

Report on the investigation into the grounding of

MV Lerrix

off the Darss peninsular, Baltic Sea

Germany

10 October 2005

Marine Accident Investigation Branch
Carlton House
Carlton Place
Southampton
United Kingdom
SO15 2DZ

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Extract from
The 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.”

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 13(9) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AB	-	Able Bodied Seaman
AIS	-	Automatic Identification System
ARPA	-	Automatic Radar Plotting Aid
DPA	-	Designated Person Ashore
EP	-	Estimated Position
GPS	-	Global Positioning System
ILO	-	International Labour Organisation
IMO	-	International Maritime Organisation
IRPCS	-	International Regulations for Preventing Collision at Sea
ISM	-	International Safety Management
MCA	-	Maritime and Coastguard Agency
MGN	-	Merchant Guidance Notice
OOW	-	Officer of the Watch
STCW	-	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
TSS	-	Traffic Separation Scheme
UTC	-	Universal Co-ordinated Time
VHF	-	Very High Frequency
6-on/6-off	-	As used in this report, watchkeeping routine shared by two officers whereby each works 6 hours on watch, followed by 6 hours off watch.



MV Lerrix

SYNOPSIS

Narrative:

All times are ships time (UTC +1)

At 2342 on 10 October 2005, the British registered general cargo vessel *Lerrix* ran aground off the Darss peninsular in the Baltic Sea. The single hold vessel was carrying a cargo of second hand vehicles destined for Klaipeda in Lithuania. Twenty five minutes later the master re-floated the vessel using astern propulsion, narrowly avoiding a second grounding as he did so.

It was the master's first full command with the company. Earlier the same day, the vessel had transited the Kiel Canal, and the master reported that his rest period between midnight and 0600 had been disturbed by nervous tension brought on by the vessel's approach to, and navigation down the River Elbe. During the afternoon, the master suffered a second disturbed rest period while transiting the canal, making several visits to the bridge to check progress and, finally, to pilot the vessel outbound from the canal lock to sea.

At about 2230, the lookout requested and was granted permission to proceed below to complete cleaning the galley. A short while later, the master fell asleep in the bridge chair. As a result, the vessel missed a planned alteration of course at 2242 within the TSS and continued on a 090 heading at 10.5 knots until grounding at 2342. The vessel's movements were monitored by Warnemunde VTS and, when it became apparent that the vessel was not following the prescribed route, the VTS operators made several attempts to contact *Lerrix* by VHF, but received no response.

When the mate arrived on the bridge at midnight the master, who had woken seconds before, was seen at the engine control lever with maximum astern power set. The general alarm was sounded, soundings were taken and at about 0007 the vessel floated free and proceeded to anchor close by. The master was breathalysed for alcohol consumption – the test proved negative.

Analysis:

Although the individual voyages onboard *Lerrix* were about 3 to 4 days long, and the time in port between voyages 1 and 3 days, fatigue was a contributory factor in the accident. Working a 6-on/6-off routine, the master was unable to fully carry out his command obligations without disruption to his 6 hours of rest time. Furthermore, the poor quality of rest achieved in the master's two previous designated rest periods directly contributed to this particular grounding.

Although a lookout had been present on the bridge earlier in the evening, it was standard practice onboard *Lerrix* for the OOW to determine at the commencement of a lookout's watch whether his presence was required. Had the lookout remained on the bridge in accordance with STCW instructions, interaction between the two would have made it unlikely that the master would have fallen asleep, and ultimately the grounding could have been avoided.

A watch alarm, fitted to comply with a previous flag administration's requirements, was found to be inoperative. Had the watch alarm been available to the OOW, and set by him when the lookout departed from the bridge, this accident could probably have been avoided.

During the investigation, it emerged that the master was using a portable GPS connected to a personal laptop computer, running a pirated navigation package as his primary source of navigation information. The pirated programme, obtained from the internet in 1999, had not been updated and the alarm functions were inoperative.

Conclusions:

Lerrix grounded because the master, who was alone on the bridge, had fallen asleep and missed an alteration of course.

It is likely that the master was fatigued at the time of the grounding. He was one of two watchkeeping officers working 6-on/6-off, and his rest periods prior to the accident had been disturbed.

His decision to allow the lookout to leave the bridge, removed the single most important barrier to prevent the accident occurring. However, having made the decision, the grounding could still have been avoided if the watch alarm had been fully functional and utilised.

Recommendations (abridged):

The Chamber of Shipping is recommended to:

- Impress upon ship owners, operators and managers the importance of addressing fatigue; and, to reiterate that masters have command obligations beyond watchkeeping that can significantly erode their scheduled rest.

Rix Shipping Limited is recommended to:

- Establish a policy to guard against the inappropriate use of personal navigational aids carried by crew members.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *LERRIX* AND ACCIDENT

Vessel details

Registered owner	:	The Lerrix Shipping Company Limited
Managers	:	Rix Shipping Company Limited
Port of registry	:	Hull
Flag	:	British
Type	:	General Cargo
Built	:	1976
Classification society	:	Germanischer Lloyd
Construction	:	Steel
Length overall	:	73.50 metres
Gross tonnage	:	1989.00 tonnes
Engine power and type	:	1177.00kW – Yanmar
Service speed	:	10.5 knots

Accident details

Time and date	:	2242 UTC (2342 ship's time) 10 October 2005
Location of incident	:	54° 24'.57N 012° 27'.02E
Persons on board	:	7
Injuries/fatalities	:	0
Damage	:	Minimal – Underwater cosmetic paint damage

1.2 BACKGROUND

Lerrix is owned by the Lerrix Shipping Company Limited, and is one of five general cargo vessels, three coastal tankers and five estuarial tankers managed by the Rix Shipping Company Limited. The vessel is British registered, having transferred from the Bahamas registry in the late 1990s.

Lerrix was involved in an earlier grounding incident in May 2005, also in the Baltic Sea, which was the subject of an MAIB preliminary examination. As a result of the extensive underwater damage sustained in that grounding, the vessel was dry docked and did not return to service until July 2005. The MAIB preliminary examination raised three main safety issues:

- The passage courses on the chart comprised solely of lines joining route marker buoys.
- More detailed passage planning was required.
- Grounding incidents must be reported to the coastal state immediately.

The German Accident Investigation Department reported this accident to the MAIB on the morning of 11 October 2005.

1.3 NARRATIVE

All times are ships time (UTC +1).

1.3.1 Trading pattern

Lerrix was operating a liner service between eastern United Kingdom ports and the Baltic States of Latvia, Lithuania, and Estonia. The programme for the seven weeks preceding the grounding consisted of nine port visits, each visit comprising 1 to 3 days alongside, and voyage lengths between 3 to 5 days. The full schedule can be found at **(Annex A)**.

1.3.2 Sequence of events

Lerrix sailed from Alexandra Dock, Hull, at 2100 on 8 October 2005, bound for Klaipeda, Lithuania via the Kiel Canal. She had a cargo of used vehicles and containers, and sailed with a draught of 2.9 metres forward, and 4.1 metres aft. On departure, the master was the OOW, and he employed the services of a local pilot who assisted navigating the vessel downriver to the Spurn light float. The pilot disembarked at about 2300, thereafter the master set course toward the River Elbe and the Kiel Canal in Germany.

The 27 hour passage across the North Sea was uneventful. Wind and sea conditions were good, and although the visibility had varied between 1 and 2 miles, the master had not deemed it poor enough to commence a fog routine¹.

¹ Sounding the prescribed fog signal, proceeding at a safe speed, engines ready for immediate manoeuvre, posting an additional lookout, exhibiting navigation lights, and the use of radar equipment if fitted and operational.

The master completed his watch at midnight on 9 October, handed over to the mate, and then went down below to sleep. At this time, the vessel was navigating in an adopted TSS and was approaching the congested waters of the River Elbe. There was no legal requirement for the master to embark a pilot for the passage from seaward to the Kiel Canal, and his intention was for the mate, as the OOW, to navigate *Lerrix* along the Elbe toward the canal pilot embarkation point.

Although the master reported having total confidence in the mate's watchkeeping ability, he found it difficult to achieve continuous rest during his sleep period between midnight and 0600. On at least three occasions, the master recalled waking, observing the traffic density and navigational situation from his porthole, smoking a cigarette, and then returning to his bed in an attempt to rest.

At 0600, the master took the watch from the mate, and at 0700 he embarked the pilot for the Kiel Canal, passing through the lock at 0745. The canal transit throughout the master's watch was uneventful; he was relieved by the mate at 1200 and then went below for lunch.

During the afternoon, the master rested lightly in his cabin with his 'feet up'. There were two occasions, at about 1300 and 1400, when he visited the bridge to check on the vessel's progress. At 1500, he returned to the bridge to take over the con from the pilot before entering the final lock. The canal pilot disembarked at 1515, and at 1535 the master conned *Lerrix* out of the lock and commenced passage to Klaipeda. Traffic around the exit from the canal was moderate, and the master remained on the bridge until 1645, when he handed the con back to the mate and then went below for supper.

When the master returned to the bridge at 1800 to relieve the mate, sea conditions were good, the wind was south south east force 3 to 4, and visibility remained similar to that experienced during the north sea crossing, at between 1 and 2 miles. The master assumed his preferred position sitting in the port side bridge seat where he had space to place his laptop computer, and where he considered it offered him a better view to starboard. The logbook shows that GPS positions were recorded at 1831, 1930 and 2120, with each position corresponding to a planned alteration of course.

At 1945 the AB/cook, who was the designated lookout for the 2000 to 2400 watch, reported to the master on the bridge. Usual practice on *Lerrix* was for the lookout to report to the OOW at commencement of the night watch, when a decision would be taken on whether lookout duties or other employment away from the bridge was undertaken. On this particular occasion, the master reported that he felt the lookout's presence was necessary, and consequently the AB/cook remained on the bridge.

The lookout sat in the starboard bridge seat and, for a while, talked quite happily to the master, who, he reported, was showing no outward signs of fatigue and was behaving in a rational and logical manner.

The lookout was due to leave the vessel the following day, and was keen to ensure that his galley was thoroughly clean and tidy prior to his relief taking over. He asked permission from the master to be excused from lookout duties and be allowed below to complete cleaning the galley area and to pack his suitcases. The exact time of this request was reported as being 2300. However, evidence from radar coverage and electronic plotting shows that in all probability it was around 2230 (**Figures 1, 2 & 3**). The master agreed to the request and the lookout left the bridge. He did not return before the grounding occurred.

The master was not aware the vessel was equipped with a watch alarm, albeit a defective one, and therefore made no attempt to activate it when the lookout left the bridge.

Once the lookout had gone below, the master reported pacing the bridge for about 5 to 10 minutes, after which he returned to his chair on the port side. As a heavy smoker, the master always ensured that he had the leeward wheelhouse door open. He had consumed three mugs of coffee since coming on watch at 1800. Shortly after returning to his seat, the master fell asleep. The vessel was in autopilot, steering 090 at 10.5 knots through the east bound lane of the Kadetrenden TSS. Twelve miles ahead was the Darss peninsular, a designated environmentally sensitive area.

Lerrix had been acquired on radar by the local traffic routing service based at Warnemunde, 13 miles south of the Kadetrenden TSS; AIS had provided the necessary vessel particulars. With the master now asleep and no lookout present on the bridge, the vessel missed the scheduled alteration of course to 036 which, by EP, should have occurred around 2242. At about 2250, it became apparent to the traffic routing operator that *Lerrix* was not complying with Rule 10 of the International Regulations for the Prevention of Collisions at Sea (**Figures 4a and 4b**). The vessel had departed the traffic lane eight cables right of her intended track on a course of 090 and was heading directly toward the land at 10.5 knots.

The Kadetrenden TSS is a fully adopted IMO TSS but there is a high rate of vessel non compliance. As a result, the German Waterways and Shipping Administration programme the patrol vessel *Arkona* to monitor and identify vessels not complying with IRPCS Rule 10. The Warnemunde traffic routing operator and the patrol launch *Arkona* made a succession of 19 VHF calls in a 16 minute period before the grounding in an attempt to establish contact with *Lerrix*. They both failed to raise any response from the vessel. As the seriousness of the situation developed, *Arkona* was tasked to investigate the movements of *Lerrix*.

Passing one cable south of the west cardinal buoy, in position latitude 54 24.9N longitude 012 24.6 E, *Lerrix* finally grounded on the Darss coastline at 2342. Both *Arkona* and traffic routing services continued to call *Lerrix* by VHF; still with

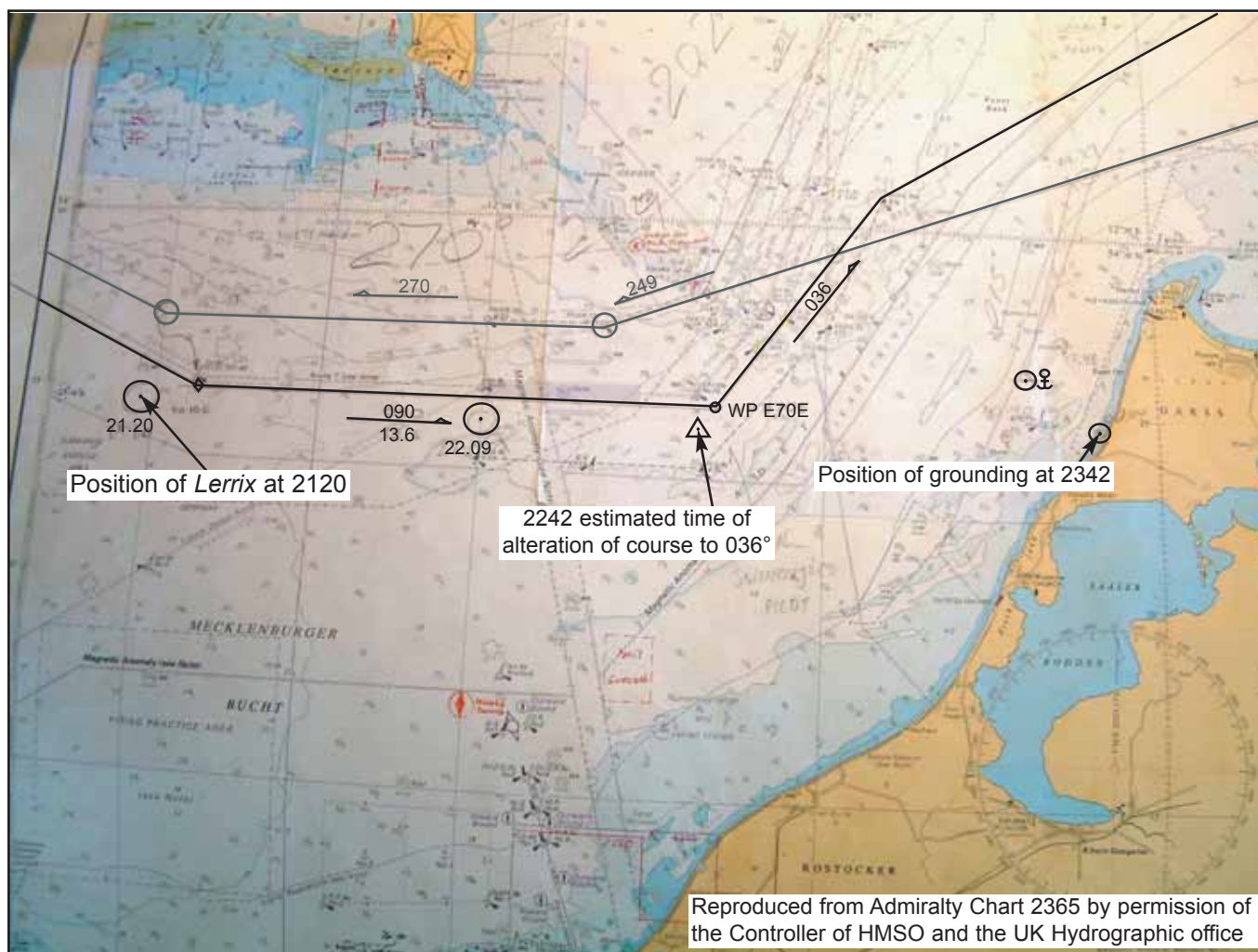
no response. With the master asleep and oblivious to the grounding, the vessel's engine continued to drive the vessel further up the beach at maximum power. No other crew member onboard *Lerrix* felt the vessel take the ground.

It was standard practice for the master, mate and lookouts to organise their own call before going on watch. The mate awoke as normal at 2345, three minutes after the grounding, and proceeded up to the bridge at midnight. The 2000 to 2400 lookout was still below and later found to be showering.

Seconds before the mate entered the bridge, the master awoke to find the small Koden radar in front of him (set on the 6 mile range scale) showing land very close to the centre spot, there were no shore lights visible. Not fully appreciating whether the vessel had grounded or was about to ground, he immediately grabbed the engine control lever and pulled it back to the full astern position. As the mate entered the bridge at midnight, the main engine alarms were sounding due to the intensity of the engine manoeuvre. Believing the vessel was about to ground, the master ordered the mate to sound the general alarm.

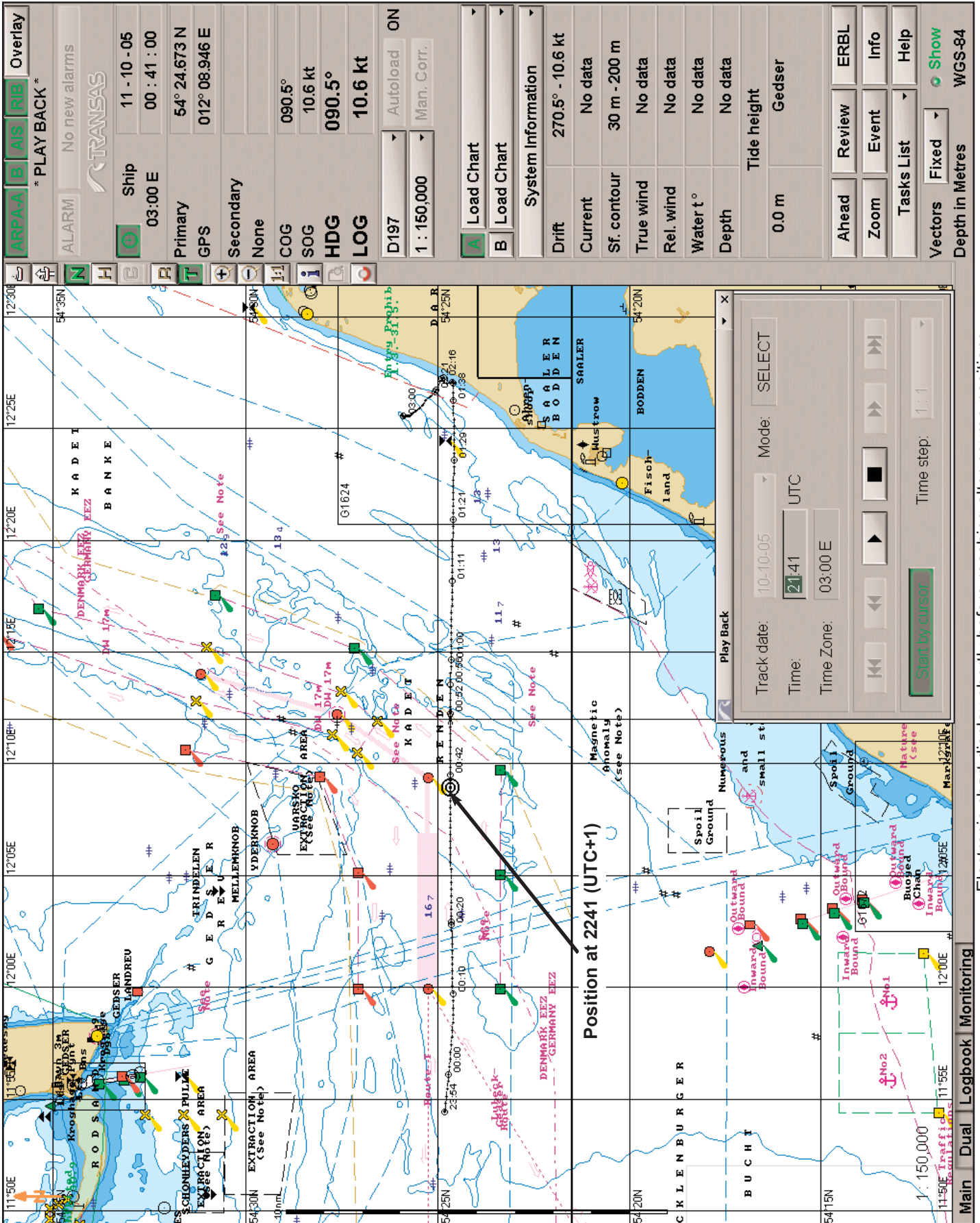
The company's ISM grounding procedures can be seen at **Annex B**.

Figure 1



Note: Subtract 2 hours from electronic chart time to obtain ships time (UTC+1)

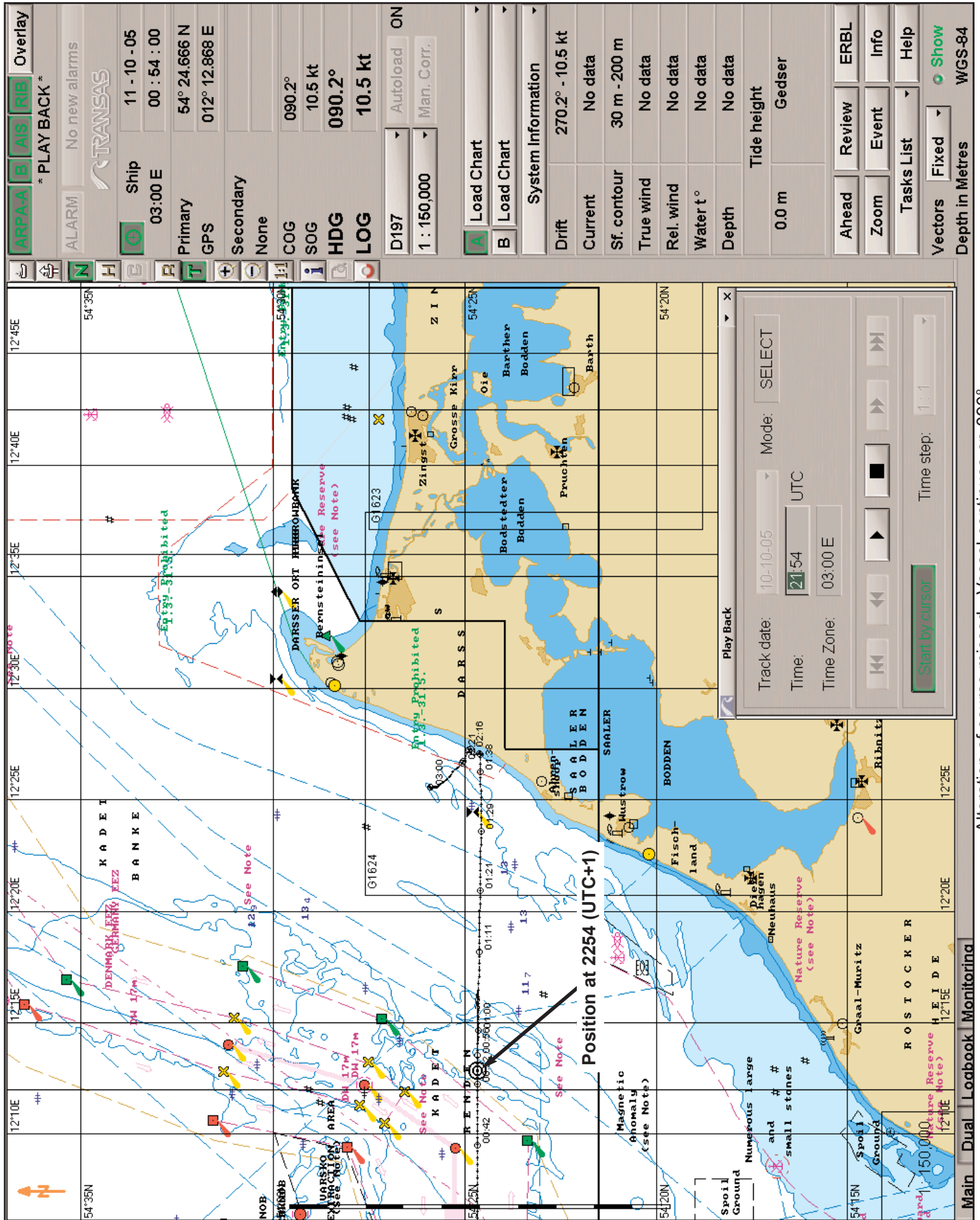
Figure 2



Electronic chart display shortly before reaching alter course positions

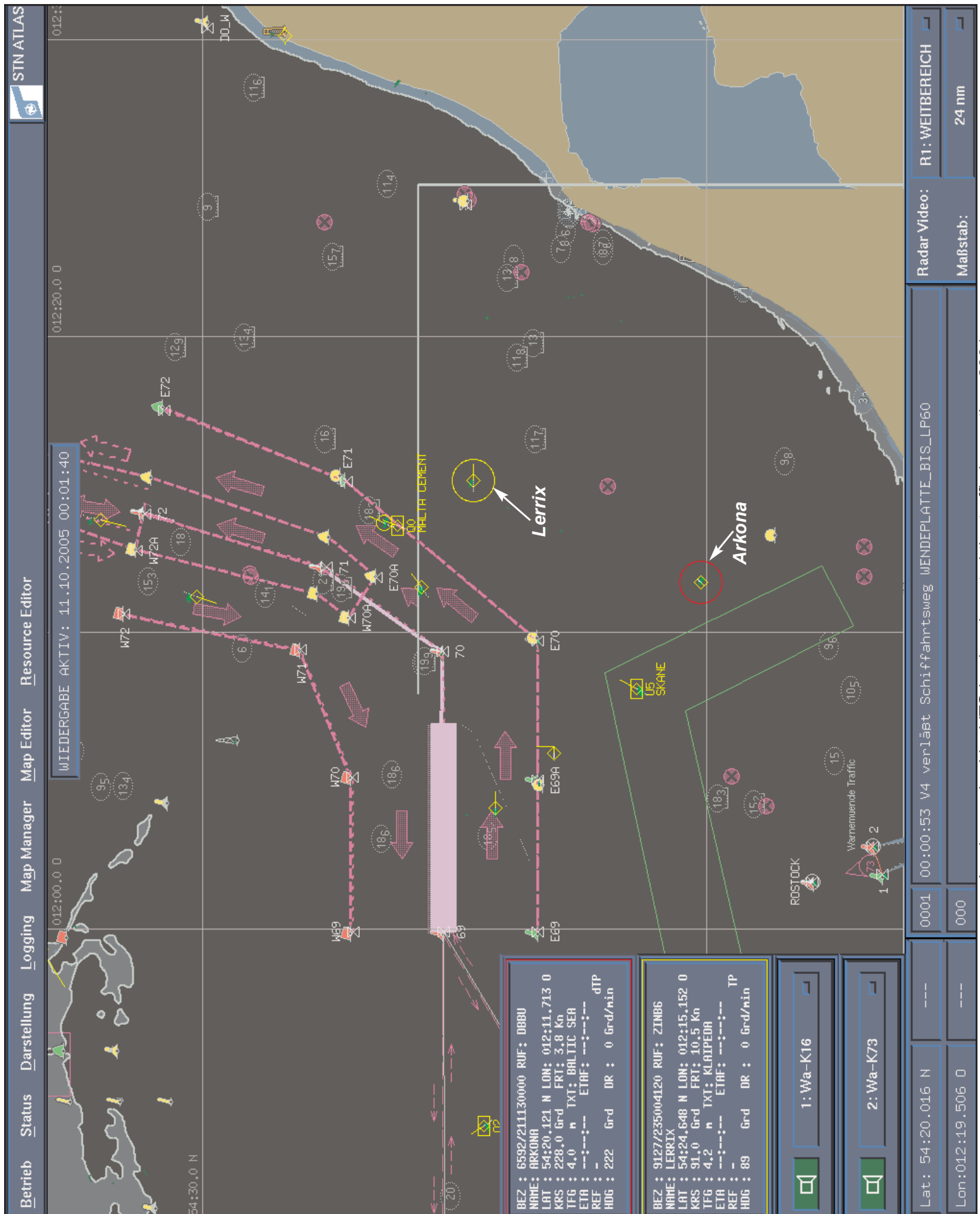
Note: Subtract 2 hours from electronic chart to obtain ships time (UTC+1)

Figure 3



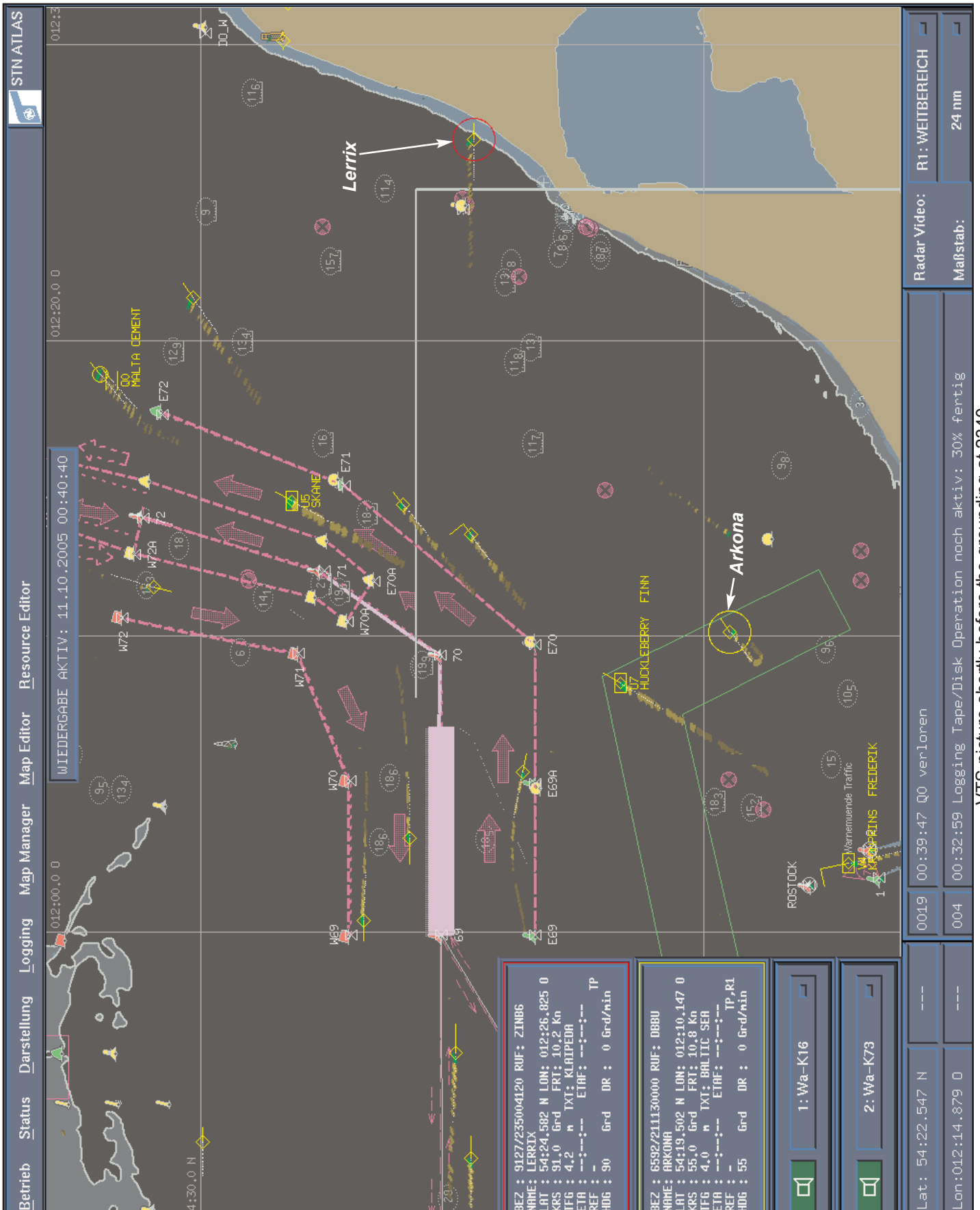
Alteration of course missed. Vessel continues on 090°

Figure 4a



Lerrix acquired by VTS having departed the traffic lane - time 2301

Figure 4b



VTS picture shortly before the grounding at 2340

1.4 EVENTS FOLLOWING THE GROUNDING

A full muster of the crew was achieved, by which time the master fully appreciated that the vessel was aground. The mate and two ABs started sounding ballast tanks, preparing the fore peak tank to pump out, and readying both anchors for letting go. Meanwhile, the chief engineer began sounding the engine room fuel tanks and bilges. The engine remained set at full astern but the steering had been changed from autopilot to hand steering and port helm applied. At 0010, the master responded for the first time to a VHF call from the *Arkona*, and it was during this conversation that he first reported the grounding incident.

At 0011, *Lerrix* appeared to pivot about the grounding position, finally moving astern at 0013. The combined effects of transverse thrust from the astern propulsion, rudder setting, and then the stern seeking the south south east wind caused the stern to move sharply to the north east. *Lerrix* moved astern at 5 knots and, as the stern swung in a clockwise direction toward the land, the master lost both his sense of direction and his distance off the shore. Glancing at the radar screen he became suddenly aware that he was in danger of grounding again, this time stern first. Setting the engine control lever to full ahead the vessel was able to achieve ahead motion and narrowly escape a second grounding (at 0016) (**Figure 5**). *Lerrix* was instructed by the German authorities to proceed to a designated anchorage for boarding, and en route the master received reports from the chief engineer that the bunker and ready use fuel tanks were intact.

At 0040 *Lerrix* anchored in position latitude 54 25.9N, longitude 012 25.55E and at 0130 was boarded by Coastguard officers from *Arkona*, who inspected the vessel for watertight integrity. Finally, at 0500, officers from the German Water Police boarded and breathalysed the master four times. Each test provided a negative result.

Subject to conditions set by its classification society, the vessel weighed anchor at 1830 and continued on passage to Klaipeda, where a full underwater survey was conducted. The survey revealed no underwater damage had been sustained.

1.5 WORK PATTERN

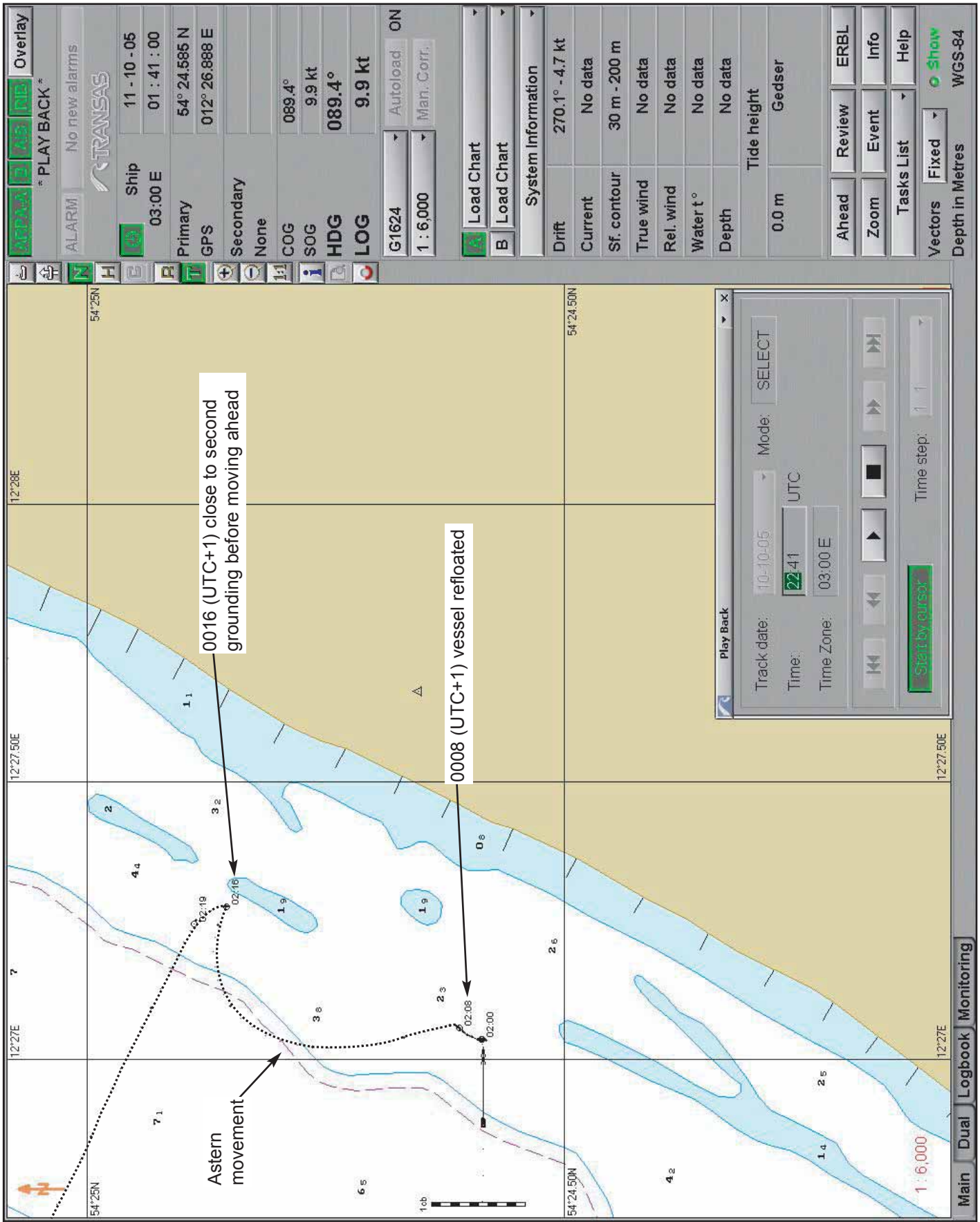
1.5.1 Master

The master held a United Kingdom certificate of equivalent competency allowing him to sail in the capacity of master, issued by the MCA on 19 July 2004, and a valid medical certificate.

The master began employment with Rix Shipping Company Limited in 1999 as a chief officer. He undertook his first trip as relief master for a period of just over 3 weeks in late 2004, and after 2½ months leave a second trip of 2½ months in February 2005. After a further 3 months leave, the master joined

Note: Subtract 2 hours from electronic chart time to obtain ships time (UTC+1)

Figure 5



Track followed by Lerrix when refloated

Lerrix on 18 July, just as repairs from an earlier grounding were completing. This was the master's first full command of his own vessel. A normal tour of duty for the master was 3 months onboard followed by 6 weeks leave, and he was due to leave the vessel approximately 2 weeks after the date of this accident. Company policy allowed extensions to the tour of duty period if an individual so requested.

Working hours onboard *Lerrix* were in accordance with the company's schedule of working arrangements (**Annex C**), which complied with IMO and flag state guidance. These stated that at sea the master would work a 6-on/6-off routine based around his duties as the 0600 to 1200 and 1800 to 2400 watchkeeping officer.

Company policy required the master to be on the bridge for entering and leaving port, in restricted visibility, and on occasions dictated by the navigational situation. Additionally, the master conducted administrative work, rounds of the accommodation, safety meetings, and statutory emergency training drills. In port, the company's schedule required the master to start work at 0700 and complete at 1800.

1.5.2 Mate

The mate had a master's certificate of competency for vessels greater than 3000 grt, issued by the administration of Lithuania on 22 March 2004, and a valid medical certificate.

The mate joined *Lerrix* on 29 July 2005 toward the end of the repair period. His normal tour of duty was also 3 months onboard followed by 6 weeks leave. This was the mate's first voyage with Rix Shipping Company Limited, having previously worked 10 years for Lithuanian shipping companies, and a short period ashore as a nautical surveyor.

Like the master, the mate's working hours were laid down in the company's schedule of working arrangements (**Annex C**), also in accordance with IMO and flag state guidance. It stated that, at sea, the mate would work a 6-on/6-off routine based around his duties as the 0000 to 0600 and 1200 to 1800 watchkeeping officer.

Additionally, he would conduct administrative work and an assessment of the work undertaken by the crew during the previous 24 hours. Statutory emergency training drills were planned with assistance from the master. In port the mate was required to commence work at 0700 and complete at 1800.

1.5.3 AB/cook

The AB/cook's certificate showed that he qualified as an able bodied seaman in accordance with the ILO No 74 convention on 10 May 2005. An endorsement on the same certificate showed that he had met the requirements under

Regulation II/4 of the STCW Convention, which allowed him to perform the duties of navigational watch rating. He was also in possession of a valid medical certificate.

The AB/cook had been employed by Rix Shipping Company Limited for the last 7 years, a standard appointment to the vessel being 4 months duration. On this occasion, he had been onboard for nearly 3½ months, and was due to commence 1½ months leave the day after the grounding. He had served as an AB/cook for 15 years.

While onboard *Lerrix*, his working hours consisted of a sea routine based around food preparation, cooking and lookout duties between 0700 and 1230, then again from 1600 to 1830. Lookout duties were designated between 2000 and 2400. In port, his working hours were specified by the company's working hours schedule, commencing at 0700 and completing at 1800.

1.6 FATIGUE

1.6.1 Hours of rest records

The hours of rest records obtained from the master, mate, and lookout for the months of September and October, until the time of the grounding, can be found at **Annex D**. Despite the vessel's operating programme for September outlined at paragraph 1.3.1, the hours of rest records for the master and mate showed a precise 6-on/6-off routine. Logbook extracts showing the time spent alongside, the time of arrival and departure, and personal work conducted outside of watchkeeping hours, show the rest hours records were inaccurate and did not reflect the actual hours of rest achieved. The AB/cook's record of rest, although different to that of the master and mate's, was also inaccurate, and did not reflect the vessel's programme.

The master forwarded records of rest hours for the crew to the company's DPA at the end of the month. However, the DPA only reviewed the 'total hours of rest' column, which did not reveal that the records were inaccurate.

The rest hour records for October, obtained during the investigation and produced retrospectively by the individuals, showed a more realistic and accurate account, which supported other documentary evidence. Using logbook entries for September, it was possible to estimate the working hours for that month which, together with the more accurate October hours, provided usable data to calculate the possible effects of fatigue.

1.6.2 Working hours

The master had been employed on the vessel for just under 3 months. Before this, he had spent 85 days on leave. He reported that throughout the period spent onboard *Lerrix*, the 6-on/6-off watchkeeping structure had suited him, although on the occasions when entering or leaving port had coincided with his

off-watch time, fatigue was an issue; particularly on departures. The master was content, however, that a period of 1 or 2 days in port, working a day routine, was sufficient for his body to fully recover from the sleep loss experienced at sea. The investigation discovered that the death of a close colleague 2 weeks previously had been causing the master some distress, and was an issue he was still coming to terms with. This, together with some of the navigational responsibilities of command, contributed to the fatigue that the master was suffering from. He had, on a number of occasions, confided to the mate during the watch changeover that he was tired, and was himself aware that the death of his colleague was causing a degree of stress-related fatigue.

The company's ISM procedure (**Annex E**) Section 11 - Preparation for Sea (Deck), addressed issues concerning the composition of a watch, and issues of fatigue, referring to the regulations laid down in STCW 78/95 which determine the minimum rest periods required. A schedule of working arrangements, which was signed by the previous master, had been drawn up for the vessel by the company's managers. Theoretically, the agreement allowed the master and mate 12 hours rest per day at sea, and 13 hours rest per day in port. The AB/cook's rest hours differed slightly, in that he was allowed 11 hours rest per day at sea. The agreement recognised that working hours may have to vary in port for shifting berth and late working of cargo, and at sea for arrival and sailing times, and prevailing weather conditions.

To assist the master assess the crew's hours of work and rest before sailing, in accordance with STCW 78/95 regulations, the company produced a rest hours flow chart (**Annex E**). Under the company's ISM system, masters were instructed to use the flow chart prior to sailing, to determine whether vulnerable personnel might be suffering from inadequate rest. The company was clear in its mind that if, because of the crew's inadequate rest, a vessel became unseaworthy and the master requested additional time in port, this would be conceded. Historically, there had been cases when other vessels in the fleet had delayed sailing in order to recoup rest deficiencies.

1.7 LOOKOUT RESPONSIBILITIES

1.7.1 Definitions

Defined in STCW 78/95, and in SOLAS V Part 3:

14. *The look-out must be able to give full attention to the keeping of a proper lookout and no other duties shall be undertaken or assigned which could interfere with that task.*
15. *The duties of the lookout and helmsperson are separate and the helmsperson shall not be considered to be the lookout while steering, except in small ships where an unobstructed all round view is provided at the steering position, and there is no impairment of night vision or other*

impediment to the keeping of a proper lookout. The officer in charge of the navigational watch may be the sole look out in daylight provided that on each such occasion:

.1 the situation has been carefully assessed and it has been established without doubt that it is safe to do so.

.2 full account has been taken of all relevant factors including, but not limited to:

- state of the weather*
- visibility*
- traffic density*
- proximity of dangers to navigation, and*
- the attention necessary when navigating in or near traffic separation schemes; and*

.3 assistance is immediately available to be summoned to the bridge when any change in the situation so requires.

Defined in the master's standing orders:

A good lookout is to be maintained at all times. If in any doubt whatsoever, the master is to be called immediately.

A good and sensible watch is to be maintained at all times.

Defined within the company's ISM system, section 13, Standing Orders to Watch Officers, paragraph 8:

During daylight there are some circumstances in which the officer of the watch can safely be the sole lookout. However this shall only be undertaken when an assessment of the situation and relevant factors such as:

- the state of weather*
- traffic density*
- proximity of navigational hazards*
- navigation in or near a TSS*

And, finally, MGN1767(M) section 3, paragraph 21.2 specifically clarified lookout requirements at night:

'...the UK does not consider it safe for the officer of the navigational watch to act as sole lookout during periods of darkness or restricted visibility'

1.7.2 *Lerrix's* lookout policy

The lookout policy during daylight hours was based upon the OOW acting as the sole lookout subject to the provisions of section 13 of the company's ISM procedures. This allowed all three ABs to continue working a normal routine throughout the day, but be available for lookout duties if required by the OOW.

During the hours of darkness, lookouts reported for duty at the start of their watch. An assessment was made by the OOW using the provisions of the ISM manual section 11 applicable during daylight hours, and a decision made as to whether a lookout was required on the bridge. The master, mate and AB/cook all reported it was common practice for the OOW to send the lookout below and assign him cleaning duties within the accommodation.

1.8 CONDUCT OF NAVIGATION

1.8.1 Passage planning

Following the grounding of *Lerrix* in May 2005, the MAIB conducted a preliminary examination that resulted in recommendations being made to the company. One such recommendation was the requirement for more detailed passage planning, ending the practice of buoy to buoy navigation, and ensuring that the course drawn on the chart was the intended track for the vessel. The company responded by issuing specific instructions to all masters on the requirements for passage planning, and the ISM manual was subsequently amended.

Scrutiny of the chart in use at the time of this accident confirmed that some of the recommendations had been heeded. IRPCS Rule 10 requires that a vessel normally joins and leaves a TSS at its terminations. However, it was noticeable that the Transas passage plan intended the vessel to leave the TSS and cut across the inshore zone² rather than follow the scheme to its termination. Leaving the traffic lane early was the master's preference, believing that the TSS was not an adopted scheme and that, by doing so, the passage distance would be shortened, and would enable him to keep clear of larger vessels following the deep water route.

The position of the ship was fixed only infrequently since sailing from the Keil Canal until the grounding. During this 8½ hour period, only 5 positions were marked on the chart and recorded in the logbook. Each recorded position coincided with an alteration of course on the passage plan.

The company's fleet instructions covering the conduct of navigation are shown at **Annex E**.

² Adopted IMO inshore traffic zone 01 July 2006.

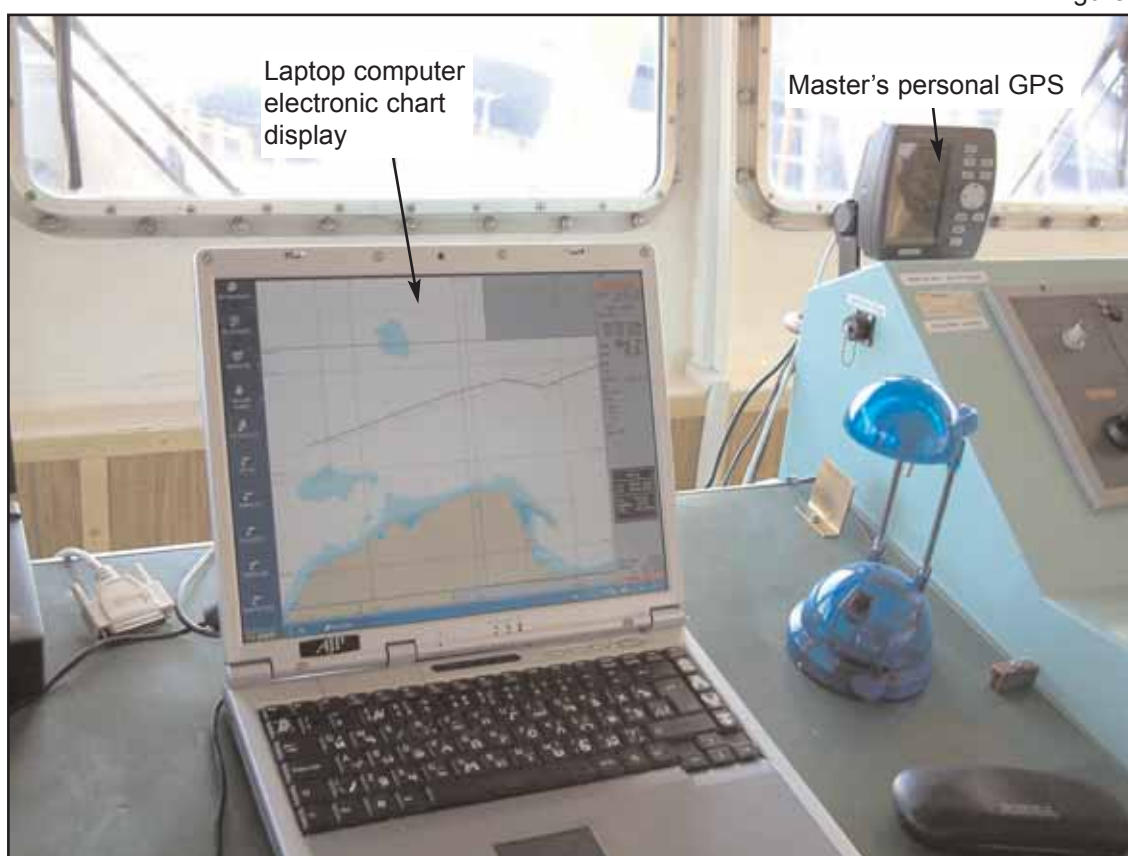
1.8.2 Electronic aids to navigation

Lerrix's bridge equipment met the criteria required for the flag state Safety Equipment Certificate. Although compliant, the navigation equipment fit was basic, consisting of 3cm and 10cm radars, neither with an ARPA facility, an echo sounder with a paper plot, and stand alone AIS and GPS sets.

During the investigation, it was noted that the master carried his own laptop computer from ship to ship, complete with a hand-held GPS. Loaded onto the laptop was a pirated programme of Transas electronic charting, which he had downloaded from the internet in 1999. The hand-held GPS, which the master had secured to the bridge console, provided the positional information for the laptop's electronic chart (**Figure 6**). Examination of the programme showed that it had not been updated since 1999, and the charts on the system were based upon 1999 data. The downloaded software did not provide any of the optional operator functions, such as warnings and alarms.

Both master and mate of *Lerrix* used the laptop to monitor the vessel's progress during passage, plotting fixes on the ship's BA paper chart as they deemed necessary.

Figure 6



Master's personal electronic navigation equipment

1.9 WATCH ALARM

1.9.1 Requirement

A watch alarm is an alarm system that is designed to alert the watchkeeper at pre-determined intervals. Initial alerting is usually by flashing light, followed, after a period of time, by an audible alarm on the bridge, which is followed after a further delay by the sounding of an alarm in the officers' cabins, or the general alarm. Once activated, the watch alarm is usually silenced by the watchkeeper pressing a button. Failure to cancel the alarm will result in the off watch officers, or even the entire crew, being alerted to a potential problem on the bridge.

There is no international requirement for the compulsory fitting of watch alarms to vessels. However, a requirement of the vessel's previous flag state – Bahamas – was the compulsory fitting of a navigational bridge watch alarm to support and underpin the safe manning certificate which required only two ABs to be carried. When the vessel transferred to the United Kingdom registry, the company automatically employed an additional seaman, pre-empting the new safe manning certificate which increased the complement of ABs to three. The United Kingdom register did not require a watch alarm to be fitted to the bridge and, as a consequence, it was ignored by the watchkeeping officers and became redundant.

1.9.2 Current fit

Although a watch alarm was fitted onboard *Lerrix*, the unmarked operating switches close to the autopilot gave no indication to the two watchkeeping officers, both sailing on this vessel for the first time and both joining in dry dock, that a watch alarm was fitted, and they did not look for one.

Examination of the alarm showed that both wires connected to the bridge alarm buzzer were disconnected (**Figures 7 & 8**). Because the crew was unaware the equipment was fitted, the defect had not been reported in accordance with the company's ISM procedures.

1.10 SAFETY MANAGEMENT

1.10.1 International Safety Management Code

The company received its document of compliance on 12 March 2001, and the vessel's current ISM certificate was issued by the MCA on 21 March 2002.

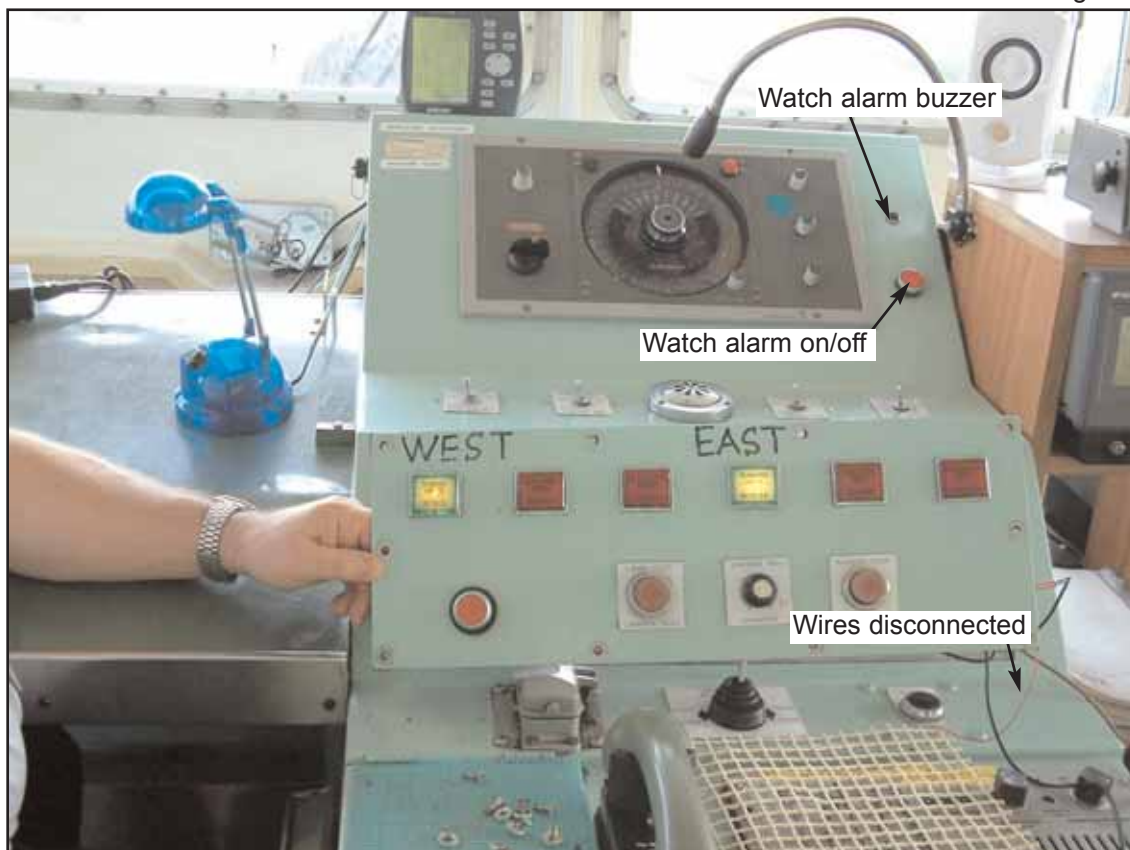
Auditor training had figured highly on the Marine Manager's list of ISM priorities. A total of eight personnel from the company's marine section had completed the auditor training course, including the Marine Manager and the DPA. To fulfil the requirements for shore-based auditing, a ship's master, who had also undergone appropriate auditor training, was incorporated into the ISM organisation.

Figure 7



Watch alarm. Buzzer found disconnected.

Figure 8



Steering console complete with watch alarm

1.10.2 Audit programme

The last ISM audit of *Lerrix*, undertaken by the company on 15 March 2005, had made two minor observations. The last internal audit of the company was conducted by the ship's master on 11 March 2005; he made 9 observations, some of which required amendments to the ISM manual. The company promulgates an annual audit programme nominating an individual auditor to each vessel, the dates of audit being left to the discretion of the nominated auditor.

1.11 ENVIRONMENTAL CONDITIONS

Tidal range in the Baltic, and particularly in the vicinity of this grounding, can be considered negligible.

Weather conditions at the time of the grounding were good:

- Wind: south easterly, Beaufort force four.
- Sea state: three.
- Mean barometric pressure: steady at 1024 millibars.
- Visibility: five nautical miles.
- Sunset: occurred at 1734.

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 CAUSE OF THE ACCIDENT

Lerrix grounded because the master, alone on the bridge, had fallen asleep. As a consequence, he missed a planned alteration of course and the vessel was allowed to continue until it grounded close to the German coastline.

The master's decision to allow the lookout to stand down was seriously flawed. Described by the master as a human error, this type of irrational decision making and poor judgment can be directly attributed to that of a person suffering from the effects, or the onset, of fatigue.

2.3 MANNING LEVELS

The short sea trade is highly competitive, the margins can be small and quality cargoes difficult to secure. It is acknowledged that the cost of crewing a vessel remains one of the largest operating overheads for the owner. Consequently, the number of crew specified on the Safe Manning Document becomes critical to the cost effectiveness of the vessel. On some vessels, margins are trimmed by utilising the master as a watchkeeping officer, working a two-watch system with the mate.

MAIB statistics show that general cargo vessels of less than 3000grt, with only two watchkeeping officers, face a greater risk of being involved in a grounding incident. With recognised safety barriers removed, such as lookouts and watch alarms, the risk of a fatigued 6-on/6-off lone watchkeeping officer falling asleep is greatly increased. It is a company responsibility to assess the risks involved in operating their vessels; including the manpower, which is required of any vessel before a Safe Manning Document can be issued. It is critical to the safe operation of any vessel that the initial assessment remains live. Manpower requirements should be frequently re-assessed to ensure they remain valid for the trading pattern, change of routes, or any other significant change to the operation.

2.4 PRE CONDITION - FATIGUE

2.4.1 Watch system

A 6-on/6-off work pattern operated by two officers of the watch can be demanding. It is common practice for the master to take the 0600 to 1200 and the 1800 to 2400 watches which, because they allow sleep during the hours of darkness, are less demanding than the mate's schedule. However, this routine may still be fatiguing, particularly when rest periods are disturbed.

At sea the 6-on/6-off system allows little flexibility when consideration is given to meal times, training drills, the plethora of ship's administrative work, and management responsibilities. It allows little or no time for a watchkeeper to follow personal pursuits³ and creates a monotonous and tiring regime, not compatible with good watchkeeping practice.

2.4.2 Command responsibilities

A vessel's arrival in and departure from port outside of an individual's standard watch time creates further disturbances. However, a potentially greater fatigue contributor than any of the preceding issues is the necessity for the master to be required on the bridge, outside of his own watch, to assist the OOW when faced with circumstances the same as those outlined in STCW Section A – VIII/2 paragraph 40, which can be found at (**Annex F**). The master will then be expected to undertake his own watch at the prescribed time, creating a conflict between maintaining a safe navigational watch on the mate's watch, and his own. These conflicts can be seen in the *Lerrix* incident when considering the master's nervousness with the traffic and navigational situation on the approach to the River Elbe, and the transit through the Kiel Canal which required his presence on the bridge. His rest pattern was also disturbed by the personal distress he was suffering.

Employing the services of a local pilot for the River Elbe transit might have helped to ease some of the master's concerns, but this option was never considered. In this case, it is clear that the disturbances to the master's rest pattern increased his level of fatigue and ultimately contributed to him falling asleep on watch.

The trading pattern of *Lerrix* provided an opportunity for the master to examine the voyage plan before departure and, if practicable, amend and adapt watchkeeping routines to cope more effectively with anticipated choke points, and help mitigate the onset of fatigue. This option was not considered by the master.

2.4.3 Hours of rest records

The requirement for maintaining and monitoring hours of rest records is clearly articulated⁴ and should be incorporated within the safety management system. Section one of this report highlighted the shortfalls of the master's reporting of rest hours for the month of September, and of the company's attention to detail during the inspection process.

The research project *Fatigue Offshore* currently being undertaken by the Seafarers International Research Centre and supported by the MCA, has found clear evidence to suggest that inaccuracies in rest hours reporting is common

³ IMO Guideline on fatigue.

⁴ Merchant Shipping (Hours of Work) Regulations 2002, and MSN 1767(M), MGN 211(M).

throughout the industry. Accurate reporting by the crew and the master of their respective hours of rest is essential if companies are to obtain a meaningful interpretation of the rest hours achieved, analyse the results, and implement measures to rectify deficiencies. Similarly, as in the case of Rix Shipping Limited, it remains paramount that rest hour records be properly scrutinised to identify any regulatory shortfalls. Any records considered to be inaccurate should be challenged and rectified using the company's own internal procedures.

2.4.4 Fatigue modelling

MAIB is working closely with the QinetiQ Centre for Human Sciences in developing a predictive model for fatigue, taking into account sleep and work patterns. The estimates generated may be regarded as reasonably conservative.

Lerrix's official rest hours for September were clearly inaccurate. Using data derived from the voyage programme and logbook extracts, an estimate of the minimum hours worked was derived for the 40 days preceding the accident. On the basis of this data, the fatigue model suggests that the master's work pattern during the 40 days preceding the grounding did not generally cause significantly elevated levels of fatigue, as long as a normal work pattern was maintained.

In the 24 hours preceding the grounding, his sleep pattern was significantly disturbed by concerns about navigation on the River Elbe and personal difficulties. It is probable that the master was noticeably fatigued throughout the morning and towards the end of his 1800 to 2400 watch.

The effects of fatigue might include slow reactions, slips and lapses in decision-making and, in a quiet and comfortable environment, an increased risk of involuntary napping. The master had to balance the lookout's request to go below, against the risks entailed with sailing without a dedicated lookout. It is, however, difficult for a tired person to assess accurately the likelihood of his falling asleep.

2.5 LOOKOUT

2.5.1 Requirement

The requirement for maintaining a lookout is widely promulgated⁵, officially by regulation, and additionally by industry bodies reporting on related incidents. It has been the experience of MAIB that the requirement for maintaining a lookout by day and night is well understood by bridge watchkeeping officers, but its onboard implementation often falls well short of the minimum standards expected.

⁵ SOLAS, STCW 95, Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations 1996.

Although sailing with the minimum permitted manning levels, *Lerrix* had the manpower to employ a lookout by day and night. However, the OOWs, having assessed the risks in accordance with STCW and company ISM guidance, both took the option to dispense with their lookouts during daylight hours. This is not uncommon practise for this type of vessel, on this trade, operating to minimum manning scales. It results in improved deck maintenance and husbandry, and gives the perception that the crew are 'better employed'. However, on *Lerrix* this was taken one stage further, with the master and mate conducting the same risk assessment during hours of darkness. Whether this enabled the designated lookout to gain rest and be available for more day work, or whether internal work was progressed at night, remains unclear, but ultimately the requirement for a lookout was ignored contrary to international, national, and company ISM guidance.

Allowing the lookout to leave the bridge removed the single most important barrier to prevent the accident occurring.

2.5.2 Lookout duties

A lookout's perception of his duties is frequently described to investigators as 'looking out to report the presence of other vessels and shore marks or lights'. The description is valid, but it fails to acknowledge that a lookout is an integral member of a bridge team; that he has been familiarised with the operation of bridge equipment, and thoroughly explained his role within the organisation. A well trained lookout can provide flexibility in the event of a crisis, allowing the OOW to divert his attention in the safe knowledge that the lookout is capable of providing the necessary support.

Onboard *Lerrix*, the 2000 to 2400 lookout saw his main duty as the ship's cook. Lookout was an additional duty which conflicted with his prime purpose. There did not appear to be any cultural barriers between the master and the AB/cook, and there is no reason to believe that their relationship was not a good one. However, the AB/cook had never received a full briefing on his lookout duties, nor had he ever been incorporated as part of a team. In this case, had he been fully aware of a lookout's role and purpose, he might have been more motivated, and understood the need to remain on the bridge. The master would then have been accompanied, and might not have fallen asleep. Had he still done so, the lookout would have been in a position to immediately wake him and/or call the mate to take over the watch. Ultimately, had the lookout remained on the bridge, the grounding could easily have been avoided.

2.6 WATCH ALARM

Although there was no legal requirement for a watch alarm to be fitted, had the master been aware of its existence, and reported the defect using the appropriate procedure within the ISM system, the alarm could have been repaired and available for use.

Had there been a compelling need to release the lookout for another task, a serviceable watch alarm would have provided a barrier against the master falling asleep. Its availability would have enabled the master to activate the system once the lookout had been stood down, thereby replacing the primary safety barrier with an, albeit slightly less effective, secondary barrier.

Undoubtedly, had the watch alarm been available and used, then the subsequent grounding would have been avoided.

2.7 ELECTRONIC NAVIGATION

Rix Shipping Limited has clear procedures for the conduct of navigation using paper charts. They were, however, unaware that the master was using his own electronic equipment to navigate their vessel. Consequently, the company had no policy permitting or prohibiting the use of such equipment, the equipment was not subject to any form of audit or scrutiny, and there were no instructions as to its operation. Such instructions could have included the use of waypoint alerts, cross track alarms, and depth alarms, as well as the requirement to periodically verify the system's accuracy by fixing using alternative means (radar, visual, Loran, etc). In the, understandable, absence of company guidance, the master used the equipment as he saw fit.

In this case, the master was positioned in a comfortable seat, with the computer screen placed where it best suited him. The programme had never been updated, and did not possess alarms, alerts or guards, and did not incorporate radar or AIS data. In the absence of other barriers, the lack of alarms, alerts or other interaction allowed the master to sink to a low state of alertness. By allowing himself to monitor a virtually passive display, with no other distractions, the master's comfortable, warm, dark environment provided the ideal conditions for sleep. In his fatigued state, the master succumbed, falling asleep shortly after the lookout had left the bridge.

An additional hazard of personal navigation systems is that often they are not updated with the latest navigational information. The system onboard *Lerrix* had not been updated since it was downloaded in 1999. In the vicinity of this grounding, only minor chart corrections had occurred in the intervening period. However, the risks of navigating using information over 6 years old are obvious, and it is for this reason that companies produce comprehensive instructions on the updating of navigation data.

Properly constituted electronic equipment, used effectively, can enhance navigational accuracy. However, colour displays are seductive, and poorly used equipment can easily lead to a false sense of security and a state of lowered alertness.

2.8 MAIB BRIDGE WATCHKEEPING STUDY⁶

The Chief Inspector of Marine Accidents commissioned the Bridge Watchkeeping study in 2003 after a series of remarkably similar accidents. Initially a review of the data identified three principal areas of concern:

- *A third of all groundings involved a fatigued officer alone on the bridge at night.*
- *Two thirds of vessels involved in collisions were not keeping a proper lookout.*
- *A third of all accidents that occurred at night involved a sole watchkeeper on the bridge.*

An analysis of the data for 23 vessels involved in grounding incidents shows a striking resemblance to that of *Lerrix*:

- Nearly 50% (11 cases) occurred between 0000 and 0600 of which fatigue was considered a contributory factor in nine of the cases.
- In eight of those nine fatigue related accidents, the vessels:
 - Carried only two watchkeeping officers.
 - Had not posted a lookout.
 - Were steering by autopilot.
 - Were not fitted with, or were not using a watch alarm.
 - Had an unaccompanied watchkeeper who had fallen asleep.

The study was well received by the marine industry, and it provided managers with the data necessary to approach company directors with logical and informed justification for the recruitment of additional watchkeeping officers. It is regrettable that, 3 years on, the grounding of *Lerrix* has the same causal factors as those identified in the study.

2.9 MANAGING FATIGUE

The management of fatigue at sea presents a serious challenge, particularly on vessels operating at minimum manning levels. This case illustrates the fine tolerances inherent in a two watchkeeper vessel operating a 6-on/6-off watch system. The master took his responsibilities very seriously, but he undoubtedly believed in his own ability to cope, and felt that it was his duty to do so.

On the day of the incident, other than delaying the voyage, the only practical mitigation of the master's fatigue was to keep the lookout on the bridge. In the long term, changes in manning levels could increase safety margins. In the short term, more diligent adherence to the requirement to keep a lookout closed up at night, backed up by a functional watch alarm, would provide some defence against fatigue.

⁶ Published by the MAIB July 2004

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES

The following are the safety issues identified in the MAIB investigation. They are not listed in any order of priority but are in the order in which they appear in the analysis:

1. *Lerrix* grounded because the master, who was alone on the bridge, had fallen asleep. [2.2]
2. The master's decision to allow the lookout to stand down was flawed. It was an irrational decision attributable to the effects of fatigue. [2.2]
3. With recognised safety barriers such as lookouts and watch alarms removed, the risk of a fatigued 6-on/6-off lone watchkeeping officer falling asleep is greatly increased. [2.3]
4. The 6-on/6-off routine provides little flexibility for the watchkeeping officer to conduct work outside of his watch. In this case, the personal distress suffered by the master, and his nervousness with the navigational situation, contributed to the onset of fatigue. [2.4.1]
5. Accurate hours of rest records are essential in order that companies can interpret and assess the data, and take appropriate steps to deal with deficiencies. [2.4.3]
6. Hours of rest records must be thoroughly scrutinised by management to examine and rectify any regulatory shortfalls. [2.4.3]
7. The importance of maintaining a lookout is well understood by watchkeeping officers, but its implementation often falls short of the minimum expected standards. [2.5.1]
8. Allowing the lookout to leave the bridge removed the single most important barrier to prevent the accident occurring. [2.5.1]
9. For lookouts to become integral members of the bridge team, it is essential that they receive proper familiarisation with the bridge and its equipment, and fully understand the function of a lookout. [2.5.2]
10. The availability of a fully functional watch alarm, if used, could have provided the safety barrier necessary to avoid the accident. [2.6]
11. The company was unaware that the master was using his personal electronic navigation equipment, and had no policy permitting or prohibiting such use. [2.7]
12. The manner in which the master used his electronic navigation equipment left him under stimulated and susceptible to fatigue. [2.7]

SECTION 4 - ACTIONS TAKEN

4.1 HOURS OF REST FORMS

Rix Shipping Limited has undertaken to more diligently monitor the content of completed hours of rest forms, analysing both the daily hours of rest and the monthly totals, ensuring that a true, accurate, and credible record of crew rest hours is being submitted.

4.2 LOOKOUT

To further remind watchkeepers of the need to keep a lookout closed up on the bridge when underway, Rix Shipping Limited intends fitting permanent signs on the bridges of all vessels stating:

‘This vessel operates on a two men on watch system.’

The signs will be produced in English, Russian, Latvian, Lithuanian, Estonian, Polish and Portuguese.

4.3 WATCH ALARM

Three days after the *Lerrix* incident, Rix Shipping Limited issued an ISM fleet instruction to all vessels instructing that watch alarms, if fitted, must be used. Masters were instructed to report any faults with watch alarms through its defect reporting procedures as soon as possible.

4.4 MAINTAINING A SAFE LOOKOUT

The MCA has recently issued Merchant Guidance Notice 315 promulgating the standards required for keeping a safe navigational watch, reflecting the requirements contained in STCW 1978 as amended. The need for maintaining a safe lookout is a key point contained within the document.

SECTION 5 - RECOMMENDATIONS

The Chamber of Shipping is recommended to:

- 2006/158 Impress upon ship owners, operators and managers the importance of the following fatigue, ILO 180 and STCW related issues:
- Encouraging masters to report if they are aware that their crews have not received adequate rest.
 - Ensuring that masters understand the importance of fully complying with the STCW requirements for keeping a safe lookout, guided by the latest advice contained in MGN 315.
 - The importance of formulating policy to guard against the inappropriate use of personal electronic navigation equipment carried by crew members.
 - The importance of establishing procedures designed to ensure shore-based managers fully scrutinise hours of rest worksheets and question any apparent discrepancies.
 - Ensure that companies have a system in place to identify personal issues which may adversely affect a crew member's performance, and safeguard against poor work performance.

Rix Shipping Limited is recommended to:

- 2006/159 Establish a policy to guard against the inappropriate use of personal electronic navigation equipment carried by crew members.

Marine Accident Investigation Branch
April 2006