Lifejacket demonstration - type 1

Figure 15b

Lifejacket demonstration - type 2

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 *SEA EXPRESS 1*

2.2.1 Bridge team did not detect *Alaska Rainbow*

a) Radar Setup

Sea Express 1's VDR recorded the starboard radar display which was in use by the captain and trainee captain. The radar was set up with the display orientated north-up and off-centred, showing true trails, with the speed input from the log, giving speed through the water. It was therefore sea-stabilised. This set up has the advantage that the "true trails" give an indication of course and speed through the water and therefore of the aspect of a target. A major disadvantage to using a sea-stabilised display in confined waters is that everything that is moving relative to the water will create a true trail. This includes all land targets, and in a river situation, the radar screen will quickly become cluttered by these trails. A ground-stabilised display will indicate a target's course and speed over the ground but, perhaps more importantly, the true trails will only be generated for returns that are moving over the ground. The land targets will not generate true trails, so the picture is much clearer.

The VDR records images of the radar screen as seen by the bridge team, at 15 second intervals. *Sea Express 1*'s VDR replay showed that *Alaska Rainbow* and her attendant tugs were visible on the radar screen, and with the true trail showing that the vessel had moved initially to the west, come close to Seacombe Stage, and then moved towards mid-river in the moments before the collision **(Figures 16a, 16b and 16c)**. However, the trails created by the radar return from Seacombe Stage and other land targets, partially obscure the return from *Alaska Rainbow,* making identification of the moving target difficult.

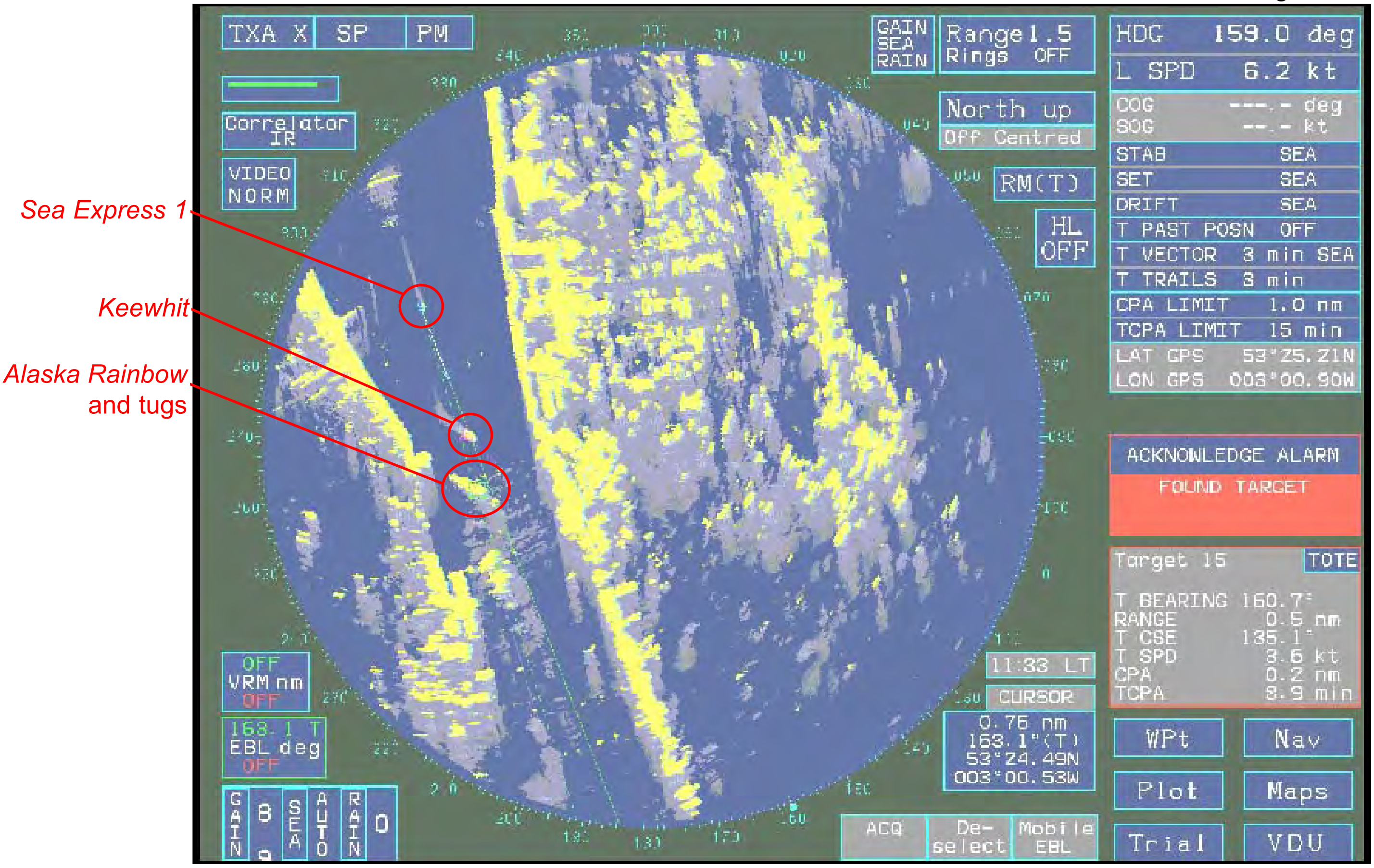
Had the radar been set up to have a ground speed input, the trails from the land would not have been present, clearing the picture, and any target moving over the ground would have developed a trail, highlighting its presence to the bridge team.

Although the trainee captain had identified the radar echoes of the tugs *Svitzer Bidston* and *Thorngarth* mid-river, and the first officer had suggested that the vessel stemming the tide was *Alaska Rainbow* 7 minutes before the collision, the bridge team did not detect the vessel's movement back into the river after coming close to the Seacombe Stage.

b) Distraction

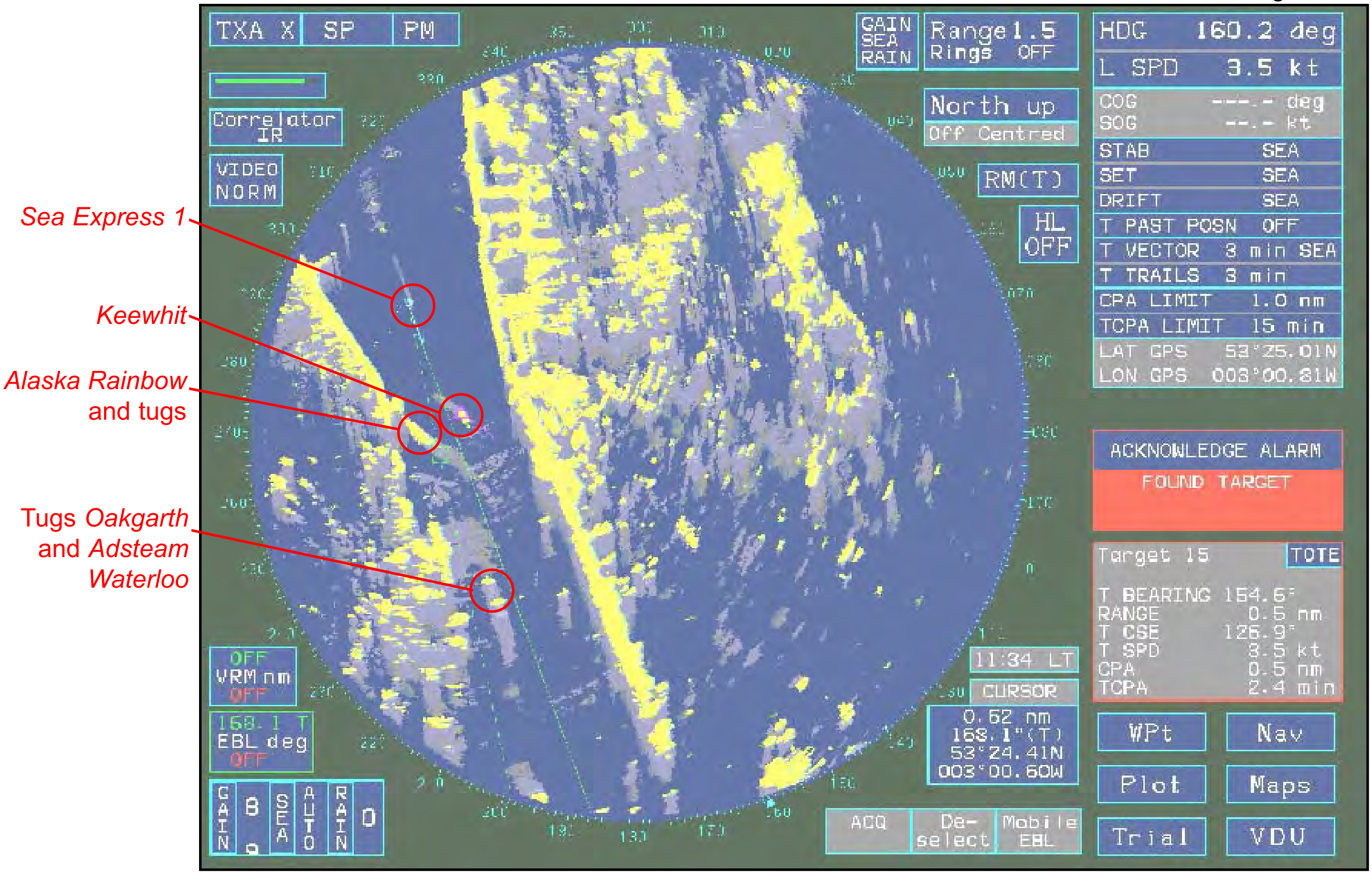
The captain, trainee captain and first officer of *Sea Express 1* all held PECs for the port of Liverpool. The approach to the port was being made in restricted visibility, a relatively infrequent event, and although the vessel was a very frequent visitor to Liverpool, it was not common for the approach to Liverpool Landing Stage to be made in fog. Preparations, therefore, took the format of a teaching session, with the

Figure 16a



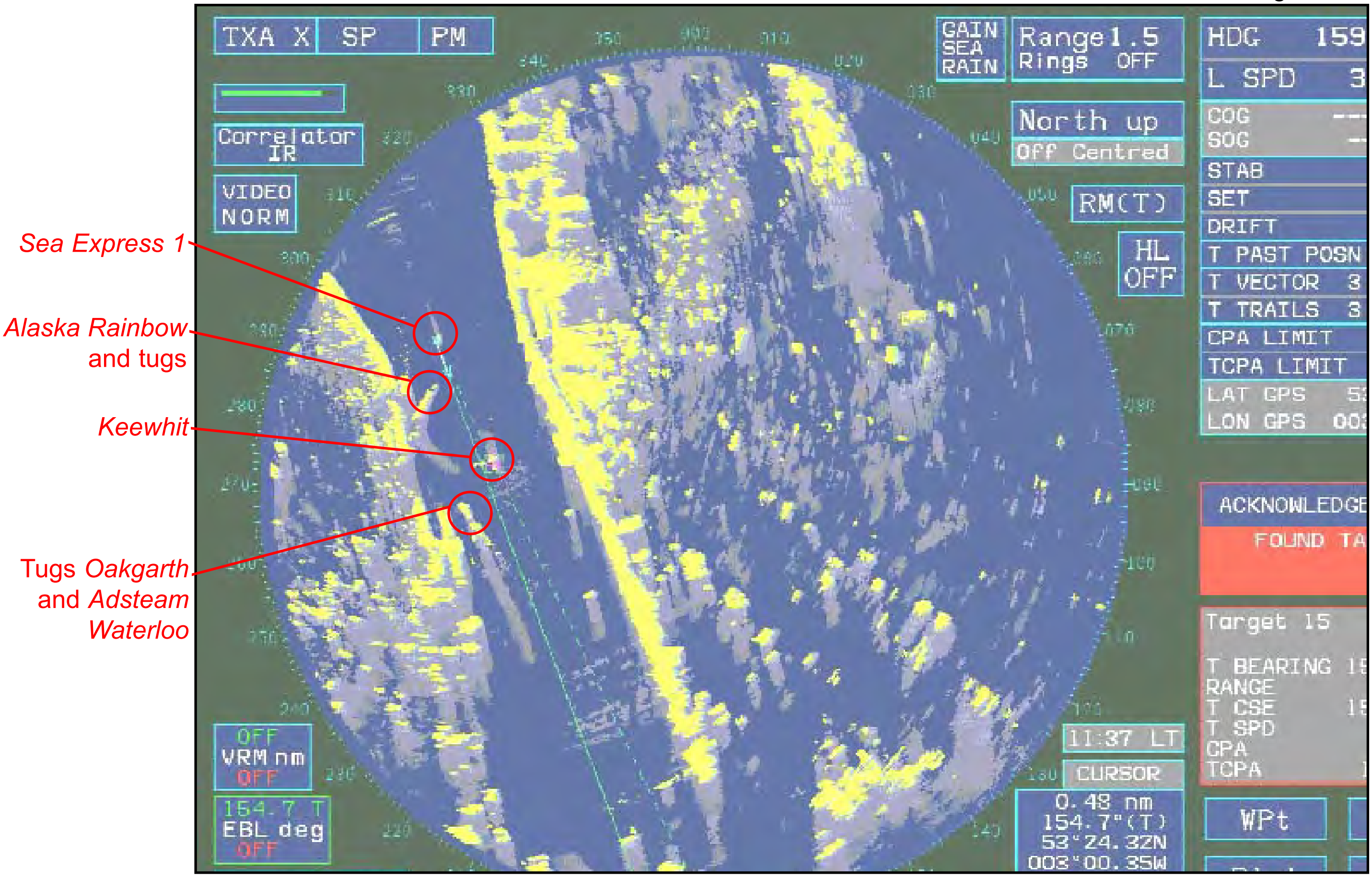
Radar display recorded on *Sea Express 1*'s VDR at 11:33:25

Figure 16b



Radar display recorded on *Sea Express 1*'s VDR at 11:34:53

Figure 16c



Radar display recorded on *Sea Express 1*'s VDR at 11:37:03

captain referring the trainee captain to methods for identifying the landing stage in fog. With the attention of the trainee captain now focussed on identifying the landing stage and preparing to be examined on berthing the vessel, and no other member of the bridge team allocated the task of collision avoidance support, other targets were not noticed or their movements tracked.

2.2.2 Bridge team did not hear *Alaska Rainbow*

a) Windows open

When *Sea Express 1* initially entered the fog, the lookout, who was standing on the port side of the bridge was asked to open the bridge window. When the second lookout was called to the bridge, the starboard side window was also opened. The VDR record shows that the fog signal on Seacombe Stage was referred to as having been heard.

Alaska Rainbow and her two attending tugs were not sounding fog signals as required by COLREGS and by the Mersey Channel Collision Rules because it was not the normal practice of the pilot to do so. The decision not to sound the signals meant the possibility that *Sea Express 1* would be alerted to the presence of *Alaska Rainbow* by this method was removed. Had *Alaska Rainbow* and her attending tugs been sounding fog signals, it is probable that the lookouts on *Sea Express 1* would have heard them in time for *Sea Express 1*'s bridge team to react to the situation and take effective avoiding action. However, the degree of noise generated by a number of vessels sounding fog signals while manoeuvring in close proximity in confined waters could potentially have an adverse effect on other forms of communication, such as VHF radio communications, and on the concentration levels of ship staff. A review of the Mersey Channel Collision Rules on the sound signals required of vessels manoeuvring in close proximity during periods of restricted visibility would appear to be appropriate.

b) VHF radio calls

Although *Sea Express 1* was not directly informed of the presence of *Alaska Rainbow*, the vessel was mentioned in a number of VHF radio conversations on Channel 12, the port's working frequency, and received on board *Sea Express 1*. Significantly, *Keewhit,* the vessel ahead of *Sea Express 1,* called the "vessel waiting off Alfred Lock", to be told by VTS that the vessel was *Alaska Rainbow.* This was 12 minutes before the collision and, although noted and mentioned by the first officer, was not acknowledged by the captain and trainee captain.

2.2.3 Examination of trainee captain

a) Type rating system

The Type Rating Examination procedure is a robust system to ensure that the additional competencies required of an officer on board a high speed ferry are examined, and the officer's competence to hold the post is confirmed. The particular method employed by IOMSPC is held by the MCA as a good example of the system required by the HSC 1994 Code.

b) Format of examination

The examination itself is part practical, part oral. The candidate is observed as he or she carries out their normal routines and emergency drills, and is questioned on theoretical aspects. The examination procedure was left to the TRE, with no procedural guidance provided by the company.

On the day of the collision, the trainee captain was an additional crew member. The captain maintained a supervisory role and overall command. Specifically, the examination was to review the trainee captain's ship handling ability, particularly with respect to the approach to the Liverpool Landing Stage. Part of the pre-sailing discussions, and the continuing conversations during the crossing from Douglas to Liverpool, involved the captain and trainee captain discussing methods of going alongside the stage under various weather conditions. It can be seen that the bridge team was concentrating on the approach to the stage. The presence of fog on the River Mersey had further heightened these discussions, since there was now a requirement to be able to identify the landing stage in fog, and attention was diverted to discussing the "blind" approach.

c) Role of trainee captain

The role of the trainee captain during the crossing was to take control of the vessel under the supervision of the captain. Once *Sea Express 1* entered the River Mersey, this role continued, with the trainee captain remaining in the right-hand seat and the first officer in the centreline seat, steering and controlling the engines. The captain positioned himself next to the trainee captain, so that he also could see the radar screen.

As the vessel continued into the river, the visibility slowly worsened. The precautions for navigation in fog were implemented by the trainee captain, who, at this stage, remained in charge of the navigational watch. However, during the period immediately leading up to the collision, the captain took over the VHF radio communications and started to affirm the instructions given by the trainee captain, and the trainee captain and first officer started to report navigational updates directly to the captain, as though a transfer of control from the trainee captain to the captain was taking place or about to take place. At no time was this adjustment to the roles within the bridge team discussed, which would have been unnecessary had the trainee captain not been present and the vessel had been operating in her normal operational mode.

Additionally, the captain engaged the trainee captain in discussions on the "blind" approach to the landing stage without giving a clear indication of when the examination was to start. In diverting his attention to the forthcoming berthing manoeuvre, the trainee captain's role of providing collision avoidance support was compromised.

In a situation where no member of the team is entirely sure which roles other members of the team are carrying out, some of the duties are likely to be either duplicated or missed altogether. In this case, duplication of effort in identifying the landing stage and discussing the 'blind approach' led to *Alaska Rainbow'*s presence in the river being missed.

2.3 *ALASKA RAINBOW*

2.3.1 Expectation that *Sea Express 1* would take avoiding action

a) Reliance on other vessel's manoeuvre

With *Alaska Rainbow* stopped over the ground with tugs attached and waiting for the visibility to improve, her pilot expected all other vessels to keep clear. As the other vessels passed, the pilot maintained the position of *Alaska Rainbow* towards the west side of the river, and the passing ships generally kept to the east. This resulted in a starboard-to-starboard passing.

With the approach of *Sea Express 1*, the pilot of *Alaska Rainbow* was expecting the same procedure to occur. *Alaska Rainbow'*s pilot assumed that *Sea Express 1'*s captain would be expecting a starboard-to-starboard passing manoeuvre, and would navigate his vessel accordingly. It was not until *Sea Express 1* was very close ahead that the pilot of *Alaska Rainbow* became concerned because *Sea Express 1* had not yet manoeuvred to keep clear. By this time, it was too late for any manoeuvre on the part of *Alaska Rainbow* to have an effect, and he made a VHF radio call to *Sea Express 1* in an attempt to confirm *Alaska Rainbow* had been detected and that *Sea Express 1* was going to alter course.

By leaving his VHF radio communication so late, the pilot had to rely on the manoeuvre of *Sea Express 1* to avoid the collision. Since he could not be sure that the ferry was aware of *Alaska Rainbow'*s presence, and would keep clear, the pilot made the VHF radio call in an attempt to remedy the situation. A VHF radio exchange at a much earlier stage could have ensured that *Sea Express 1* was aware of *Alaska Rainbow'*s presence and that *Sea Express 1* would take avoiding action in good time. Even when the pilot of *Alaska Rainbow* made the VHF radio call he failed to mention where *Alaska Rainbow* was, and although the reply from *Sea Express 1* confirmed that *Alaska Rainbow* had been detected, it did not confirm whether *Sea Express 1* intended to take any action to avoid the imminent collision.

b) Port Collision Regulations

In June 2002, the MDHC issued a publication entitled Mersey Channel Collision Rules. These rules are in addition to the COLREGS, and among other arrangements detail the lights to be carried by vessels alongside jetties in the river, and special requirements for ship launching. These rules require compliance with COLREGS except where the rules require otherwise. There is no specific mention in the Mersey Channel Collision Rules of actions to be taken in restricted visibility, and therefore COLREGS apply, particularly Rule 19 *Conduct of Vessels in Restricted Visibility.*

Rule 19(c) of the COLREGS requires a vessel which detects by radar alone the presence of another vessel, and determines that a close-quarters situation is developing and/or risk of collision exists, to take avoiding action in ample time. Rule 19(e) additionally requires a vessel that cannot avoid a close-quarters situation with another vessel forward of her beam to reduce her speed to a minimum at which she can be kept on her course, to take all way off if necessary, and in any event navigate with extreme caution until the danger of collision is over.

Although *Alaska Rainbow*'s pilot was aware that a close quarters situation was developing with *Sea Express 1*, he took no avoiding action, contrary to Rule 19(c), on the incorrect assumption that *Sea Express 1* was aware of the presence of *Alaska Rainbow* and would keep clear. Although the pilot attempted to keep *Alaska Rainbow* in position and on course, the vessel nevertheless moved laterally from a position close to the west bank to almost mid-river.

Rule 2(a) of the COLREGS requires precautions to be taken in the ordinary practice of seamen or in special circumstances. In view of the restricted manoeuvrability of *Alaska Rainbow,* and the difficulty the pilot was having in maintaining position, it would have been wise for him to have taken the precautionary measure of proactively communicating with both *Sea Express 1* and VTS to ensure that both were aware of *Alaska Rainbow*'s position, identity and intentions, and the hazard that the vessel presented to other traffic.

2.3.2 Inappropriate manoeuvre close to Seacombe Stage

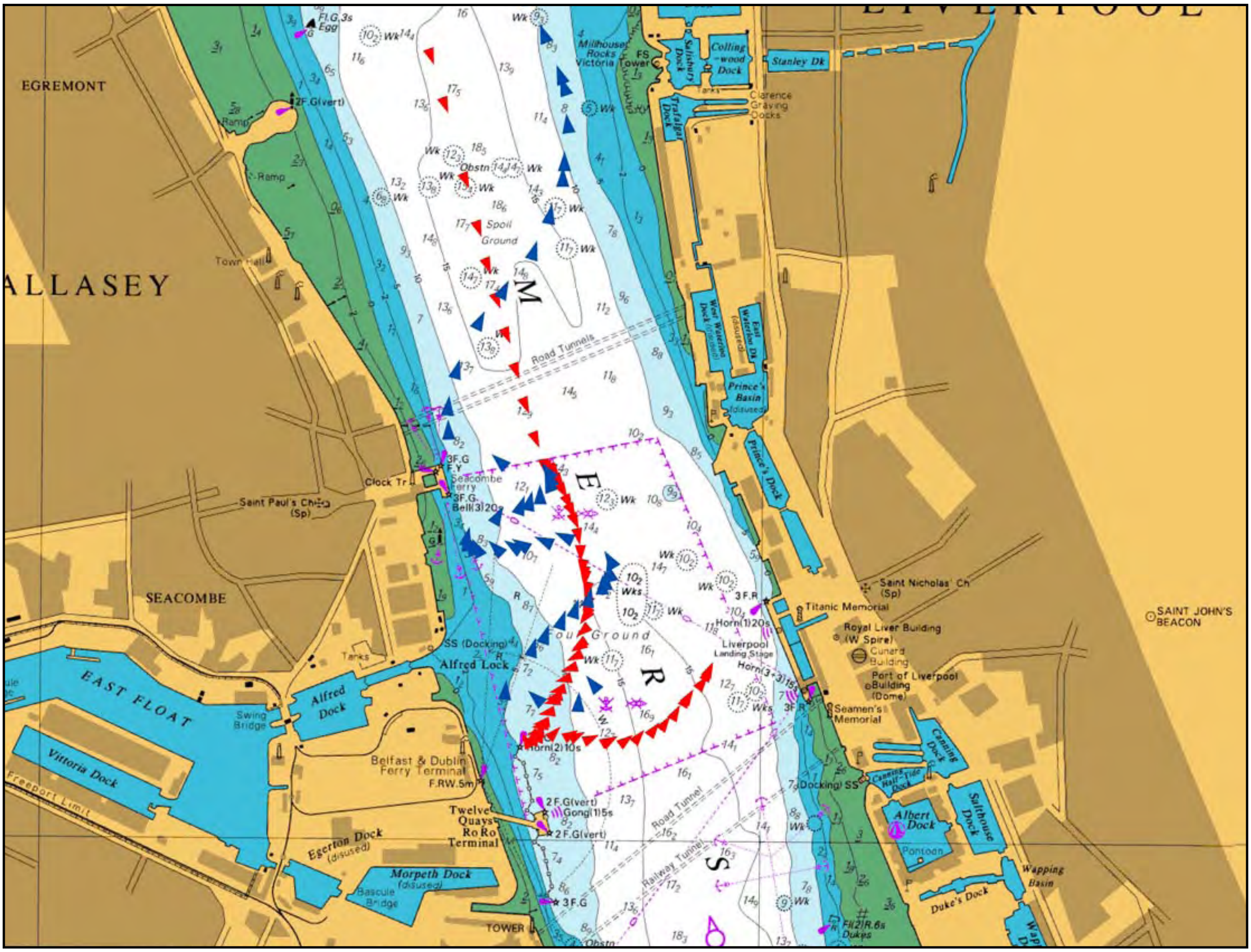
a) Tidal effects

Vessels which are required to enter Alfred Lock are routinely required to enter the River Mersey on the flood tide and arrive off the lock before high water. The vessel will then make fast to tugs forward and aft with a third tug standing by, as required, before entering the lock. Such vessels will normally be swung to stem the tide, and positioned off the lock between Seacombe Stage and Twelve Quays Terminal to the west side of the river, and clear of the main channel. However, as high water approaches, the ebb starts to run close to the shore, and the tidal eddy progressively increases in width. Waiting vessels therefore experience a continually changing tide line between the last of the flood tide in the centre of the river and the start of the ebb near the bank, which requires periodic manoeuvring to counter the effects on the vessel's position and heading.

Stemming the flood tide, the engines would be set to give approximately 3 knots ahead for a vessel to remain stationary over the ground. With a small movement towards the bank, the vessel would enter the ebb stream, and would move over the ground due to its own speed and the rate of the ebb flow. The vessel would start moving ahead, requiring a vigorous manoeuvre to arrest the ahead movement, particularly as the vessel closes with Seacombe Stage.

The movements of *Alaska Rainbow,* as recorded by VTS radar, the radar display of *Sea Express 1*'s VDR and AIS data **(Figure 17)**, indicate that the pilot was not maintaining position and during a manoeuvre to the west, overshot the optimum position and entered the developing ebb stream. This caused the vessel to move north, requiring a large manoeuvre with both engines and steering, and the tugs to assist in avoiding Seacombe Stage, resulting in a significant move towards mid-river.

Figure 17



AIS data from *Sea Express 1* (red) and *Alaska Rainbow* (blue)

b) Ship handling with tugs attached

The training scheme for pilots in Liverpool acknowledged that manoeuvring a large vessel with tugs is a skill that has to be developed since a particular requirement for advancement is leadsman trips working with tugs. It was also recognised that pilots needed good knowledge of the use of radar, and blind navigation techniques, since the refresher course at Lairdside Simulation Centre concentrated on these skills. However, these two important skills were not brought together in bespoke training, to specifically prepare a pilot for maintaining position with tugs attached in fog. Due to the relatively low frequency of fog in the port, demonstration of this skill may not be experienced by the trainee pilot before advancement to the next class of pilot, and, in any event, it is not extensively practised by those pilots already authorised.

c) Attention to ship's position

Once *Alaska Rainbow* had swung around to stem the tide, the pilot set up the radar to monitor the vessel's position in the river. To monitor any east/west movement, a VRM was set at 1.5 cables as this was the distance off the bank that the pilot attempted to keep the vessel. To monitor north/south movement, the radar EBL was used to line up with the line of the Birkenhead docks, which was identifiable on the radar. This system had the benefit that it could be used on any radar, without resource to additional functions, such as parallel index lines, whose use may not be immediately apparent to the pilot using the radar equipment for the first time.

When monitoring a ship's position by radar alone, a close watch would need to be kept on the apparent movement of the bearing and range markers against the radar returns of the land. The observer has to estimate the rate at which the range to the land or the bearing is changing to decide how fast and how large the reaction is needed to counter the movement and maintain position.

In clear weather, any movement of the ship would be readily apparent, due to the wealth of natural transits in the area. Small changes in position can be countered very quickly. However, in restricted visibility, when these visual clues are not available, the first that the observer knows that the vessel is moving is a change in range or bearing seen on the radar. This change has to be assessed to decide on the size of the corrective action to take. There is therefore a delay inherent in the use of the radar in taking corrective action, even assuming that the radar display is under continuous observation. Due to the difficulty in assessing small movements, the chance of over-running the optimum position is increased, requiring further large alterations to regain the position.

The pilot of *Alaska Rainbow* was using the radar to monitor the vessel's position, as well as for collision avoidance, and, at the same time, was communicating by radio with tugs and "Mersey Radio" on different VHF radio frequencies. Given his workload and the importance of continuously monitoring the vessel's position in the prevailing circumstances, the pilot would have benefited from increased support from *Alaska Rainbow*'s bridge team.

2.3.3 Lack of support to the pilot from the bridge team

a) Safety Management System requirements

The safety management system in use on *Alaska Rainbow* contained a procedure entitled *Pilot on Board*. This described the responsibilities of the bridge team and pilot and described the procedures and record keeping requirements. In detailing the responsibilities, the procedure quoted IMO Resolution A.285 (VIII), Annex A(v), which states:

> *Despite the duties and obligations of a pilot, his presence on board does not relieve the master or officer of the watch from their duties and obligations for the safety of the ship.*

The procedure also required a master-pilot information exchange and for the pilot to sight the pilot card. On this occasion, the procedure was carried out and recorded in the bridge logbook. The procedure also required the officer of the watch (OOW) to frequently plot the position on the chart, ensure that the radar was properly adjusted and that the pilot was aware of the range scale in use, and that the pilot's orders were correctly understood and carried out. The OOW was positioned at the engine room telegraph and additionally tasked with maintaining the bell book. Due to the layout of the bridge, the OOW could not see the radar screen from where he was standing, so was unable to assist the pilot in carrying out the radar lookout.

The master's responsibility and actions were also described in the procedure. It stated that the master was ultimately responsible for the safety of the vessel, and that the pilot was on board to assist with the navigation. In the minutes before the collision, the master had been pacing on the bridge wing, and occasionally returning to the wheelhouse to look at the radar and chart. He was therefore not assisting the pilot in his task of navigating the vessel, nor was he assisting in keeping a continuous radar lookout.

As a consequence, the pilot was carrying out the navigation and radar lookout alone, with no oversight from the vessel's bridge team. Although *Alaska Rainbow's* safety management system required the OOW to provide reactive support by carrying out the pilot's orders, it included no specific instructions for the master and OOW to give proactive support.

b) Pilot not proactive in requiring support

The pilot had stationed himself on the bridge in such a position that he could see the port radar and observe the helmsman and the third officer at the engine room telegraph. He therefore was in a position to monitor the navigation and visually verify that any orders he gave were carried out correctly. Had he requested assistance from the bridge team, the manning on the bridge was such that it would have been possible for either the master or OOW to assist. The trainee pilot could also have assisted the pilot, but was not called upon to do so.

2.4 VESSEL TRAFFIC SERVICES

2.4.1 Perception

Between 1034 and the time of the collision, *Sea Express 1* and the VTS station communicated with each other four times by VHF radio. On each occasion traffic movements were passed to the vessel, but in none of the messages was *Alaska Rainbow* mentioned.

A little over a minute before the collision, the captain called VTS to inform the operator that *Sea Express 1* was about to turn to port towards the landing stage. With *Alaska Rainbow* less than 2 cables off the starboard bow of *Sea Express 1*, the information service VTSO warned only of one ship, *Leistein,* which might, in his opinion, conflict with the turn, and this was south of Pluckington Bank and over 2 miles away.

During the period leading up to the collision, the information service VTSO did not specifically communicate the proximity of *Alaska Rainbow* to *Sea Express 1* because, in addition to the number of references made to *Alaska Rainbow* on VHF Channel 12, *Alaska Rainbow* appeared to be proceeding inward to Alfred Lock, and *Sea Express 1* appeared to be passing clear. His attention was then taken by *Leistein,* which had turned around and was now outbound, and the need to make *Sea Express 1'*s captain aware of this change.

The VTSO had misinterpreted the situation with respect to *Alaska Rainbow.* In restricted visibility, increased VTS monitoring and communication are essential to maintain an accurate overview and to overcome the inability of approaching vessels to determine each other's circumstances by sight.

2.4.2 Workload

Traffic movement in the Port of Liverpool was largely restricted to a period around high water, at which time the workload of both VTSOs was at a peak.

On a Saturday or Sunday morning, when the time of high water was between 0800 and 1000, the normally busy period coincided with the pilotage desk VTSO having to additionally take pilotage bookings. It was normal practice for the information service VTSO to assist the pilotage desk VTSO by occasionally answering the phone or operating the VHF radio for him.

Although not significant in this particular case, the additional workload created by taking pilotage bookings during a period when, given the time of high water, the normal workload of both VTSOs was likely to be at a peak, had the potential to result in the information service VTSO becoming distracted from his main function of providing an information service to vessels in the River Mersey on the position, identity and intentions of other traffic in the river.

2.4.3 Manning

The VTS station manning with two VTSOs may be sufficient to cover the working week day-to-day operation of the station under normal conditions. However, the workload can be significantly increased for the pilotage desk VTSO if he is additionally required to take many bookings for future acts of pilotage, and for the Mersey Radio VTSO if there is restricted visibility, necessitating a closer watch on vessel movements to ensure safe traffic flow. At such times, there may be no opportunity for either VTSO to assist the other.

2.4.4 Fog routine

The presence of fog in the VTS area is a considerable barrier to safe navigation. The risks involved in navigating in confined waters in restricted visibility can be mitigated by the additional assistance that VTS can provide in keeping all vessels frequently updated with the position, identity, intentions and movements of other traffic, as well as providing vessels in the area with frequent updates on the state of visibility. This increased level of support requires additional VTSO actions which can be detailed by a port authority in the form of a "fog routine".

At the time of the collision, the Port of Liverpool VTS station did not have an established "fog routine". Work carried on as normal, with no additional actions being taken because of the fog other than those listed in the Initial Response Card for Restricted Visibility. The rationale for this was that fog is a relatively rare occurrence in the River Mersey, and so the introduction of a specific "fog routine" was considered unnecessary. However, although fog is rare, where the consequent risks associated with it are nevertheless unacceptably high, a routine should be established to mitigate the risks.

Measures that could be introduced by VTS stations as part of a "fog routine" include:

- Diversion of incoming telephone calls to an answer machine.
- Providing additional duty staff.
- Detailed reports on the state of visibility from vessels navigating through the VTS area.
- Regular, more frequent broadcasts on the prevailing visibility and traffic movements in the VTS area.
- Restrictions on ship movements.

2.4.5 Risk assessments

The PMSC introduced a national standard for every aspect of port marine safety. It established a measure by which harbour authorities are accountable for their legal powers and duties by which they run their ports safely.

A harbour authority can only effectively discharge its duties, and therefore comply with the PMSC, if its rules, plans and procedures are maintained by reference to a full risk assessment and safety management system.

The process of risk assessment must be continuous such that new hazards and changed risks are properly identified and addressed. The safety management system should be documented and formally reviewed periodically or when circumstances require. The collision between *Sea Express 1* and *Alaska Rainbow* should trigger a full review of the relevant aspects of the port's safety management system.

When undertaking risk assessments, harbour authorities should refer to "A guide to good practice on marine operations". This document accompanies the PMSC and outlines the specific points to be considered for individual risk assessments.

The Port of Liverpool's VTS provided an Information Service to vessels; this should have ensured that essential information was made available to vessels in time for onboard decision-making. The fact that the normal VTS procedures were not revised at times of restricted visibility indicates that the mariner was not receiving the level of information he could reasonably have expected. Further, that restricted visibility does not occur frequently in the Port of Liverpool VTS area should have triggered the need for enhanced control measures when it did occur, rather than expecting VTS duty staff to absorb the additional workload that operation in restricted visibility demands.

An independent audit of the Port of Liverpool's safety management system as required by the PMSC might have identified this shortfall.

2.5 ACTIONS FOLLOWING THE COLLISION

2.5.1 Actions by tugs

The four tugs available on the river at the time of the collision acted with speed in connecting to *Sea Express 1* and then taking control of the vessel. *Sea Express 1* was drifting towards the Twelve Quays Terminal, and the action of the tugs prevented a collision with this structure. Once the tow was established, the communication between vessel and tugs was minimal. *Sea Express 1'*s captain confirmed that he wanted the vessel to be taken to the Liverpool Landing Stage, and to berth port-side-to, and the tugs carried out these wishes. There were no controlling directions given by the captain, and it was through the co-operation between the tug masters that *Sea Express 1* was safely berthed.

When *Sea Express 1* was turned round on the berth, the same system was adopted. The captain told the tugs what was required, and the tugmasters, using their skill and experience, turned the vessel round safely.

2.5.2 Passenger control

The control of passengers following an emergency is an often exercised evolution on *Sea Express 1*. It is part of the additional training required of staff on high speed craft.

When the emergency alarm sounded, the cabin staff mustered at their emergency muster positions. The CSO took a megaphone from its stowage and informed the passengers that they should find a seat, sit down and put on the lifejacket which could be found under the seat. This is part of the emergency drill, and the announcement made is a prepared script kept in the megaphone stowage. Returned passenger questionnaires indicate that not all the passengers could clearly hear the announcements made. Whether or not the passengers heard the announcements depended on where they were sitting. A review of video taken on scene by passengers, shows that the operator was holding the megaphone pointing in one direction only, and as announcements were made to passengers on either side, the speaker's head moved but the megaphone did not. However, the passengers were encouraged and guided by the rest of the cabin staff to sit down and put on their lifejackets. The staff also assisted those passengers who were having problems donning their lifejackets to get settled, and also collected lifejackets for children from their stowage in the upper forward main cabin. The CSO reported to the captain 9 minutes after the collision that all the passengers were seated and that they all had lifejackets on. Considering that this included the time taken to muster the passengers in the main cabin area, and carry out a sweep of the toilets and other passenger areas, to ensure all passengers were in the main cabins, these 9 minutes had been well used.

Announcements from the captain over the passenger space public address system were delivered in a calm and authoritative tone, and while passing on as much information as was available, also had the effect of calming the passengers. This was precisely what was needed, and the regular updates provided assisted in preventing panic among the passengers.

Once the ferry was alongside, and the gangway rigged, the passengers began to disembark. They were asked to remove their lifejackets before getting ashore, and hand them to crew members stationed at the top of the gangway. Once the passengers got to the bottom of the gangway, there was little in the way of reception staff to assist. The marine fire brigade units were based at the Landing Stage, and once alerted were on scene in under a minute. They were shortly followed by two fire tenders, ambulance and police units. But for the first passengers ashore there did not appear to be any staff to assist. Shore staff from the passenger terminal did start to take charge and usher the passengers towards the terminal building some minutes after the first passengers were ashore. There was little time between the passenger terminal being informed of the collision, and the first passengers coming ashore. However, there appears to have been little urgency in getting people away from the scene so that the emergency services could start to assist.

The vessel was confirmed clear of passengers when the crew swept through the spaces. However, this method did not account for any passenger who might have jumped or fallen overboard after the collision. Had that been the case, no-one would have had any idea that a passenger was missing using this method. A position ashore, set up to collect passenger details, would serve three purposes. Firstly it would provide a focus for the exchange of information between passengers and the ferry company. It would also act as a clearing station for any injuries. Thirdly, and perhaps most importantly, it would confirm that all the passengers were accounted for.

2.5.3 Lifejackets

Passenger Questionnaires returned to the MAIB raised concerns over the provision of children's lifejackets and the stowage of adult lifejackets. The children's lifejackets were stowed in the upper forward main cabin, and part of the emergency drill is for a member of the cabin crew to be assigned to collect them as necessary. This caused a delay in the provision of children's lifejackets, but one which did not significantly affect the overall time for passenger muster.

The vessel was equipped with two different types of lifejacket, the wearing of both being explained in the departure safety film. Both are fitted with tapes to tie around the wearer's waist when worn. The lifejacket stowage, below the passengers' seats, requires that the lifejackets are folded. The tapes are used to tie the lifejacket into a compact shape to fit the stowage. If the tapes are tied too loosely, over time they will undo, and the trailing tapes will present a trip hazard, which may also damage the lifejacket. If the tapes are tied too tightly, then in an emergency the lifejacket will be difficult to don. Although difficulty was experienced by some passengers with the way the lifejackets were tied up, it again did not significantly affect the overall time for passenger muster.

The safety instruction card provided in each passenger seat illustrated only one type of lifejacket. This was one of two types of lifejacket carried, but it meant that at some of the seats the safety instruction card did not illustrate the type of lifejacket stowed beneath the seat. There existed a potential for confusion if passengers had attempted to follow the instructions while faced with the alternative type of lifejacket.

2.5.4 Actions by VTS

Having decided through the risk assessment process that a VTS service was required, Mersey Docks and Harbour Company further decided that it would offer an information service to shipping. The VTS station was manned and equipped for this function.

Part of the role of VTS is to react to emergency situations within the VTS area. This would include the initiation of pre-planned reactions, and acting as a co-ordinating point for the actions within the port. The plans produced should include the interaction with the emergency services and local authority emergency planners, such that an effective, co-ordinated response to the emergency can be achieved.

The Civil Contingencies Act 2004 requires local authorities to have plans available as detailed in Section 1.8.1 of this report. These local plans which were developed after consultation, declare that the responsibility for Search and Rescue (SAR) at sea lies with the MCA. The local authorities and emergency services were under the impression that the coastguard would be immediately aware of an incident occurring on the River Mersey. However, the coastguard did not routinely monitor the port operations channel, VHF radio Channel 12. Its reaction was therefore dependent on being informed of the incident. On this occasion, the coastguard response was delayed, since it was not informed until 1154, 16 minutes after the collision. The plan the coastguard used to respond to the situation was a generic procedure and not a port-specific response.

The role of VTS is also to provide information to shipping concerning hazards to navigation in the VTS area. No specific traffic broadcasts were made to alert other port users to the presence of a disabled vessel and of the efforts of the tugs to tow the vessel to safety. However, where a vessel not associated with the incident called VTS, the operator did ask for confirmation that they were aware of the incident, but gave no further information. The expectation was that the transiting ships' staff would be monitoring the VHF radio working channel and therefore would have heard all the VHF radio conversations. The fact that the visibility remained at about 100m in the area of the collision meant that any approaching vessel would only be aware of the situation through overhearing the VHF radio conversations. This was a significant barrier to safe navigation, and the VTS station was not proactive in informing all port users of the situation and of developments.

The publication entitled "A guide to good practice on port marine operations", which accompanies the PMSC, highlights the importance of full and effective consultation with stakeholders when a harbour authority undertakes its risk assessments. As the risk assessment process should be continuous, there should be a process for ensuring that the harbour authority meets relevant stakeholders sufficiently regularly to ensure that its risk assessments remain valid. The fact that the specific risks associated with the carriage of passengers had not been separately assessed, particularly with regard to emergency response, might well have been highlighted in advance by external stakeholders at such meetings, especially given the intention to significantly increase the frequency of passenger ship calls to the Port of Liverpool in the future.

2.5.5 Notification of collision

The captain of *Sea Express 1* correctly informed the VTSO of the incident seconds after it had happened. However, even though the vessel had almost immediately listed to starboard and trimmed by the stern, had lost electrical power and the use of the starboard engines, his message to the VTSO was "I'm afraid we've made contact with the vessel outbound from Alfred Lock. We're just stopped here for the moment". There was little sense of urgency contained in this message, or any indication of how serious the situation was. This call was not replied to, because before a reply could be made, the pilot of *Alaska Rainbow* called the VTSO and stated "Just had a collision with *Sea Express 1*". The VTSO's response to this call was to tell the pilot that the call had been "noted in the logbook". At this stage, the VTSO had no idea how serious the collision was, or of the damage sustained by either vessel, and made no attempt to discover any further information. The rescue plans for the area depended on the coastguard taking a co-ordinating role. At this moment, the only person ashore who knew of the incident was the VTSO, and he then took 16 minutes to pass the information to Liverpool Coastguard.

It would have benefited the VTSO to have available a set of emergency action checklists, to prompt the VTSO to carry out planned actions in response to an emergency. This could include a list of telephone contacts to be made. To expedite informing the MCA, a direct line to the Liverpool Coastguard incident desk could be installed, such that communication to the Coastguard watch officer is almost instantaneous.

SECTION 3 – CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT WHICH HAVE RESULTED IN RECOMMENDATIONS

Factors related to *Sea Express 1*:

1. A ground stabilised radar display was not used in the confined waters of a river transit, thereby making it difficult for the operator to distinguish moving targets from land radar returns. [2.2.1]

Factors related to *Alaska Rainbow*:

2. The pilot did not proactively communicate with *Sea Express 1* and VTS at an early stage to ensure that all parties were aware of the hazard that *Alaska Rainbow* presented to other traffic, resulting unnecessarily in the development of a close quarters situation. [2.3.1]

3. The pilot was not proactive in requiring support, and neither the master nor the OOW was proactive in providing support to the pilot, thereby unnecessarily increasing the pilot's workload. [2.3.3]

4. Neither the pilot nor the master ordered fog signals to be sounded, thereby omitting a means by which *Sea Express 1* might have been alerted to the presence of *Alaska Rainbow*. [2.2.2]

Factors related to the VTS station:

5. No fog routine was in place, thereby preventing a closer watch on vessel movements being maintained to ensure safe traffic flow at times of restricted visibility. [2.4.3] [2.4.4]

6. The VTS duty staff were expected to absorb the additional workload that operation in restricted visibility demands; an independent audit of the Port of Liverpool's safety management system might have identified this shortfall. [2.4.5]

7. A review of the Mersey Channel Collision Rules on the sound signals required of vessels manoeuvring in close proximity during periods of restricted visibility would appear to be appropriate. [2.2.2]

3.2 OTHER SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION ALSO LEADING TO RECOMMENDATIONS

Factors related to *Sea Express 1*:

1. The initial communication made by *Sea Express 1*'s captain to VTS lacked urgency and detail as to the seriousness of the situation, thereby delaying an appropriate external emergency response. [2.5.5]

Factors related to the VTS station:

2. The VTSOs were not proactive in ascertaining further information following the initial report of the collision and in notifying Liverpool Coastguard, thereby delaying an appropriate emergency response. [2.5.4] [2.5.5]

3.3 SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION WHICH HAVE NOT RESULTED IN RECOMMENDATIONS BUT HAVE BEEN ADDRESSED (SEE SECTION 4)

Factors related to *Sea Express 1:*

1. The allocation of bridge team duties in preparation for the type rating examination was unclear, resulting in the presence of other vessels in the vicinity to be missed during the period immediately leading up to the collision. [2.2.1] [2.2.2] [2.2.3]

Factors related to *Alaska Rainbow:*

2. The pilot was insufficiently practiced in maintaining *Alaska Rainbow's* position in the prevailing circumstances, resulting in the vessel moving significantly between the west bank and mid-river. [2.3.2]

Factors related to the VTS station:

3. Additional workload created by the VTSOs having to take pilotage bookings at a time when performance of their normal duties was at a peak, had the potential to result in the VTSO responsible for the Information Service becoming distracted. [2.4.2]

4. Specific risks associated with the carriage of passengers had not been separately assessed, particularly with regard to emergency response. [2.5.4]

SECTION 4 - ACTION TAKEN

4.1 MERSEY DOCKS AND HARBOUR COMPANY HAS:

- Provided clerical assistance to VTS pilot desk on Saturday mornings.
- Arranged an external review of the PMSC formal risk assessments and the Safety Management System which will be followed by an audit.

  The review will:

  - Include passengers on ships as part of the formal risk assessment process
  - Add a procedure for navigation in restricted visibility to the Safety Management System **(see Annex 5)**, and
  - Determine whether the risks require an upgrade of the VTS to a Traffic Organisation Service.

- Requested Liverpool Pilotage Services Ltd to include in its simulator training use of tugs in poor visibility, especially when stemming the tide.
- Commenced a system of annual audits of Liverpool Pilotage Services Ltd.
- Issued Notice to Mariners 9-2007 concerning procedures for navigation in restricted visibility **(see Annex 5)**.

4.2 ISLE OF MAN STEAM PACKET COMPANY LIMITED HAS ARRANGED FOR:

- Captain, trainee captain and first officer to attend a Bridge Team Management course at a UK College, with specific reference to High Speed Craft, restricted visibility and narrow channels.
- Bridge Team Management Training, already in place, to be extended to all captains and navigating officers throughout the fleet.
- Customer services personnel involved to complete a refresher course in Crowd Management Training, which included discussion of the lessons learnt.
- A Service Engineer to test the radar functionality of *Sea Express 1* (found to be satisfactory).

In addition, the company has:

- Issued a memorandum to all of its vessels with a view to amending its Route Operating Manual, requiring masters to clearly stipulate roles and duties of all concerned prior to, and during, type rating instruction and examination.
- Carried out an independent audit of bridge management and navigation equipment on board the company's other vessels.
- Undertaken a technical evaluation of the possibility of integrating AIS information with radar/ECDIS.
- Introduced Landing Cards to its procedures which will form part of its Emergency Procedures in case of evacuation.

SECTION 5 - RECOMMENDATIONS

The Isle of Man Steam Packet Company Limited is recommended to:

2007/185 Review its Safety Management System with particular respect to:

- using ground stabilised radar display in the confined waters of a river transit;
- improving external communications in the event of an emergency in terms of urgency and detail.

2007/186 Ensure that the passenger safety instruction card illustrates the lifejacket to be found under the seat for which the card is provided.

J.G.Goumas (Shipping) Co. S.A. is recommended to:

2007/187 Ensure its masters are given clear guidelines which detail the importance of effective dialogue with pilots and identify the need for the ship's bridge team to:

- be proactive in providing support to pilots;
- challenge decisions or actions taken by pilots at an early stage so that, when required, effective corrective action can be taken to prevent accidents.

Mersey Docks and Harbour Company is recommended to:

2007/188 Complete its review of compliance with the requirements of the PMSC with particular reference to:

- VTS operations, ensuring that an effective fog routine is established and that the VTS station is sufficiently manned to absorb the additional workload that operation in restricted visibility demands, and that VTSOs are proactive in ascertaining further information in the event of incident;
- Pilotage best practice, highlighting the need for pilots to proactively communicate with approaching vessels and VTS at an early stage to avoid unnecessary development of a close quarters situation; to be proactive in requiring support from the ship's bridge team; and to sound appropriate fog signals in restricted visibility.

2007/189 Following satisfactory completion of its review into PMSC compliance, invite the MCA to conduct a PMSC verification visit to the Port of Liverpool.

2007/190 Review the Mersey Channel Collision Rules with respect to sound signals required by vessels manoeuvring in close proximity during periods of restricted visibility.

Marine Accident Investigation Branch
September 2007

Safety recommendations shall in no case create a presumption of blame or liability