Report on the investigation of

the collision between ***Arctic Ocean*** and ***Maritime Lady***,

capsize of ***Maritime Lady*** and contact with wreck of

Maritime Lady by ***Sunny Blossom***, and its subsequent grounding

in the Elbe River

5 December 2005

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The following is a joint investigation report with the Marine Accident Investigation Branch (MAIB) the German Federal Bureau of Maritime Casualty Investigation (BSU), The Gibraltar Maritime Administration and the Bahamas Maritime Authority. MAIB and BSU have taken joint lead of the investigation pursuant to the IMO Code for the Investigation of Marine Casualties and Incidents (Resolution A.849(20)).

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."

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.

Extract from the

German Accident Investigation Regulations

The investigation was conducted in conformity with the law to improve safety of shipping by investigating marine casualties and other incidents (Maritime Safety Investigation Law - SUG) of 16 June 2002.

According to this the sole objective of the investigation is to prevent future accidents and malfunctions. The investigation does not serve to ascertain fault, liability or claims.

The English text shall prevail in the interpretation of the Investigation Report.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ARPA	-	Automatic Radar Plotting Aid
AB:	-	Able Seaman
AIS:	-	Automatic Identification System
BMA	-	Bahamas Maritime Authority
°C:	-	Degrees Celsius
CEC:	-	Certificate of Equivalent Competency
COLREGS:	-	International Regulations for Preventing Collisions at Sea
CPA:	-	Closest Point of Approach
DNV:	-	Det Norske Veritas
GMRS:	-	The German Maritime Rescue Service
gt:	-	Gross tonnage
IMDG Code:	-	International Maritime Dangerous Goods Code
IMO:	-	International Maritime Organization
km:	-	kilometre
kn:	-	knots
kNm:	-	kilonewton metre
LBP:	-	Length Between Perpendiculars
LOA:	-	Length Overall
LT:	-	Local Time
m:	-	metre
mm:	-	millimetre
MCA:	-	Maritime and Coastguard Agency
MMSI:	-	Maritime Mobile Service Identity
MRCC:	-	Maritime Rescue Co-ordination Centre
MSC	-	Maritime Safety Committee

NOK:	-	Nord Ostee Kanal (The Kiel Canal)
NvD	-	Nautical Officer on duty in the VTS Centre or nautical supervisor
PEC:	-	Pilotage Exemption Certificate
rpm:	-	revolutions per minute
SAR:	-	Search and Rescue
SeeSchStrO:	-	Seeschifffahrtsstraβen-Ordnung
SMA:	-	Swedish Marine Administration
SMD:	-	Safe Manning Document
STCW:	-	Standard of Training, Certification and Watchkeeping Convention for Seafarers 1995
t:	-	tonne
TEU:	-	Twenty foot equivalent units
TSB:	-	Transportation Safety Board (Canada)
UTC:	-	Universal Co-ordinated Time
VHF:	-	Very High Frequency (radio)
VTS:	-	Vessel Traffic Services
WSA:	-	Waterways and Shipping Office
WSD:	-	Waterways and Shipping Directorate
WSV:	-	Waterways and Shipping Administration, a collective term for the senior WSDs and their subordinate organisations (eg VTSs)

SYNOPSIS

At 1955 on 5 December 2005, the UK registered 6326gt container feeder vessel, *Arctic Ocean*, was leaving Brunsbüttel Lock basin to turn east across the westbound fairway of the Elbe River to head for Hamburg. At the same time, the Gibraltar registered 1857gt general cargo vessel *Maritime Lady* was in the westbound fairway approaching the exit from the lock basin and heading for the North Sea.

The two vessels collided at 1957, with the result that *Maritime Lady* capsized. All her crew were evacuated safely. *Arctic Ocean* suffered minimal damage.

Neither vessel was required to carry a pilot. The master of *Arctic Ocean* held a Pilotage Exemption certificate and *Maritime Lady* was below the size where regulation required a pilot to be carried. Both masters were attempting to carry out the duties of pilot and watchkeeping officer. This caused them both to be overloaded at a critical stage of their vessel's passage, leading to misjudgements.

The capsized wreck of *Maritime Lady* drifted in a strong ebb stream until it came to rest about 30 minutes after the collision in a position in the westbound fairway, 0.75miles south-west of the exit basin of Brunsbüttel Locks.

After the collision, Brunsbüttel Locks were closed until 2100. The first vessel to then leave the locks was the Bahamian registered 11598gt chemical tanker, *Sunny Blossom.* She had a pilot on board and was to head west, to the North Sea, after leaving the lock's exit basin.

After leaving the lock basin, *Sunny Blossom* was attempting to make the turn to the west, when her stern struck the wreck of *Maritime lady,* causing serious propeller damage and a total loss of propulsion. She then continued south across the Elbe River, until she grounded on the south bank. There was only slight damage to her hull, and no pollution was caused.

*Sunny Blossom'*s ability to make the westerly turn and clear the wreck of *Maritime Lady* was overestimated. Contributing to this error of judgment was a strong westerly ebb tide, some cropping of *Sunny Blossom'*s propeller, her effective rudder area being at the lower end of acceptable limits and the effects of shallow water in the lock exit basin. There was a parallel failure to recognise and assess the risk posed by the wreck of *Maritime Lady* in the fairway before Brunsbüttel locks were reopened to traffic.

Recommendations have been made to the owners of *Arctic Ocean* and *Maritime Lady* to review advice to their masters and offer training in the management of bridge personnel and resources.

The UK Hydrographic Office has been recommended to review its Sailing Directions for the Elbe River to remove any possible confusion over a vessel's right of way.

The Federal Ministry of Transport, Building and Urban Affairs has been recommended to review: requirements for bridge manning levels on vessels in its pilotage waters; emergency procedures; procedures covering the briefing of vessels leaving Brunsbüttel Locks to enter the Elbe; prioritisation of VTS operators' tasks; its advice to mariners of the strength and other characteristics of the tidal stream in the Elbe River south of Brunsbüttel Locks.

SECTION 1 - FACTUAL INFORMATION

Notes on the investigation

This investigation has been undertaken under The International Maritime Organization's (IMO) 'Code for the Investigation of Marine Accidents and Incidents'. It has involved the maritime administration of four nations: UK, Germany, Gibraltar and Bahamas. The exchange of information between the investigators representing these parties has been totally free and offered in the spirit of mutual co-operation. All parties had the same objective of identifying the lessons in order to enhance safety at sea and the safety of mariners.

It is unfortunate that this openness between investigators has not been reflected in the willingness of two stakeholders to co-operate with the investigation. The master of *Maritime Lady* and the nautical supervisor (NvD) of VTS Brunsbüttel were important witnesses to events and were unwilling to share their recollections with the investigators. In deciding on this policy, it is accepted that they were following advice from their lawyers.

There are potential consequences when important witnesses decide not to share what they have seen and heard. The results are lost lessons and material that might otherwise bring about significant changes to safety regulations, ship design, ship manning etc. Ultimately, it is the seafaring community that loses the potential improvements in safety. The commercial arms of the shipping industry are also likely to be affected by the policy; failure to reduce accident rates affects insurance costs, loses shipowners' revenue and damages their reputations.

Under UK law, the obligation for the master of *Maritime Lady* to be interviewed by MAIB Inspectors remains. He and his legal advisers must be aware that a visit to the UK, or service on a UK ship, may offer Inspectors that opportunity. If he then provides important new evidence, it is possible for the investigation to be reopened.

To a degree, this report may appear to indicate that *Arctic Ocean* could, or should, have done more to avoid the collision with *Maritime Lady.* This would be an unfair interpretation and may be seen as the result of the investigation having inadequate reliable information about the actions and intentions of the master of *Maritime Lady.*

Under German law, a witness is entitled to refuse to answer questions, the answers to which might incriminate him. Even though it is not the aim of marine accident investigations to determine faulty behaviour, liability, or claims, and individual statements are protected from transmission to other entities, as these interviews would have been conducted under German jurisdiction, the right to remain silent has been respected by accident investigation bodies.

The missing subjective perspective of the NvD has resulted, however, in questions remaining open regarding the processes within the VTS and decisions taken there.

1.1 VESSELS INVOLVED

1.1.1 Particulars of *Arctic Ocean*

Vessel details

Registered owner	:	Kai Freese, Barnkruger Hafenstrasse 9, Drochtersen 21706, Germany
Manager(s)	:	Owners, as above
Port of registry	:	London
Flag	:	UK
Type	:	Container
Built	:	1995. Hamburg, Germany
Classification society	:	Germanischer Lloyd
Construction	:	Steel, ice strengthened
Length overall/draught	:	133m/7.1m
Gross tonnage	:	6326
Engine power and/or type	:	7000kW, MaK diesel
Service speed	:	18.5kn
Other relevant info	:	Bow thrusters, CP propeller, bulbous bow

Accident details

Time and date	:	1957LT. 5 December 2005
Location of incident	:	In the westbound fairway of the Elbe River, south of the Brunsbüttel Locks **(Figure 1)**
Persons on board	:	14
Injuries/fatalities	:	Nil
Damage	:	Minor

1.1.2 Particulars of *Maritime Lady*

Vessel details

Registered owner	:	Maritime Lady AS, C.Sundsgate 37, N-5004 Bergen, Norway
Manager(s)	:	Maritime Management AS, Strandavegen 12, 6863 Leikanger, Norway
Port of registry	:	Gibraltar
Flag	:	Gibraltar
Type	:	Dry cargo
Built	:	1984. Duisburg, Germany
Classification society	:	Germanischer Lloyd
Construction	:	Steel
Length overall/draught	:	80.73m/4.16m
Gross tonnage	:	1857
Engine power and/or type	:	600kW. MaK diesel.
Service speed	:	10.5kn
Other relevant info	:	Bow thruster, single hold, double bottom and wing tanks

Accident details

Time and date	:	1957LT, 5 December 2005
Location of incident	:	In the westbound fairway of the Elbe River, south of the Brunsbüttel Locks **(Figure 1)**
Persons on board	:	Seven
Injuries/fatalities	:	One injured
Damage	:	Capsized. Total loss.

1.1.3 Particulars of *Sunny Blossom*

Vessel details

Registered owner	:	Yellowfin Shipping Co. Ltd., Gibraltar
Manager(s)	:	Laurin Maritime (America) Inc. 2350 North Belt East, Suite 280, Houston, Texas 77032, USA
Port of registry	:	Nassau
Flag	:	Bahamas
Type	:	Chemical/products tanker
Built	:	1986. Usuki, Japan.
Classification society	:	Det Norske Veritas
Construction	:	Steel
Length overall/draught	:	160.81m/9.35m
Gross tonnage	:	11598
Engine power and/or type	:	5148kW, Mitsui-B&W reversing diesel.
Service speed	:	13kn
Other relevant info	:	Double hull propeller diameter = 5m Rudder area = 1.53% of length x draught

Accident details

Time and date	:	Contact with capsized *Maritime Lady* at 2124LT, grounding at 2127LT, 5 December 2005
Location of incident	:	In the westbound fairway of the Elbe River, south of the Brunsbüttel Locks, 200m south of buoy 58a **(Figure 1)**
Persons on board	:	24
Injuries/fatalities	:	None
Damage	:	Propeller, propeller shaft and hull damage.

Figure 1

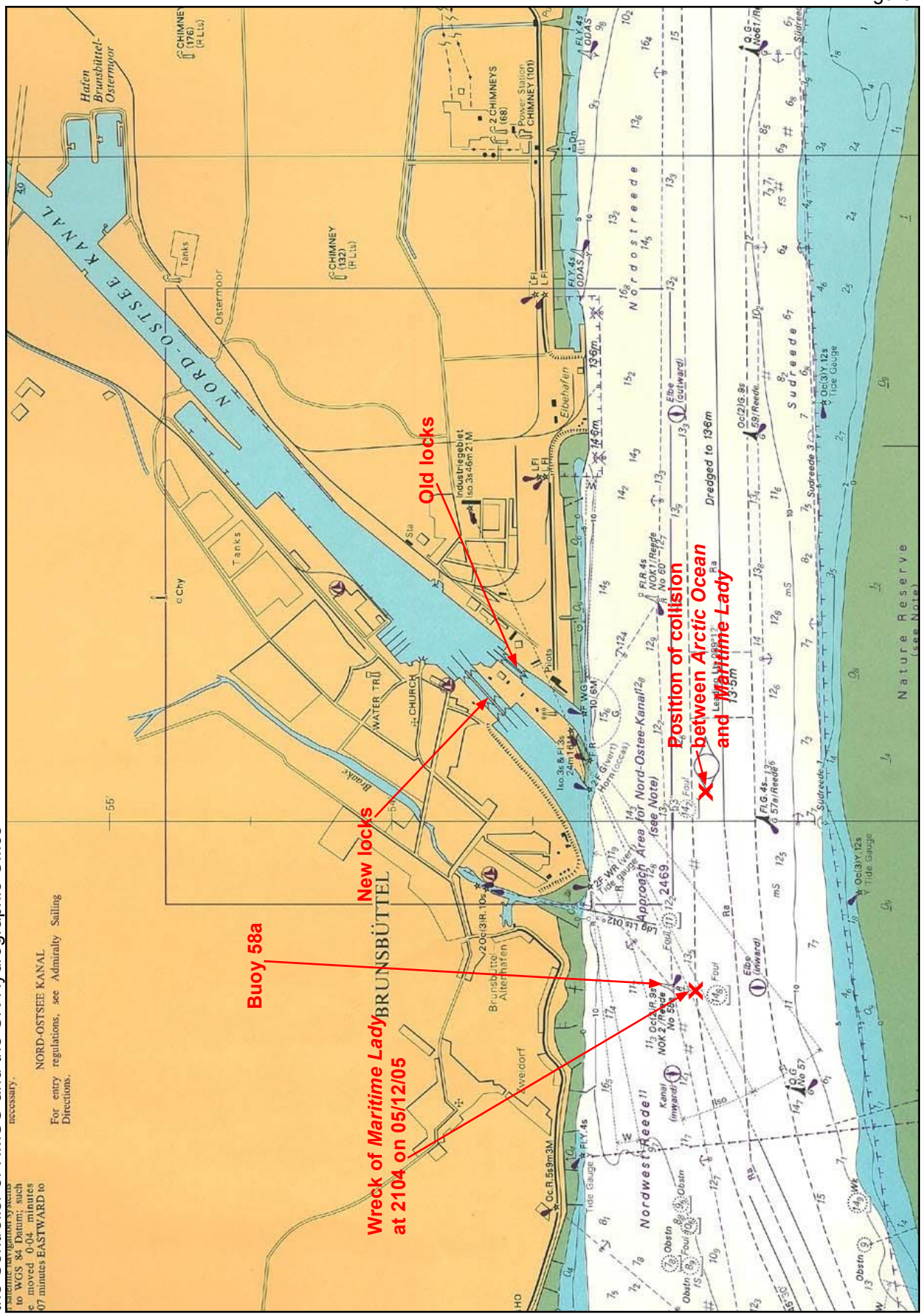


Chart of area

1.2 NARRATIVE

(All times are local time - GMT+1)

1.2.1 Events on *Arctic Ocean*

Arctic Ocean was on a passage from Muuga Harbour, at the Port of Tallinn, Estonia, to Hamburg, Germany. A transit of the Kiel Canal, to reach the Elbe River, was part of her passage.

Between 1120 and 1142 on 5 December 2005, the vessel was in the locks at Holtenau, at the eastern end of the canal. After leaving the locks, and entering the canal, the vessel began her transit with a canal pilot and approved helmsmen on board. During the canal transit the vessel's master, although available, was able to rest, leaving the chief officer or second officer to alternate duty periods on the bridge with the canal pilot and helmsmen.

At about 1442, the vessel reached the pilot station at Rüsterbergen at 55km, and the pilot was changed. The canal passage completed at 1930 when the vessel entered Brunsbüttel Locks, at the western end of the canal, and the canal pilot and helmsmen left the vessel. By this time it was completely dark, the sun having set at 1605.

At 1941, *Arctic Ocean*'s master contacted Brunsbüttel Elbe Traffic giving: his vessel's position in the lock; Hamburg as his destination; his vessel's draught as 7.1m; and, that no Elbe or harbour pilot was required **(Figure 2)**.

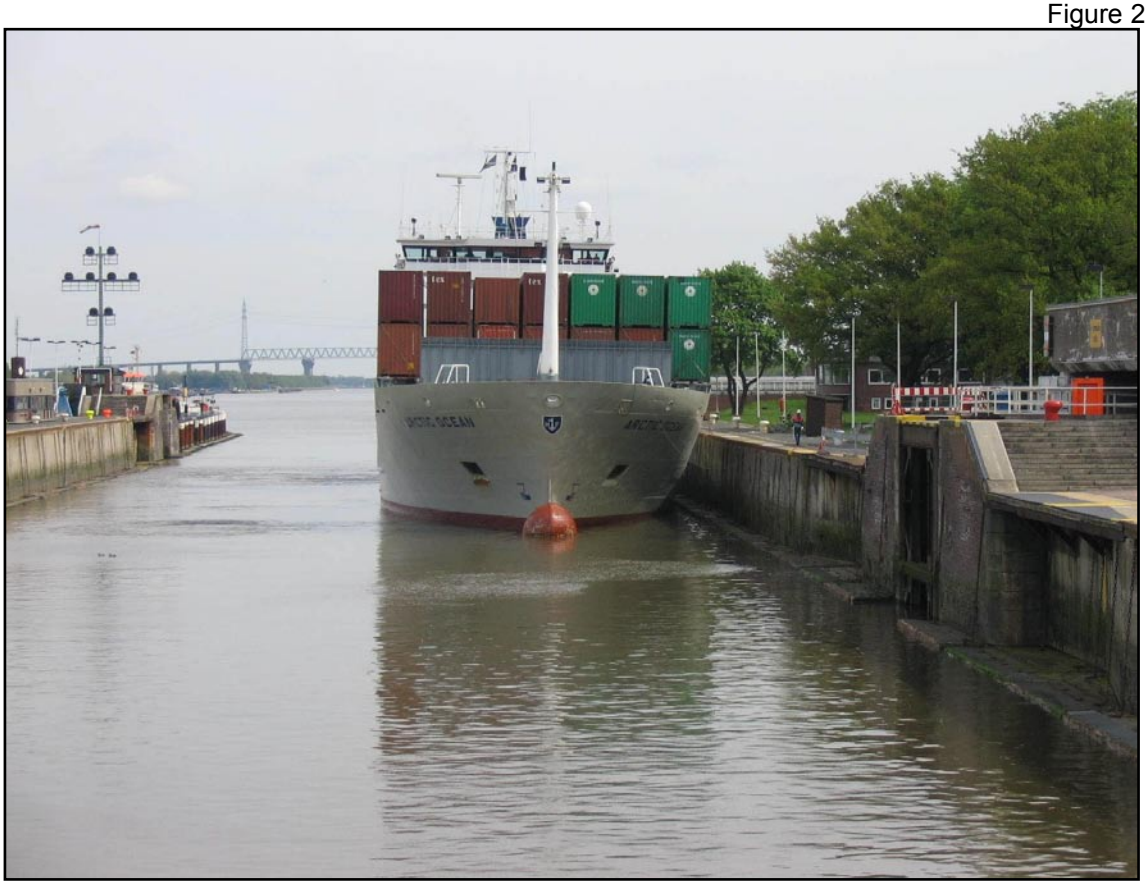
At about 1950, *Arctic Ocean* began to leave the southerly new lock at Brunsbüttel. The master was on the bridge and the chief officer was forward **(Figure 3)**. The master, alone on the bridge, put the engine controls to half ahead and *Arctic Ocean* accelerated out of the lock and along the basin until she had reached a speed of between 8 and 10 knots as she entered the Elbe River.

At that stage, the master was able to see the green navigation light and masthead light of a vessel in line with buoy 60 to the east. He identified her as *Maritime Lady* from the automatic identification system (AIS), and visually judged her range as 1.5 miles **(Figure 4)**.

At about that time, after standing down the forward mooring party, the chief officer was expected to go to the bridge. However, the chief officer's clothing was wet from some fine rain that had fallen while he was deck, and he called the master on his portable VHF to ask whether he could go to his cabin to change. The master agreed, and then applied port helm to begin the turn across the westbound fairway into the eastbound fairway of the river, to head for Hamburg **(Figure 5)**.

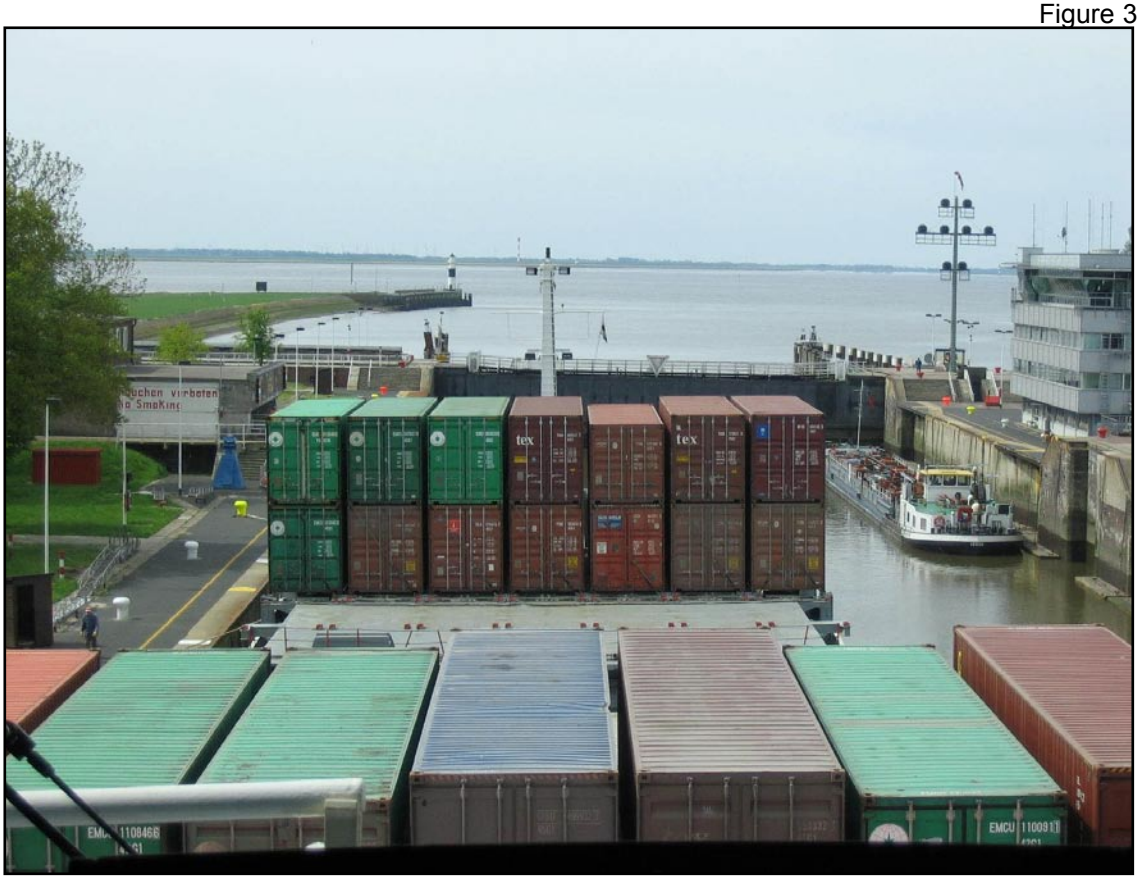
Arctic Ocean continued her turn to port and approached the westbound fairway. During the turn, the master realised he could still see only the green sidelight of *Maritime Lady,* and not both red and green sidelights, as he expected. He called *Maritime Lady* on Ch 68 VHF at 1955:40, just as *Arctic Ocean* was entering the westbound fairway.

Figure 2



Arctic Ocean in Brunsbüttel Locks during daylight

Figure 3



Exit basin from Brunsbüttel Locks - from bridge of *Arctic Ocean* during daylight

Figure 4

View east by day from bridge of *Arctic Ocean* in exit basin from Brunsbüttel Lock

*Maritime Lady'*s master replied, without identifying his vessel, with 'Ya OK, red to red'. *Arctic Ocean*'s master acknowledged with 'red to red', and asked whether 'you (*Maritime Lady)* are going to the canal or proceeding to the sea?' The reply received was 'proceeding to the sea'. During this exchange, the master of *Arctic Ocean* could still see only the green sidelight of *Maritime Lady*.

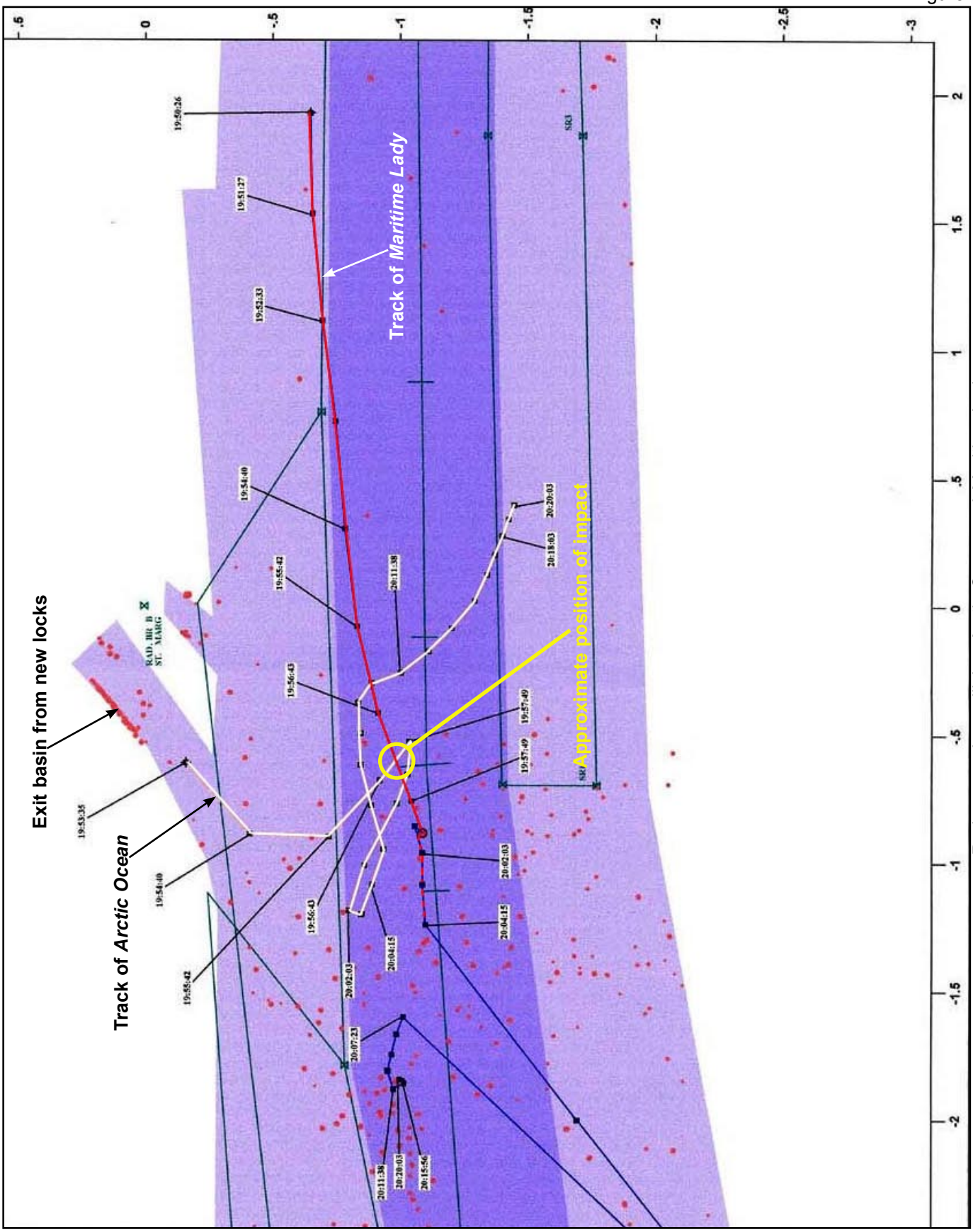
Ten seconds later, *Maritime Lady*'s master*,* in an apparent continuation of the VHF exchange, replied with the message 'sorry green to green, I have a problem with my rudder'. Following this, *Arctic Ocean*'s master put the engine control to stop.

Half a minute later, *Arctic Ocean*'s master heard another VHF message, apparently from *Maritime Lady,* 'I have stopped my engines'.

Arctic Ocean's master called *Maritime Lady*, again without identifying the calling vessel, with '*Maritime Lady, Maritime Lady,* we go to collision now'. At about that stage, *Arctic Ocean*'s master put his engine controls to full astern, the bow thrusters to port and the helm amidships. The reply heard on VHF from *Maritime Lady* was 'I am turning to port, hard to port'.

The two vessels collided at about 1957, some 90 seconds after their first exchange on VHF **(Figure 5)**.

Figure 5



Radar records - collision *Arctic Ocean* and *Maritime Lady*

Brunsbüttel Elbe Traffic made a request on VHF Channel 68 for tugs to go to (buoys) 58a and 60, 'as there has been a collision'. They followed this message with a "Mayday Relay" requesting all ships to help following a collision in front of Brunsbüttel Locks, and asking the two vessels for details of any injuries.

Arctic Ocean's chief officer was on his way to the bridge after changing his clothes when the collision occurred. He immediately ran forward to examine the damage. His first radio report, made after the two vessels separated, was that there was 'white powder on the bows'. With other crew members, he proceeded to check other forward spaces and reported there was no damage.

After the two vessels disengaged, *Arctic Ocean*'s master put the engine control to stop. As a result, the vessel began to drift towards the west with the ebb stream. This drift continued for several minutes until Brunsbüttel Elbe Traffic directed *Arctic Ocean* to move clear of the fairway and anchor. At 2020, the vessel was anchored, outside of the fairway, on the south side of the river midway between buoys 57a and 59.

1.2.2 Events on *Maritime Lady*

Maritime Lady **(Figure 6)** had arrived in Hamburg early on Sunday 4 December 2005, after a ballast voyage from Vlissingen, The Netherlands. She had then loaded a cargo of 1805t of Potassium Chloride, bound for New Holland, UK.

At 1445 on Monday 5 December, a Hamburg Harbour pilot boarded and the vessel began her passage at 1455. Once outside port limits, at Seemannshöft, the pilot disembarked and the master continued passage downriver without a pilot.

Figure 6

Maritime Lady under former name

The river passage was without event until *Maritime Lady* was approaching Brunsbüttel. The vessel was making good progress, with an ebb tide helping to give her a speed over the ground of between 11 and 12 knots.

At around this time, the master sent the duty AB to carry out a final check around the deck before the vessel left the river and entered the North Sea. This left the master alone on the bridge.

At 1950, as *Maritime Lady* approached the locks at Brunsbüttel, she was on the northern edge of the westbound fairway and running at 12 knots over the ground. The master saw *Arctic Ocean*, for the first time, in the exit basin from the locks. He was also able to see a second vessel astern of *Arctic Ocean.*

Knowing there were two vessels leaving the locks, he used the autopilot to change course slightly to port, towards the middle of the fairway **(Figure 5)**.

At 1955:40, when *Maritime Lady* was abeam of the old Brunsbüttel Locks and still moving towards the centre of the fairway, she received a call from *Arctic Ocean* on VHF. Thinking *Arctic Ocean* intended to cross the fairway ahead of him, *Maritime Lady*'s master answered 'red to red', but did not identify his vessel by name.

Judging that there would be room to pass if he went hard to starboard, *Maritime Lady*'s master switched to hand steering and put the tiller hard to starboard. This helm movement did not give the response the master expected; the turn to port appearing to be only slightly arrested.

Re-assessing his position, the master decided he might, by turning to port, allow *Arctic Ocean* to pass to starboard. He told *Arctic Ocean*, on VHF, 'sorry green to green, I have a problem with my rudder'. He then put the helm hard to port.

Shortly after, he put the engine to stop and then full astern. He noticed the bows continuing to swing to port.

The master's rapid movement of the engine controls caused engine room alarms to sound, prompting the two engineers to go to the engine room. The vibration and sounds that resulted from going astern also alerted the chief officer, who looked from his cabin window to see another vessel approaching close on the starboard side.

The other three crew members, who were in or around the crew mess, were alerted by hearing on the duty AB's VHF an instruction from the master for the 'watchman to go to the bridge'. All three men arrived on the bridge in time to see *Arctic Ocean* collide with the starboard side of their vessel. They then went to their cabins to collect lifejackets and warm clothing.

Meanwhile the chief officer, having seen the collision through his cabin window while dressing, also went to the bridge. Once there, he saw *Arctic Ocean* disengage from *Maritime Lady*, which began to take on a starboard list. He, too, returned to his cabin to collect a lifejacket and warm clothing.

The two engineers, still in the engine room at the time of collision, evacuated the space after hearing the emergency alarm signal and seeing the associated warning lamp illuminate.

The crew quickly donned warm clothing, or survival suits, and prepared some of the lifesaving equipment for use. The starboard liferaft was thrown into the water and inflated. The port liferaft was also thrown into the water, but it failed to inflate. Efforts were made to prepare the lifeboats for launching, but these were soon abandoned due to the vessel's increasing list.

At about 2001, 4 minutes after the collision, *Maritime Lady*'s master contacted Brunsbüttel Elbe Traffic on VHF with 'I have a list on the starboard side and require a place to berth'. The response suggested it was possible that Brunsbüttel Elbeport, on the north side of the river between buoys 60 and 62, could be used, and indicated that Brunsbüttel Elbe Traffic would contact the harbourmaster. *Maritime Lady*'s master acknowledged this and he put the engine controls ahead. However, the extent of the starboard list soon caused him to stop the engine and collect his lifejacket.

By this stage, the pilot boat *Kapitan Kircheiss* was on scene on the port side of *Maritime Lady*. The chief officer was the first to jump onto the pilot boat at 2007.

By 2008, *Maritime Lady* was on her starboard side.

The remaining six crew all swam to the *Kapitan Kircheiss*, or the pilot boat *Osteriff*, that had also arrived on scene. To enter the water, four crewmen walked across the near horizontal port side of *Maritime Lady*. The two engineers fell from the deck into the water on the starboard side as the list increased. One engineer sustained an injury in the fall.

Maritime Lady began to drift in the fairway, with the ebb current towards the west. She stopped in the westbound fairway, just south of buoy 58a.

Gillis Gullbransson, a German Maritime Rescue Service (GMRS) vessel, arrived at the wreck at 2020 and stood by. She was joined by another GMRS vessel, *Hermann Helms,* at 2104.

1.2.3 Events on *Sunny Blossom*

Sunny Blossom **(Figure 7)** was on passage from the Baltic port of Klaipeda, Lithuania, to North America via the Kiel Canal. Her intended passage from the locks at Brunsbüttel was along the Elbe River to the North Sea, and then trans-Atlantic to North America.

At 2032 on 5 December 2005, *Sunny Blossom* completed her westbound transit of the Kiel Canal, and landed her canal pilot and helmsmen at the north lock at Brunsbüttel.

At 2036, an Elbe River pilot boarded in the lock. The master passed the vessel's pilot card to him and was told there might be some delay in leaving the lock due to an earlier collision between two vessels. Although most of the

Photograph courtesy of FotoFlite

Figure 7

Sunny Blossom

VHF radio traffic was in German, the master also understood from the pilot that rescue operations following the collision were complete and that when his vessel was cleared to leave Brunsbüttel Locks by VTS, he would be provided with additional traffic and navigational information on VHF Channel 62 by Brunsbüttel Radar 1.

The pilot told the master that the wreck from the earlier collision was in the vicinity of buoy 58a, that there was an ebb stream across the exit from the lock basin of 3 to 4 knots, and that there was no other traffic in the river. The master and pilot agreed that after leaving the lock basin, the vessel would alter her course to port and pass the wreck clear on her starboard side.

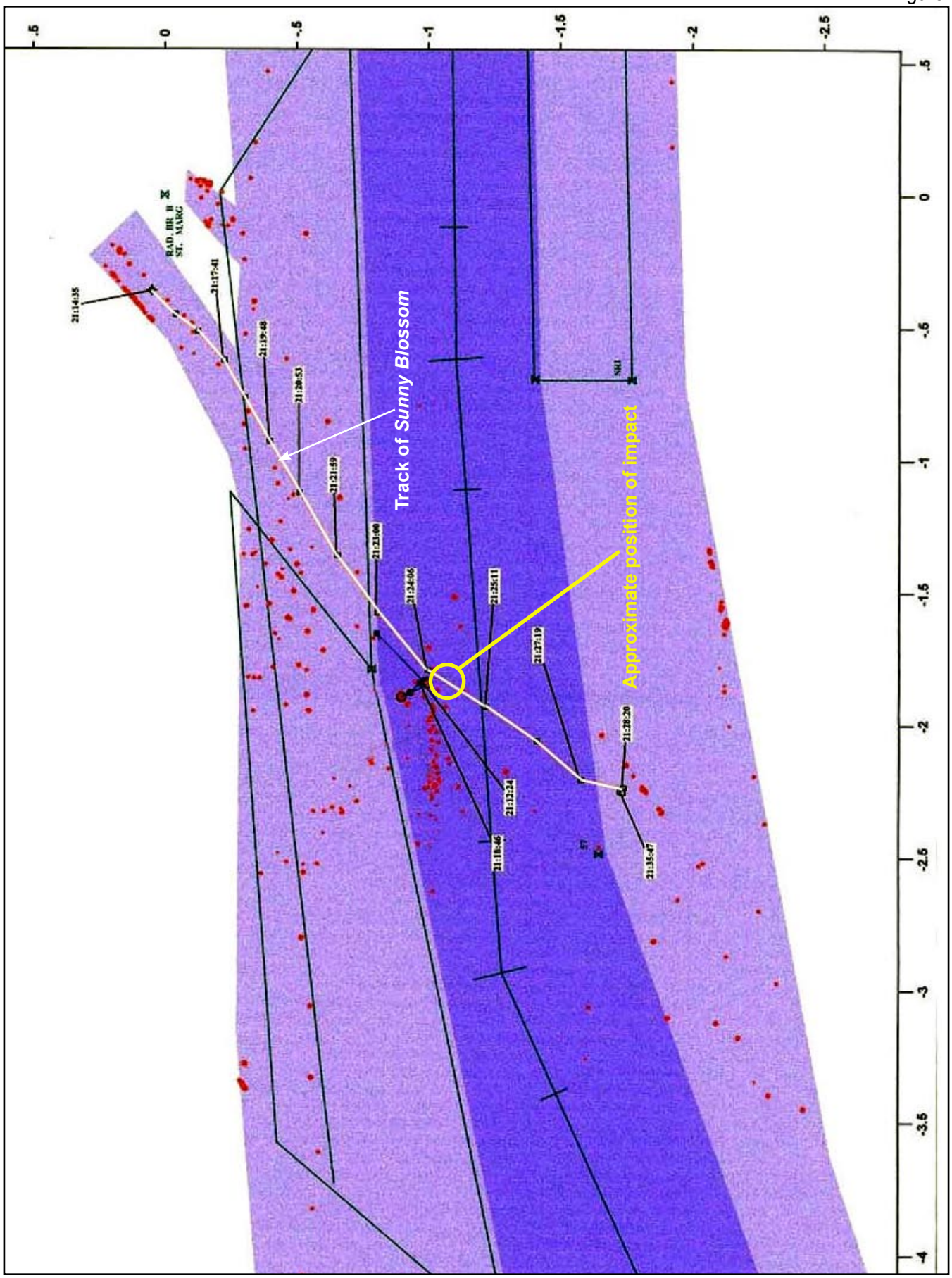
The master was content for the pilot to translate into English any relevant VHF messages.

At 2104, *Sunny Blossom* began to move out of the lock. The master, chief officer and a helmsman were on the bridge as well as the pilot. At this time, Brunsbüttel Radar 1 reported, on Channel 62 VHF, that 'everything is clear outside' and 'to the south of the wreck is clear, but to the north there are two or three vessels around'.

At 2110, the vessel cleared the lock and began gradually increasing speed as she passed down the basin **(Figure 8)**.

At 2115, Brunsbüttel Radar 1 reported 'for *Sunny Blossom'* that 'to the south of the wreck it's all clear, the emergency vessels are to the north'.

Figure 8



Radar records - grounding of *Sunny Blossom*

This was followed, at 2117, by another report from Brunsbüttel Radar 1 'for *Sunny Blossom'* and 'the wreck is 200m to the south of the buoy'.

At 2118, as she reached the end of the basin, *Sunny Blossom*'s course and speed over the ground were 236.1° at 4.7 knots. The pilot requested "full ahead" and "port 10°" helm. The engine was at full ahead manoeuvring speed before the vessel cleared the lock's exit basin.

As the bow of the vessel entered the river, it came under the influence of the strong ebb stream, and the pilot requested "hard to port". The rudder indicator was seen to swing to 30° to port.

As *Sunny Blossom* entered the river, her course over the ground remained consistently between 236° and 239° until 2123, although her speed gradually increased to 8.7 knots.

At 2123, *Hermann Helms* called Brunsbüttel Radar 1 on Channel 62 reporting that 'the vessel sailing up river must keep a little more to port otherwise it will run into it. We are on the inside of the wreck, towards land'. At this stage, *Sunny Blossom* was about 2 cables from the wreck.

Brunsbüttel Radar 1 responded on Channel 62 with: '*Sunny Blossom* the *Hermann Helms* has reported in about the situation. It (*Hermann Helms)* is to the north of the wreck, to the north of the wreck and you must head south, you must head away a little, your course still seems to be heading towards the wreck.'

Over the next 1½ minutes *Sunny Blossom*'s speed dropped to 7.5 knots and her course over the ground altered to port to 210°.

At 2124, the bows of *Sunny Blossom* were about to clear the wreck and *Hermann Helms* announced on Channel 62 that 'it needs to turn its stern away, it's almost hit it, it needs to go hard to starboard, it still looks tight.'

This was followed by Brunsbüttel Radar 1 transmitting, 'and *Sunny Blossom, Hermann Helms* says you have to go hard to starboard or your stern will hit the wreck.'

At about this stage the pilot on *Sunny Blossom* advised that the helm should be put hard to starboard. This was done.

At about 2125, the starboard quarter of *Sunny Blossom* made contact with the inverted wreck of *Maritime Lady.* Propulsion was lost at impact.

The master sounded the general alarm and deployed crew to sound tanks to locate possible damage.

Following the collision, the wreck of *Maritime Lady* again began to drift to the west and she rotated further towards the fully capsized position before coming to rest again.

Sunny Blossom continued, at progressively reducing speed, on a course of about 215° towards the south side of the river.

At about 2130, the port anchor was released and the vessel stopped at 2132, about one cable east of buoy 57.

The first efforts to take *Sunny Blossom* in tow, at 2230, established she was aground. Soundings taken around the vessel indicated she was lightly aground on the starboard side, forward.

At 0030 on 6 December, *Sunny Blossom* was refloated by the tugs and towed to Elbe Harbour, Brunsbüttel, arriving at 0145.

1.3 EMERGENCY RESPONSE

The staff in the Brunsbüttel Elbe Traffic control room were able to see the collision between *Arctic Ocean* and *Maritime Lady* as it happened directly in front of their observation window. They quickly initiated a "Mayday Relay" on Channel 68, asking for all vessels in the area to assist, directed tugs to the area of the casualties, and checked there were no injuries on the two vessels. The tug *Bugsier 15* responded to this call, leaving her berth in the old locks basin at 2000 and arriving on scene at 2010.

The first two vessels at the scene, in response to the "Mayday Relay", were the pilot boats that operate from the exit basin of the old, south locks at Brunsbüttel. The first was alongside *Maritime Lady* less than 10 minutes after the collision, sufficient for the chief officer to step across.

At 2005, the rescue boat *Gillis Gulbransson* of the GMRS was alerted by a lock-keeper of Brunsbüttel locks. She slipped from her berth on the Elbe side of the locks at 2015 and reached the scene of the accident at 2020. By this time, the crew of *Maritime Lady* had been recovered by the pilot boats and *Gillis Gulbransson* stood by the casualty to monitor developments.

At 2007, the rescue cruiser *Hermann Helms* was alerted by the Brunsbüttel Elbe Traffic and she left Cuxhaven at 2010.

At 2015, MRCC Bremen was informed of the incidents off Brunsbüttel by the *Hermann Helms*. In turn, MRCC Bremen contacted the *Gillis Gulbransson* but found she had already been alerted and tasked. At 2016, MRCC Bremen contacted Brunsbüttel Elbe Traffic for details of events. Shortly afterwards, at 2020, Brunsbüttel Elbe Traffic was able to confirm that all *Maritime Lady*'s crew had been recovered.

At 2022, Brunsbüttel Elbe Traffic contacted the tug *Bugsier 15* to check she was on scene beside the wreck. The tug was then requested to take the wreck in tow, first to the south and then to the north, to clear the main shipping channel. *Bugsier 15* reported back that this was not possible as the superstructure of the capsized wreck was aground and only the bow area was showing above the waterline.

At 2104, *Hermann Helms* reached the scene of the accident and took up position between buoy 58a and the wreck of *Maritime Lady*. Brunsbüttel Elbe Traffic then released *Bugsier 15* to return to her normal tasks.

Hermann Helms used four searchlights, three mast lights and a blue warning light to mark and illuminate the wreck.

The decision was then made that it was safe to allow traffic to again exit Brunsbüttel Locks to enter the River Elbe. *Sunny Blossom* was the first vessel to leave the north lock when its gate opened. Because of the circumstances, she was required to use the 'radar pilot' service in addition to carrying a pilot.

As *Sunny Blossom* approached the wreck of *Maritime Lady*, after leaving the lock basin, *Hermann Helms* used VHF Channel 62 to update Brunsbüttel Radar 1 (the 'radar pilot') on *Sunny Blossom*'s approach to the wreck. At the time *Sunny Blossom* collided with the wreck of *Maritime Lady, Hermann Helms* was approximately 50m from the wreck.

At 2215, *Gillis Gulbransson* returned to her berth. *Hermann Helms* continued to stand by the wreck until 0810 on 6 December.

At 2215, the Central Command for Maritime Emergencies, Germany (Havarie Kommando) assumed overall responsibility and command of the emergency response effort. The Havarie Kommando remained in command until the wreck of *Maritime Lady* was removed from the river at 0815 on 19 December 2005. This aspect of the emergency response effort is not covered further in this report.

1.4 VESSELS' DAMAGE

1.4.1 *Arctic Ocean*

Damage to *Arctic Ocean*, as a result of the collision, was confined to her bulbous bow and stem. The bulbous bow suffered minor paintwork damage but no obvious indentation of the plating. The stem, several metres above the bulb, was slightly indented **(Figure 9)**.

1.4.2 *Maritime Lady*

As an immediate result of the collision with *Arctic Ocean,* the starboard side of *Maritime Lady*'s hold was completely opened to the sea, through the starboard wing tanks, The opening was about 5m diameter, located 7 to 8 metre aft of the forward end of the hold, and extended vertically down into the double bottom **(Figure 10)**.

Substantial further damage occurred as a consequence of the vessel's capsize, drift in the river, contact by *Sunny Blossom* and salvage. This included: loss of all hatch covers except two sections, crushing of the wheelhouse; displacement of most equipment in the wheelhouse; loss of funnel; loss of masts; destruction of the starboard lifeboat davit; accommodation linings torn free; total loss of cargo, aft peak tank holed and rudder and stock deflected **(Figure 11)**.

Figure 9

Damage to bows of *Arctic Ocean*

Figure 10

Damage to starboard side of *Maritime Lady*

Figure 11

Maritime Lady during recovery

Following the vessel's salvage, an examination of the steering system was carried out by the classification society, Germanischer Lloyd, and a specialist steering equipment company. This found no damage to the hydraulic system or components. Electrical components of the system showed no signs of poor connections, overheating, spark, smoke or fire damage. A functional test of the hydraulic connection between bridge and steering gear was performed, and it was concluded that it was still fully operational. Electrical resistance and continuity checks were not made because the equipment had spent several days immersed in sea water, and it was considered that any test results would not be representative of the system's condition at the time of the accident.

1.4.3 *Sunny Blossom*

Following her collision with the wreck of *Maritime Lady*, the following damage to *Sunny Blossom* was found: a slight fore and aft crease in the starboard quarter of her hull plating, in way of the engine room; damage to the rudder stock and bearing; one blade of her propeller was deflected aft; and the tail and intermediate shafting were damaged.

Although the damaged propeller blade did not make contact with the rudder, the degree of deflection was such that the blade extended aft of the leading edge of the rudder **(Figure 12)**. While recording this damage, it was noted that two further blades had previously been cropped **(Figure 13**).

The forward part of the vessel's bottom plating showed signs of having made contact with a soft bottom.

Figure 12

Damage to propeller blade of *Sunny Blossom*

Figure 13

Propeller of *Sunny Blossom* - showing two cropped blades

1.5 WEATHER AND TIDAL CONDITIONS

The weather in the Brunsbüttel area on 5 December 2005 was overcast throughout, with rain or drizzle. The following data was recorded:

Local Time	2000	2100	2200
Wind speed:	8knots	8knots	8knots
Wind direction:	190°	210°	210°
Visibility:	2.8km	3.8km	3.9km
Air temperature:	5.8°C	6.0°C	5.9°C
Water temperature:	6.0°C	6.0°C	6.0°C

High water occurred at 1646, low water at 2338.

Sunset occurred at 1605, Civil Twilight at 1646, and Nautical Twilight at 1731.

1.6 GENERAL DETAILS OF *ARCTIC OCEAN* AND HER CREW

1.6.1 *Arctic Ocean* (Figure 2)

1.6.2 General arrangement (Figure 14)

Arctic Ocean is a fully cellular containership, built by J.J.Sietas KG Schiffswerft GmbH & Co, Hamburg in 1995. Accommodation and wheelhouse are right aft, and she can carry 660 twenty foot equivalent unit (TEU) containers forward in the four cargo holds and on deck. The cargo holds are surrounded by double bottoms and wing tanks, and the vessel carries 680t of heavy fuel oil for her main engine and approximately 150t of gas oil for her auxiliary engines.

She is typical of many container ‘feeder’ vessels operating in European waters, although her hull is ice strengthened. Much of her present service is in the Baltic Sea.

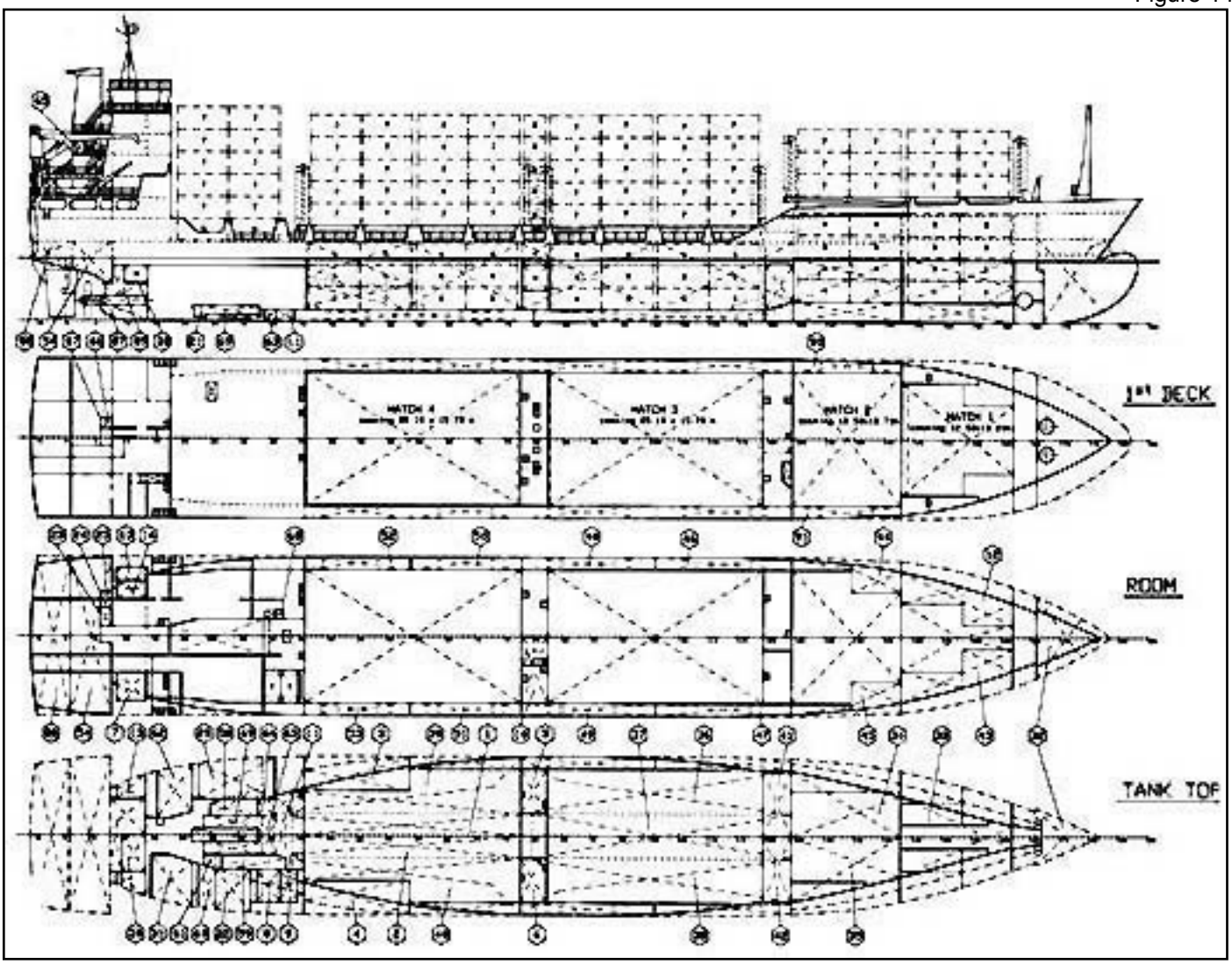
Her lifesaving appliances include one enclosed free-fall lifeboat launched from the stern, and a six person, rigid hulled rescue boat on her starboard quarter, launched from a crane. Three inflatable liferafts are carried; 2 x 20 persons units aft and 1 for 6 persons forward.

1.6.3 Propulsion

A single controllable pitch propeller is driven by a six cylinder diesel engine, running at 425rpm, burning heavy fuel oil. Propeller control is normally by a single control lever located on the bridge console.

A generator can also be driven by the main engine. Two other generators are driven by independent diesel engines.

Figure 14



General arrangement of *Arctic Ocean*

1.6.4 Cargo

Ten units containing dangerous goods were loaded in Tallinn and Helsinki to be unloaded in Hamburg or Bremerhaven. These were:

6 units of Class 5.1, UN Number 1463, stowed in the hold

1 unit of Class 3, UN Number 1263, stowed on deck

1 unit of Class 2.2, UN Number 3337, stowed on deck

1 unit of Class 9, UN Number 3077, stowed in the hold

1 unit of Class 2.2, UN Number 3159, stowed on deck

Of these substances, UN1263 and UN3077 are classified as Marine Pollutants or Severe Marine Pollutants.

1.6.5 Crew

At the time of the collision, *Arctic Ocean* had a crew of 13 and was carrying one passenger. The crew included the master, chief officer, second officer, chief engineer and second engineer.

The vessel's Safe Manning Document (SMD) specified 14 as the minimum crew number to be carried. These numbers included a master, chief mate, two deck officers and two engineers. However, when operating within specified geographical limits, which included the Baltic Sea, the SMD allowed the complement to be reduced by one deck officer and one engineer.

The master and the passenger were German nationals, the chief officer and chief engineer were Ukrainians and the remaining crew were Filipino.

As none of the deck officers or engineers had a UK Certificate of Competency, each had a Certificate of Equivalent Competency (CEC) issued by the vessel's Flag State, the United Kingdom's (UK) Maritime and Coastguard Agency (MCA). These CECs allowed the holders to sail on UK ships in the capacity specified by the CEC, and they were issued following MCA's acceptance of certificates of competency issued by the individual's national administration.

The master held a Pilotage Exemption Certificate (PEC) which allowed him to dispense with the services of a pilot on *Arctic Ocean* in the Elbe River. The PEC had been issued following an examination on 15 December 2004, and was valid until 14 December 2005.

1.6.6 Previous incident

On the night of 17 November 2005, *Arctic Ocean* was off the Swedish coast, bound for Kotka, Finland. The master was standing the 2000 to 2400 watch and, at about 2330, allowed the AB lookout to leave the bridge to call the next watch and undertake fire rounds.

A few minutes later, at about 2335, the master reported severe stomach cramps. He checked the radar, noticing a fishing vessel about 4 miles on the starboard bow. He assumed the closest point of approach (CPA) with this fishing vessel was 1.5 miles, but the trace was lost a few seconds later. He then entered the bridge toilet, leaving the bridge unattended.

The fishing vessel stopped at about 2340, and her skipper made a check of traffic in the area. After deciding all vessels were passing clear, he left the wheelhouse to have a meal in the mess room.

Arctic Ocean collided with the fishing vessel at 2350. The master came out of the toilet to see the fishing vessel drifting about 100m off his starboard beam. This master was on board for the collision with *Maritime Lady* on 5 December 2005.

1.7 GENERAL DETAILS OF *MARITIME LADY* AND HER CREW

1.7.1 *Maritime Lady* (Figure 6)

1.7.2 Change of owners

Maritime Lady changed owners and name on 2 December 2005, 3 days before this accident. Until that date, she was called *Sea Ems.* The changes did not include a change of Flag, and she remained registered in Gibraltar.

1.7.3 General arrangement (Figure 15)

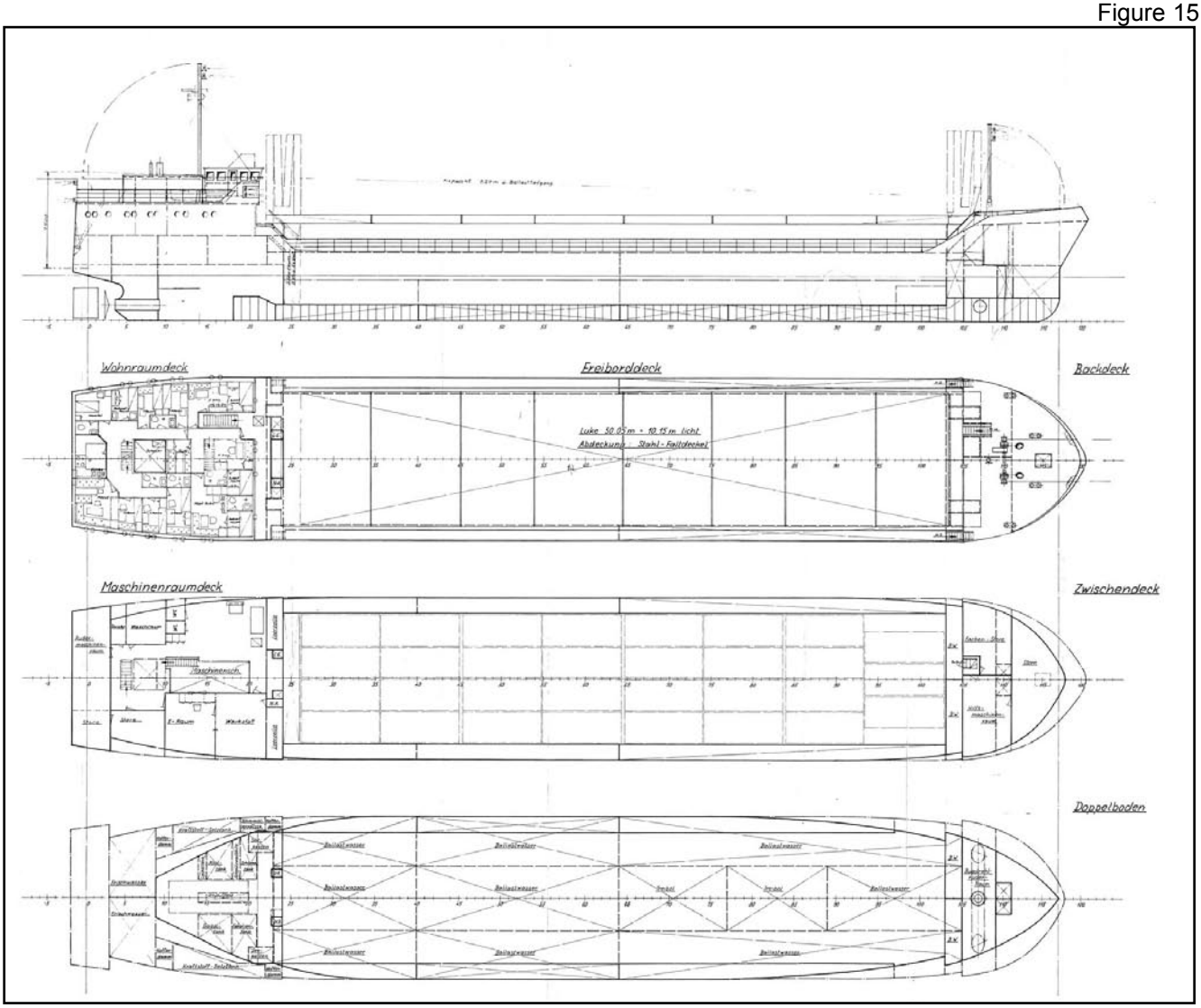
Maritime Lady was a single hold general cargo vessel, strengthened for the carriage of heavy cargoes and equipped for the carriage of containers.

Wheelhouse and crew accommodation was aft. The forward and aft masts could be lowered to allow the vessel to pass under low obstructions.

The hold was fitted with hydraulically powered, steel hatch covers. Double bottom tanks extended the full length of the hold, with wing tanks either side.

Two davit launched lifeboats were carried, one each side of the poop deck. Adjacent to each davit was a cradle for an inflatable liferaft.

Figure 15



General arrangement of *Maritime Lady*

1.7.4 Propulsion and steering

Main machinery, consisting of a MAK diesel engine delivering 600kW to a single fixed pitch propeller through a reversible gearbox, could be controlled from the bridge.

The single rudder was a high performance design with an attached fin. The 200mm diameter rudder stock was connected to a hydraulic steering gear capable of producing a turning moment of 60kNm.

1.7.5 Cargo

Maritime Lady's cargo at the time of the collision was 1805t of potassium chloride, in powder form. This is not classified in the International Maritime Dangerous Goods Code (IMDG Code), but the Code of Practice for Solid Bulk Cargoes (BC Code) classifies the substance as one that is neither liable to liquefy nor to possess chemical hazards. The BC Code also describes the material as a fertilizer, normally found as white crystals in granular and powder form, having an odour of iodine.

Available safety data suggests the material is, to a small degree, toxic to fish and other water-borne organisms. The data particularly indicates that spillage of large quantities may affect fresh water species.

1.7.6 Crew

The flag state's minimum manning requirement for *Maritime Lady* was for a crew of six: a master, chief officer, chief engineer, a cook and two ABs. At the time of the accident, she was carrying seven, the seventh being an additional chief engineer. This officer had sailed with the vessel during her previous ownership and had remained on board to assist in familiarising the new crew with the vessel.

The new crew had joined on 1 December, in Vlissingen, The Netherlands. The chief officer and both of the engineers were Russian, the remainder Polish.

To allow the master, chief officer and engineers to sail on a Gibraltar registered ship, each had made an application to the Government of Gibraltar for an endorsement of the certificate of competency issued by his national administration.

The additional chief engineer's application had already been accepted, and he had been issued with an endorsement by the Gibraltar administration. The others had made their applications between 28 November and 1 December 2005, and each had been issued with "Provisional Recognition of a Certificate", valid for 3 months. These documents allowed each to sail on a Gibraltar registered vessel in the specified capacity, pending issue of a formal endorsement by the Administration in accordance with Regulation I/10.5 of the STCW Convention.

1.7.7 Previous incidents

No records have been found of any significant accidents to this vessel that might be attributed to her handling, systems or equipment.

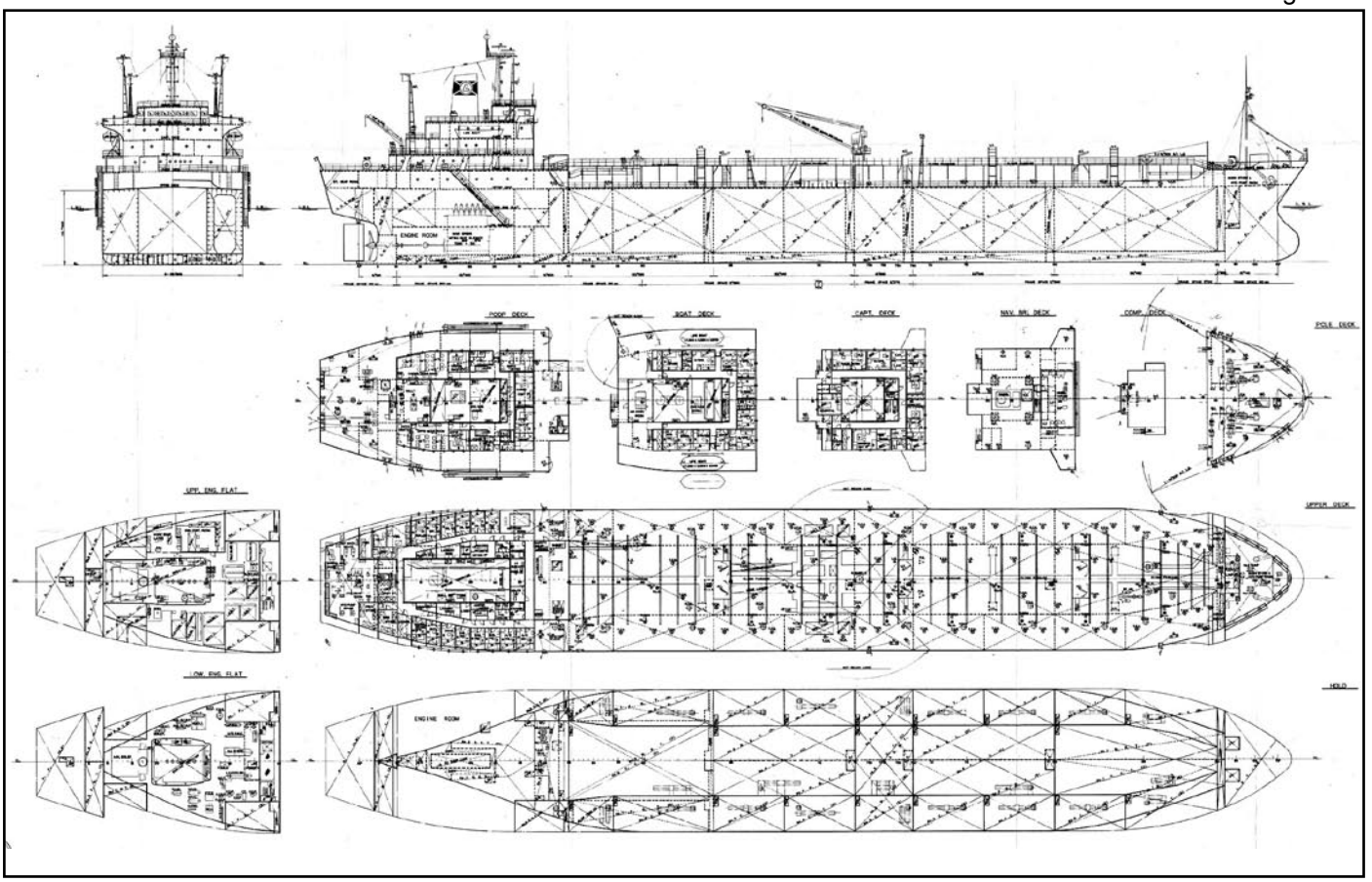
1.8 GENERAL DETAILS OF *SUNNY BLOSSOM* AND HER CREW

1.8.1 *Sunny Blossom* (Figure 7)

1.8.2 General arrangement (Figure 16)

Sunny Blossom is a Type 2 chemical tanker of 19,995 tonnes deadweight, with her bridge, accommodation and machinery spaces aft of her cargo tanks. A continuous double bottom extends the full length of the vessel aft of the fore peak.

Figure 16



General arrangement of *Sunny Blossom*

1.8.3 Propulsion and steering

A single fixed pitch propeller is directly coupled to a locally controlled slow speed diesel reversing engine. Manoeuvring speeds ahead, as given on the Pilot Information Card, were:

		Loaded	Ballast
Full Ahead:	90rpm	10.9knots	10.2knots
Half Ahead:	62rpm	7.0knots	7.8knots
Slow Ahead:	55rpm	6.2knots	6.9knots
Dead Slow Ahead:	45rpm	5.1knots	5.6knots

During survey by the vessel's classification society, Det Norske Veritas (DNV) between 7 and 17 June 2005, the tip of one propeller blade was recorded as damaged over a length of approximately 600mm. The same amount of material was removed from the opposite blade, and the blade edges rounded off and faired in.

Following this survey, a classification society condition was imposed requiring permanent repairs be made to the propeller by 31 March 2006. Ship's staff were advised to adjust engine speed in such a way as to avoid possible excessive vibration. Any abnormality in service was to be reported to DNV.

The single spade rudder is coupled to a ram-type hydraulic steering gear. Hydraulic power is supplied by two pumps, each driven by an electric motor.

The steering gear was tested by ship's staff at 0830 on 5 December 2005, before the transit of the Kiel Canal. The report on this test stated that all was in good working order. After the collision with *Maritime Lady*, the steering gear was tested again by the local Water Police and found in good order.

1.8.4 Cargo

Sunny Blossom was carrying a cargo of 18,120t of Urea Ammonium Nitrate Solution at the time of her contact with *Maritime Lady.* This material is not classified in the IMDG Code.

The International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) covers this cargo because of its safety and pollution hazards. The IBC Code gives this cargo a pollution category of 'C'. A Category 'C' substance is defined in Annex II of the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 as:

> *Noxious liquid substances which if discharged into the sea from tank cleaning or deballasting operations would present a minor hazard to either marine resources or human health or cause minor harm to amenities or other legitimate uses of the sea and therefore require special operational considerations.*

MARPOL 73/78 places limitations on the discharge of Category 'C' substances into the sea. Various limitations and conditions apply, such as total quantity discharged, minimum speed of vessel, concentration of substance in the wake astern, depth of water, distance from land and discharge to be below waterline.

Urea Ammonium Nitrate is required to be carried by a vessel having a standard not less than Type 3, as classified in the IBC Code. This classification requires the vessel to have cargo tanks which offer the minimum level of protection.

Urea Ammonium Nitrate commonly is used in the agricultural industry as a fertiliser and it is not generally considered to be a substantial hazard to the environment. However, where large spills do occur, general advice is that local health and wildlife officials, and operators of nearby water intakes should be alerted to possible contamination.

1.8.5 Crew

All 24 crew were Filipino nationals. Those officers that required certificates of competency had the necessary certificates and endorsements from the vessel's flag state.

The master joined the vessel on 10 August 2005. He had previously sailed on *Sunny Blossom,* as master, between March 28 and May 17 of 2005. His first transit of the Kiel Canal, as master, was an eastbound passage on 1 December 2005. His previous experience of the Kiel Canal was as a chief officer.

1.8.6 Previous incidents

The Transportation Safety Board of Canada (TSB) and BMA produced reports describing two groundings of *Sunny Blossom*, on 16 July 1999 and 18 May 2000, in the St Lawrence Seaway. Although neither grounding was directly attributable to the vessel's handling characteristics, a major finding of all the reports was that the vessel was hard to steer and did not respond well to helm changes at slow speeds in shallow water. Full details are contained in TSB Canada's Marine Investigation Reports M99C0027 and M00C0019.

1.9 THE KIEL CANAL

1.9.1 Geography

The Nord-Ostsee Kanal (NOK), also known as the Kiel Canal, connects Brunsbüttel on the Elbe River with Holtenau in the port of Kiel.

The canal is 99km long, with sea locks at either end, and provides a short-cut for ocean going vessels between the southern North Sea, via the Elbe River, and the Baltic Sea.

Built in the late nineteenth century, the canal was widened and deepened in the early part of the twentieth century. To cater for the increased size of ship that could be handled by the enlarged canal, new larger locks were built at each end. The new locks are used primarily by commercial traffic, though the smaller, older locks remain in use.

The maximum permissible draught for transit of the canal is dependent on a vessel's length and beam. For a vessel of 160m length and 22.8m beam, such as *Sunny Blossom,* the maximum draught is 9.5m.

1.9.2 Pilotage and helmsmen

Pilotage is compulsory for the majority of commercial vessels passing through the Kiel Canal; only small vessels are exempted. Criteria are length, beam, draught and type i.e. tanker.

Small vessels are required to have their helm manned by qualified and experienced crew. Vessels above specified limits of length, beam and draught are required to embark, for transit of the canal, a helmsman who is approved and recognised by the Canal Authority. Still larger vessels, are required to employ two such helmsmen.

Both *Arctic Ocean* and *Sunny Blossom* required the services of pilots and helmsmen for their canal transits.

1.9.3 Canal Vessel Traffic Services (VTS)

At the time of the accident, the traffic on the Kiel Canal was controlled by two Vessel Traffic Services (VTS), namely VTS NOK I and VTS NOK II.

VTS NOK I was located in Brunsbüttel and was responsible for the western half of the canal, from the 49.5km point to Brunsbüttel. This VTS was the responsibility of the Waterways and Shipping Office (WSA) Brunsbüttel.

The VTS NOK II was responsible for the eastern half, i.e. from the 49.5km point on the canal to Kiel-Holtenau. It was located in Kiel-Holtenau and was the responsibility of WSA Kiel-Holtenau.

Both WSAs were the responsibility of the Waterways and Shipping Directorate North (WSD North) which, in turn, was the responsibility of The Federal Ministry of Transport, Building and Urban Affairs.

For the organisation of the traffic, all vessels, except leisure craft less than 15m in length, are obliged to report. These vessels are assigned to one of six possible “ship groups”, according to their length, breadth, draught and the degree of hazard posed by the cargo. The assignment of a vessel to a “ship group” is crucial for the safe passing and overtaking of other vessels in the canal.

All vessels in the canal are updated on the current traffic situation, via VHF, at half-hourly intervals.

1.9.4 Brunsbüttel Locks

The western end of the Kiel Canal opens onto the Elbe River at Brunsbüttel. Here there are four locks. The southern pair is the original, smaller locks. The northern pair is larger and was used by *Arctic Ocean* and *Sunny Blossom* **(Figure 1)**.

Before leaving Brunsbüttel Locks to enter the Elbe River, each vessel over 50m LOA is required to make a report to Brunsbüttel Elbe Traffic on Channel 68. This report is to include:

- name, call sign, if necessary IMO number and/or MMSI number and type of vessel
- position of vessel in the locks
- length, breadth and draught of vessel
- port of departure and destination
- state of cargo tanks on tankers (gas free etc)
- declaration of any dangerous cargo
- statement of deficiencies with regard to vessel or cargo
- total number of persons on board.

Some of this information is used by VTS operators to identify the radar contacts of vessels leaving the locks, and thus allocate an identification letter and number to a vessel. Once a radar contact is acquired and assigned an identification code, the radar system automatically maintains track on the vessel as it travels along the river.

Once a vessel has supplied the required information to Brunsbüttel Elbe Traffic, she is informed about the traffic on the Elbe River, as far as the VTS operator considers it relevant.

After leaving the locks, and before entering the river, vessels are required to again report to Brunsbüttel Elbe Traffic. This second report should include the following particulars:

- name and distinctive numbers or letters of the vessel;
- position;
- speed;
- the time of the vessel's passage.

1.10 THE ELBE RIVER

1.10.1 Geography

The Elbe River is one of the most important commercial waterways in Germany; its importance is emphasised by its connection with the Kiel Canal at Brunsbüttel.

The river's main fairway begins at the Elbe Light-buoy on the North Sea. Brunsbüttel, and its locks to the Kiel Canal are 65km east of the buoy, with Hamburg a further 62km to the east.

1.10.2 Pilotage

Tankers carrying gas, chemicals, petroleum or petroleum products in bulk, or not gas-free or made inert after carrying oil or oil products with a flashpoint below 35°C, are required to embark a pilot.

All other vessels exceeding 90m in length, or 13m beam, or with a draught greater than 6.5m are also required to embark a pilot.

Vessels regularly travelling on the estuary may, up to certain dimensions and draughts, be granted an exemption from the obligation to take a pilot, if a specified number of transits under pilot advice were carried out.

A pilotage exemption certificate (PEC) may be granted to vessels greater than 120m length or 19m width and a draught of not more than 8m, if the individual receiving the exemption has completed the transit at least 24 times under pilot advice and met further conditions such as having sufficient knowledge of the German language.

1.10.3 VTS

The Elbe VTS, with full radar surveillance, is maintained for the control of shipping in the Elbe River. The scheme is controlled and co-ordinated by VTS centres at Cuxhaven, Brunsbüttel and Hamburg through a chain of radar and VHF radio stations. Each VTS centre has its own call sign and dedicated VHF channel.

Participation in the scheme is mandatory for vessels over 50m LOA.

For the stretch of the Elbe River east and west of Brunsbüttel, from buoys 53/54 to 125 the competent VTS centre is Brunsbüttel Elbe Traffic, based at Brunsbüttel. Communications between ships and Brunsbüttel Elbe Traffic occurs on VHF channel 68. Information broadcasts are also made on channel 68 every hour at 5 minutes after the hour, in English first followed by German.

In common with the other VTS centres serving the Elbe River, Brunsbüttel Elbe Traffic can provide a vessel, on request, with radar assistance and advice from a qualified pilot based in the VTS control room; often called a 'radar pilot'. This assistance can, on request, be given in English and uses VHF Channel 62; call sign Brunsbüttel Radar 1. The radar pilot service does not obviate the requirement for a vessel to embark a pilot, but can be used by any vessel, whether or not it has a pilot on board.

Under certain circumstances, such as poor visibility, a vessel can be obliged to accept the assistance of the radar pilot service.

1.10.4 Right of way and navigating in a fairway

Traffic Regulations for Navigable Waterways (revised) of 22 October 1998 Seeschifffahrtsstraβen-Ordnung, (SeeSchStrO), set out the requirements for navigating on the Elbe River and other waterways of Germany.

In the matter of a vessel's right of way in a fairway, these regulations override the International Regulations for Preventing Collisions at sea, 1972, (COLREGS) as amended. In Paragraph 25, they state:

> *A vessel proceeding along the course of the fairway channel, irrespective of whether or not she can safely navigate only within the fairway channel, shall have right of way over vessels*
>
> 1. *entering that fairway*
> 2. *crossing that fairway*
> 3. *making turns in that fairway*
> 4. *leaving their anchoring or mooring grounds*
>
> *A vessel having to yield the right of way shall, in good time, demonstrate through her conduct that she has the intention to wait. Passage shall not be resumed until the person in command of her is in a position to verify that he or she can do so without affecting the safety of other vessels in the vicinity.*

Admiralty Sailing Directions for the area, (North Sea (East) Pilot) in Chapter 1 reiterates the above guidance and at 1.91 contains a caution:

> *Some regulations contained in SeeSchStrO include details which are different from The International Regulations for Preventing Collisions at Sea (1972); the main difference being that vessels navigating in a fairway have right of way over vessels entering crossing or turning in that fairway or leaving an anchorage or berth adjacent to the fairway.*

Admiralty Sailing Directions, Chapter 1, section 1.96, states also:

> *Right of way vessels include extraordinarily large vessels, or vessels being forced, on account of draught, length, or some other characteristics, to navigate in the deepest channel of the fairway and*
>
> *A right-of-way vessel is deemed to be a "vessel restricted in her ability to manoeuvre" as defined in Rule 3(g) of The International Regulations for Preventing Collisions at Sea (1972) and exhibits the lights and shapes prescribed by Rule 27(b)*

Admiralty Sailing Directions, Chapter 7 covering *Die Elbe including Hamburg and der Nord-Ostsee Kanal*, section 7.15 states;

> ***Right-of-way vessels.*** *Vessels claiming right of way in accordance with SeeSchStrO must report the fact to the appropriate VTS centre and exhibit the lights and shapes prescribed by Rule 27(b) of The International Regulations for Preventing Collisions at Sea (1972).*

The provisions of Rule 9(a) of the COLREGS are applicable to navigation in the Elbe River, requiring vessels to keep as near to the outer limit of the channel or fairway which lies on her starboard side as is safe and practicable. SeeSchStrO contains exceptions to this requirement, but none is relevant to this accident.

1.11 HYDROGRAPHIC DATA

Abreast of the Kiel Canal, published maximum speeds of the tidal streams in the Elbe River are 2½ kn flood and 3¼ kn ebb. Local knowledge suggests the ebb stream can approach 4 kn.

Soundings of water depths in Brunsbüttel Locks, the lock basins and the area of the Elbe River abreast of the lock basins were taken between October and December 2005. These show the minimum depth, below chart datum, in the exit basin from the locks used by *Arctic Ocean* and *Sunny Blossom*, was generally at least 10m. In the river, at the exit from the basin into the channel, the minimum depth was 10.2m.

At 2110 on 5 December 2005, the time *Sunny Blossom* was leaving Brunsbüttel Locks, minimum depths, including height of tide for these two areas, were 11.4m and 11.6m. However, the more typical depth in the river, when approaching the main channel from the lock basin, was 13m to 14m.

1.12 SEARCH AND RESCUE RESOURCES

In the Federal Republic of Germany, the Federal Government has assigned the following duties and responsibilities to the German Maritime Rescue Service (GMRS):

- co-ordination and execution of maritime search and rescue at the German coasts
- monitoring of VHF channels used for the purpose of emergency and safety
- medical aid on board the vessels at sea and evacuation of critically ill and seriously injured persons by the GMRS.

The GMRS is a private, independent and voluntary institution which finances itself solely by donations, and receives no financial support from the government. Its head office is located in Bremen, as is the MRCC.

The GMRS has 54 stations covering the entire German coastline. The GMRS fleet includes: 21 rescue cruisers between 23m and 46m in length, operated day and night by 184 professional crewmen; and, 40 rescue boats of between 7m and 12m length, manned by more than 800 volunteers. The type of vessel based at a station is dependent on the operational area.

The rescue cruisers and boats have all been specially developed for the GMRS. They are self righting and equipped for fire-fighting, towing and are able to offer medical aid. The rescue cruisers also have independent daughter boats.

The vessels of the GMRS may be alerted by the MRCC or an SAR watch, which are then obliged to transfer the information direct to the MRCC. After being alerted, the large rescue cruisers respond within an average time of 5 minutes. The smaller rescue boats respond within 15 minutes.

To monitor VHF channels, and for operational communications, GMRS has a net of relay stations around the German coast. The GMRS is additionally supported by "SAR watches" which are at the VTS centres.

Two SAR stations are located in the area of the Elbe River. The 27m class rescue cruiser, *Hermann Helms*, with a maximum speed of 23 kn, is based in Cuxhaven. The 9.5m class rescue boat, *Gillis Gulbransson,* is based in Brunsbüttel.

For search and rescue operations at sea, the GMRS co-operates with airborne SAR units of the German Navy. An SAR helicopter, based on the island of Heligoland, is on 60 minutes notice for operations at night, and has a flying time to Brunsbüttel of 20 minutes.

1.13 PREVIOUS COLLISIONS IN THE REGION

During 1995, two separate collisions occurred involving vessels leaving or bound for the Kiel Canal at Brunsbüttel.

The first occurred on 11 May 1995, when the 54m long *Sina* was bound for the Kiel Canal from the sea. As she approached the canal, she crossed the westbound fairway to make for the northwest roads, just west of the exit basin from the locks. The other vessel involved, the 83m long *Scotfield,* had just cleared the locks at Brunsbüttel and joined the westbound fairway to head for the sea. As *Sina* crossed the fairway she was in collision with *Scotfield.* Although the subsequent investigation identified several causal factors, it found that *Scotfield* had been given no information on the traffic in the Elbe River before leaving Brunsbüttel Locks.

The second accident occurred on 2 October 1995, and involved the 100m long *Janra,* leaving the locks at Brunsbüttel and heading for Hamburg, colliding with the 177m long *Stolt Tenacity,* heading for the sea; the circumstances were

very similar to the encounter between *Arctic Ocean* and *Maritime Lady.* The investigation into this incident identified several factors, one of which was the lack of a report to *Janra* on the traffic in the Elbe before she left Brunsbüttel Locks.

Following these two collisions, on 6 October 1995 WSD North issued a requirement for the passing of safety related information to vessels leaving Brunsbüttel Locks and entering the Elbe River.

The requirement stated: all vessels leaving the North Sea-Baltic Sea Canal (Brunsbüttel Locks) will be informed by the Brunsbüttel Traffic Control Centre of traffic on the Elbe, insofar as it is relevant to filtering into the traffic on the Elbe. The wording of this requirement made it clear that it was effective immediately.

Since August 2003, ten incidents of damage to buoy 58a have been recorded. Nine of these have been attributed to contact with a merchant vessel. None has resulted in loss of life or injury. Four of these contacts were with vessels that had left Brunsbüttel Locks, without a pilot on board, and were turning to the west to head for the North Sea. In each case, the tide was on the ebb and so running to the west.

1.14 LOOKOUT RESPONSIBILITIES

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) Section A-VIII/2, Part 3 includes the following:

13. A proper look-out shall be maintained at all times in compliance with rule 5 of the International Regulations for Preventing Collisions at Sea .

14. The look-out must be able to give full attention to keeping a proper look-out and no other duties shall be undertaken or assigned which will interfere with that task.

15. The duties of the look-out and helmsperson are separate and the helmsperson shall not be considered to be the look-out 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 look-out. The officer in charge of the navigational watch may be sole look-out in daylight provided that on 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 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.

Rule 5 of the International Regulations for Preventing Collisions at Sea states:

Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

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 FATIGUE

2.2.1 *Arctic Ocean*

The recorded hours of rest for *Arctic Ocean*'s master show that since completing his watch at 2400 on 4 December 2005, he had worked 6 hours before the collision. Records for the previous few days, indicating working hours of between 11 and 13 hours per day, show he had the opportunity to take a reasonable amount of rest. Over the previous month of November, he averaged between 10 and 11 hours of work per day.

While his vessel was in the Kiel Canal, on the afternoon of 5 December, the master took the opportunity to rest. The canal pilot and helmsmen were on board and, in common with the practice on many vessels using the canal, the master felt confident that he could leave his chief officer and second officer to alternate monitoring the passage.

When *Arctic Ocean* left Brunsbüttel Locks, shortly before 2000 on 5 December, the master had been on duty for about 1 hour following this period of rest. In view of the brevity of this working period and his recent opportunity to rest, it is considered unlikely he felt seriously fatigued.

2.2.2 *Maritime Lady*

Over the night of Sunday 4/Monday 5 December, *Maritime Lady*'s master had the opportunity to sleep and be well rested for the start of his days work on the Monday. At the time of the accident, he had been awake since that morning but had not yet become exhausted or seriously fatigued. Once his vessel cleared Hamburg Port, and disembarked the pilot, he was fully employed navigating the vessel. He had not embarked a river pilot as, for a vessel the size of *Maritime Lady,* he was not required to do so.

However, between departing Hamburg at 1455 and the collision shortly before 2000, the master was the only bridge watchkeeper. These 5 hours were spent on navigational tasks that, at times, required reasonably intense concentration. While such duties may be performed for 5 hours without inducing serious fatigue, they are, nevertheless, tiring if performed without respite.

By the time *Maritime Lady* was approaching Brunsbüttel, her master was undoubtedly feeling tired from his 5 hours on the bridge. While not classifying his state as being seriously fatigued, his tiredness might have been sufficient to have resulted in poor judgment and decision making.

2.2.3 *Sunny Blossom*

Unlike the masters of *Arctic Ocean* and *Maritime Lady,* the master of *Sunny Blossom* did not need to stand a navigation watch. He had a chief officer, second officer and third officer each following a 'conventional' 4-on/ 8-off watchkeeping pattern. The provision of sufficient watchkeeping officers to allow the master to be free of watchkeeping duties ensures, in the absence of emergencies, he has no need to work excessive hours. This is supported by his records of working hours over the few days before this incident.

*Sunny Blossom'*s pilot had been called for duty at 1800 on 5 December. He drove to the station at Brunsbüttel and was feeling rested and fit for the work ahead of him. Based on his own judgment, and that *Sunny Blossom* was to be the first pilotage he was to undertake during this period of duty, it is considered the pilot was not suffering from fatigue.

2.3 APPROACH BETWEEN *ARCTIC OCEAN* AND *MARITIME LADY*

At 1941, from inside Brunsbüttel Locks, *Arctic Ocean'*s master made the mandatory report to Brunsbüttel VTS giving his vessel's details and destination. He did not report again at 1953 as his vessel transited through the exit basin before entering the river, nor did he receive a report from VTS alerting him to traffic movements in the river. Had such an exchange taken place, it is possible that *Arctic Ocean'*s master would not have made his subsequent misjudgment.

The first visual contact between the two vessels was, according to *Arctic Ocean*'s master*,* just as his vessel was leaving the lock basin. His estimate of the range was 1½ miles and he saw the lights of *Maritime Lady* in line with buoy 60. Although this bearing was probably correct, radar records show the range was nearer to ¾ mile; half of that estimated. This was a significant misjudgment.

The first VHF contact between *Arctic Ocean* and *Maritime Lady* was about 90 seconds before their collision, when they were slightly less than 4 cables apart and with a combined closing speed of 15knots.

Waterway regulations gave *Maritime Lady* right of way, as she was the vessel in the fairway. However, the immediate response of *Maritime Lady*'s master to the first VHF call from *Arctic Ocean,* was to indicate he wished to pass 'red to red'. That could only be achieved by *Arctic Ocean* crossing the bows of *Maritime Lady. Arctic Ocean*'s master interpreted this reply to mean *Maritime Lady* was conceding the right of way, and that he was content for *Arctic Ocean* to pass ahead of his vessel before joining the eastbound fairway.

The decision of *Maritime Lady*'s master to spontaneously offer a 'red to red' passing appears inexplicable. Unfortunately, it has not been possible to question him about these events and, without his perception of the situation, the reasons for him reaching this decision must remain obscure.

Part way through this manoeuvre, *Maritime Lady*'s master reported he was having problems with his rudder, or steering. However, by that stage, collision was probably inevitable. Again, without the master's recollection of the reasons

he reached this conclusion, and with post accident examination of the vessel's steering system identifying no clear fault, it is impossible to offer fair comment on the merits of this claim. However, it is noted that this was the master's first loaded passage on *Maritime Lady*, and her characteristics might still have been strange to him. The possibility also exists that, in his potentially 'tired' state on a 'new' vessel, the master made an error when he changed from autopilot to hand steering that resulted in him losing control.

2.4 RIGHT OF WAY

The COLREGS make provision for local special rules, made by an appropriate authority to have primacy. Therefore, the local regulations governing right of way when navigating inland waterways in Germany, overruled the provisions of the COLREGS. However, the actions of *Maritime Lady*'s master suggest he was unaware that his vessel had the right of way under German regulations, and so was applying the COLREGS to his encounter with *Arctic Ocean.*

As he approached Brunsbüttel Locks, *Maritime Lady*'s master observed there were vessels leaving the locks and about to enter the river. He changed course to port, towards the middle of the river, with the aim of making space for the vessels entering the main fairway. It would appear this course change was about 5° to port, and radar recordings show that *Maritime Lady* started to swing to port and to the south, towards the centre of the fairway, as she approached the Brunsbüttel area.

The master's next action was in response to the VHF call from *Arctic Ocean,* when he spontaneously proposed that the two vessels should pass 'red to red'; or port side to port side. The master saw that *Arctic Ocean* was underway, and to achieve a 'red to red' passing manoeuvre would have to cross ahead of his vessel. To facilitate his proposed course of action, the master therefore attempted to turn *Maritime Lady* to starboard and pass round the stern of the other vessel.

Had *Maritime Lady* been the 'give-way' vessel, this would have been an appropriate manoeuvre. Suggesting such a course of action, therefore, could indicate that the master considered *Maritime Lady* to be the 'give-way' vessel in a crossing situation (COLREGS, Rule 15), rather than the 'right of way' vessel as defined by local rules.

Had he been aware that his vessel had the right of way, and thus needed to take no immediate action when he saw the two vessels about to leave the locks, *Maritime Lady*'s master might not have taken the actions he did. This included indicating to *Arctic Ocean*'s master that he could pass ahead of *Maritime Lady* – something his vessel was unlikely to achieve given the range between the two vessels and their closing speed at the time they first made VHF contact. Without this encouragement, *Arctic Ocean*'s master might have initiated more effective avoiding action at an earlier stage.

Whether any of the above speculation in any way reflects *Maritime Lady*'s master's thinking, is not known; he has declined to offer his version of events in an interview with investigators.

2.5 SAILING INSTRUCTIONS

Maritime Lady carried publications and charts issued by the UK's Hydrographic Office. Admiralty Sailing Directions (North Sea East Pilot), Chapter 7, gives guidance to mariners on navigation on the Elbe River, including Hamburg and the Kiel Canal.

If read in isolation, this Chapter can give a misleading definition of a 'right of way' vessel. Only Section 7.15 in this Chapter discusses 'right of- way', and then in the context of a vessel restricted in her ability to manoeuvre, as defined in the COLREGS. Chapter 7 notes the requirement for right-of-way vessels to claim their 'right of way' by reporting to the appropriate VTS centre, and by exhibiting the lights and shapes prescribed by Rule 27(b) of the COLREGS. The master of *Maritime Lady* did not, and had no reason to do this, and had he read Chapter 7 only, without noting the wider provision in Chapter 1, he would have been unaware that transiting vessels routinely had 'right of way' over vessels joining the fairway.

The UK's Hydrographic Office should review its guidance to remove possible confusion on 'right of way' in the Elbe River.

2.6 USE OF VHF

Records of a number of collisions and near collisions show that inappropriate use of VHF has contributed to many of the incidents.

The initial VHF contact between *Arctic Ocean* and *Maritime Lady* had the potential to cause confusion. Although the master of *Arctic Ocean*, when first calling *Maritime Lady,* identified his own vessel and the vessel he was calling, the 'reply' he heard contained no vessel identification. This reply was simply 'red to red', and was assumed by *Arctic Ocean*'s master as coming from *Maritime Lady*.

In the event, this assumption proved correct but, in making it, the master of *Arctic Ocean* was committing himself to a course that conflicted with the local rules for right of way in a fairway. Had the 'red to red' message been proven spurious or been made by another, unidentified vessel or station in the area, the two vessels would have approached each other with a totally incorrect impression of the other's intentions.

These were fundamental procedural errors made by two professional seamen who, almost certainly, knew better. The only extenuating factor that can be offered is that both were, probably, experiencing a brief period of intense workload.

2.7 MASTERS' WORKLOADS AND MANNING

2.7.1 *Arctic Ocean*

The recorded working hours of the master of *Arctic Ocean* are typical of a master who also keeps a watch, and they do not suggest that he was seriously fatigued at the time of the collision.

He had, however, just embarked on a passage from Brunsbüttel to Hamburg, along the Elbe River and was to perform pilotage duties for this passage, as permitted by his PEC.

Leaving the locks, he was alone on the bridge. Normal procedure called for the chief officer to go to the bridge once his forward mooring party was no longer required. On this occasion, the chief officer had become wet while forward, and he had requested permission to change his clothes before going to the bridge. In agreeing, the master committed himself to being alone on the bridge for, possibly, the most difficult part of the river passage; entering the river and crossing the westbound fairway to enter the eastbound fairway.

The master's decision to allow the chief officer to delay his arrival on the bridge was critical and was probably motivated by concern for the chief officer's sodden condition. The master's primary responsibility was, however, the safety of his vessel. The chief officer should have been told to proceed to the bridge and delay his change of clothes until the vessel was safely established in the eastbound fairway. This would have taken 10 minutes at the most.

The consequence of this decision was that the master had the assistance of no other officer, crew member or pilot as he manoeuvred his vessel into the river. He had to handle engine controls, steering, VHF and, critically, attempt to keep a good lookout both visually and by radar; all at a time when he was entering potentially busy waters. This was an unreasonable workload to take on and made a significant contribution to him making at least one critical misjudgement; the range of *Maritime Lady*.

It must be concluded that *Arctic Ocean*'s master did not use the manpower available to best effect, with the consequence that he was left attempting to perform too many tasks at a safety critical time. A similar observation about his management of resources could be made about his vessel's earlier collision with a fishing vessel on 17 November 2005, in The Baltic, and points to a need for him to be given additional training.

2.7.2 *Maritime Lady*

On *Maritime Lady*, the master's situation was slightly different. He, too, was alone on the bridge, but he did not have the benefit of being able to call on another deck officer to assist during the river passage.

The only other deck officer on board was the chief officer. During the river passage from Hamburg, he was given the opportunity to rest in preparation for the watch he was to start once the vessel reached the North Sea. For him to have done otherwise, could have caused him to be improperly rested for his watch and, ultimately, exceed his statutory hours of work limit.

Maritime Lady's manning levels thus resulted in the master undertaking the river passage alone, albeit with the company of a lookout AB. Whatever the ability of the AB, he was on the bridge for lookout duties and was no substitute for a properly qualified deck officer. Notwithstanding the likely limitations of using the AB lookout to assist the master, this AB was also given other duties such as checking all was secure on deck, which he was doing at the time of the accident.

Another reason the master was alone on the bridge was that *Maritime Lady,* being less than 90m LOA, was not required to take a pilot for the river passage. Had a pilot been required, then it is reasonable to suppose that the pilot would have had either the master or the chief officer on the bridge with him. Thus, two qualified navigators would have been on the bridge, offering assurance that neither was overloaded.

The master of any vessel, carrying only a master and one other deck officer, is likely to be faced with a dilemma when his vessel enters pilotage waters where his vessel is not required to take a pilot. Either the vessel is navigated, often in busy and restricted waters, by just one officer or both officers are on the bridge for the passage and they risk exceeding the allowable hours of work. Neither is desirable.

Increased manning

A large number of vessels operate in European water with only two deck officers. Studies of bridge watchkeeping practices and manning, completed by MAIB and the Swedish Marine Administration (SMA), identified that fatigue and manning levels are inextricably linked. MAIB concluded that vessels operating with only two bridge watchkeepers were of particular concern.

The MAIB study made a recommendation to the International Maritime Organization (IMO), via the UK's Maritime and Coastguard Agency (MCA), to review the guidelines on manning levels to ensure that vessels over 500gt have a minimum of master plus two navigating officers on board. As a result, a joint proposal was made to the Maritime Safety Committee (MSC) to address the issue of manning. At the time of this investigation, this proposal is still under consideration.

Should the proposal result in fewer vessels operating with only a master and mate as her navigators, their workload and fatigue levels should be reduced. However, extra manpower alone may not enhance safety. This is demonstrated by the events on *Arctic Ocean* as she entered the Elbe River on 5 December 2005. She had a master plus two deck officers but, at a safety critical stage, only one navigator was on the bridge. Should increased manning levels indeed result of the MCA's proposal to IMO, this manpower will still need to be used correctly.

Alternative manning

Coastal States are able to make their own regulations and requirements to ensure the safety of shipping in their waters. Germany already has specific regulations covering many aspects of navigation, pilotage and reporting on her waterways. The introduction of local regulations to require two navigators on a vessel's bridge while transiting pilotage waters has the potential to prevent the type of situation in which the masters of *Maritime Lady* and *Arctic Ocean* found themselves; alone on the bridge, in busy waters, attempting to carry out too many tasks.

This requirement, which is very similar to present requirements for smaller vessels on the Kiel Canal, would have no impact on vessels that are required to carry a pilot. For these vessels, the ship's navigator and the pilot could be seen as fulfilling the requirement. Vessels that presently are not required to carry a pilot are the smaller vessels which are more likely to be operating with only two deck officers. Using both deck officers on a long river passage may result in hours of work being exceeded. The vessel would, therefore, be compelled to take a pilot to satisfy both local and international requirements.

Vessels with PEC holders on board might need to be monitored by the Administration under this regime. However, the existence of this requirement would be a powerful reason for masters and owners to comply.

2.7.3 Lookouts

During the few minutes before the collision between *Arctic Ocean* and *Maritime Lady*, neither vessel had a lookout on its bridge. The requirement that a look-out be used, particularly during the hours of darkness, is well set out and known to seafarers. However, numerous investigations of collisions and groundings show that these requirements are frequently not implemented.

Arctic Ocean had no look-out on her bridge as she left Brunsbüttel Locks even though she had sufficient manning available. Again, the failure of her master to use the manpower available is a reflection of his ability to properly utilise his staff.

The master of *Maritime Lady* had fewer crew to call on for look-out duties. However, an AB was delegated as the duty AB and was performing look-out duties until he was given the task of checking the deck area as a last inspection before the vessel reached the sea. While the master's aim of satisfying himself that his vessel was safe to proceed to sea was a worthy one, his timing and choice of the duty AB to carry out the inspection was unfortunate and unnecessary.

Firstly, by selecting the duty AB he lost the bridge look-out, which conflicted with the requirement that the look-out be given no other duties. The second AB was awake, available and could have been used for the final inspection of the deck area.

Secondly, by instructing his duty AB to leave the bridge as the vessel approached Brunsbüttel locks he lost important assistance at a stage where his vessel was approaching potentially hazardous waters.

Thus neither master used his crew to best advantage, resulting in no look-out being on the bridge of either vessel at the time of the collision. This points to a need for the vessels' owners to offer guidance to their masters on the optimum use of bridge manpower.

2.8 VESSELS ENTERING THE ELBE FROM BRUNSBÜTTEL LOCKS

The German Traffic Regulations for Navigable Waterways obliges any vessel over 50m LOA leaving Brunsbüttel Locks to enter the Elbe River, to report into Brunsbüttel Elbe Traffic before she leaves the locks.

Not contained in these or other regulations is the requirement, imposed in 1995 following two accidents in the area, for Brunsbüttel Elbe Traffic to inform all traffic leaving the locks of traffic on the Elbe River, insofar as it is relevant to filtering into the traffic on the river. This requirement remains a stand-alone letter, despite a number of revisions to the regulations since 1995.

Because it was not included in the regulations, it was unlikely that the requirement for the VTS to brief vessels in the locks would have been well known to the masters of vessels who were not frequent users of the canal. However, pilots and PEC holders were probably accustomed to these reports being given to vessels. Indeed, *Arctic Ocean*'s master has a recollection of receiving a report of no traffic in the river at the time he reported to Brunsbüttel Traffic Control, although VHF recordings show he was not actually given such a report.

The lack of a report about river traffic might result in the assumption that there is no river traffic. It is notable that the master of *Arctic Ocean* unconsciously made this interpretation. As the VTS operator is given the option not to make a report if there is no traffic, or if he considers a report is unnecessary, uncertainty may result. Masters, pilots and safety would be better served if every vessel was given a river traffic report by the VTS before, or as she left, Brunsbüttel Locks; even a report of zero traffic would be of value in removing possible doubts.

2.9 *SUNNY BLOSSOM*'S COLLISION WITH THE WRECK OF *MARITIME LADY*

2.9.1 Overview

Sunny Blossom, a vessel known to have sluggish performance in shallow water and at low speeds, was allowed to depart Brunsbüttel Locks into a strong ebb stream, to pass the unsecured wreck of *Maritime Lady* lying to the south of a channel buoy (No 58a) that had a history of being struck by vessels attempting the same manoeuvre at similar states of the tide. The only additional control measures put in place for *Sunny Blossom*'s passage were the illumination of the wreck by a rescue vessel, and the requirement for her to receive the services of a shore-based radar pilot. In the event, *Sunny Blossom*'s performance was insufficient to overcome the effects of the ebb stream, and she struck the wreck a glancing blow as she passed. As a result of the collision, *Sunny Blossom* lost propulsion and she subsequently grounded.

This investigation has found there were two principal contributing factors to this accident:

- That neither the pilot nor the VTS authorities had been informed that *Sunny Blossom*'s performance had been reduced by the cropping of two of her propeller blades.
- That the VTS authorities did not apply sufficient safety control measures before allowing *Sunny Blossom* to leave the lock.

2.9.2 Reopening of the Brunsbüttel Lock

At 2100, the wreck of *Maritime Lady* had been in a position 200m south of buoy 58a for about 40 minutes. A strong ebb stream was still running, and the wreck had not been secured to a tug, or otherwise. During this time, the VTS Supervisor (NvD) twice contacted the on-scene tug, *Bugsier 15*, first asking if it would be possible to tow the wreck to the south then, subsequently, north out of the fairway. The master of *Bugsier 15* declined, stating it was not possible to tow *Maritime Lady* as she had capsized, her superstructure was aground, and only her bow was showing above the water.

Although the tide was obviously falling, there was no certainty that the wreck was not going to move again and, as she was on the edge of the westbound fairway, this posed a risk to traffic. The requests to the tug show that this risk had been identified by the NvD. The level of risk, however, was neither known nor had it been completely evaluated and, once the rescue vessel *Hermann Helms* was on scene, *Bugsier 15* was released, leaving the wreck still unsecured.

Any vessel leaving Brunsbüttel Locks to head west, needed to pass the wreck, and could do so only by passing through a channel that was reduced in width by 200m, from about 750m. The effect was similar to moving buoy 58a south by 200m.

Before buoy 58a had been placed in position, there had been a tendency for vessels leaving Brunsbüttel Locks to drift into the Nordwest Roads, an anchorage area for vessels waiting to enter the canal. Buoy 58a had been placed in this particular position to provide shipping with an additional reference point for avoiding the anchorage area, though the buoy itself was often struck by passing traffic.

The frequent damage to the well charted buoy 58a, from vessels departing Brunsbüttel Locks to the west, might have indicated the difficulty a vessel on similar passage could have in clearing the wreck, particularly when a strong ebb stream was running. It appears that even had the lessons from these incidents been identified, they had not been fully incorporated into the operational guidance to VTS operators.

Shortly after arriving at Brunsbüttel, the pilot designated for *Sunny Blossom* was told of the collision between *Arctic Ocean* and *Maritime Lady*, and that the wreck of *Maritime Lady* was lying 200m south of buoy 58a and was well illuminated. He boarded *Sunny Blossom* at 2038 and exchanged information with the vessel's master. Shortly before 2100, he was advised that the vessel could leave the lock, and that the 'radar pilot' system would be manned for advice on VHF Channel 62; Brunsbüttel Radar 1.

By taking *Sunny Blossom* out of the locks, it would appear this pilot was content with the decision that was made. However, he was not consulted on the decision to re-open the Brunsbüttel Lock and played no role in the decision making process. Since the pilot was highly experienced, and it was his responsibility to navigate the first vessel out of the locks past the wreck of *Maritime Lady*, it appears illogical that, of all the people involved, he was one of the key people whose opinion was not sought.

In allowing *Sunny Blossom* to leave the locks, the only condition on her movement was that she was required to make use of the 'radar pilot' system. Since the wreck of *Maritime Lady* was well illuminated and visible to *Sunny Blossom*'s bridge team, this requirement had no positive value for the vessel. In fact, the purpose of this control measure was to relieve the workload on the NvD, by ensuring the continuous observation of *Sunny Blossom* by the radar pilot.

The hazard posed by contact with the wreck was significantly greater than of hitting buoy 58a. It appears, however, that this increased level of risk was not fully recognised and assessed before the locks were re-opened to traffic. Had the levels of risk been correctly assessed, then suitable control measures could have been imposed. Possible options might have included:

- Total safety of all traffic, by closing the canal and river until the wreck was removed.
- General risk reduction, by securing the wreck and imposing a minimum safe passing distance.
- Safety to vessels leaving Brunsbüttel Locks, by closing the locks until the ebb stream had eased.
- Specific safety to *Sunny Blossom,* by providing her with tug assistance.

Each would have been a control measure of sufficient robustness to reduce the risk of collision to an acceptable level.

It would be unreasonable to be critical of the VTS staff involved with making the decision to re-open Brunsbüttel Locks. They are all highly qualified and experienced mariners, well able to make sound judgments within a system of working aimed at producing high standards of safety. However, the safety system they were operating did not provide them with guidance on the appropriate control measures to be implemented.

2.9.3 The Federal Waterways and Shipping Administration[1] normal operating and Emergency Policy

The Waterways and Shipping Administration's (WSV's) safety management philosophy was to allow responsible employees discretion to operate freely within well defined parameters to achieve specified objectives. The objective specified for the VTS, and in particular the NvD, was to ensure the 'safe and smooth flow of the traffic' on the waterways.

Personnel selected for NvD duties were experienced marine professionals who had undergone additional specialist training in VTS operations, shipping safety and emergency response. Their margins of discretion were then defined by a framework of administrative provisions, procedures, ordinances and alarm plans.

In order to assist NvDs manage emergency situations, a computer-based Emergency Reporting and Alerting Plan had been drawn up for the WSV, in this case for WSD North and VTS Brunsbüttel. The purpose of the plan was

[1] For structure of The Federal Waterway and Shipping Administration see Annex 1

to anticipate risks, then assess their likelihood and possible consequences. Through consideration of possible risks before they resulted in an accident, the opportunity was taken to introduce systems and procedures to minimise the risks, and identify criteria that operators needed to consider in the high pressure period following an accident. The plan covered a large number of possible serious accidents and natural disasters, and defined: the initial actions to be taken; alerting procedures; and the communications plan.

In accordance with WSV's policy, the plan did not include specific further steps required after initial actions had been taken to avert or mitigate the imminent danger. Instead, NvDs were allowed the freedom to take whatever action they determined necessary, within their operating framework, to ensure the safe and smooth flow of traffic and the re-establishment of normal operation. Accordingly, VTS personnel were not provided with criteria or guidance to assist them make significant decisions, such as closing the locks or directing a vessel to accept tug assistance.

This method of managing safety proved successful for day to day operation of the German navigable waterways. However, the Kiel Canal and Elbe River are of crucial significance as main navigable waterways, and the combined objective of both a 'safe' and 'smooth flow' of traffic has the potential to present VTS staff with a conflict, especially in emergency situations where a restricting action serving the safety of traffic might, under certain circumstances, interfere with its smooth flow. As currently constructed, the safety system leaves this conflict to be resolved by the NvDs without providing them with guiding principles or criteria to apply.

No clear procedure or guidance was followed in making the judgment to re-open the locks to traffic. Instead, reliance was placed on individual VTS staff making a judgment on the safety of resuming vessel movements based on their own professional knowledge and experience, rather than on pre-considered and reasoned criteria.

As there will be unavoidable differences in the experience and knowledge of the individuals making judgments in an unfamiliar situation, leaving safety critical decisions to them has the potential to produce inconsistent and, in the extreme, undesirable results. Personal characteristics while under stress may also affect individuals' decision making ability when faced with emergency situations.

2.9.4 International Marine Safety Management

The international shipping industry is required to apply the principles of safety management to its operations. The IMO's International Management Code for the Safe Operation of Ships and for Pollution Prevention (The ISM Code) has been applied to seagoing vessels over 500gt since July 2002. The ISM Code was introduced following a number of marine accidents where inadequate management of safety was identified as a significant cause. The important facets of any safety management system operating under the ISM Code relevant to this accident are: emergency preparedness; the learning of lessons

from accidents; the appointment of a Designated Person, with responsibility and authority for monitoring safety and pollution prevention operations; and, the independent audit of procedures.

Emergency Preparedness. While WSV's emergency response plan ably catered for initial emergency responses, the plan did not provide guidance on the restoration of normal operations, nor guidance on how an NvD should balance the potentially conflicting aims of 'safety' and 'smooth flow'.

Learning from previous accidents. The ISM Code requires, *'the inclusion of procedures ensuring that non-conformities, accidents and hazardous situations are reported…, investigated and analysed with the objective of improving safety and pollution prevention'*. Such analysis of the buoy 58a collisions that had taken place had focussed on the movements and actions of ships and their masters. The role and activities of VTS personnel appear not to have been considered during these investigations. Additionally, the investigations did not result in guidance to VTS staff on controlling vessels requiring to transit the current shear zone south of the Brunsbüttel Locks during emergencies in that area.

Appointment of a Designated Person. Following the collision between *Arctic Ocean* and *Maritime Lady*, the VTS manager was notified of the accident and attended the VTS Centre. His role, however, appears not to have included providing advice to the NvD to assist him with his post-incident decision making or actions.

Independent audit. Following the accident, WSD North conducted its own post accident enquiry. The results of this enquiry were that no blame should be attached to any VTS staff, and that no procedures needed amendment, although it is unclear whether the enquiry reviewed these areas or restricted itself to the actions of the vessels involved. The results of this enquiry have not been offered to the investigators for independent review.

The ISM Code does not apply to the activities of VTS organisations, and there is no obligation for WSV to comply with it. However, the principles espoused in the ISM Code have been universally adopted by all international shipping over 500gt since July 2002, as well as by many vessels under that size or engaged solely on internal voyages. It sets a widely recognised international standard, and it is recommended that WSV review, and where appropriate adopt the principles of the ISM Code.

2.9.5 Actions on board *Sunny Blossom*

The steps taken by the pilot and master of *Sunny Blossom* as she entered the river from the lock basin might appear reasonable. The engine was put to full ahead and full port helm applied, with the objective of taking the vessel to the south of the wreck and buoy 58a before heading west to the North Sea.

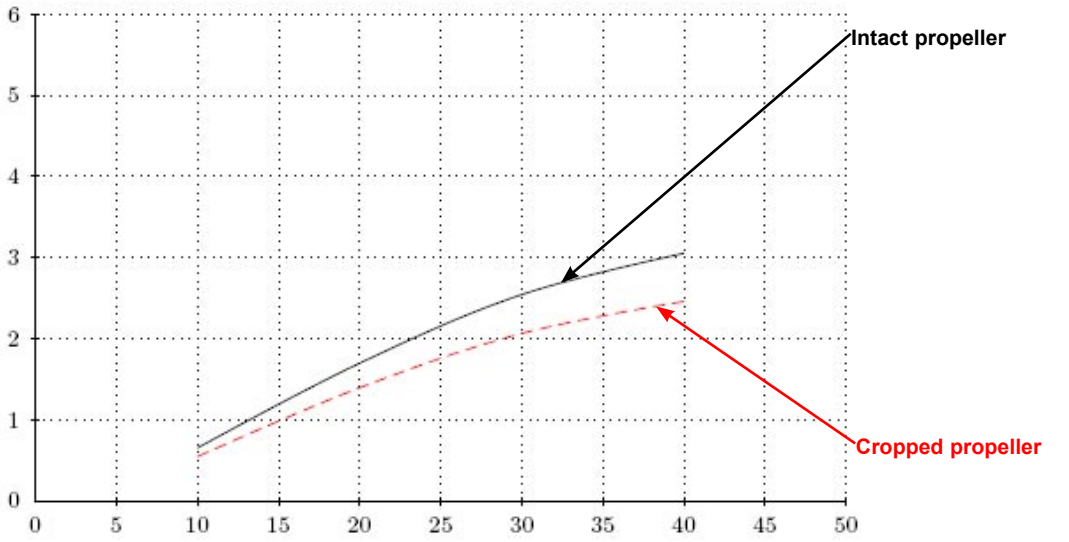
To better understand why these actions did not produce the results anticipated, two independent studies were commissioned[2 and 3]. These considered the following factors and data:

- the inherent manoeuvring behaviour of the vessel
- the effects of cropping two propeller blades
- the effects of shallow water
- the effects of the tidal stream
- a Hydrographic survey of the river, dated October 2005.

The examinations came to several conclusions:

- The vessel's installed power of 5150kW is in line with expectations for a ship of this size, and the hull form is not especially heavily loaded.
- The rudder area, of approximately 1.53% of the product of LBP and draught is at, or slightly below, the lower limit of acceptability.
- The propeller's slipstream covers about 83% of the rudder span so that not all the rudder receives its benefit.
- Cropping of two propeller blades reduced thrust at a given shaft speed. At 90rpm the calculated reduction was from 375kN to 275kN.
- Cropping of two propeller blades reduced the slipstream over the rudder and transverse rudder force. At 90rpm (full ahead) and 30° of rudder, the calculated reduction was from 254kN to 205kN **(see Figure 17)**.
- Water depth/draught ratios of the order of 1.3 to 1.4 in the river would also affect the vessel's steering, but not as much as in the shallower lock basin, and a reasonable response would be expected.

Figure 17



Rudder forces at 90rpm

[2] Investigations into the manoeuvring behaviour of the tanker *Sunny Blossom*. Technical University of Hamburg, Institute for Ship Design and Ship Safety. Prof. Dr Ing Stefan Kruger and Dipl Ing Lars Greitsch.

[3] Hydrodynamic aspects of the collision between the *Sunny Blossom* and the wreck of the *Maritime Lady*. BMT Sea Tech Ltd. Gosport, Hampshire. Dr Ian Dand.

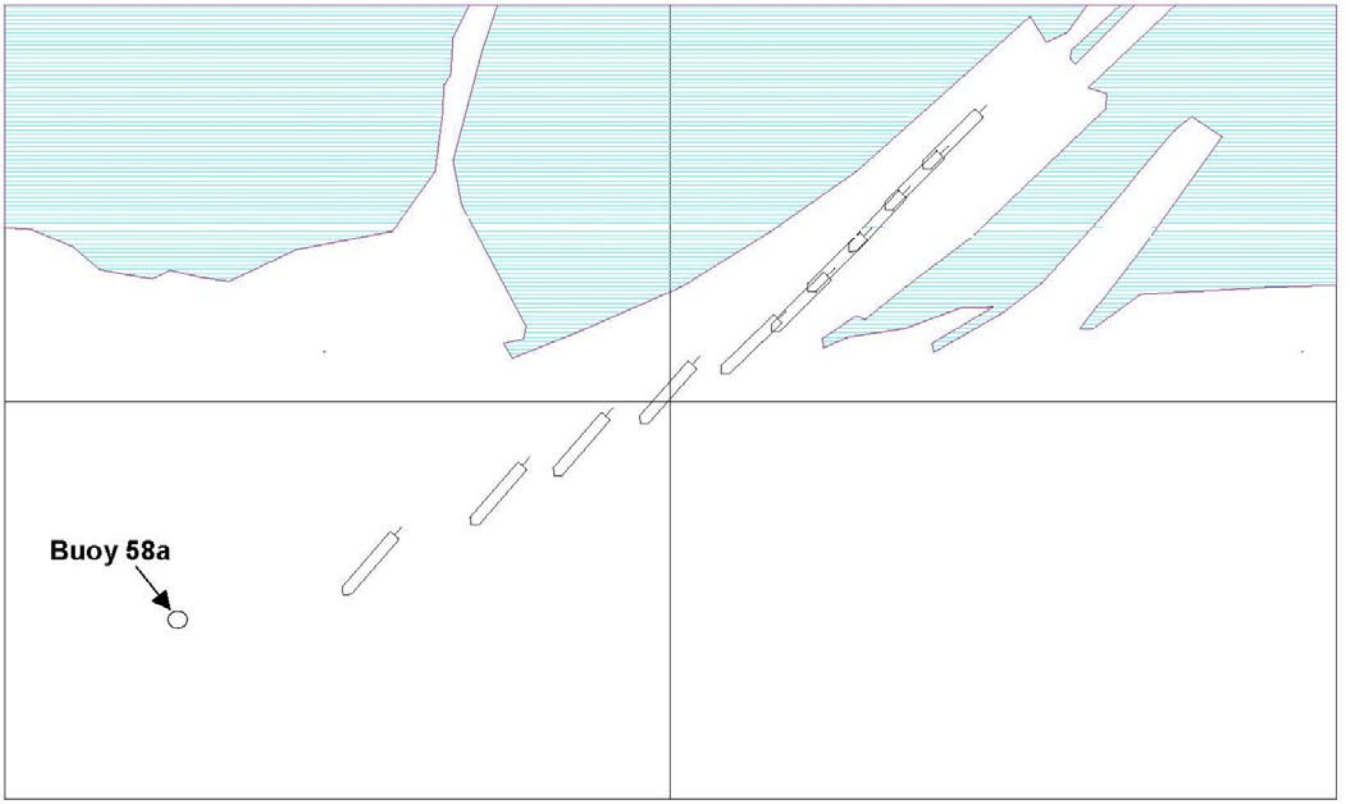
Overall, the studies suggested that *Sunny Blossom*'s sluggish response to her rudder was due in part to insufficient effective rudder area, in part to the coverage of the rudder by the propeller slipstream and in part to the reduced strength of the slipstream caused by the cropped propeller blades.

Most of the vessel's characteristics that contributed to her poor response to the helm, had been extant since build; the single exception being the cropped propeller blades. One of the consequential effects on the rudder was a reduction in turning force from 254kN to 205kN, or about 18%. This was a significant reduction that substantially reduced the vessel's ability to turn.

In addition, at a time when good acceleration and rudder response would have been invaluable to tackle the current shear caused by the ebb stream in the river, the shallow water in the lock basin would have added to the already sluggish response of the vessel in both steering and acceleration.

Sunny Blossom, therefore, moved at a rather slow speed when she passed through the current shear zone at the exit from the basin, and appears not to have picked up much speed through the water before hitting the wreck of *Maritime Lady.* Because of her slow acceleration, a more easterly heading, before she left the lock basin, would have been necessary to allow full port helm to counter the tidal shear due to the ebb **(see Figure 18)**.

Figure 18



Sunny Blossom track reconstructed from AIS information

While, individually, many of these factors might be familiar to mariners, their cumulative effect would be difficult to predict. It is common, therefore, for mariners to build in the maximum possible margin of safety to any operation or manoeuvre where a number of uncertainties exist.

It had become acceptable for passing distances off buoy 58a to be small, as demonstrated by its history of damage from contact with vessels. However, once the hazard of the buoy was replaced by that of the wreck of *Maritime Lady,* a much more substantial obstruction, the acceptable passing distance should have been substantially increased. If any doubt existed that this could be achieved, the manoeuvre should not have been attempted until more favourable conditions returned, or other suitable control measures were in place, for example imposing tug assistance.

To make a decision such as this, in the face of possible pressure from vessel operators, masters and senior managers, places an unfair burden on VTS staff and pilots. They require the support of clear guidelines and measurable criteria against which they should make their judgments. A formal safety management system should cover the necessary issues, and the local maritime authorities, responsible for VTS operations at Brunsbüttel, should consider introducing such a system (see 2.9.4).

One part of such a system might be a procedure to ensure that all safety related information is transferred between VTS and vessels. Not only should safety information be supplied to masters of vessels, but VTS and pilots should also be expected to receive any information that could conceivably influence their decision making.

Sunny Blossom's pilot could reasonably have expected to be given information about the vessel's cropped propeller. Studies made following the accident clearly show that *Sunny Blossom* would almost certainly have been able to avoid the wreck of *Maritime* Lady if her propeller had not been previously cropped, although the margin of safety might still have been minimal. While *Sunny Blossom*'s master did not consider the propeller's condition to be significant, and could not have given the pilot any information on the effect on performance of the cropped blades, a 'Condition of Class' had been imposed by the vessel's classification society, Det Norske Veritas. This alone was sufficient reason for the pilot to have been told of the propeller's state. The owners of *Sunny Blossom* should review their safety management system to ensure masters, and thus subsequently pilots, are given all information about a vessel's condition that could conceivably affect her performance under pilotage.

The findings and comments made during the TSB investigations of *Sunny Blossom'*s groundings during 1999 and 2000, particularly with regard to the vessel's response to the helm, should have alerted her owners to the potential effect on the vessel's behaviour of cropping the propeller. It is accepted the propeller was properly examined and assessed by a classification society, DNV, and judged safe for a limited period of operation. This assessment, however, considered only the integrity of the propeller, shafting and engine system, and required ship's staff to report any adverse vibration in service. Little or no obvious consideration was given to the effect of cropping on the propeller's

performance and vessel manoeuvring characteristics. For a vessel such as *Sunny Blossom,* having inherently sluggish handling, this was a critical omission. The vessel's owners should amend their safety management system to ensure the safety implications of conditions of class are fully assessed and, where judged necessary, introduce suitable risk control measures while the condition of class remains in place.

2.9.6 Grounding of *Sunny Blossom*

There can be no doubt that *Sunny Blossom* grounded on the south bank of the Elbe River because she had totally lost propulsion after her propeller struck the wreck of *Maritime Lady.* As she approached the riverbank, the master did let go an anchor in an attempt to arrest the vessel. Because she came to a stop shortly afterwards, it was concluded that this had been effective. However, sounding around the vessel, and later attempts to move her with a tug, showed this interpretation was incorrect and that she was lightly aground.

Her grounding is, however, understandable once she had lost power, and is of less interest than the causes of her colliding with the wreck of *Maritime Lady.*

2.10 BUOY 58A

Four recent incidents involving buoy 58a are significant to the collision of *Sunny Blossom* with the wreck of *Maritime Lady.* Three of these happened during 2005, the other in 2004, but each involved a vessel leaving Brunsbüttel Locks, to enter the Elbe River. Each vessel struck the buoy while turning west to the sea with an ebb stream in the river. In no case was the vessel significantly damaged, but the buoy was damaged.

Because each of these vessels was less than 90m long, none required a river pilot, so did not have one on board.

Full circumstances of these incidents are not known, but the frequency with which buoy 58a has been struck by vessels leaving Brunsbüttel Locks should have been a concern to the authorities. Lessons from these incidents might have influenced decisions made on 5 December 2005 following the collision between *Arctic Ocean* and *Maritime Lady.*

Each master of these vessels undertook his own pilotage out of Brunsbüttel Locks, and on entering the Elbe River found his vessel under the influence of the ebb stream. It is suggested that, had the ebb stream not been running, these collisions with buoy 58a would probably have been avoided.

Pilots operating in the Elbe River are, no doubt, familiar with the characteristics and effects of the tidal stream that can run across the exit basins from Brunsbüttel locks. However, not all vessels in the area have pilots on board, and the four incidents mentioned above clearly show how the masters of substantial vessels - all were over 80m length - can find the movements of their vessels significantly affected to an unexpected degree. This indicates a need for more details of the tidal stream in the area to be made available. Substantial work has been done on investigating the tidal streams of the Elbe River, the results of which, if presented in a suitable form, could be of significant value to river users. The authorities are recommended to make this data available, particularly for the area of the Elbe River south of Brunsbüttel Locks.

2.11 EMERGENCY ACTIONS

2.11.1 Shore units

The NvD duty officer at Brunsbüttel VTS was in an excellent position to observe the collision between *Arctic Ocean* and *Maritime Lady.* He quickly established whether there were any fatalities or injuries, and broadcast a “Mayday Relay” requesting all vessels in the area to assist.

The response to the “Mayday” was prompt and effective. The two locally based pilot launches were quickly on scene to recover all the crew from *Maritime Lady.* The nearest SAR helicopter, based on the island of Heligoland, about 20 minutes flying time away, was not tasked. All rescue activities were complete by 2020, comfortably within the night time notice of takeoff required by this helicopter. While, in retrospect, this might be a justification for not alerting the SAR helicopter, it is generally considered a sound principle to alert all units that may be required at the earliest possible stage. If events show these units are not required, they can be stood down. Nobody knew, or could have anticipated, how events would unfold at the time Brunsbüttel VTS broadcast the “Mayday Relay”. Had the SAR helicopter also been alerted at that time, the 60 minutes required for it to get airborne, would have been reducing, thus guaranteeing its earliest possible arrival on scene had it been required.

Formal co-ordination of the search and rescue measures was not considered necessary or carried out. The first units on scene were the two pilot boats which had recovered all persons at risk very quickly. This obviated the need for a formal co-ordination of SAR units.

Following her capsize, *Maritime Lady* drifted west until she came to rest just south of buoy 58a. While the wreck was drifting across the exit to the lock basins, Brunsbüttel Locks were closed to traffic. No traffic was allowed to enter the Elbe River from Brunsbüttel Locks for about 1 hour after the collision between *Arctic Ocean* and *Maritime Lady.* This was clearly an essential provision.

Once the capsized *Maritime Lady* had come to rest, by buoy 58a, *Hermann Helms* remained in the vicinity and illuminated the wreck. This made her clearly visible and no vessel, least of all *Sunny Blossom*, had any difficulty seeing the wreck.

2.11.2 *Arctic Ocean*

No general alarm was sounded on *Arctic Ocean* either before or after her collision. While this might be justified from a recognition that the vessel was not obviously in peril, the crew’s safety was not so certain.

A mooring party had been forward until the vessel began travelling along the lock’s exit basin. These men were out of sight of the bridge, hidden by the cargo of deck containers.

After the bow of *Arctic Ocean* hit *Maritime Lady* there could have been no certainty that all members of the forward party had cleared the area. Sounding the general alarm would have ensured a quick muster of the crew and any missing identified.

A number of accidents to vessels have been investigated by MAIB over recent years where the general alarm has not been sounded. Usually this has been a result of omission, rather than a conscious decision of the respective master; although they have frequently attempted to justify their action after the event.

Besides achieving an accurate crew muster, sounding the general alarm might have prompted *Arctic Ocean'*s master to consider using his rescue boat to assist the crew of *Maritime Lady.* It is acknowledged that the two pilot boats arrived on scene quickly, making it unnecessary to launch *Arctic Ocean*'s rescue boat, but having his crew mustered aft, and available to launch the boat, might just have caused him to consider its use.

2.11.3 *Maritime Lady*

It is apparent that the master gave a verbal instruction to abandon ship shortly after the collision, but because none of the crew, other than the engineers, recall hearing the general alarm, there must be some doubt as to whether it was sounded.

Efforts to launch the two liferafts were sensible, but were only partially successful. The starboard liferaft fully inflated and was available for boarding. However, the port liferaft, although thrown into the water, failed to inflate. This unit was not recovered after the incident, so it could not be examined to establish the cause of the failure. It is presumed that, as the chief officer launched both liferafts, the failure was not one of procedure. Had his procedure been incorrect, it is assumed neither liferaft would have inflated.

All the crew took sensible steps to ensure their survival. Each collected a lifejacket and donned warm clothing: either a survival suit or a well insulated, water resistant working suit.

2.11.4 *Sunny Blossom*

Immediately after his vessel hit the wreck of *Maritime Lady,* the master of *Sunny Blossom* sounded the general alarm. This was followed by his crew sounding tanks to identify possible damage. Apart from preparing the forward party to drop anchors, there was little more the master could have done; he was literally powerless.

2.12 POLLUTION HAZARDS

Following the capsize of *Maritime Lady,* her complete cargo was lost into the River Elbe. The rate of discharge into the river is not known, but was probably substantial once the hatch covers broke free.

Notwithstanding this large release of Potassium Chloride into the river in a comparatively short time, no reports have been received of any measurable damage to the environment or to marine life. This suggests available data, indicating it is not a hazardous substance but may adversely affect marine life, is correct.

No cargo was lost from *Sunny Blossom.* However, the minor plating damage on her starboard quarter suggests that a heavier contact in way of a cargo tank had the potential to open out that tank(s). The IBC Code specifies that a ship Type 3 is required for sea transport of Urea Ammonium Nitrate Solution. Type 3 ships are required to offer the minimum standard of protection to their cargo tanks. *Sunny Blossom* is a Type 2 vessel and so offered a greater level of protection against cargo tank damage than was required for the cargo carried.

The cargo carried on *Arctic Ocean* was all containerised and, although a number of containers held dangerous goods or pollutants, none was lost or damaged in the collision with *Maritime Lady.* The potential for loss of dangerous good from the containers on *Arctic Ocean* is considered to have been negligible.

2.13 POTENTIAL CONSEQUENCES

In reviewing the events and circumstances of this accident, it is evident that, had there been only small differences, the consequences could have been substantially different, and far less favourable than was the case.

In particular, the evacuation of *Maritime Lady* could so easily have resulted in one or more of the crew being swept away from the wreck by the strong ebb tide. Searching for a man in the water, in the dark and possibly a substantial distance from the vessel, would have been a far more difficult operation than was the case. Under such circumstances major SAR units, such as the helicopter, might have been necessary. To some degree. it was good fortune that the two pilot launches were nearby to respond to the “Mayday Relay” from Brunsbüttel Elbe Traffic.

While being undesirable, the total loss of *Maritime Lady’*s cargo into the Elbe River was also fortunate in the sense that it was not an aggressive pollutant. Had the cargo had different properties, with regard to its hazard to wildlife and water supplies, its loss into the river might have prompted a large-scale clean up operation.

Similarly, it was fortuitous that *Sunny Blossom’*s hull was not punctured and cargo, or heavy fuel oil, discharged. Again, the pollution clean up problems would have been substantial.

In the event, all these undesirable consequences were avoided. However, the margins between catastrophic and largely tolerable consequences were small and, to a degree, were the result of good fortune rather than sound safety management. The lessons learned from this investigation should be taken as an opportunity for the Elbe River authorities to enhance safety management procedures, such that the risk of another accident, with potentially more serious consequences, can be avoided in the future.

SECTION 3 - CONCLUSIONS

3.1 FINDINGS

3.1.1 *Arctic Ocean*

Arctic Ocean's master visually estimated the range of *Maritime Lady* was 1½ miles, when radar records show the range was nearer to ¾ mile; half of that estimated. This was a significant misjudgement. [2.3]

Arctic Ocean's master had the assistance of no other officer on the bridge as he manoeuvred his vessel into the river. [2.7]

The unreasonable workload undertaken by *Arctic Ocean*'s master*,* as he manoeuvred into the river, significantly contributed to him misjudging the range of *Maritime Lady*. [2.7]

Arctic Ocean's master had not properly used the manpower available, and this reflects on his ability to manage resources. [2.7]

3.1.2 *Maritime Lady*

By the stage *Maritime Lady* was approaching Brunsbüttel, her master's tiredness might have been sufficient to have resulted in poor judgment and decision making. [2.2]

Waterway regulations gave *Maritime Lady* right of way, as she was the vessel in the fairway. [2.3]

Maritime Lady's master*,* with only one other navigating officer on board, did not have the resources to operate with a second navigator on the bridge. [2.7]

Maritime Lady's bridge team was diluted during a crucial part of the river passage when the master sent the AB lookout to check the deck. [2.7]

3.1.3 *Sunny Blossom*

*Sunny Blossom'*s master did not consider the propeller's state to be significant and could not have given the pilot any information on the effect on the vessel's performance due to the cropped blades. [2.9]

Sunny Blossom would almost certainly have been able to avoid the wreck of *Maritime* Lady if her propeller had not been previously cropped. [2.9]

Sunny Blossom's sluggish response to her rudder was due to several factors, including: insufficient rudder area, limited coverage of the rudder by the propeller slipstream; reduced strength of the slipstream caused by cropped propeller blades. [2.9]

The launch *Hermann Helms* remained in the vicinity of *Maritime Lady to* illuminate the wreck, making her clearly visible to *Sunny Blossom.* [2.11]

3.1.4 VHF

There were fundamental VHF procedural errors made by the masters of *Arctic Ocean* and *Maritime Lady* that had the potential to cause confusion. [2.6]

3.1.5 VTS

Arctic Ocean's master has a recollection of receiving a report of no traffic in the river at the time he reported to Brunsbüttel Elbe Traffic, although VHF recordings show he was not given any report. [2.8]

At the time Brunsbüttel Locks were reopened to traffic, there was no certainty that the wreck of *Maritime Lady* was not going to move again. [2.9]

The pilot of *Sunny Blossom* was not consulted and played no role in making the decision to reopen Brunsbüttel Locks. [2.9]

The level of risk to traffic from the wreck of *Maritime Lady* was not recognised or assessed against predetermined criteria or following set procedure, before Brunsbüttel Locks were reopened to traffic. [2.9]

The hazard posed by contact with the wreck was significantly greater than of hitting buoy 58a. It appears, however, that this increased level of risk was not fully recognised and assessed before the locks were re-opened to traffic. [2.9]

The response to the "Mayday Relay" broadcast by Brunsbüttel Elbe Traffic was prompt and effective. The two locally based pilot launches were quickly on scene to recover all the crew from *Maritime Lady.* [2.11]

The decision to prevent traffic entering the Elbe River, from Brunsbüttel Locks, for about 1 hour after the collision between Arctic *Ocean* and *Maritime Lady,* was essential. [2.11]

3.1.6 Other

Chapter 7 of the Admiralty Sailing Directions, North Sea (East) Pilot, may give a misleading definition of a right of way vessel in the Elbe River. [2.5]

Further details of tidal streams in the Elbe River at Brunsbüttel need to be made publicly available. [2.10]

SECTION 4 - ACTION TAKEN

WSD North has taken the following actions:

1. The NvD at VTS Brunsbüttel has been provided with an additional AIS terminal displaying the area in front of Brunsbüttel.

2. WSA Cuxhaven has been tasked to investigate the provision of appropriate and continuous tidal information to shipping in the NOK district. The results of this investigation should be submitted to WSD by the end of the first quarter of 2007.

3. WSA Cuxhaven has been tasked to request that the Federal Marine and Hydrographic Agency includes more information on tidal currents and cross currents for the region in front of the Brunsbüttel Locks in the updated North Sea Pilot – Eastern Part.

4. The case of "*Maritime Lady/Arctic Ocean/Sunny Blossom*" will be included in basic and advanced training, and will be incorporated into VTS training simulations as an additional emergency scenario.

5. WSAs Cuxhaven and Hamburg, in co-operation with the Elbe Pilots Association, will review and as necessary amend the requirements for, and examinations of, PECs.

SECTION 5 - RECOMMENDATIONS

The owners of *Arctic Ocean* and *Maritime Lady* are recommended to:

2007/101 Provide guidance to masters, on the need to adopt manning levels appropriate to their area of navigation, taking into account the increased risks of grounding and collision inherent to navigating in pilotage waters.

If appropriate, consider offering masters a period of suitable training in the effective use and management of bridge personnel, teams and resources.

The United Kingdom's Hydrographic Office is recommended to:

2007/102 Review the sections of its 'Admiralty Sailing Directions' (North Sea (East) Pilot) covering the Elbe River, with a view to removing any possible ambiguity in the wording that sets out the right of way of a vessel in a fairway.

The Federal Ministry of Transport, Building and Urban Affairs is recommended to:

2007/103 Review, in light of its ongoing PEC re-assessment, the minimum number of navigation officers required on the bridges of vessels transiting German Pilotage waters.

2007/104 Introduce a requirement for all vessels entering the Elbe River from Brunsbüttel Locks to be given a safety briefing covering river activity relevant to their intended movements.

2007/105 Develop its existing emergency procedures into a comprehensive Safety Management System. This should, as a minimum, include:

- A system for the review of safety, including the analysis of incidents and accidents, to ensure safety controls and procedures are continuously updated.
- Establishing guidance and procedures to ensure that safety margins are not eroded as normal operations are resumed following an accident.

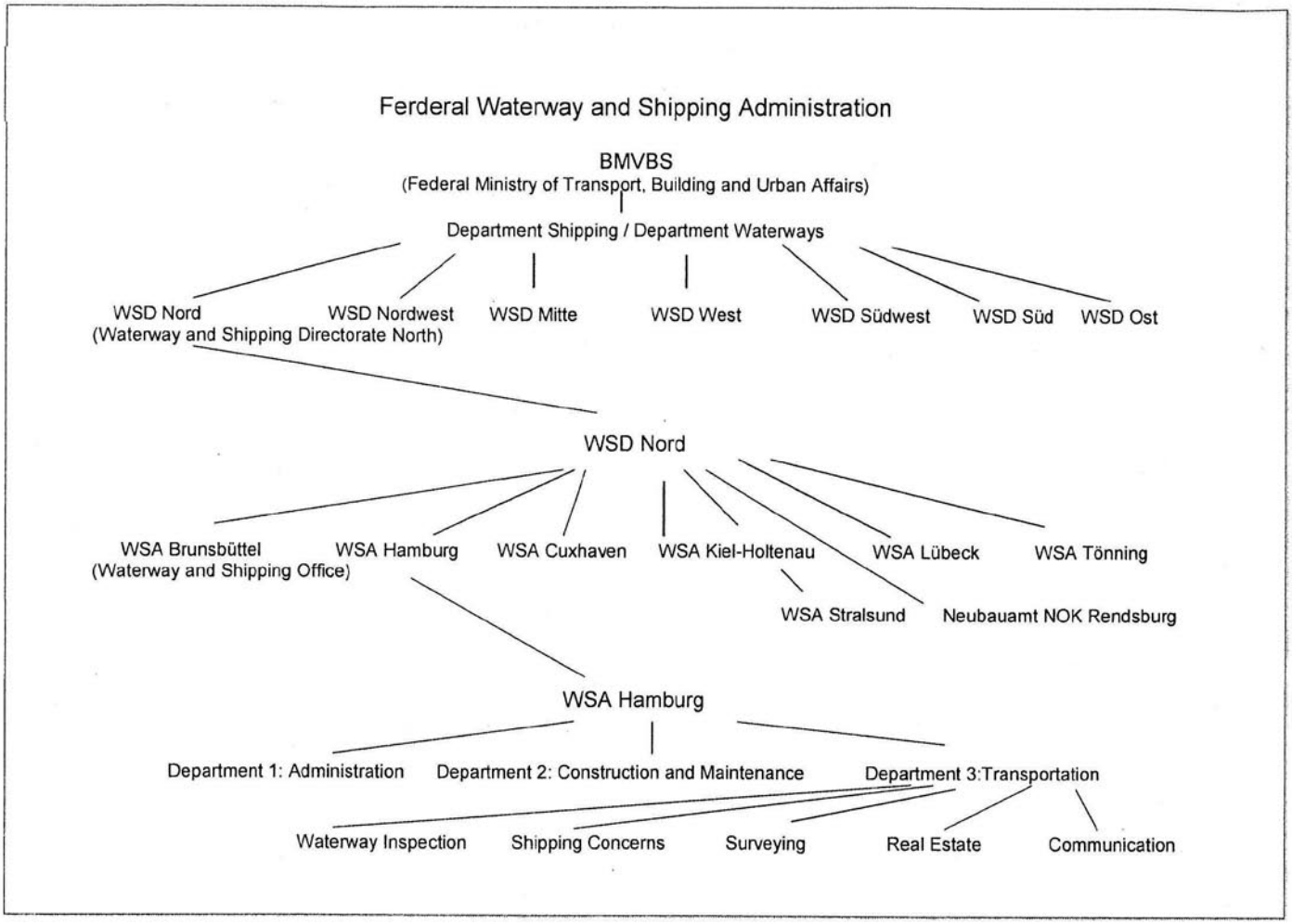
Laurin Maritime (America) Inc. is recommended to:

2007/106 Review its safety management system to ensure that degradations in its vessels' performance, particularly those associated with Conditions of Class, are identified, and suitable risk control measures implemented. Specifically, external authorities such as VTS, harbour authorities and pilots should be notified of operating limitations so that they can apply appropriate risk control measures as necessary.

Marine Accident Investigation Branch
Bundesstelle für Seeunfalluntersuchung
Bahamas Maritime Authority
Gibraltar Maritime Administration

February 2007

Annex 1



Structure of The Federal Waterway and Shipping Administration