Report on the investigation of the
flooding of the engine room on the general cargo vessel

'Unimar'

in the Baltic Sea

29th January 2006

Government of Gibraltar
Ministry of Maritime Affairs
Maritime Administration
Watergate House
2/8 Casemates Square
Gibraltar

NOTE

This report is not written with liability in mind and is not intended to be used for the purpose of litigation. It endeavours to identify and analyse the relevant safety issues pertaining to the accident, and to make recommendations aimed at preventing similar accidents in the future.

CONTENTS

GLOSSARY OF ABBREVIATIONS, ACRONYMS AND TERMS

- AB Able Seaman
- DPA Designated Person Ashore
- IMO International Maritime Organisation
- ISM International Safety Management (Code)
- SMS Safety Management System
- STCW Standard of Training Certification and Watch keeping
- UTC Universal Coordinated Time
- VHF Very High Frequency

SYNOPSIS

At approximately 1800 (UTC +1) on 29th January 2006, the general cargo vessel *Unimar* was on passage from St Petersburg to Torino via the Baltic Sea.

During that passage, the chief engineer, with the master's approval, decided to remove the auxiliary generator fresh water cooler cover so an investigation into the loss of cooling water could be undertaken. The cooler was of the type that had no seawater shut-off valves, and relied on the tube stacking being secured to the ships bedplate, forming part of the hull.

When the cover was removed the tube plate lifted clear of the sea water space and a substantial ingress of sea water was observed. Attempts were made to replace the tube stack but were unsuccessful.

As a result of the rapid ingress of seawater the master gave the order to abandon ship after he informed the authorities, who in turn informed nearby shipping.

All of the 8-man crew took to the rescue boat and were later picked up by one of the nearby ships.

After being abandoned, *Unimar* did not founder, but settled in the water by her stern. She was later taken in tow by a Finnish tug and towed into the port of Kotka. There were no injuries to the crew and there was no pollution.

Several factors contributed to the accident including:

- The task being carried out while under sea passage, with the masters approval.
- Not informing the company's technical department that the task was to be undertaken while on sea passage.
- The engineering cadet being left unsupervised.
- The failure by the chief engineer to consult drawings and carry out an assessment of the risks.
- The incorrect securing devices, being fitted to the cooler plate.
- The failure, by the chief engineer, to take the correct of course in an attempt to avert the flooding.
- The absence in the Safety Management System for the requirement to conduct a risk assessment for certain tasks.
- The absence in the Safety Management System of any specific guidelines for senior officers with respect to practical training and supervision of cadets whilst undertaking dangerous tasks.

Appropriate recommendations have been made to those concerned which can be found at the end of this report.

SECTION 1 – FACTUAL INFORMATION

1.1 PARTICULARS OF *'UNIMAR'*, AND ACCIDENT

Vessel Details

Name of Vessel	:	*'Unimar'* (IMO No. 9155949)
Registered Owner	:	Atobatic Shipping Aktiebolag Hamntorget 2 SE 27139 Ystad Sweden
Bareboat Charters	:	Island View Shipping Co Ltd 28 Irish Town Gibraltar
Operator	:	Briese Schiffahrts GmbH & Co KG Hafenstrasse 12 D-26789 Leer Germany
Port of Registry & Flag	:	Gibraltar
Type	:	General Cargo Vessel
Built	:	1997 Holland
Classification Society	:	Germanischer Lloyd
Construction	:	Steel
Gross Tonnage	:	2,820
Engine power and type	:	1 x MAK 2147 kW

Accident details

Injuries	:	None
Pollution	:	None
Damage	:	Substantial flooding damage to engine room.
Location of Accident	:	060^{o} 0' N / 026^{o} 45.4 E – Baltic Sea
Date and Time	:	1900 (UTC + 1) on 29th January 2006

1.2 BACKGROUND

The *Unimar* arrived at St Petersburg on 25th January 2006 for the purpose of loading scrap metal.

After arrival in port the chief engineer reported to the master a loss of fresh cooling water from the main auxiliary generator header tank. The loss was calculated to be approximately 20 litres over a time period of 12 hours.

Consequently, the company's technical superintendent was informed and it was agreed that an investigation be carried out during her stay in port. The chief engineer and the engineering cadet were assigned the task of carrying out the investigation.

However, the following day the chief engineer reported to the master that the leakage appeared to have stopped. As a result, any further investigation was cancelled.

At 0500 on 29 January the vessels main engine was started and a short time later *Unimar* left her berth bound for the port of Torino in Norway. Her route involved a southwest course across the Baltic as part of a convoy of vessels, which were assisted by an icebreaker vessel for part of the voyage.

At 1530 hours *Unimar* cleared the ice, departed the convoy and set course for Torino. At that time the power supply was transferred form the main auxiliary engine to the shaft generator, as was normal practice when clearing thick ice.

Later that afternoon when the master came on watch the chief engineer reported to him that water loss had again been experienced from the main auxiliary engine cooling system. Arrangements were then made to continue the original investigation once the auxiliary engine had cooled down.

On enquiring whether it was safe to continue such investigation at sea the master was informed by the chief engineer that it was.

The company superintendent was not informed.

1.3 THE CREW

At the time of the accident the crew on board *'Unimar'* consisted of the master, chief officer, chief engineer, motorman/ engineering cadet, two navigational watch ratings, cook and a deck cadet.

The chief engineer was duly qualified in accordance with STCW regulation III/2 and was an experienced seaman.

The engineering cadet had been at sea for 10 weeks after a period at college. There were no guidelines set out in the Safety Management System (SMS) for training and supervision at sea for engineering cadets. The engineering cadet had an'onboard training' record book issued by the administrative

section of his training college; the Russian Maritime Training Organisation. The sole responsibility of the successful completion of this training book was a matter for the engineer cadet presenting it to the master and chief engineer on board. The company kept no record of a cadets training except for a general report from the Master. The document record itself, as far as engineering cadets are concerned, was in the Russian language and relied on a Russian speaking chief engineer to be appointed to the same vessel.

All crewmembers were of Russian nationality except for the motor-man who was Ukrainian. All held valid qualifications issued by their respective flag state and the officers were in possession of valid Gibraltar endorsements in recognition of their certificates of competency. All medical fitness certificates were in order and valid.

1.4 ENVIRONMENTAL CONDITIONS

At the time of the accident the weather conditions were a south – southwesterly wind force 5-6, with a slight sea swell. The visibility was good with ice conditions experienced.

1.5 NARRATIVE OF EVENTS (ALL TIMES UTC + 1,)

The Chief engineer and the Cadet finished their evening meal and entered the Engine room on or about 18.00hrs. They then prepared the tools to undertake the investigation and completed the removal of the water ‘down pipes’ from the fresh water cooling ‘header tank’ to the cooler box at plate level. On this cooler box construction there were no seawater suction shut off valves.

The tube plate was secured to the box bedplate, which in turn was welded to the ships bottom hull construction.

Shortly before 19.00 hrs the cadet was instructed by the chief engineer to remove the cooler box cover. This, he proceeded to do until 16 bolts and the 4 corner studs and nuts had been removed. While the cadet was engaged in this task the chief engineer spent most of that time gathering tools from the workshop.

The cover was then lifted and the engineers proceeded to clean and clear the cooling tubes of the stack with compressed air. The chief engineer was unaware that the complete tube plate was not secured to the box bedplate despite the four corner studs/securing devices being removed; He was under the impression that the tube plate was welded to the bedplate.

After the tube plate/stack, had been exposed for some minutes, just as the chief engineer was about to return to the workshop to collect some tube plugs, water appeared at the tube plate. This was followed by the lifting of the tube stack due to the hydrostatic head of water which was estimated to be in the region of 2 meters, in line with the aft draft. The tube nest was then lifted clear of the cooler box, before falling to the deck.

This was followed by ingress of a wall of ice-cold water into the engine room. Several attempts by the engineers were made to replace the cooler stack, to the extent of sitting on it to force it back into place. However, despite those efforts the stack could not be located or kept in place for re-location and pressing down. In addition, the engineer's visibility was seriously impaired by the ingress of water.

The time lapse between the incident happening and the Master being alerted was estimated to have been 10 minutes. No attempt at communication by the chief engineer with the bridge was made during the incident.

On failure to relocate the stack the cadet went to the accommodation to call for help. The chief engineer remained in the vicinity of the cooler. The engineer cadet alerted both AB's and the cook, and also woke the chief officer and the other cadet.

The chief engineer reported seeing an AB look down the engine room and disappear. He then left the engine room. By this time the engine room was beginning to flood rapidly. No attempt was made to start the ballast pump, which had a capacity of 150 cu m/hr, or the emergency bilge suction.

The chief officer, who had been woken by the engineering cadet, came across the chief engineer in the accommodation. Enquiring as to what was the trouble the chief engineer stated that 'we're sinking'. The chief officer then offered his assistance but could get no reply. He then looked down the engine room where he noted a substantial ingress of water. He then made his way to the bridge.

The master who was on watch on the bridge heard shouting from the accommodation. He then handed over the watch of the bridge to the watch rating whilst he descended below to investigate.

The Master on making his way to the engine room came across the chief engineer and the engineer cadet at the control room level. They were both wet through.

When asked what the problem was by the master, the chief engineer shouted loudly that they were sinking. At this stage, the main engine was still running and the shaft generator was still on the board. The chief engineer was asked if the water ingress could be stopped, however, no verbal response could be obtained from the chief engineer for some considerable time from that point onward.

On observing the water in the engine room and its continuing ingress the master gave the order to the chief engineer to stop the engine. All power failed with the stopping of the engine and the shaft generator. As a result the emergency generator started.

Prior to leaving the engine room the master verbally gave the order to the chief engineer and cadet to proceed to the rescue boat. Similar orders were given to the other cadet, AB and cook.

When the master returned to the bridge the chief officer was instructed to muster the crew and make ready the rescue boat. The time was 19.05hrs.

The Master then transmitted a May Day on VHF channel 16. He then contacted the company superintendent by mobile telephone. Co-ordination was established between the vessel and St Petersburg Rescue Centre who informed the master that the nearest vessel to them had been contacted. This was the vessel *OOCL St Petersburg*. Contact was established with this vessel before the master left the bridge.

There were two further occasions when the master revisited the engine room. On the final occasion he could see that the water level had reached the turbo charger on the main engine. Having ascertained all the crew were in the rescue boat the master informed the company's office that he was abandoning the vessel and proceeded to do so by the after main deck boarding ladder to the rescue boat. The time was approximately 1930hrs.

As the rescue boat pulled away the master noted that *Unimar* was settling by the stern. Some 40 minutes later the vessel stabilised. By that time, the lights had failed. It was then assumed that the water level had reached the emergency generator switchboard.

At 0315 hrs a Finnish Tugboat *Vikari* arrived and took *Unimar* in Tow. The tow commenced at 0355 hrs. *OOCL St Petersburg* remained in the vicinity until after it had been confirmed that *Unimar* was being towed to Kotka in Finland

Briese Schiffahrts, the operators, instructed the Master not to have any contact with the tugboat. The Master had also been requested by 'Russian traffic control' to stop the tugboat towing the vessel away but had repeatedly replied to them that he could do nothing as he was no longer on board or in control of the vessel. During this time the master was in constant contact with the Briese Schiffahrts emergency team, providing regular updates.

He had also offered to re board the vessel when she had stabilised and settled in the water. However, the offer was vetoed by the company as there was nothing to be gained by re-boarding in the prevailing temperatures.

Attempts were made by the company to talk to the chief engineer but these were unsuccessful.

The *OOCL St Petersburg* continued its voyage to Kiel where the entire crew of *Unima*r were put ashore. No injuries or loss of life were reported. Later after obtaining sufficient rest the crew were transported to the company offices in Leer, Germany.

1.6 SUBSEQUENT EVENTS

Later it was established that Unimar had successfully been towed by the the tug *Viikari* to the Finnish port of Kotka.

Once along side a diver replaced the tube stack quite easily and re- secured the cooler cover with the original bolts, this included the four corner studs found. The cooler cover bolts including four corner studs were found in a tin on the plates adjacent to the cooler.

The engine room space was then successfully pumped out

It was established that all the bolts including the four tube stack securing studs found had been removed; the Chief Engineer believing the tube stack to be welded to the hull mounted bedplate.

It was also established through calculation, that with a hydro-static head of 2m at the tube plate level, considering the upward force exerted and the weight of the cooler, that an accumulative downward force of approximately 100 kgs would have been sufficient to have re located the cooler stack.

Furthermore, the original fitting of the four corner stack plate securing studs, (possibly at the last dry docking), was incorrect.

1.7 THE COOLER

The cooler was manufactured by ‘Nederlandse Radiateuren Fabriek B.V’ (NRF). It consisted of an open box, which was welded to the hull internally, and open to the sea.

The ‘tube stack’ consisted of a series of ‘U tubes which in turn were expanded and braised to a tube plate. This tube plate in turn was secured to a bedplate mounting , which in turn was welded to the open box which formed part of the hull.

The tube stack was secured to the bedplate mounting at each corner by four special studs, the collar on the studs being the securing surface. This collar sat in an upper recess in the tube plate

The ‘U’ tubes conduct the cooling agent through the seawater space. The cooling agent (In this case Fresh Water) did not come in direct contact with the Seawater. It was only cooled by it.

The seawater did not enter the internal spaces of the engine room but was merely a space in the outer hull which contained seawater. Therefore there was no requirement for a sea suction valve or seawater discharge valve within the engine room space

The cover incorporating two spaces sat on top of the tube plate and was secured, by 16 bolts. The two spaces referred to formed the inlet and outlet

spaces for the cooling medium which in turn took in and returned the cooling medium to the fresh water ‘header tank via a pump.

1.8 COOLER TUBE PLATE SECURING DEVICES

The Four cooler stack tube plate securing devices, or specialised studs hold the tube plate to the bedplate mounting, which in turn is welded to the seawater box forming part of the hull.

The four securing studs are designed in such a way that the securing collar at the mid section of the stud, sits in a recess in the tube plate, securing the tube plate to the mounting plate.

As the collar is recessed into the tube plate, this does not interfere with the mounting joint and surface of the cooler cover, which, in turn, is secured to the mounting by 16 independent bolts.

To screw the specialised studs into the tube plate, the upper end of the stud had a hexagonal section at the top end, which was used as the purchase for a turning device such as a spanner.

When the cooler cover is fitted and secured, it should not have been possible to turn or extract the studs. It creates an ‘interlock’ which prevents the tube plate being loosened until the removal of the cover bolts and cover.

The only time that these studs could safely have been removed is when the cooler box was dry which would indicate at the dry-docking of the vessel.

Photographic evidence shows the re-instated stack and cooler cover. (This was done by divers prior to the vessels’ engine room being pumped out at Kotke).

The photograph clearly shows the top section of a stud protruding as normal from the corner of the cover. The stud section shows evidence of paint, indicating that this was fitted in this way originally. There is no evidence of the hexagonal section at the top of the stud. (Indicating that this was either the wrong stud or the interlock stud had been fitted upside down which is unlikely).

The upper end of the stud indicated that a nut had been fitted. This was also painted and appeared undisturbed on the stud during removal (or replacement by the diver when reapplying the original stud after the cover had been replaced).

An ‘Intermediate class survey conducted by Germanischer Lloyd of the vessels’ bottom hull and machinery was held at Swinouscie (Poland) in June 2005.

The auxiliary engine cooler was examined at the time. It is likely that the incorrect studs and their fitting occurred at that time.

1.9 ISM Code

The International Safety Management Code for the safe operation of ships and for Pollution Prevention (ISM Code) came into force fully on 1st July 2002. The Code requires companies to document and implement clear procedures, standards and instructions for safety management on board. It also requires companies to provide safe working practices and identify risks.

The Safety Management System (SMS) operated by Briesse Schiffahrts was ran by a sub-contractor, Guideline GmbH who was responsible for the safety management system manual, its publication and amendments and for conducting the company's internal audits. They in turn reported to the company Designated Person Ashore (DPA) who had overall control over the SMS.

It was noted that in the company's SMS manual *Chapter 3 'Management Tasks' section 5.3 'Policy'* it clearly stated as part of their main principles:-

'to ensure safety and security at sea'

'to prevent human injury, loss of life and damage to the environment'

It further went on to state *'In order to achieve these principles' the following rules apply.* With reference to the second paragraph i.e. the second stated rule:-

'We do our utmost to prevent emergencies (e.g. by using checks, safety measures, technical support and ongoing searches for potential risks)'

With reference to the 'Shipboard Work Processes' 'process No 2 7.4.4 & 8.0 there is no requirement for the chief engineer to conduct risk assessments prior to undertaking maintenance.

Furthermore, in *Section 5.0 Responsibilities*; no reference to risk assessment is to be found and although *'Preventative Action'* requirements form a part of the SMS no formal risk assessment policy and process can be found.

Additionally, no reference to cadet training and supervision can be found in the SMS and no reference to any other company training manuals or international/ government or academic references/ regulations are made under training.

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 GENERAL

Fortunately, there was no injuries or pollution as a result of this incident and the vessel did not founder. However with better on board management and appropriate assessment of the risks involved the incident could have been avoided.

2.3 ACTION BY THE CREW

The necessity to undertake a task such as this whilst under sea passage in the prevailing conditions was not essential, given the availability of alternative power supplies and no immediate emergency with the rate of water loss.

The Master should have informed the technical department, as was the case previously in port. The maintenance of the cooler could have been delayed until arrival at the next port without any undue concern.

The decision not to pursue the investigation and repair the hull constructed generator fresh water cooler whilst in the port of St Petersburg is considered to be poor working practice, especially with the time available in port and the safety backup a port would offer.

Likewise the decision to re -instigate the investigation without consultation with the company's technical department, was irresponsible and created an unnecessary risk as well as a danger to the vessel.

Despite the engineering cadet having only spent 10 weeks at sea he had been left alone on at least one occasion while working at the cooler. This is considered to have had a bearing on the subsequent events, considering his limited training at sea and the type of task in hand. The engineer cadets' sea going training under the German Maritime Educational system covers a period of 3 years. It is unclear of the time span required by the Russian Educational Authorities, but 10 weeks would not have embraced significant training with respect to familiarisation of machinery/ equipment and its' safe method of maintenance.

The sudden shock of being hit by freezing water had a bearing on the failure by the chief engineer and cadet to re-locate the cooler stack into the seawater box. Therefore, under the circumstances, it is considered the chief engineer was suffering from shock and this was responsible for his lack of action in trying to avert the flooding; attempting to stop the water ingress,

communication with the bridge, the starting of a ballast pump or bilge pumps and calling for assistance otherwise than from the bridge. It would have been difficult to coordinate these tasks considering the emergency, and the available personnel.

The decision by the master to abandon the vessel was reasonable under the circumstances, as he had basically lost the means of communication for a reasonable discussion and co-operation with the engineering department. It appears that all reasonable action was taken prior to the final abandonment.

The apparent rate of water ingress appeared to the Master as considerable. His decision to abandon ship was not straightforward taking into account the speed of events that were happening around him. By the time he was fully aware of the incident, the flooding of the engine room was beyond control. In addition, the loss of engineering department support in any assessment discussion phase would have impaired his ability to act in any other way than he did. The safety of his crew was his priority. As for a damage calculation, which may have shown that the vessel would not necessarily sink, with the speed of the ingress of water, it is considered the risk in terms of time was outweighed by the safety of the crew

The crew, who were eventually informed by the engineer cadet of a problem in the engine room, had apparently only looked from the ladders into the engine room. Having not been given any specific reason or cause of the water ingress, and any guidance of action or instruction with respect to required assistance, instinctively reported to the bridge and muster station as instructed.

2.4 THE COOLER STACK (and events in the engine room)

The four corner securing devices were not the correct fittings. This enabled them to be withdrawn prior to the removal of the cooler cover and therefore the loosening and release of the cooler plate from the bedplate at the same time. This should have been impossible if the correct securing interlock devices had been fitted.

On trying to relocate it, the cooler stack was possibly entered at an angle into the recess box preventing it from re-location. Having said that, it is considered that reasonable efforts were made to re-locate it.

Without the assistance of a third party at least, the chances of successfully lining up, re locating, and re-securing the tube plate would have been slim under the circumstances. The ease at which it has been calculated that the cooler nest could have been relocated might have been achievable, given more time for calculated thought and, in a more temperate zone.

In light of the events, it is considered that the chief engineer was not fully aware of the construction of the cooler and safety aspects of the securing devices for the cooler tube stack and that the correct job preparation was not

completed prior to undertaking the investigation and repair of the cooler. (i.e. consultation with the cooler construction drawings and the briefing of all partaking staff prior to commencement of the job). The Chief Engineer was convinced that the tube plate was welded to the cooler box bedplate.

The engineering cadet who had been left alone in the engine room had not been given the correct information about the four corner securing studs and the dangers of removing them. He had been left alone without supervision and no reference to drawings had been made, or a briefing undertaken. In addition, there was no risk assessment carried out. Therefore it is understandable all bolts, as well as the four incorrectly fitted securing studs, were loosened and removed by him.

The ease at which these studs were removed at the same time as the cover indicates that the studs were not of the correct type and no 'Interlock' had been in place.

The presence of one or two other persons at the scene of the incident would have possibly allowed all contingencies to have been covered and possibly the stack to be re instated. The fact that the other members of the crew were not alerted for up to 10 minutes was a contributory factor in the flooding of the engine room.

The proper course of action should have been, with the limited staff available, immediate alert and communication; operation of the pumps and protection of the shaft generator before an attempt was made to re-locate the cooler stack.

2.5 ISM

The SMS inclusive of policy has been generally proven and well tested in the past by this Administration.

However, this particular incident has revealed that not having a specific 'risk assessment' procedure implemented as part of the SMS, especially with a work task of this nature, seriously compromised safety and the protection of the environment and could have resulted in the loss of life and property.

If a risk assessment procedure was part of the SMS, reference to the cooler drawings and discussion of the procedures and risks prior to undertaking the task, would have revealed the construction and the design incorporating the stack tube plate 'interlock' securing devices.

The requirement to make it clear in the 'work process' that the chief engineer (and other senior officers) need to conduct a 'risk assessment prior to undertaking tasks and maintenance should be of utmost importance.

The safety management system does not include specific measures and guidelines for senior officers with respect to the sea training and supervision of cadets. This would indicate a 'loophole' in the responsibility of the company

and insufficient instruction to the responsible officers on board. This matter should be addressed.

2.6 TRAINING AND SUPERVISION

An engineer cadets training consists of a combination of college and sea time. The cadets training both, college and sea time, is monitored by the maritime educational administrations of the maritime college and is generally monitored by government educational authorities.

Both German and Russian systems follow similar methods of seagoing training, and rely on the endorsements of the master and chief engineer on board the vessel to complete the *'on board training record book for engineer cadets'.*

This appears to be the only record of a Russian Engineering cadets' training, and has been sourced by the company in question, in the Russian language only.

This would preclude any responsibility of the company to supervise, record and check the progress of the engineering cadets' sea going training beyond any personal reports from the vessel.

The company or their manning section does not keep records of seagoing training of cadets.

SECTION 3 – CONCLUSIONS

3.1 SAFETY ISSUES

The following are safety issues identified by the investigation. They are not listed in any order of priority.

- The task being carried out while under sea passage, with the masters approval.
- Not informing the company's technical department that the task was to be undertaken while on sea passage.
- The engineering cadet being left unsupervised.
- The failure by the chief engineer to consult drawings and carry out an assessment of the risks.
- The incorrect securing devices, being fitted to the cooler plate.
- The failure, by the chief engineer, to take the correct course of action in an attempt to avert the flooding.
- The absence in the Safety Management System of any specific guidelines for senior officers with respect to practical training and supervision of cadets whilst undertaking dangerous tasks.
- The absence in the Safety Management System for the requirement to conduct a risk assessment for certain tasks.

SECTION 4 – RECOMMENDATIONS

The owners/operators of *'Unimar'* are recommended to:

1. Ensure adequate operating procedures are promulgated in its safety management system in accordance with ISM to ensure:

    - The appropriate shore staff are informed if major maintenance is to be undertaken.
    - The provision of instructions and guidelines to responsible officers for the training of cadets.
    - Instructions and guidelines for the training and supervision of staff, especially cadets, are adhered to.
    - Risk assessments are carried out prior to the undertaking of major maintenance.
    - Adequate procedures in the case of an emergency.

2. Ensure all coolers of this type are fitted with the correct tube plate 'interlocking' securing devices (Interlock studs).

Government of Gibraltar
Gibraltar Maritime Administration
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