The Swedish Club

CASEBOOK

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Hatch covers

1.1 Leaking cargo hatch covers caused cargo damage

A bulk carrier had been fully loaded with grains. The vessel had side rolling cargo hatch covers. For six days, the vessel encountered heavy weather at Beaufort scale 9 which caused it to pitch and roll heavily. During the voyage the cargo hatch covers were washed over by seawater.

Hatch covers were opened

When the vessel was at anchor and waiting for an available berth all the hatch covers were opened. This was to ensure the vessel was gas free since fumigation had been carried out in all cargo holds at the loading port.

Whilst opening the cargo hatch covers it was found that cargo in a number of holds had been damaged by water. Most of the water-damaged cargo was below the middle cross joint of the hatch covers and below the aft hatch coaming's corners.

Survey results

According to the Master there had not been any ventilation to the cargo holds during the voyage. A surveyor carried out an inspection and found the following hatch cover parts to be in poor condition:

- Hatch cover panels
- Hatch coamings
- Water drain channels
- Non-return valves
- Quick cleats
- Rubber gaskets

The survey indicated that seawater had leaked through the middle cross joint drain channel and through the corner of the hatch coamings.

What can we learn?

- Before loading, completion of loading and after discharge, the crew should inspect the hatch covers to ensure they are in a weathertight condition. It is essential that cargo hatch covers are inspected and tested at regular intervals to ensure that the weathertight integrity is maintained, and that the vessel is in a cargo worthy and seaworthy condition.

- Ensure that gaskets and coamings are in good condition.

- It is important that records are kept about what maintenance and service has been completed in the PMS.

- Inspection of cargo hatches and coamings, including securing devices, is part of both the annual load line survey and safety construction survey normally carried out by the vessel's classification society. The main purpose of these inspections is to ensure that the vessel is in a seaworthy condition, and not necessarily to confirm that the vessel is in a 'cargo worthy' condition. A few tons of water in the cargo hold will not jeopardise the seaworthiness, but it might completely destroy the cargo.

- Carry out a weathertightness test at least annually and always after repairing or replacing components in the cargo hatch system. When carrying water-sensitive cargo such as grain, soyabeans, paper, etc. it is recommended that weathertightness is tested before each loaded voyage. The most effective method is to use an ultrasonic device, which can pinpoint the area which is leaking, and if the compression of the gasket is sufficient. The advantages of using this type of equipment are evident, since ultrasonic tests can be carried out during any stage of the loading without risking cargo damage. The test can also be completed in sub-zero temperatures.

1.2 Crack in the cargo hatch cover caused wet damage

A bulk carrier had a full cargo of zinc concentrate on board and was sailing from the west coast to the east coast of South America.

When the vessel passed Cape Horn it experienced heavy weather of Beaufort scale 9 with green sea covering the cargo hold covers 1, 2 and 3. This continued for four days as the vessel battled the waves. The vessel had no weather routeing.

Wet damage in hold 1

When the weather had calmed down the Master asked the Chief Officer to inspect the cargo holds. The Chief Officer found that water had entered cargo hold 1 and caused wet damage. No water had leaked into the other holds. The Chief Officer also inspected the hatch coaming and the hatch cover for hold 1, and found a crack on the hatch coaming. The drain pipes for the non-return drain valves were also full of debris and cargo.

Survey results

During discharge the surveyor found that the sounding pipes for the cargo bilges were also blocked by debris. When the vessel was alongside and the cargo hatch covers were removed, puddles could be seen in hold 1. It took several extra days to get the wet cargo off the vessel and most of the cargo was refused by the buyer.

What can we learn?

- The sounding pipes should be clear of any debris or cargo, as they are important for taking soundings before loading and during the voyage.

- It is important to be aware that zinc concentrate may liquefy if shipped with a moisture content in excess of its transportable moisture limit (TML) as per the IMSBC code. Puddles of water will obviously exceed the TML.

- It should be a PMS job to check that the drainpipes and drain valves are not clogged and that the float (ball inside) moves freely.

- Hatch covers, and coaming steel structures are heavily loaded elements. Their condition has a direct effect on the load carrying capacity and the safety of the vessel. The steel construction should always be inspected after an unusual loading case, and there should also be regular checks as per the PMS.

- When repairs are carried out, only steel approved by the classification society should be used. High tensile steel is commonly used for cargo hatches and coamings.

- The classification society should be contacted before making any structural steel repairs.

- Weather routeing should be considered as it provides the vessel with the option of avoiding heavy weather, but also ensures that vessels are provided with a new and updated ETA to the discharge port. This helps the crew on board the vessel, shoreside personnel, and cargo owners, to plan accordingly.

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2

Heavy weather

2

2.1 Containers were lost in heavy weather because of stiff vessel

A large container vessel was sailing on a SE course in the North Atlantic, bound for a European port. During the voyage, heavy weather was encountered from ENE at Beaufort scale 9, with 7 metre waves. This meant that the wind was on the vessel's port side, causing heavy rolling. The maximum recorded roll angle was 30°.

Collapsed containers

During the morning watch, the OOW and the Master were on the bridge. Hearing a loud noise astern of the bridge they looked out of the window and could see that a number of containers had collapsed and some had fallen into empty bays. The collapsed containers were all 20' TEU and were stowed in four bays. The side containers on the starboard side had toppled inboard into an empty space and others had fallen overboard.

After the incident the Master broadcast a safety alert over the VHF. In response to the heavy weather, he then ordered a more easterly course of ESE and reduced speed from 16 knots to 7 knots.

Cause

The CSM required that the bottom containers on deck were secured by manual twistlocks. However, the twistlocks in the container shoes were unlocked. In accordance with the vessel's procedures, the lashings were to be checked prior to every departure, which the Chief Officer stated he had done. At the loading port the Chief Officer had signed the lashing report without noting any deficiencies.

The vessel had a GM of 11 metres which made it very 'stiff'. This means that the vessel would quickly return to the upright position after being inclined by an external force such as wind or waves.

What can we learn?

- The base twistlocks had not been locked as they were found undamaged and still located in the shoe fittings. The combination of unlocked twistlocks and a very stiff vessel sailing through heavy weather led to the collapse of the container stacks.
- The Chief Officer should have ensured that the manual twistlocks were checked before departure.
- The officers should have reduced speed and altered course to ensure the effect of heavy weather was minimised. This was only carried out after the accident had happened.
- A GM of 11 metres was excessive for this vessel. A stiff vessel will affect the top and side containers the most. The top containers collapsed and fell onto other containers which than fell overboard. Principally, the main forces affecting the containers in the lower tiers consisted of:

  (i) The static weight of the upper containers in the stack.

  (ii) Transverse/longitudinal/vertical acceleration forces on the top side containers when the vessel was rolling.

  (iii) Transverse/ longitudinal forces of wind pressure or seas impacting the vessel.

- When the vessel was rolling in heavy weather, the frames and corner posts for the lowest containers were affected by excessive racking forces. The larger the roll, the greater the racking force will be.
- Heavy rolling can impart enormous forces on the container structures and lashings.
- All of the above-mentioned loads will increase the compression and tension forces on the corner posts and to the intermediate twistlocks between them.

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3

Fire

3

3.1 Explosion caused by fumigation

A bulk carrier had loaded yellow corn in all cargo holds up to the hatch coamings. After the loading was complete, fumigation technicians came on board and fumigated the cargo with fumitoxin pellets.

As per the cargo documentation, the fumigation pellets were required to be applied subsurface. In this instance the technicians poured the pellets from flasks while walking on the hatch coamings or hatch covers. This work took a little more than an hour and afterwards all the cargo hatches were closed and the vessel sailed.

A series of explosions

A couple of hours later an explosion occurred in one of the holds. The crew noted that the hatch covers had moved slightly and blue gray smoke was seen coming from under the edges. About an hour later another explosion occurred in a second hold, and a couple of minutes later an explosion occurred a third. There were explosions in the remaining holds shortly afterwards.

Cause

Fumitoxin pellets and similar fumigants are made up of around 55% aluminium phosphide which reacts with water to produce phosphine, an extremely toxic and effective fumigant. Phosphine gas will form an explosive mixture when mixed with air at a concentration exceeding around 1.8% to 2% by volume (the lower flammable limit). The concentration of phosphine in the air in each of the holds exceeded this lower flammable limit.

The fumigant pellets in each hold had not been distributed across the entire cargo surface, or applied to the subsurface, but had been applied by simply pouring the pellets on top of the cargo. This method of application had permitted the accumulation of the pellets in limited areas and promoted a relatively rapid reaction of the pellets with moisture, generating concentrations of phosphine gas above the lower flammable limit, which lead to the explosions.

What can we learn?

- The manager should provide training to the crew to ensure that the crew is aware of the requirements and procedures for the fumigation operation. The crew need to ensure that the fumigation pellets are distributed as per the cargo documents.

- Agricultural products in bulk may be fumigated in ships' holds to prevent insect infestation. Solid aluminium phosphide (or similar) is often used for fumigation. Aluminium phosphide reacts with water vapour (humidity) in air to produce phosphine, a toxic and flammable gas, which kills insects. Heat is also given off during the reaction. The solid fumigant may be applied in fabric 'socks' or as pellets on the surface, just before closing holds. Holds are then kept closed for a period before ventilating. People must keep out of holds that are being fumigated due to the toxic fumigant.

- If there is an excessive amount of fumigant in one place, or if the fumigant is in contact with liquid water e.g. from sweating or condensation, then the fumigant can react too quickly. This can evolve excessive heat and lead to ignition of cargo and/or packaging such as bags or paper placed over the top of the cargo. Under certain conditions the fumigant gas itself may ignite, producing an explosion. It is important that fumigant is applied according to the correct instructions. As holds are always un-ventilated for a time after fumigation, there may be a risk of excessive condensation, which can produce sweating or dripping. This can lead to cargo damage as well as the fire and explosion risks mentioned above. The weather conditions and cargo conditions, such as moisture content, therefore need to be considered properly before fumigation, which is often carried out by specialist companies.

3.2 Misdeclared container caused fire

It was early morning and from the bridge the Master saw a large cloud of smoke issuing from the forward part of the vessel. At the same time the fire detection system for cargo hold 2 sounded on the bridge. The Master described the smoke as being white at first and then greyish. The Chief Officer, however, described the smoke as being "dark grey, almost black".

The ventilation fans for the cargo holds were stopped. The fans for cargo hold 2 were not operating at that time but natural ventilation was being provided for the holds as the covers for the vents were open. Crew members closed the covers of the vents for cargo hold 2 and no crew member entered the cargo hold.

Discharge of CO_2

Meanwhile the Master navigated the ship to a nearby anchorage. After various checks had been performed, the Chief Engineer released the contents of 197 CO_2 cylinders into cargo hold 2. This discharge was the designated full complement of CO_2 required for the hold, and appeared to extinguish the fire. A couple of hours later smoke began to issue from the hold and a further 57 CO_2 cylinders were released into cargo hold 2. About six hours later smoke was observed issuing from cargo hold 2 and the Chief Engineer released a further 57 CO_2 cylinders.

Salvors boarded the vessel the following morning. Shortly before midnight, temperature checks were completed by the vessel's crew indicating that the temperature in cargo hold 2 was rising so five more CO_2 cylinders were released. In the morning another 15 CO_2 cylinders were released. The salvors entered cargo hold 1 and measured the temperature for the bulkhead to cargo hold 2 - it was 83°C. It was decided that cargo hold 2 should be filled with water from the fire hydrants. The water filled three container tiers up and after a couple of hours the salvors considered the fire to be extinguished.

Dangerous cargo

The container where the fire started was not declared as dangerous cargo but was actually loaded with calcium hypochlorite and had been misdeclared by the shipper. The charterer had loaded the container as per the rules of the IMDG code. As per the manifest, the container was allowed to be loaded in the cargo hold, but as the cargo was calcium hypochlorite it should not have been loaded below deck or in the position it was stowed in.

What can we learn?

Cargoes that fall into this category include calcium hypochlorite and other oxidising solids. They are often used for swimming pool sterilisation and fabric treatment (bleaching or washing). These materials do not oxidise but they can be relatively unstable chemicals that decompose slowly over time, evolving oxygen. This self-decomposition can evolve heat. A self-heating process can therefore happen in which the material towards the middle of a body of cargo becomes hotter, so the rate of decomposition and heating increases. This can lead to 'thermal runaway' with very rapid self-decomposition and evolution of heat and gases, sometimes including further oxygen. The effects of this in a hold can be similar to an explosion. The heat and oxygen produced can lead to fire spreading.

Potential causes of self-decomposition incidents include:

- Exposure to heat e.g. solar radiation (before or after loading), cargo lights and heated fuel tanks.
- Cargo formulation.
- Contamination of cargo at manufacture.
- Spillage and thus reaction between cargo and combustibles e.g. timber.
- Excess quantity of cargo in containers giving insufficient dissipation of heat Inadequate separation of packages in containers, also giving insufficient dissipation of heat.

3.3 Floodlights caused cargo fire on bulk carrier

A bulker had loaded sugar beet pellets in all three cargo holds with the operation taking 27 hours. When loading was completed the ventilation hatches and all other access points to the cargo holds were secured. In cargo hold 1 there were two metres of space between the cargo and the cargo hatch. In cargo holds 2 and 3 the cargo was almost up to the hatch coaming.

Smoke from cargo hold 2

Two days into the voyage the crew noticed smoke coming from cargo hold 2. Hot spots were discovered in hold 2 on the transverse hatch coaming, both forward and aft on the portside, and an additional hot spot was also discovered on hold 3 on the transverse hatch coaming, on the portside aft. All hot spots were located adjacent to recesses in the coamings for the cargo holds' floodlights.

The crew isolated the electrical power to the floodlights. Because of the increased temperature of the hot spots in hold 2, the Master released CO_2 into the hold. The CO_2 did not extinguish the fire but reduced its severity for a while. When the vessel arrived at the discharge port the cargo hatches were opened, and flames broke out from hold 2. At the same time a plume of smoke escaped from hold 3. The top layer of cargo in hold 2 had been burned.

Burn marks around floodlights

About 4 metres below the cargo surface the cargo was in good condition. It was discovered that the cargo in hold 3 had been damaged by condensation and tainted by smoke. There were clear burn marks around the floodlights and distinct burn marks by the coaming at the same locations where the hot spots had been discovered.

The floodlights were situated 1 metre below the cargo surface in holds 2 and 3 and there was black, burned cargo covering the floodlights. There were two floodlights fitted in cargo hold 1, port and starboard and four floodlights fitted in both cargo holds 2 and 3. All the floodlights were installed in recesses in the hatch coaming. The floodlights were protected by round bars preventing crane hooks, grabs etc from hitting them, but these bars do not prevent cargo like sugar beet pellets from covering the lights. The floodlights were controlled from the bridge on a panel with four key-switches. These switches were marked 1, 2, 3 and 4 respectively. No drawings or legends were attached clarifying which areas these key-switches served.

What can we learn?

- The subsequent investigation revealed that the cargo floodlights were not connected according to the approved 'as built' circuit diagrams delivered with the vessel. It was not clear on board which lights were controlled by which keyswitch.

- The fire was caused because a number of cargo lights were operating while cargo covered them, so the lights ignited the cargo. There was a lack of information on board about how the light circuits were connected and how the light system should be operated. There was also a lack of records concerning use of the lights.

- Many bulk carrier/general cargo holds have fixed cargo lights. Halogen-type lights can easily ignite combustible cargoes such as grain, animal feed, wood chips, pulp and paper if they are too close to the light.

- Cargo lights in holds need to be properly isolated before cargo is loaded. This is best done by removing fuses or other physical links in the electrical circuits so that the lights cannot be switched on by mistake. In container ships the lights need to be properly placed so that they do not overheat cargo or other combustibles and thus cause damage or fire. Lights in car carriers and ferries are usually fluorescent, which are unlikely to cause ignition. Nonetheless it makes sense to leave lights switched off when they are not needed, particularly in cargo areas where combustibles are present.

3.4 Hot work caused container fire

A container vessel was awaiting instructions for when to enter the port. During the wait the Chief Officer made the decision to carry out repairs to the cell guides in one of the cargo holds. The engine fitter and an AB began to prepare the welding job for the cell guides.

Container fire

Before the welding commenced a risk assessment and hot work permit were completed. As per the hot work permit, fire extinguishers were in place and one AB was the designated fire watch. The Chief Officer approved the job and was also present. Some time into the job, the engine fitter began to smell burned rubber, and on investigation saw that a container had caught fire. In the vicinity were a couple of oxygen and acetylene bottles which the engine fitter moved to safety. The Chief Officer ordered everyone to evacuate the cargo hold and informed the bridge that a container had caught fire. The general alarm was sounded and a fire team assembled and began boundary cooling.

The heavy smoke and high temperature made it impossible for the fire team to approach the fire so the Master decided to release the CO_2 system into the cargo hold, which extinguished the fire. The container that had caught fire was an open top container covered by a tarpaulin and containing cloths, tyres, wooden plates and machinery.

What can we learn?

- Many cargoes, including a wide range of bulk cargoes and general cargoes can be ignited by cigarettes and/or hot work. Smoking and hot work therefore need to be properly controlled. Control of smoking can be difficult where stevedores are working on board and hot work permits need to be properly considered, not just a 'tick box' exercise. Once a fire has started, some bulk cargoes will smoulder for long periods even after closing and sealing holds and using CO_2 to maintain a low oxygen concentration in the ullage space. This extended smouldering is often due to residual oxygen absorbed into the cargo and air/oxygen in voids in the cargo e.g. between pellets. In cases of extended smouldering the only option may be to discharge part or all of the cargo.

4

Injury

4.1 Fatal fall from ladder

Two stevedores were in the cargo hold finishing their job. It was morning, and having started their shift the previous evening, they had been working for more than 12 hours. To exit the cargo hold they had to first climb up a vertical ladder, then ascend a spiral staircase and for the last 2.5 metres climb up another vertical ladder.

The stevedores had brought a thermos and tea cup each. The cup did not fit in the first stevedore's boiler suit pocket so he held it in his hand instead. This wasn't a problem when he ascended the spiral staircase. However, when he reached the last platform there was still the vertical ladder to climb up.

20 metre fall

Climbing up the last ladder he only used one hand as he had the tea cup in the other. He was not wearing a safety harness. When he was almost at the top he slipped and fell down. Unfortunately, he did not hit the platform below but fell more than 20 metres and landed at the bottom of the cargo hold.

The other stevedore shouted for help which the bosun heard. He could see the stevedore lying at the bottom of the cargo hold and instantly called the Chief Officer on the radio and told him about the accident. The Chief Officer assembled a rescue team with a stretcher and gave the stevedore first aid. An ambulance arrived shortly afterwards and he was lifted out of the cargo hold by a crane. Unfortunately, he was declared dead at the hospital.

Damaged ladder

It was later found that a steel bar was missing from one of the lower railings at the beginning of the spiral ladder. The railing was most likely damaged during the loading by one of the crane grabs, or an excavator as it was covered by the cargo when it arrived at the discharge port.

What can we learn?

- The definition of 'working at height' should be addressed in the risk assessment, in addition to details of the safety measures that need to be taken.
- In the risk assessment it should state whether the specific job requires a work permit.
- It is up to every company to define if they consider it an acceptable risk to enter the cargo hold on a vertical ladder without a safety harness attached.
- In this specific case the person climbing the ladder only used one hand and had no safety harness. The problem here is how the stevedore perceived the risk at the time.
- Most of us would agree that it is safer to use both hands when climbing a ladder. However, when climbing ladders is a daily occurrence it is easy to forget that the consequences of slipping can be fatal. Advise from COSWP states that when climbing a ladder three points (foot or hands) should always be in contact with the ladder. When the consequences of falling from that ladder are so severe, a harness should really be used.
- It would be beneficial to have a toolbox meeting with the stevedores' supervisors to explain what is required of the stevedores when working on board.
- It is understood that many ports require that stevedores wear a safety harness when climbing the cargo ladder. It is important that the Chief Officer emphasises the importance of complying with this requirement.
- After both loading and discharging, the Chief Officer should inspect the ladders to ensure they have not been damaged during the cargo operation.
- This accident highlights the minimal effort it takes to do a job safely, and the consequences of not making that effort.

4.2 Lost balance while washing down caused serious injury

A bulk carrier was in port and one of the ABs was washing the hatch coaming gutter. He had connected a fire hose to a fire hydrant and was spraying water. The cargo hatch covers were open and the AB was wearing a safety harness.

Unclipped safety harness

The harness became tangled with the fire hose and so the AB briefly unhooked it so he could untangle the safety cord. At the same time the pressure in the hose changed causing the AB to lose his balance and fall 16 metres down into the cargo hold.

First aid was given to the AB by the crew and the Master called for an ambulance. Unfortunately, he did not recover and died at the hospital.

What can we learn?

- Working aloft is a high-risk operation and all vessels have procedures on how to do so safely. It is a requirement to fill out both a risk assessment and a work permit for any job in this category. The risk assessment and COSWP requires that all risks should be evaluated and that the harness should be connected at all times.
- The AB in this case was wearing a safety harness, but at the time of the accident had it unhooked at the same time as he lost his balance. This highlights once again that it only takes one second to make a fatal mistake.
- If two persons had been assigned for this job it would have meant that the AB could work on his assigned task by washing down and the other AB could assist with the hose.
- Working at sea is by default a dangerous job and the crew is often involved in high risk operations e.g. working aloft, mooring, securing cargo and other operations. A case like this highlights that a decision to unhook the safety harness when at the same time holding a pressurised fire hose can lead to a fatal fall.
- Everybody looks on risk differently – that is why it is so important that the safety department ensures the crew is trained in evaluating and understanding risks, and the potentially fatal consequences of forgetting this.

4.3 Injury during mooring operation

It was early morning with no wind or currents and a vessel was approaching port. On the stern an AB was preparing the mooring ropes. The stern lines were put partly around a bollard with a bight at a right angle to the normal pull direction. After the AB had prepared the mooring lines, the Third Officer joined him. The spring lines were sent ashore and made fast, and the Master, who was on the bridge, put the engine pitch to zero allowing the vessel a slight forward movement. The rudder was hard to starboard as the vessel was berthing port side alongside. After the spring lines were secured the heaving line was connected to both stern lines.

The Chief Officer, who had been by the manifold, came to the stern to assist and took charge of the mooring winch. The Third Officer walked to the stern railing by the fairlead.

Mooring commences

The linesmen shouted that they were ready to receive the stern lines, so the AB started to lower the stern lines to the water. He was facing the mooring winch and had his back to the Third Officer by the railing. He let the mooring lines run out at a very high speed. Suddenly the Third Officer started to scream and when the AB turned around he could see the Third Officer caught between the mooring line and the fairlead. The mooring line was now coming out very quickly and began cutting into the Third Officer's leg, with such a speed that his leg was cut off just below the knee.

Mooring rope stuck in propeller

The Chief Officer saw that the mooring rope was stuck in the propeller and screamed over the VHF to the Master to stop the engine. The Master pushed the emergency stop and the propeller stopped.

The Third Officer was in severe shock and collapsed. The Chief Officer ran over to give first aid and the gangway was rigged. A first aid team from shoreside came on board, and 30 minutes later an ambulance arrived and took the Third Officer to hospital.

Life changing consequences

The Third Officer survived, but is now disabled and can never work at sea again.

What can we learn?

- The vessel had a risk assessment for the mooring operation, but this did not include the risk of the mooring line getting stuck in the propeller, as the mooring line should be floating in normal circumstances. This time the mooring line was lowered too quickly, ending up under the surface. As the propeller blades were only 2 metres below the surface the lines were sucked into the propeller, which caused the accident.

- In addition the mooring line was partly around the bollard, with a bight and a right angle to the normal pull direction. This arrangement caused the snapback zone to cover the entire area between the bollard and railing. When the rope ran out rapidly and got caught in the propeller it snapped back to where the Third Officer was standing, even though he was not inside the normal snapback zone.

- This shows the importance of everybody involved in the operation being aware of the risks of potential snap back zones. Mooring a vessel is a normal operation, but the risks need to be evaluated every time, as it is a risk operation.

5

Stowaways

5.1 Stowaways in the steering gear trunk

A container vessel had departed from Lagos and the next port of call was in Malaysia.

Before departure, the crew performed a stowaway search as per the SSP. No stowaways were found.

The vessel departed and after disembarkation another search was carried out. Still no stowaways were found.

Knocking sounds

The following day the Bosun heard knocking sounds coming from the hull in the steering gear room. He informed the Master straight away. The crew started to investigate the sounds and could hear knocking coming from what they believed was the rudder trunk.

There was no access to the rudder trunk as it is space taken up by the rudder stock. The rudder trunk is only accessible from the outside of the vessel. This was a so-called unbalanced rudder, which means that the rudder stock is attached aft of the rudder hinges. The hinges are at the forward end of the rudder. The vessel was in open sea and the Master brought the vessel to a stop. The crew lowered a camera on the stern to see if they could see anything by the rudder. When they recovered the camera and watched what they had filmed they could see three people sitting on the rudder.

Vessel had to divert

The crew lowered the rescue boat and picked up the three men. The stowaways had used a small rowing boat to reach the vessel and had than managed to climb up the rudder and then into the rudder trunk. So that the stowaways could disembark, the vessel had to divert to Cape Town.

There is never access to the rudder trunk from the inside of the vessel as it is just an open void considered part of the hull.

What can we learn?

- It is extremely unlikely that a person would be able to sit on the rudder and not be washed out of the rudder trunk during a sea passage. If people in the rudder trunk are not found before departure or shortly after departure, they will most likely be lost at sea.
- To prevent stowaways achieving access, please consider the following if the vessel is in a port with a high risk of stowaways,

  (i) Inspect the rudder and if possible the rudder trunk with the rescue boat before departure if the rudder is above the waterline.

  (ii) Install protective grating or steel bars onto the steering gear trunk to prevent access from the rudder.

6

Piracy

6.1 Piracy attack while waiting for berth

A laden product tanker was drifting 20 miles outside a West African port where it would discharge its cargo. There had been pirate attacks in the area and so the Master had ordered preventive measures to be implemented as per the SSP.

Two ABs were assigned to the poop deck and forecastle, and they were also assigned to monitor the main deck. The crew prepared the deck and attached a single coil of barbed wire on the poop deck, forecastle and on the railing around the vessel; locked all doors and turned on all the outside lights. The Chief Officer noticed that a couple of lights were broken amidships and told the Bosun to repair them the next day.

Delays in berthing

The agent had called the Master and informed him that the berth would be occupied for another two days and would be in contact when the berth was ready.

After midnight the Second Officer was on watch and monitoring a VHF channel dedicated to local navy broadcasts. The main engine was kept running so the vessel could manoeuvre instantly, and two ABs carried out regular patrols on deck.

Boarded by pirates

Shortly after midnight a small boat slowly approached the vessel. It stopped amidships by the broken lights where the freeboard was only 2 metres. The boat crew put a ladder on the railing, which had a carpet attached to protect them from the barbed wire, and climbed on board.

None of the ABs saw the small boat approaching. The boat did not give a stable echo reading on the radar as it was made of wood and the choppy sea interfered.

The five men who climbed on board were pirates and armed with machine guns. They made their way to the poop deck and surprised the AB on watch.

Death threats made

The pirates demanded that the AB should take them to the bridge or they would kill him. When the pirates had secured the bridge they asked for the Chief Engineer to be brought to the bridge. He was beaten when he arrived and told that he would be killed if he tried to sabotage the engine and that any engineer would be killed if they tampered with the engines.

The Second Officer was told to show two of the pirates to the Master's cabin and the other three remained on the bridge with an AB and the Chief Engineer. The Master was forcefully woken up, beaten and forced to open the safe and give all the money to the pirates. When the Master was taken to the bridge, ten more pirates had arrived. A larger vessel was drifting alongside which looked like a fishing boat.

One of the pirates identified himself as the leader and explained to the Master that all the crew should be summoned to the mess room. If anyone resisted or tried to sabotage anything on the vessel he would be killed.

All the crew, except the Master, were placed in the mess room and their hands were tied. The Master remained on the bridge. One of the SSAS buttons was under a radar console but the Master was not close to it and was too scared to push it.

Ship-to-ship transfer

The pirates took control of the vessel and sailed it for ten hours when they stopped beside another smaller tanker. They started a ship-to-ship operation and when the other tanker had been loaded it sailed off. The other two pirate boats had followed and were drifting alongside the vessel. The pirates took the Master to the mess room and tied him to a chair. He finally freed himself and when he reached the bridge he realised that the pirates had left, because both pirate boats were gone. He called the office and informed them what had happened.

What can we learn?

- Best management practices should be followed and need to be adapted to every different area the vessel is visiting. It is essential that a piracy risk assessment for the trading area has been completed as described in 'Best Management Practices to Deter Piracy 5 (BMP5)' and 'Guidelines for Owners, Operators and Masters for Protection Against Piracy in the Gulf of Guinea'.

- It is not common for pirates in the Gulf of Guinea (GoG) to use ladders, but in this attack, ladders were used to board the vessel, so preventive measures should be analysed and implemented. Physical barriers which increase the height will make it more difficult for the pirates to attach the ladders. A proper risk assessment needs to be completed.

- It is imperative that all required equipment is in working condition. In this case a number of floodlights were broken.

- Ships operating in the GoG area are strongly urged to plan according to the following:

    1 Arrive at the pilot station, port, anchorage or STS area 'just in time'. Plan transit times with consideration to safe speed and maintaining distance offshore or use an offshore waiting area.

    2 Rendezvous - where possible, avoid waiting and slow steaming. Consider offering several alternative rendezvous points and advise rendezvous points at the last minute. If waiting, keep well off the coast (up to 200 NM). Do not give away waiting positions. Do not drift and keep engines ready for immediate manoeuvres.

    3 Vessels should proceed within the 200 NM range at full speed.

    4 Anchoring - where practicable, a prolonged stay at anchorage is to be avoided.

    5 Minimise use of VHF and use e-mail or secure satellite telephone instead. Where possible, answer only known or legitimate callers on the VHF, bearing in mind that imposters are likely, and may even appear in uniform.

    6 The greatest risks of piracy are at night and these need to be factored into all planning. Where possible, operations should start and end during daylight hours.

    7 The use of privately contracted armed guards on board is banned in Nigerian waters.

    8 If using an armed escort, due diligence on the company providing this service must be conducted to ensure strict adherence to the MOU issued by the Nigerian Navy and Nigerian Maritime Administration & Safety Agency (NIMASA).

    9 Shipowners and managers must have a means of verification that hardening measures are available and in place on vessels prior to entering the GoG area.

    10 Spot checks for verification at ports within the GoG area are an additional option to consider.

    11 Nigerian naval armed guards can protect merchant ships utilising patrol boats to escort ships in the region.

    12 Maintain all-round visual lookouts and good radar watch.

    13 Report to MDAT-GoG (the Maritime Domain Awareness for Trade – Gulf of Guinea, operated jointly by French and UK Navies): watchkeepers@mdat-gog.org/emergency
    tel: +33(0) 298 22 88 88.

    14 The MDAT-GoG will liaise directly with the navies in the region in the event of an attack. If a ship does not report to the centre, then there is likely to be a delay in the response from the regional navy. Alerts and warnings will be issued by MDAT-GoG and they will also contact vessels in the immediate vicinity of an incident.

THE SWEDISH CLUB CASEBOOK

7

Collision/Contact

7

7.1 Collision as vessel was overtaken

Vessel A was a small general cargo vessel sailing at night in a busy area in the Baltic Sea. Visibility was good, and winds were westerly at Beaufort scale 3. The vessel was maintaining a speed of about 10 knots.

Bridge equipment

The S-band ARPA radar was set up in off centre, range 12 NM, north up, in relative motion mode, while the X-band radar was on standby. Both radars had similar blind zones as the masts were positioned close to each other on the ship's upper bridge. The bridge equipment included an ECDIS, which the Master who was on the 8-12 watch was monitoring. A lookout was also on the bridge.

Handover

There were a number of vessels astern of vessel A. Five minutes before midnight the Second Officer came to the bridge for his night watch. During the handover, the Master informed him about the vessels which were astern and advised that they were being overtaken by a number of them. After the handover the Master left the bridge.

The Second Officer was aware of a vessel overtaking them on the portside but was not aware of vessel B also overtaking them, but on the starboard side. He switched the radar between centred display to off-centre several times. The lookout was on the port bridge wing.

One minute from collision

The Second Officer was monitoring the ARPA S-band radar when he noticed a target astern on the starboard quarter - it was very close. This was vessel B and it was one minute from collision and only a few cables away. The officer turned around and looked out through the aft starboard bridge windows. Vessel B was almost on top of them. He tried to call the Master but could not reach him. He then switched to manual steering and altered hard to starboard which was towards the overtaking vessel, and the vessels collided.

Collision

Soon after the collision the Master came onto the bridge. He noticed that the engines were still full ahead and the rudder was hard to starboard, but the vessel was not turning. He reduced the engines to 60%. Vessel A was not moving. Vessel B had struck vessel A on the starboard side in way of cargo hold 2. After a while vessel B moved astern, and the vessels disengaged. The Master contacted vessel B but the OOW on vessel B responded that they had only been involved in a near miss. After a while they admitted that they had been involved in a collision.

Recording

The Master saved the VDR. However, only the X-band radar was interfaced with the VDR and as that radar was in standby mode, radar screenshots of the developing close quarter situation had not been recorded by the VDR.

COLREGs

Rule 5 - Look out:

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.

It is essential that the OOW ensures that a proper lookout is maintained all-round the vessel in cooperation with the AB on watch. This is the responsibility of the OOW. It is unclear why the lookout did not actively inform the OOW about the vessel overtaking on the starboard side.

Rule 7 - Risk of collision:

(a) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt [then] such risk shall be deemed to exist.

This may include running both radars. The ARPA radars should always be used for plotting all critical traffic. The X-band radar was the only radar recorded by the VDR, which means that the X-band radar should always be running when the vessel is on passage. It is also imperative that the OOW is aware of the bridge equipment's limitations and is not over-reliant on any specific equipment.

Rule 13 – Overtaking:

(a) Notwithstanding anything contained in the Rules of Part B, Sections I and II, any vessel overtaking any other shall keep out of the way of the vessel being overtaken:
(b) A vessel shall be deemed to be overtaking when coming up with another vessel from a direction more than 22.5° abaft her beam.

In this collision vessel B was overtaking vessel A and should have kept out of the way of vessel A.

Rule 17 - Action by stand-on vessel:

(a) (i) Where one of the two vessels is to keep out of the way the other shall keep her course and speed.
(ii) The latter vessel may however take action to avoid collision by her manoeuvre alone, as soon as it becomes apparent to her that the vessel required to keep out of the way is not taking appropriate action in compliance with these rules.

(b) When, from any cause, the vessel required to keep her course and speed finds herself so close that the collision cannot be avoided by the action of the give-way vessel alone, she shall take such action as will best aid to avoid collision.

Vessel A was the stand-on vessel. The OOW on vessel A noticed vessel B only one minute prior to the collision. The OOW took the action that he thought would be effective However, it was too late to be able avoid the collision.

What can we learn?

- In this accident vessel B did not alter course or adjust its speed at any point. Vessel A was the stand-on vessel and vessel B was the give-way vessel as it was overtaking vessel A on the starboard quarter. Vessel B would have been able to see the stern light of vessel A but not its sidelights.

- Rule 5 stipulates that every vessel shall maintain a proper look-out by all available means. The proximate cause of this collision was poor lookout by those on the bridge of vessel B. Vessel A was the stand-on vessel as it was being overtaken. However, it is essential that the bridge team (the OOW and the dedicated lookout) maintain a proper 360° lookout, track all traffic around the vessel and use all navigation equipment available on the bridge.

- It is imperative that the OOW and lookout discuss all traffic concerned and that the lookout updates the OOW with any change in the movement of the targets. It is the responsibility of the OOW to ensure that the lookout is actively reporting targets observed.

- The X-band radar can, depending on the sea conditions, be better at detecting smaller targets compared to the S-band radar. However, it was on standby. Preferably both radars should be running all the time, as with today's modern ARPA radars there is no reason not to do this. Furthermore, there is an IMO requirement on VDRs installed after 1 July 2014 that both ARPA radars should be recorded to the VDR which was not the case when the VDR was installed on vessel A.

7.2 Collision in restricted visibility when approaching port

Vessel A, a 1000 TEU container vessel, was approaching the pilot station at 17 knots. The vessel was in manual-steering mode and was on a course of 280°. That afternoon visibility was restricted to approximately 0.1 NM due to fog. The Bosun was on deck preparing the pilot ladder after which he would go to the forecastle to act as a lookout.

The bridge

The Master, the Second Officer and the AB were on the bridge. The Master had the conn, the Second Officer was monitoring, and the AB was on the wheel. Two ARPA radars were used alternatively on ranges between 6 NM, 3 NM and 1.5 NM. Both the Master and OOW were monitoring the vessel's progress on the radars.

Monitoring

The Master saw a target on the radar and acquired it on the ARPA as vessel B. The target was 10° on the port bow, 4 NM away with a CPA of 0.2 NM. Vessel A was overtaking vessel B. It could be seen that if vessel A maintained this course, it could hit vessel B on the starboard side. Vessel B was also on a course of about 280° and making a speed of 6 knots. The Master started the fog signal.

C -15 minutes: Vessel B was on course of 293° and the CPA was 0.14 NM. Vessel A was maintaining its course and speed.

C -10 minutes: Vessel B's course was 285°, CPA 0.04 NM and distant 1.4 NM.

C -5 minutes: Vessel B's course was 289°, CPA 0.03 NM and distant 0.65 NM.

C -2 minutes: Vessel B's course was 304° and CPA 0.01 NM and distant 0.3 NM. Vessel B was still on the port bow of vessel A. At this point the Master on vessel A realised that vessel B was very close and ordered hard to starboard and stop engines.

Collision: It was too late to avoid the collision and vessel A struck vessel B on its starboard side about midships. The Master saw that vessel B was a small tanker. Shortly afterwards vessel B began to list heavily to starboard and the crew were forced to deploy the life rafts and abandon ship. They were all rescued by vessel A.

COLREGs

Rule 5 - Look out:

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.

In this collision neither vessel seems to have maintained proper lookout.

Rule 6 - Safe speed:

Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions. In determining a safe speed, the following factors shall be among those taken into account:

(a) By all vessels:
(i) the state of visibility

The OOW must have time to take proper and effective action to avoid collision as required under Rule 6 to be considered to have proceeded at safe speed. Vessel A was making a speed of 17 knots in restricted visibility while approaching a congested area and a pilot station and this would probably be considered not to be a safe speed in the prevailing circumstances. This is also emphasised in *Rule 19*.

Rule 7 - Risk of collision:

(a) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt [then] such risk shall be deemed to exist.

(b) Proper use shall be made of radar equipment if fitted and operational, including long-range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects.

Vessel B was plotted on the ARPA on board vessel A and showed a small CPA. Despite the small CPA, no action was taken by the bridge team on vessel A.
At about C-15, the CPA to vessel B was 0.14 NM, which indicated that a risk of collision existed between the vessels. Visibility was restricted and so it was even more important to ensure that the CPA was large enough to account for any margin of error in the equipment. As per ARPA performance standards regulation the CPA should be calculated by the ARPA within three minutes with an accuracy of within 0.5 NM. This means that if the ARPA reports a CPA of 0.5 NM the actual CPA could be 0.0 miles or 0.5 miles. The bridge team must factor in this margin of error of the CPA when planning any collision avoidance manoeuvres and the passing distances to other vessels.

Rule 8 - Action to avoid collision:

(e) Any action taken to avoid collision shall be taken in accordance with the Rules of this Part and shall, if the circumstances of the case admit, be positive, made in ample time and with due regard to the observance of good seamanship.

(f) Any alteration of course and/or speed to avoid collision shall, if the circumstances of the case admit, be large enough to be readily apparent to another vessel observing visually or by radar: a succession of small alterations of course and/or speed should be avoided.

It is prudent and good seamanship to take action at an early stage by altering course and/or reducing speed to open up the CPA. In this case neither vessel took any action to avoid collision.

Rule 13 – Overtaking:

(a) Notwithstanding anything contained in the Rules of Part B, Sections I and II, any vessel overtaking any other shall keep out of the way of the vessel being overtaken:

Vessel A was overtaking vessel B.

Rule 19 - Restricted visibility:

(a) This Rule applies to vessels not in sight of one another when navigating in or near an area of restricted visibility.

(b) Every vessel shall proceed at a safe speed adapted to the prevailing circumstances and conditions of restricted visibility. A power-driven vessel shall have her engines ready for immediate manoeuvre.

(d) A vessel which detects by radar alone the presence of another vessel shall determine if a close-quarters' situation is developing and/or risk of collision exists. If so, she shall take avoiding action in ample time, provided that when such action consists of an alteration of course, so far as possible the following shall be avoided:
(i) an alteration of course to port for a vessel forward of the beam, other than for a vessel being overtaken:
(ii) an alteration of course towards a vessel abeam or abaft the beam.

In restricted visibility both vessels have a requirement to stay clear of each other. It is likely that vessel B was altering course as per its passage plan. It is still the responsibility of vessel A to ensure they stay clear of vessel B as per Rule 19.

What can we learn?

- The bridge team on vessel A acquired vessel B on the ARPA at about C -15 minutes. The CPA was 0.14 NM. With such a small CPA this should be considered a close quarter situation. At this point the bridge team had time to make an alteration to ensure the collision was avoided but no action was taken on vessel A.
- When sailing in restricted visibility all vessels have a responsibility to stay clear of each other. All vessels also have a responsibility to proceed at a safe speed which ensures that they can stop quickly. Maintaining full speed in restricted visibility under these navigational circumstances could be considered proceeding at an unsafe speed. Vessel A was approaching a pilot station in restricted visibility which meant there was also an increased risk of encountering a greater concentration of different types of vessels.
- In restricted visibility both vessels have an obligation to stay clear of each other. However, we do not know why vessel B altered to starboard. It is possible vessel B altered course in accordance with their passage plan. Vessel A was overtaking vessel B which required vessel A to stay well clear of vessel B.
- It is important that the officers understand the rules and increased risks when sailing in restricted visibility. It is also important to understand the limitations of the navigation equipment. It appears that the bridge team on vessel A considered a CPA of 0.14 NM to be an acceptable margin. To ensure situational awareness is maintained, the bridge team should discuss all plotted targets, what risks they pose and take appropriate action.

7.3 Collision in river

It was the middle of the night and vessel A, a 6,500 TEU container vessel, was sailing out from a port in a busy river with a pilot conning the vessel. The weather was fine with clear skies and winds at around Beaufort scale 6. All navigation equipment on vessel A was in good working order except for the AIS transceiver, which was not working.

Vessel A was on an easterly course in the outbound deep-water channel of the river fairway. Vessel B was proceeding on a reciprocal course in the inbound fairway of the river. The vessels were in sight of each other. The Master, Chief Officer, lookout, helmsman and the pilot were on the bridge of vessel A.

Underestimated weather conditions

Vessel B, a handymax bulk carrier, then reduced speed in order to time arrival for its berth. However, the bridge team on vessel B underestimated the impact of the wind and current, and the vessel was set towards the outbound fairway and its heading altered to port and towards vessel A. This caused vessel B to enter the outbound fairway.

No room for manoeuvre

Vessel A was sailing in the fairway of the extended deep-water channel but towards the centreline between the inbound and outbound fairway. The bridge team saw that vessel B had slowed down and that its heading was changing towards them.

There was some room for vessel A to turn to starboard and still remain in the fairway, but it was limited. The vessels were approaching each other, and vessel A was not able to turn to starboard and clear vessel B and still remain in the fairway.

An attempt to communicate

The pilot on vessel A flashed the signal lamp and called vessel B on the VHF but vessel B did not respond. The pilot ordered full astern and tried to alter course to starboard with the bow thruster. This did not prevent the collision. The Master on vessel A saved the VDR data after the accident. There were no injuries or pollution.

COLREGs

Rule 5 - Look out:

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.

In this case vessel B failed to keep a proper look-out.

Rule 7 - Risk of collision:

(a) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt [then] such risk shall be deemed to exist.

When vessel B drifted towards the outbound side of the channel it should have been clear to both vessels that a risk of collision was developing. Vessel B did nothing, and vessel A tried to contact vessel B instead of taking evasive action. The COLREGS do not mention the use of VHF. The rules are clear and should not require any discussion between the vessels.

Rule 9 - Narrow channels:

(a) A vessel proceeding along the course of a narrow channel or fairway shall keep as near to the outer limit of the channel or fairway which lies on her starboard side as is safe and practicable.

Neither of the vessels navigated near the outer limits of the fairway.

What can we learn?

- If we look at this case from vessel A's point of view, there are several problems in this collision which could have been resolved if the pilot had clarified the intentions of vessel B.
- The major fault in this collision lies with vessel B as it drifted into the opposite fairway when it slowed down. What happened on vessel B's bridge and why it did not respond to vessel A or take any action when it started to drift is unknown.
- It is important to continually evaluate all traffic, especially if the vessel is in a congested area such as approaching or departing a port. In the port state investigation, vessel A was found to be positioned close to its starboard side of the fairway, and this was identified as a fault. However, vessel B was found to be preponderantly to blame. The bridge team was not maintaining a proper look-out, they did not respond on the VHF and vessel B failed to stay clear of vessel A as it drifted into the opposite side of the fairway. The investigation also raised the issue of vessel A not having a working AIS.
- It is important that the bridge team has a departure briefing, where different scenarios are discussed, and the potential risks identified. When the pilot boards, the Master should discuss the plan for the pilotage. It is also important that the Master asks about local regulations, concerned traffic, expected currents and winds, and knows what the passing requirements are and how the pilot plans to approach the departure. If the local language is spoken the pilot must share the conversation, in English, with the bridge team.
- If the Master for some reason is not confident in the pilot's orders, he needs to voice this concern immediately. If he believes the vessel's safety is at risk, he must relieve the pilot. It is not uncommon for The Swedish Club to find that following navigational claims the Master has afterwards stated that he was concerned with the pilot and how they navigated the vessel. However, he did not relieve the pilot and take over.
- It is important that Masters are confident enough and are trained on how to challenge correctly. As in any line of work there is a vast difference in competence between different pilots and officers around the world. The safety of the crew and vessel should always be the Master's priority.

7.4 Collision in busy anchorage after grounding

In an evening with good visibility, vessel A, a 2,470 TEU container vessel, was approaching port. The Master had received orders to arrive at the pilot station at 20:40, which was one hour earlier than previously planned. To make the new ETA the speed had to be increased from 10 knots to 14 knots. Instead of following the passage plan, the Master decided to take a shortcut through an anchorage.

On the bridge was the Third Officer, who was the OOW, the Master who had the conn and the Chief Officer who was monitoring traffic both on the radar and visually. He was also talking on the VHF. An AB was manually steering whilst the Third Officer was filling out the logbook. The two ARPA radars were in north up, relative motion and the radars were switched between 3 NM and 6 NM range. The CPA alarm was set to 0.3 NM.

Passage plan not updated

The Second Officer who was the navigation officer, had already entered the waypoints for the original passage plan into both ARPA radars and the ECDIS, and a cross-track error alarm of 1 cable had been set up. During the approach he was not on the bridge and the passage plan was not updated for the shortcut as the Master did not consider it was necessary.

C -15 minutes: During the approach to the pilot station there were two smaller vessels ahead of vessel A that would be overtaken on their starboard side. Shortly after the vessels had been overtaken the Master ordered an alteration to port which meant that vessel A crossed in front of the bow of the two vessels.

C -12 minutes: The Master was also aware of two outbound vessels from the port, vessels B and C. These vessels were not acquired on the radar. Vessel B called up vessel A and asked what their intentions were. The Master responded that he would like to have a port-to-port passing. Vessel B replied that it was turning hard to starboard to make the passing. The Master altered course to starboard. At this time vessel B was about 1 NM away on the port bow.

C -9 minutes: The Master became aware of vessel C on the port bow. He could see the green, red and forward top lights on vessel C but did not take any action. Vessel A was maintaining a speed of 10 knots.

C -7 minutes: The Master decided to open up/increase the CPA by altering 5 degrees to starboard for vessel C. A minute later the Master realised that vessel C was very close, and he ordered full ahead and hard to starboard. The vessels just passed each other clear by 10 metres. When vessel C was abeam the Master became aware of an island just ahead and he ordered hard to port. When vessel C passed clear the Master ordered midships and then 20 degrees to port.

C -4 minutes: A minute later the pilot called the vessel on the VHF and asked why the vessel was heading dangerously close to the island. The vessel was now very close to it. The Master once again ordered midships and believed they would stay clear of the island.

C -3 minutes: Suddenly the vessel started to vibrate heavily and there was a loud noise. The vessel's speed was reduced to 5 knots. The Master was initially confused about what had happened but then understood that the vessel had hit the bottom but was still making way.

C -2 minutes: The Master identified that vessel D was at anchor only 0.15 NM ahead of them, at which point the AB informed him that the rudder was not responding. The Master ordered starboard 20 and then hard to starboard, but the AB repeated that the rudder was not responding. The vessel was now sailing at about 7 knots. The Chief Officer suggested dropping the anchor, but the Master declined.

Collision: The Master ordered full astern but shortly afterwards vessel A's bow hit the side of vessel D.
The Master reported the grounding to the VTS but did not consider it was necessary to report the collision.
Shortly afterwards the vessel managed to disengage from vessel D by engine manoeuvres and later dropped anchor.

COLREGs

Rule 5 - Look out:

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.

The bridge was manned properly in terms of the number of individuals present and number of functions represented. However, the different members of the bridge team had not been assigned properly defined roles and duties. The Master was in charge, but he did not use the members of the bridge team to provide him with the information he needed to make decisions about the safe navigation of the vessel.
A bridge team will be more efficient if roles and responsibilities are defined as outlined in The Swedish Club ***Bridge Instructions*** booklet.

Rule 6 - Safe speed:

Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions. In determining a safe speed, the following factors shall be among those taken into account:

(a) By all vessels:
(ii) the traffic density including concentrations of fishing vessels or any other vessels:
(iv) at night the presence of background light such as from shore lights or from back scatter of her own lights.

Proceeding at a speed of 14 knots through a busy anchorage can probably be considered to be unsafe. We know that the Master stated at the hearing following the incident that the vessel was not proceeding at a safe speed but that he was determined to make the ETA.

Rule 7 - Risk of collision:

(a) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt [then] such risk shall be deemed to exist.

(b) Proper use shall be made of radar equipment if fitted and operational, including long-range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects.

All available equipment on the bridge should be used to determine if a risk of collision exists. In this case not all the vessels were plotted on the ARPA, not even vessels which were in close quarter situations. It is imperative to plot all vessels to determine if risk of collision exists. The bridge was manned with three officers including the Master. However, the Master had not delegated the task of monitoring surrounding traffic and reporting close-quarters situations before they became dangerous.

Rule 8 - Action to avoid collision:

(a) Any action to avoid collision shall be taken in accordance with the Rules of this Part and shall, if the circumstances of the case admit, be positive, made in ample time and with due regard to the observance of good seamanship.

(b) Any alteration of course and/or speed to avoid collision shall, if the circumstances of the case admit, be large enough to be readily apparent to another vessel observing visually or by radar: a succession of small alterations of course and/or speed should be avoided.

The Master appears not to have communicated his intentions to the bridge team. The Master did not make a proper appraisal of the possibility of arriving at the pilot station at the time requested by the pilots.

What can we learn?

- There are several reasons why this vessel went aground and also suffered a collision. These were set in motion by a change to the passage plan caused by the order to arrive earlier at the pilot station. This is a common root cause of groundings and other accidents.

- In his desire to arrive at the pilot station on time the Master lost focus on safe navigation.

  1. He improvised the passage plan, which meant that no evaluation of the safety of the route was made.

  2. He demonstrated a complete loss of situational awareness.

  3. He failed to communicate his intentions to the bridge team and did not delegate tasks to the officers on the bridge.

  A proper evaluation of the options would probably have resulted in the Master calling the pilots to say that they could not make the desired ETA but would arrive 20 minutes later.

- It is not good seamanship to cross in front of vessels that have just been overtaken. Once again it highlights the risks the Master was willing to take to make the ETA.

- Any deviation from the passage plan other than for collision avoidance should be documented and subject to a proper appraisal. The passage plan should be berth to berth and not only pilot station to pilot station. The new passage plan needs to be entered in the ECDIS. All bridge team members need to sign the updated passage plan. If paper charts are used, the charts must be updated and the route plotted on the charts.

7.5 Collision due to miscommunication when approaching port

Vessel A, a capesize bulk carrier, was approaching port while fully loaded with iron ore. It had an overall length of 325 metres, a breadth of 52.5 metres and drafts of 17.8 metres. The water depth in the fairway of the port was more than 18 metres. However, the water depth to the north and south of the fairway was less than 17 metres. Vessel A was constrained by her draught and had the correct lights displayed. The fairway was about 420 metres in breadth.

Pilot briefing carried out

The pilot had embarked, and three tugs were lining up to connect to the vessel. The Master and pilot on vessel A had carried out a pilot briefing and the pilot had received a copy of the pilot card. It was evening with clear skies and light winds. Vessel A had a speed of 7 knots and a course of 310 degrees and both steering pumps were switched on. All navigation equipment was working. The vessel was in manual steering mode. Both X-band and S-band ARPA radars were set to north up and true motion. The range was switched between 3 NM and 6 NM.

On the bridge of vessel A were the Master, the Third Officer who was OOW, the pilot and the helmsman. According to the wheelhouse poster the minimum manoeuvring speed for vessel A was 5 knots. In ballast condition, it would take it about 12 minutes to stop if the engines were put from full ahead to full astern. If vessel A was sailing at 15 knots in deep water, it would take about 153 seconds to alter course by 90 degrees at hard-over angle.

C -30 minutes: Vessel B outbound from the port was acquired on the ARPA. It was a panamax bulk carrier with a length overall of 225 metres, breadth of 32.3 metres and was about 10 degrees on the starboard bow, 6 NM away. The ship was on a course of 125 degrees making about 10 knots, giving it a course almost reciprocal to the course of vessel A. Vessel B had a CPA of 0.5 NM and was shaping up to pass down the starboard side of vessel A. Those in vessel A observed the starboard green sidelight and masthead lights on vessel B. The vessel had a pilot on board.

C -14 minutes: Vessel B was about 3 NM distant. Behind vessel B there was a third outbound vessel. Vessel B was still slightly on the starboard bow of vessel A. Vessel B was outbound and navigating in the waters outside and to the north of the fairway.

C -12 minutes: The pilot on vessel A talked to the pilot of vessel B in the local language, and was advised that vessel B's pilot had just disembarked, before which he had told the Master of vessel B that he should pass vessel A green to green. Vessel A's pilot ordered the tugs to standby as they were approaching the buoyed fairway.

C -11 minutes: The pilot on vessel A called vessel B on the VHF and asked to pass green to green, which an officer on vessel B agreed upon. Vessel A was now on a course of 300 degrees and making about 8 knots. At about the same time, the VTS called vessel B and informed it that vessel A was inbound. Vessel B's officer acknowledged that they were aware of vessel A and that they would pass green to green.

C -9 minutes: The pilot ordered the first tug to make fast on the stern, the second on the starboard side and the third to follow the vessel on the port side. Vessel B was at a distance of 2.3 NM.

C -2 minutes: When vessel B was about 0.5 NM off the starboard bow it started to alter to starboard and towards vessel A and the red side light on B could be seen. The pilot on vessel A was alarmed by vessel B and called on the VHF and yelled 'green to green vessel B' and at the same time ordered hard to port and stop engine. An officer on vessel B replied, 'too close have to pass port to port' and continued to alter to starboard.

Collision: The pilot on vessel A ordered hard to starboard and full astern but it was too late, and the vessels collided. Vessel B's port side shell plating was torn open from cargo hold 2 to cargo hold 6.

COLREGs

Rule 3 - General definitions:

(h) The term 'vessel constrained by her draught' means a power-driven vessel which, because of her draught in relation to the available depth and width of navigable water, is severely restricted in her ability to deviate from the course she is following.

Vessel B should have stayed clear of vessel A as she was constrained by her draught.

Rule 8 - Action to avoid collision:

(a) Any action to avoid collision shall be taken in accordance with the Rules of this Part and shall, if the circumstances of the case admit, be positive, made in ample time and with due regard to the observance of good seamanship.

(b) Any alteration of course and/or speed to avoid collision shall, if the circumstances of the case admit, be large enough to be readily apparent to another vessel observing visually or by radar; a succession of small alterations of course and/or speed should be avoided.

(c) If there is sufficient sea-room, alteration of course alone may be the most effective action to avoid a close-quarters situation provided that it is made in good time, is substantial and does not result in another close-quarters situation.

Reviewing the radar screenshots recorded by the VDR on vessel A shows that the vessels were positioned to make a safe 'starboard to starboard' passing had they kept their courses. At this point there was no risk of collision. However, just before the vessels began to pass each other, vessel B called 'port to port' on the VHF and altered starboard to cross ahead of vessel A. The distance between the two vessels was about 0.5 NM when vessel B called port to port. The sudden starboard alteration by vessel B changed a safe starboard-to-starboard passing into a risk of collision. Vessel B caused a risk of collision to arise.

Rule 9 - Narrow channels:

(a) A vessel proceeding along the course of a narrow channel or fairway shall keep as near to the outer limit of the channel or fairway which lies on her starboard side as is safe and practicable.

(d) A vessel shall not cross a narrow channel or fairway if such crossing impedes the passage of a vessel which can safely navigate only within such channel or fairway. The latter vessel may use the sound signal prescribed in Rule 34(d) if in doubt as to the intention of the crossing vessel.

Vessel A was sailing on the starboard side in the fairway/narrow channel with constrained draught.

Vessel B was outside of the fairway and then suddenly altered to starboard at a distance of 0.5 NM and tried to cross ahead of vessel A, which is in violation with (d).

Rule 18 - Responsibilities between vessels:

(a) A power-driven vessel underway shall keep out of the way of:

(ii) a vessel restricted in her ability to manoeuvre;

(d)

(i) Any vessel other than a vessel not under command or a vessel restricted in her ability to manoeuvre shall, if the circumstances of the case admit, avoid impeding the safe passage of a vessel constrained by her draught, exhibiting the signals in Rule 28.

Vessel B should stay clear of vessel A.

What can we learn?

- Vessel A was a huge vessel, constrained by her draught and was assisted by tugboats which made it difficult for her to manoeuvre. To enter the fairway, vessel A needed to be lined up at an early stage. The agreement between the two vessels was to pass 'starboard to starboard'. This meant that vessel B would keep sailing outside and to the north of the fairway (B was already sailing outside the fairway) whilst A would proceed in the fairway. If vessel B had not altered to starboard there would not have been a collision.

- The pilots on vessels A and B made a verbal agreement to pass 'starboard to starboard'. This was also confirmed later between the pilot on vessel A and an officer on vessel B. The VTS was also in contact with vessel B and informed them that vessel A was an incoming vessel. They also did not raise any concerns about the 'starboard to starboard' passing.

- Collisions between vessels in a narrow channel are one of the few scenarios in collisions between two vessels underway where one vessel can be held solely at fault for not maintaining position on its starboard side of the fairway. These are issues that Masters need to be aware of.

7.6 Collision in restricted visibility

Vessel A was a 2,692 TEU container vessel underway. Shortly after commencing the sea passage, visibility worsened. The vessel was sailing through dense fog with SW winds at Beaufort scale 6. On the bridge were the Master, OOW and a lookout. The Master had the conn. At 20:00 the Second Officer took over the watch from the Third Officer. The visibility was only 0.1 NM and the fog was persistent into the evening. The Master stayed on the bridge the entire time.

Speed of 17 knots

Vessel A was maintaining a speed of 17 knots on a course of 240 degrees, the vessel was sounding fog signals. Both the ARPA X-band and S-band radar were used and the ranges were changed between 3 NM and 6 NM.

C -12 minutes: Vessel B was on the port bow about 3 NM from vessel A, making a speed of 6 knots on a 010 degree course according to the ARPA. Vessel B was about 11 o'clock from vessel A and crossing from port to starboard. The CPA was 0.0 NM and so a risk of collision existed.

C -10 minutes: The Master saw the name of vessel B on the AIS and called it on VHF channel 16, but had no response. He also used the searchlight to flash at the direction of vessel B as a warning signal. It is unlikely that vessel B would have seen this.

C -5 minutes: The Master ordered hand steering and an alteration to port to 210 degrees, in order to let vessel B pass ahead of vessel A. Shortly afterwards vessel B started to alter to starboard, resulting in a distance of 0.5 NM between them. The Master on vessel A ordered hard to port.

Collision: The vessels collided, and vessel B struck the starboard side of vessel A. The Master on vessel A now saw that vessel B was a fishing vessel.

Continued at same speed and course

However, the Master of vessel A continued the voyage at the same speed and course. After a while the VTS called vessel A and told them to stop and await the coast guard. At the time of the collision the fishing vessel was fishing by casting fishing pots overboard.

COLREGs

Rule 5 - Look out:

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.

The bridge was manned sufficiently and the bridge team on vessel A plotted vessel B at an early stage. However, the bridge team did not act on their observations.

Rule 6 - Safe speed:

Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions. In determining a safe speed, the following factors shall be among those taken into account. [(a) By all vessels:]

(i) the state of visibility:

(ii) the traffic density including concentrations of fishing vessels or any other vessels:

A speed of 17 knots in restricted visibility in an area with fishing boats can be considered unsafe.

Rule 7 - Risk of collision:

(a) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt [then] such risk shall be deemed to exist.

The CPA was 0 when vessel A plotted vessel B at C -12 minutes. It should have been apparent to those on the bridge of vessel A that there was a risk of collision.

Rule 19 - Conduct of vessels in restricted visibility:

(a) This Rule applies to vessels not in sight of one another when navigating in or near an area of restricted visibility.

(b. Every vessel shall proceed at a safe speed adapted to the prevailing circumstances and conditions of restricted visibility. A power-driven vessel shall have her engines ready for immediate manoeuvre.

(d) A vessel which detects by radar alone the presence of another vessel shall determine if a close-quarters situation is developing and/or risk of collision exists. If so, she shall take avoiding action in ample time, provided that when such action consists of an alteration of course, so far as possible the following shall be avoided:

> *(i) an alteration of course to port for a vessel forward of the beam, other than for a vessel being overtaken:*
>
> *(ii) an alteration of course towards a vessel abeam or abaft the beam.*

Vessel A altered to port, which is in contravention of rule 19 as vessel B was on the port bow of vessel A. At no time did the Master on vessel A reduce speed.

What can we learn?

- The Master and OOWs must always consider the safe speed of the vessel. The crew may be under the impression that they have to maintain a high speed to meet a schedule and this can create conflicts of interest between meeting a schedule and sailing at a safe speed. This is something that the Master and the owners must deal with in their safety management procedures to ensure that the vessel is navigated safely.

- In addition, the greater risk of sailing at a high speed must always be evaluated by the Master and instructions conveyed to the bridge officers. Rule 6 advises that a vessel needs to be able to avoid a collision as per the prevailing situation. Proceeding at higher speeds will also attract a higher degree of blame when the courts apportion liability between the vessels involved in collision.

- The bridge team on vessel A was aware of vessel B for about 12 minutes before the collision. Despite the clear indication that the vessels were on collision courses, the Master of vessel A altered to port, towards vessel B and in contravention of rule 19. Under no circumstances should a vessel alter to port towards a vessel on its port bow in restricted visibility as vessel A did in this collision. The Master on vessel A stated that this manoeuvre was because he believed that vessel B was the give-way vessel and that vessel B would pass forward of vessel A. Under Rule 19, both vessels have an equal obligation to avoid a collision.

- It is not acceptable to continue a voyage after a collision and this was a very bad decision by the Master. He should have ensured that all crew on vessel B were safe before continuing the voyage, which he did not do.

- The Master had been on the bridge for five hours when the collision occurred. It is unknown how long he had been awake prior to this. However, according to the flag state investigation it is unlikely that the Master suffered from fatigue.

- In this case vessel B was plotted but the bridge team on vessel A did not act on the information and assumed that vessel B would alter course. It is important to ensure that bridge officers are well trained so that they can take critical decisions quickly and correctly. They must understand the consequences of their actions, appreciate when no action needs to be taken, and know how to prevent a close-quarters situation.

- Some safety management systems stipulate minimum CPA limits and manning levels in the navigation policy, depending on visibility and during critical operations such as approaching or leaving a port. However, generic requirements in the navigation policy may not illustrate to officers what are acceptable limits and what are unacceptable limits. Many of these issues are covered in the Club's ***Bridge Instructions*** booklet.

7.7 Contact while berthing in river

It was early morning and a 150 metre long, 14,900 DWT general cargo vessel, vessel A, was sailing up a South American river with a pilot on board. The Master and pilot had carried out a pilot briefing where the pilot presented the plan for berthing. The vessel would be berthed portside alongside, between two vessels which were already berthed. The Master asked the pilot if any tugboats would be necessary, but the pilot did not believe so as there would be a 200 metre gap between the berthed vessels, giving vessel A about 50 metres clearance from the berthed vessels.

Strong current and brisk winds

During the berthing the Chief Officer was by the radar and the ECDIS on the bridge, monitoring progress. The vessel had a speed of about 2 knots over the ground in the river and was on a NNW course. There was a strong SSE current at around 2-3 knots and a NE wind at Beaufort scale 3. During the final berthing manoeuvre the vessel passed one of the berthed vessels with only 20 metres clearance on the portside. The wind set the vessel towards the berthed vessel.

The Master had the conn and was positioned on the port wing. As he was manoeuvring the vessel, the pilot gave him advice and instructions. When the Master noticed that his vessel was very close to the berthed vessel he ordered full power to starboard on the bow thruster.

Master lost control

Despite the Master's efforts to turn the bow to starboard the vessel continued turning to port and the bow collided with the berthed vessel. The vessel's superstructure was forward, so the bridge wing also caused damage to the berthed vessel.

The Master finally managed to gain control of the vessel and berth it. Upon berthing the vessel, the Master noted that the distance between the two other vessels was 10 metres forward and 20 metres aft.

What can we learn?

- When the Master approached the berth, he should have evaluated if the available tugs should be used or not. If he was unsure about the clearance, he should have asked the pilot for tug assistance before berthing.

- It is important that the Master and pilot discuss what is anticipated and how to carry this out in the safest way. When the vessel was sailing up the river there were strong currents and some wind. During the manoeuvre the Master had the conn but needed constant updates from the pilot and Chief Officer about how strong the current was. These discussions should also have taken place during the pilot briefing. Having an NNW course and NE winds on the starboard bow will push the bow to port, especially when the vessel is lining up for the final approach and altering slowly to port and slowing down. The current will also make the approach more difficult as more power must be used during the final manoeuvre as the current would push the bow to starboard.

- The entire bridge team should be involved in berthing. In this instance the Chief Officer was by the radar and ECDIS and was the person who could have informed the Master about changing current or wind. The current also took the pilot by surprise. An efficient bridge team are assigned roles where they all know what they are expected to do and what the other persons are supposed to do. If someone makes a mistake this should be identified by a member of the bridge team. The Chief Officer was on the bridge and he should have supported the Master with information. This is further explained in the Club's ***Bridge Instruction*** booklet.

7.8 Excessive speed when approaching berth

It was morning with clear skies and NW winds at Beaufort scale 7. A 200 metre RoRo vessel had picked up the pilot. There had been a short pilot briefing where the bridge team were advised that that the vessel would berth starboard side at berth A which had a course of 285 degrees. The approach in the fairway was 090 degrees. This meant that the vessel had to make a large port alteration of 165 degrees to line up with the berth. The port had no breakwater and was open to the sea.

Two tugs standing by

The pilot had the conn and the vessel was sailing down the fairway on a 90 degree course and a speed of 9 knots over the ground. Two tugs were standing by but were not connected. At the position where the pilot decided to begin the alteration there were less than 500 metres of space between the quays in the port basin.

Wind pushed vessel away from berth

The pilot ordered the vessel to come around to port and stop the engines. The vessel was still making 9 knots. The vessel was sensitive to the wind because of the large hull and superstructure. This caused the NW wind to push the vessel away from the berth.

The vessel started to alter to port and was facing the berth at a 90 degree angle when it was only 50 metres away. The pilot realised the danger and ordered slow astern and hard to port, followed instantly with full to port on the bow thruster. As the speed was excessive for the bow thruster nothing happened.

Bow hit quay at speed

At the same time the Master realised that the vessel was not slowing down so he ordered the port anchor to be dropped and full astern on the engines. It was too late, and the bulbous bow hit the quay at a 90 degree angle.

After the contact the tugs were connected and berthed the vessel.

The vessel had to dry dock and repair the bulbous bow. The berth also needed extensive repairs.

What can we learn?

- The vessel was approaching at excessive speed. Maintaining a speed of 9 knots when starting to swing around and as close as 50 metres highlights that the berthing plan was not safe and that the bridge team had not planned it accordingly regarding wind and speed.

- The Master did not challenge the pilot until it was obvious that the vessel would make heavy contact with the quay. It is imperative during the pilot briefing that the approach is discussed in detail with the entire bridge team, so orders can be challenged if there is concern.

- Two tugs were standing by but were not connected. Once again, if the vessel had slowed down and had the tugs connected the berthing manoeuvre would have been controlled. If tugs have been ordered why not use them?

8

Loss of anchor

8.1 Loss of anchor in heavy weather

A vessel was waiting for its berth to become available so the decision was made to anchor. A pre-anchor briefing was held on the bridge where the number of shackles to be used was discussed, and the crew were assigned their tasks for the anchoring operation.

One week earlier the bosun had inspected the windlass including the brake linings and had reported that all was in good condition.

Rough weather forecast

The weather forecast warned of rough weather the following day. The Master informed the bridge team that he would decide what to do later regarding the anticipated heavy weather. The anchoring party consisted of the Chief Officer, Bosun and two ABs. The bosun was controlling the brake, the Chief Officer was reporting what was happening to the bridge and giving orders to the Bosun and ABs. This was the first time the crew had anchored at this anchorage.

The vessel approached the dedicated anchor position as directed by the VTS. When the vessel was fully stationary the Chief Officer ordered the bosun to walk the anchor out using the windlass motor. When the anchor was about half a shackle above the seabed the anchor was let go. All went well and the crew resumed their normal duties when the vessel was safely anchored.

During the night the weather deteriorated. The OOW noticed that the vessel had begun to move and realised that the vessel was dragging. He called the Master who came up on the bridge. The weather was now rapidly deteriorating, and the Master woke up the Chief Officer and told him to assemble the anchor party and heave up the anchor.

Windlass motor fails

The weather had now increased to Beaufort force 8 and the bow was slamming because of the large waves. At that point, while the anchor was being heaved up the windlass motor stopped. The Chief Officer could see smoke coming from it and it was obvious that the motor could not be fixed straight away. At the same time the weather was deteriorating even further so it was decided that the anchor chain should be let go. The bitter end was removed, and the anchor chain was released. The vessel then left the anchorage and drifted in a safer position. The anchor and chain were lost and the vessel was not allowed to continue its journey until the anchor and chain had been replaced. The vessel had a spare anchor but the operation to replace the main anchor and chain took several days.

What can we learn?

- It is imperative that the crew understands the limitations of anchor equipment.
- This case study highlights the fact that the crew were not aware of the classification societies' rules or maybe did not fully understand them.
- Anchor equipment is not designed to endure heavy weather. If heavy weather is anticipated the anchor should be raised.
- Classification societies have unified rules for the design of anchoring equipment, and it is essential that the crew is aware of these limits. When planning to anchor, the following should be considered:

  1 The anchor is designed for temporary mooring in a harbour or sheltered area.

  2 The equipment is therefore not designed to hold a ship off fully exposed coasts in rough weather or to stop a ship which is moving or drifting.

  3 Anchoring equipment is designed to hold a ship in good holding ground in conditions such as to avoid dragging of the anchor. In poor holding ground the holding power of the anchor is significantly reduced.

Anchor equipment

Classification societies assume the following maximum conditions for anchor equipment:

- Current velocity: max 2.5 metres per second (about 4.8 knots).
- Wind velocity: max 25 metres per second (about 48 knots or force 10 on the Beaufort scale).
- No waves.
- Equivalent condition including wave loads:

  1. Current velocity: max 1.5 metres per second.

  2. Wind velocity: max 11 metres per second.

  3. Significant wave height max 2 metres.

- Length of paid out chain: cable: 6-10 shackles

In addition, the following should be noted:

- The design load for the performance of the anchor winch motor is a minimum lifting capacity of 3 lengths of chain, i.e. 82.5 metres plus the anchor.
- The windlass brake is essential to control the pay-out of the chain. The design load for the windlass brake is 45% of chain breaking load when a chain stopper is installed and 80% of chain breaking load when no chain stopper is installed. The conventional design is with brake bands but there are also disc brake systems.
- In heavy weather conditions or strong current, the rudder and engine must be fine-tuned to prevent too high tension in the chain and overload of the windlass motor. Ensure that the chain is kept as vertical as possible.

8.2 At anchor during a typhoon resulting in a grounding and total loss

A laden 45,000 MT deadweight tanker had anchored in a bay outside an Asian port. It was late summer and the vessel was waiting for a berth to discharge its cargo.

Weather warnings forecast

Weather warnings about an approaching typhoon for the area where the tanker was anchored had been broadcast for two days prior to the vessel arriving at the anchorage. The tanker had anchored with 7 shackles of chain in the water. There were some islands around the anchorage and the Master considered the anchorage would be a suitable place to ride out the approaching typhoon, which had been upgraded to a category 2 typhoon.

Around 04:00 the following morning the wind increased to Beaufort scale 9 and the Master told the Chief Officer to pay out 2 more shackles of chain in the water, making a total of 9. During the morning the wind continued to increase to Beaufort scale 12 which caused the anchor to drag.

Wind continued to increase

The Master tried to manouvre the vessel into the wind using the engines. However, two hours later the wind had increased even further, and it was not possible to turn the bow into the wind with the vessel at anchor. The vessel was now turned so that the wind was acting on the broadside of the dragging vessel.

The Master ordered the Chief Officer to heave up the anchor. However, this was not possible as the vessel was dragging. The windlass was not designed for these environmental loads, as it was only designed to lift the weight of the anchor and three shackles of chain (82.5m) in calm water.

Vessel ran aground

At this point there was nothing the crew could do, and the vessel ran aground on one of the islands surrounding the anchorage.

The Master sent a distress signal and the crew abandoned the vessel. Shortly after abandoning the vessel the crew was rescued by a local tug. Fortunately, there was no pollution and no injuries to the crew.

What can we learn?

- It is not uncommon for crews to be unaware of the environmental loads for which anchoring equipment is designed. Classification societies have unified rules for the design of anchoring equipment, and it is essential that the crew is aware of these limits (see below).
- A category 2 typhoon, as in this case, will have a predicted wind velocity of about 45 metres per second (about 87 knots) which is almost twice the load the anchoring equipment is designed for.
- If heavy weather is anticipated, as in this case, it is important that the vessel leaves the port/anchorage as soon as possible. This case highlights the risks and consequences of not leaving in sufficient time.
- It is recommended to use weather routeing which will warn about approaching heavy weather and suggest an alternative route for the vessel.

Anchor equipment

Classification societies assume the following maximum conditions for anchor equipment:

- Current velocity: max 2.5 metres per second (about 4.8 knots).
- Wind velocity: max 25 metres per second (about 48 knots or force 10 on the Beaufort scale).
- No waves.
- Equivalent condition including wave loads:

  1. Current velocity: max 1.5 metres per second.

  2. Wind velocity: max 11 metres per second.

  3. Significant wave height max 2 metres.
- Length of paid out chain: cable: 6-10 shackles

In addition, the following should be noted:

- The design load for the performance of the anchor winch motor is a minimum lifting capacity of 3 lengths of chain, i.e. 82.5 metres plus the anchor.
- The windlass brake is essential to control the pay-out of the chain. The design load for the windlass brake is 45% of chain breaking load when a chain stopper is installed and 80% of chain breaking load when no chain stopper is installed. The conventional design is with brake bands but there are also disc brake systems.
- In heavy weather conditions or strong current, the rudder and engine must be fine-tuned to prevent too high tension in the chain and overload of the windlass motor. Ensure that the chain is kept as vertical as possible.

9

Grounding

9.1 Grounding in unsurveyed waters

A 50,000 GT RoRo vessel had been loading in a European port. The navigation officer had prepared the passage plan for the voyage to the next port of call which was in central America. Prior to departure the Master received weather routeing for the passage, which suggested a route over the Silver Bank and via the Windward Passage.

The navigation officer planned the route in the ECDIS and on paper charts and discovered that the minimum depth the vessel would encounter was at the Silver Bank where the water depth was 16 metres according to British Admiralty chart 3908.

The vessel's draft was 7.5 metres, so a 16-metre water depth was considered acceptable as per the company's ISM under keel clearance procedure. The procedure stated that there had to be a minimum of 20% under keel clearance of the maximum draught.

'Inadequately surveyed' warning

On the British Admiralty chart the Silver Bank is marked 'Inadequately surveyed' in three places. On the route planned by the navigation officer there was no specific mention of inadequately surveyed waters. The navigation officer did not consult the Admiralty Sailing Directions when preparing the passage plan.

After checking the entire route on the ECDIS and on the paper charts, the Master decided to follow the route suggested by the weather routeing company. The passage was uneventful over the Atlantic from Europe and the vessel maintained a speed of 13.5 knots. Shortly after entering the Silver Bank the vessel's bow suddenly swung to starboard, which caused a list for about 3 to 5 seconds, with excessive vibration. The OOW changed to hand steering. A couple of minutes later the vessel's bow swung to starboard, but this time with less vibration. The vessel's bow swung a third time to starboard and listed for about 3 seconds, with vibrations. After carrying out a damage assessment it was found that the forepeak tank and a water ballast tank had water ingress. All the fuel tanks were intact.

Vessel repaired in dry dock

The vessel arrived at the destination port, discharged the cargo and carried out an in-water survey. It was found that the tanks had been punctured as the vessel had touched bottom. The vessel had to be repaired in dry-dock.

What can we learn?

- The vessel had on board the Admiralty Sailing Directions NP 70, West Indies Pilot, where it is stated that Silver Bank has been inadequately surveyed and it is not advisable to attempt to cross it. The sailing directions had not been reviewed before or after making preparing the passage plan. It is important to ensure that all reference literature is used when making a passage plan.

- It is important to perform a two-person check for critical operations such as a passage plan. It is more likely that another person will find a mistake rather than just carrying out your own double checking.

- The ECDIS chart information is based on data from the paper charts. If the quality of the data in the paper charts is poor, then so will the data in the ECDIS charts cell be. Each chart cell contains a CATZOC code (Category Zone of Confidence), which indicates the accuracy of the data in the cell. As part of the passage plan appraisal the navigation officer should check the quality of the data. The sailing directions will give good information about routeing and will also mention recommended routes. There are many areas in the world where the chart data is uncertain so even if the chart is vectorised as per IHO standards, it is necessary to check the quality of the data used.

9.2 Grounding as channel buoys were in the wrong position

A 20,000 DWT dry cargo vessel had picked up the pilot and was approaching the fairway to the port. It was morning with clear skies and light winds.

On the bridge were the Master, the pilot the OOW and the helmsman. The Third Officer was the OOW and had completed the pre-arrival checklist. The vessel was in hand steering mode and the pilot had the conn. The Master had given the pilot a pilot card, but they had not carried out a pilot briefing. The pilot asked for 7 knots in the fairway and lined up the vessel between the buoys.

Everything seemed in order

The OOW was monitoring the vessel's position on the radar and the ECDIS and was also filling out the logbook. The vessel passed the first buoys, and everything seemed in order to the Master when he looked outside.

Suddenly the vessel vibrated heavily and the speed fell rapidly until the vessel completely stopped. The Master realised that the vessel had run aground. He told the pilot that the vessel was aground, but the pilot did not believe him as the vessel was in the middle of the fairway.

When the pilot also realised that the vessel had run aground he started to talk on the VHF in the local language.

Vessel ran aground outside the fairway

The vessel had run aground on a bank which was outside the fairway. The vessel was clearly visible outside of the channel on the ECDIS and radar. This was also confirmed when the position was plotted.

The Master began to deballast the vessel and carried out engine manoeuvres in an attempt to get the vessel off the bank. Subsequently the Chief Engineer called the Master and told him that the steering gear was not responding.

The Master immediately stopped the engines and asked the Chief Officer to sound all tanks and also take soundings around the vessel.

Tugs called to assist

The pilot told him that two tugs were coming from the port to assist the vessel.

The Master had not signed any salvage contract, but the two tugs began to attempt to refloat the vessel with the assistance of the pilot and authorities. The tugs managed to remove the vessel from the bank the following day.

What can we learn?

- The bridge team did not check the position of the vessel on the chart, radar, or by any other means than visually.
- The passage plan should be berth to berth, so there should have been a planned route into the port which would have highlighted the discrepancy in the vessel's position on the ECDIS.
- The vessel had an ECDIS, but it appears no one was monitoring the display during the approach.
- There was a leading line for the approach, but for some reason it was disregarded. The bridge team did not monitor the vessel's progress with all the available navigational equipment.
- It is important that the shipowner has a navigation policy that details which navigation equipment should be used and how the bridge should be manned efficiently at different stages of the voyage. Leading lines should always be used, and the vessel's position should be confirmed by radar, GPS and visually. This was not done.
- In addition, the passage plan should be berth to berth and it should detail how to conduct a pilot briefing. It is obvious that the pilot should have known that the buoys were out of position. It is important that the bridge team follows the passage plan and monitor the actions of the pilot.

9.3 Grounding as the OOW missed waypoint

It was night and a 700 TEU container vessel was sailing near the coast towards the next port. It was raining, so visibility was reduced.

On the bridge was the Second Officer who was OOW. The passage plan had been approved by the Master and the bridge team and entered into the GPS and radar.

Vessel began vibrating heavily

Suddenly the vessel vibrated heavily and veered strongly to port. The OOW was confused about what had happened. Soon afterwards the bow thruster room high level alarm sounded. The Master came to the bridge and when he asked what had happened the OOW was still confused.

The Master called the Chief Officer and asked him to check the forepeak and bow thruster room. A couple of minutes later the Chief Officer informed him that there was water ingress in both locations.

The Master stopped the engines and the vessel drifted until the situation could be assessed. The Master realised that the vessel had hit the bottom and contacted the nearest JRCC and informed them that the vessel had grounded and was taking on water. The Master asked for assistance as he was unsure what had happened.

Fortunately there was no pollution and no injuries, and the steering gear, engines and bow thruster were all operational. A rescue vessel from the nearest port came out to the vessel but no assistance was needed, and the vessel sailed to the nearest port and berthed without incident to assess the damage.

Waypoint not entered on GPS

The vessel frequently traded in the area, so the voyage was not unusual. It was found that the navigation officer had forgotten to insert a waypoint in the GPS. This meant that the course took the vessel straight over a shallow area where it ran aground.

What can we learn?

- When preparing a passage plan it is suggested that the plan is double-checked by another officer to ensure all waypoints have been entered into the navigation equipment. It is prudent to perform a two-person check of the passage plan and all critical navigational equipment, such as the GPS, before departure. The passage plan needs to be signed by all bridge officers and the Master.

- It is also suggested that every officer taking over the watch ensures that the passage plan is correct and that all the correct parameters are included in the GPS, radar and ECDIS. Any deviation from the passage plan during the watch needs to be reported when handing over to the next watch officer.

- If the passage plan is entered in the ECDIS and the correct safety depth is entered in the system, the software can check that the passage plan is not crossing any area with less depth than the safety depth. If any shallow areas or any other dangers are detected a warning will be triggered, which the navigation officer must check and rectify. In this case the passage plan was not entered into the ECDIS and was only entered into the GPS and radar.

- Once again, we highlight that all navigation equipment should be used and checked during the voyage.

9.4 Grounding in heavy weather

It was an autumn night, and strong winds of Beaufort scale 10 hit a handysize bulk carrier. The vessel was in ballast condition and sailing through an archipelago.

Difficulty in maintaining course

The Third Officer, acting as OOW, and a helmsman were on the bridge. The vessel was in hand steering mode and was only making 2 knots over the ground. It was difficult to maintain course and the wind was blowing in on the port bow. The helmsman had put the rudder hard to port but the vessel began to alter to starboard. The OOW called the Master and informed him that it was difficult to maintain course. The vessel was between two islands, which made the winds even stronger as the islands were creating a wind tunnel.

The Master came up on the bridge and ordered the OOW to go to the emergency steering room. The vessel was classed to have the engine control room constantly manned. The Master called the duty engineer and asked for the engine controls to be transferred to the bridge. When transferring the engine controls the engine had to be put on standby.

Engine controls transferred to the bridge

The Master made an announcement on the PA system and asked all crew to come to the bridge. The Chief Officer was told to prepare the anchors.

The OOW was now in the steering gear room and confirmed that the rudder was hard to port.

Impossible to enter main deck

The Chief Officer informed the Master that it was impossible to enter the main deck as large waves were washing over the deck.

The duty engineer called the Master and informed him that the bridge now had the engine controls. However, the vessel had drifted very close to an island during the engine transfer. Before the Master managed to increase the engine speed the vessel hit rocks.

What can we learn?

- In heavy weather it is important to reduce speed, but this can only be done if l the steering can be maintained. To put the engines on standby to transfer the control to the bridge was a poor decision, as the vessel was then drifting between the islands in heavy weather. If the Master wanted the bridge to have the engine controls, it would have been safer to shift the controls when the vessel was in open water and not battling heavy weather.

- The vessel was in ballast condition and if heavy weather is anticipated the vessel should be ballasted in such a way to increase the draft and reduce the wind area.

- The bridge team was not prepared for the heavy weather and did not amend the route. It would have been possible to remain in open waters and not pass between the islands.

- Why the Master sent the OOW to the steering gear room is unclear. It seems that the Master did not trust the rudder indicator and wanted to confirm the angle.

9.5 Grounding at high speed

A suezmax oil tanker loaded with crude oil was transiting the Suez Canal from North Africa to India. On the bridge were the pilot, Master, helmsman and Chief Officer. It was morning and a second set of pilots had just boarded the vessel. The pilots carried out a handover on the bridge – this was carried out in Arabic. After the handover the new pilot ordered the vessel to increase to full speed ahead. The Master asked the pilot if full speed was really necessary as the vessel was fully loaded and had a draught of 14.5 metres. The pilot replied that there were strong currents ahead and that full speed was required. The vessel managed to achieve a speed of 9 knots over the ground.

Vessel listed heavily

About one hour later the vessel had to alter course to port from 171 degrees to 154 degrees. The pilot ordered 'port 20' to the helmsman, and the vessel began to alter at a rate of turn of 15 degrees per minute. It was rapidly closing the distance to the eastern canal bank at full speed. To counteract this the pilot ordered hard to starboard. This caused the vessel to swing to starboard at a 25-degree rate of turn, and the vessel listed heavily.

Master relieved the pilot

The Master asked the pilot if the western branch of the channel was safe. The pilot stated that it was not. At this point the Master took over and relieved the pilot as he determined that the pilot had lost control of the vessel.

The Master ordered hard to port and the vessel just missed the buoys by the centre embankment. The vessel was again heading for the west bank and the Master initially reduced the engine speed to slow ahead, but realised that he needed to turn more quickly, so he ordered full speed ahead to increase the rate of turn.

Vessel made contact with bank

Unfortunately, the Master could not avoid the bank and made contact a couple of times before ending up in the middle of the canal where the vessel finally stopped.

About an hour later the vessel anchored in the Bitter Lakes and informed the Suez Canal Authorities about the incident. There was no pollution and divers inspected the vessel and found several dents in the hull.

The vessel had to dry dock to repair the damage to the hull at a substantial cost. The vessel was out of service for over a month.

What can we learn?

- This was a fully laden tanker, and increasing the speed to full ahead in the Suez Canal caused the stern of the vessel to swing towards the near bank (the Bank effect). Neither the pilot or the bridge team discussed this possibility as the pilot increased the speed. It is obvious that the Master was uncomfortable with the pilot's decision, but he still accepted it.

- The reality was that there were no strong currents at the time. If the bridge team had checked the current this could have been brought to the pilot's attention.

- The pilot's action was not up to the expected standard and to relieve a pilot is an unpleasant and stressful experience. It is essential that managers train their Masters to challenge a pilot who does not comply with the vessel's SMS and company's ISM regulations. However, there should have been a proper pilot briefing where the pilot and the rest of the bridge team discussed the upcoming pilotage and what to expect. This should have included expected environmental conditions, what speed and what rate of turn would be suitable, how the vessel performed when it was fully laden and any upcoming traffic. If these issues are discussed it is likely that all involved parties can give their input on why a suggested action is advisable or not.

9.6 Grounding because of poor cooperation

A 1,000 TEU container vessel departed its berth after loading. During the loading there had been some delay and the gantry cranes had stopped operating because of strong winds, so the Master was eager to depart. The navigation officer had prepared the bridge before departure.

Pilot plan was not discussed

On the bridge were the Master, pilot, lookout and Chief Officer. A tug assisted the vessel during departure. The Master gave the pilot the pilot card and offered him some coffee. After this the Master gave the pilot the conn. The pilot was steering from the port side bridge wing. The berth had a heading of 317 degrees and there were still WSW winds at Beaufort scale 9. The vessel was moored at the end of the berth. The fairway leaving the port had a heading of 230 degrees. The pilot's plan was for the vessel to go astern and swing to port and clear the end of the berth and then follow the fairway. However, he did not explain the plan to the Master and the Master didn't ask the pilot about any plan.

The Master ordered all lines let go. The bow started to fall off quicker than the stern as the wind pushed on the vessel's port side, off the berth. The pilot ordered half astern and the plan was to use the bow thruster to let the vessel's bow swing past the end of the berth and to position the vessel to sail out in the fairway. At this time the vessel had a course of 310 degrees.

Drifting towards buoy

The tug assisted with pushing the vessel on the starboard side. The vessel was now moving astern at 2 knots and towards the opposite side of the fairway, the south side. There were several buoys marking the fairway. The closest buoy was on the starboard quarter about 50 metres away.

The wind continued to push the vessel from the portside causing the vessel to drift SE in the fairway towards the south side of the fairway. The vessel had a stern thruster and it was set full to starboard to assist the vessel in turning to port. The vessel started to slowly come around and had a heading of 291 degrees but was still drifting SE towards the buoy.

Multiple warnings ignored

The Second Officer was on the stern and warned the Chief Officer over the UHF that a buoy was only 30 metres away on the starboard quarter. The vessel now had a heading of 320 degrees which was a 90-degree angle towards the fairway. The Chief Officer informed the pilot and Master but neither of them acknowledged or took any action. The Second Officer now informed the Chief Officer that the buoy was only 10 metres away. The pilot ordered half ahead on the engines. For some reason the stern thruster was stopped. At the same time the pilot received a job-related mobile phone call which he answered. The vessel continued its movement astern and hit the buoy on the starboard quarter. The entire buoy was dragged underneath the vessel and damaged the propeller, rudder and rudder stock. The damage caused the vessel to lose its steering and because of the damage the Master stopped the main engine. This caused the vessel to start drifting even quicker SE towards shallow waters.

The pilot suggested that the anchor should be dropped, and so the Master ordered the port anchor to be dropped. This was delayed as the Second Officer had to cross from the stern to the bow. When he reached the bow and the bosun tried to drop the anchor it became entangled and it took a minute before it was released. At the same time the vessel ran aground.

What can we learn?

- Underestimating natural forces such as strong winds is the third most common reason for vessels running aground.

- A big concern in many navigational claims is that the bridge team does not work efficiently as the different members don't discuss the plan - or sometimes don't even have a plan as in this case.

- It is important for the Master to be polite but assertive when he feels that the vessel's safety might be at risk. To avoid such a situation occurring, the Master's expectations need to be discussed during the pilot briefing. In this case there had not been a pilot briefing. The Master should inform the pilot of any parameters e.g. the rate of turn and speed he is comfortable with, and the pilot should explain to the Master what the plan is to ensure the operation is safe. This is what we would consider as having good situational awareness. This is especially important as there were strong winds.

- During the pilot briefing the Master should ask the pilot about local regulations, concerned traffic, expected currents and winds, passing requirements and how the pilot plans to approach the departure. If the local language is spoken the pilot should be asked to explain the conversation, in English, to the bridge team. If a plan is discussed and agreed, it is easier to amend the plan if there are complications.

- The pilot must be included in the bridge team and anything unclear about the vessel's progress or deviation from the plan needs to be voiced within the bridge team at once. To have efficient communication is one of the most important factors for a functional bridge team. In this case there had not been a pilot briefing.

THE SWEDISH CLUB CASEBOOK

10

Machinery failure

10

10.1 Machinery failure caused by contamination

A vessel was in ballast and at anchor, awaiting further instructions. After seven days the weather deteriorated and the vessel´s anchor dragged. The anchor was heaved up and the vessel started to slow steam in the area. After about 24 hours the differential pressure alarm of the main engine duplex lubrication oil filter sounded in the engine control room. The crew found aluminium and other metal inside the lubrication filter, and in the crankcase of the main engine, metal particles were found.

Serious damage to the main engine

The subsequent investigation alongside revealed that the metal particles found in the lubrication oil filters emanated from piston rings and piston skirts. Three pistons had almost seized. The main engine, a six-cylinder medium speed type, had severe damage and the following parts had to be renewed: all cylinder liners, three complete pistons, piston rings on all cylinders, all main and connecting rod bearings.

In addition, the turbo charger had to be overhauled as the nozzle ring was broken. The complete lubrication system had to be carefully cleaned and flushed. The vessel was off hire for almost two weeks.

The pistons in cylinder units no.1 and 3 were melted down in certain areas and the skirt in no.4 was torn. Liners were scuffed as a result of the above. The cylinder lubrication channels were found clogged and so cylinder lubrication had been inactive. The lubrication oil pump was found deteriorated due to the hard impurities in the lube oil system.

Lubrication oil contaminated for some time

It was obvious that the engine had been operated on a high thermal load for a long time and that the turbocharger efficiency had been affected by fouling. The lubrication oil had actually been contaminated for some time.

There had been indications that something had gone wrong, for example it was written in the log book that the auto filter had been shooting up to 609 times a day.

- Fuel oil samples before and after purifiers were taken and analysed. The result indicated that the purifiers were working satisfactorily. All fuel oil analyses from bunkering were within specification.
- Several samples of the damaged piston rings were sent to a laboratory. The conclusion was that the excessive wear of liners and pistons was not caused by catalytic fines.
- The cylinder liner lubrication system was tested and was found to work properly.
- At the time of the casualty the main engine, including turbo charger, had been running 7,300 hours since its previous major overhaul. This overhaul had been carried out 18 months previously.
- Investigation of the maintenance records showed that maintenance had been carried out in accordance with manufacturer's instructions.
- When reviewing the monthly main engine reports it became obvious that the main engine exhaust temperatures of all cylinder units had increased 30°C – 40°C for the previous six months.
- The turbo charger revolutions had dropped from about 14,500 rpm to 12,000 rpm at 85% load as had the charge air pressure from 1.7 bar to 1.2 bar. These changes also began to appear in the past six months.
- Due to high exhaust gas temperatures, the engine was under a high thermal load, which finally caused it to break down.

What can we learn?

- A first step to avoiding damage is to have a well implemented and proper management system. This implementation can only be assured with proper training and education for the crew and providing them with the essential knowledge and experience required for ordinary daily work and maintenance according to company procedures.
- Always take engine alarms seriously, for example oil mist detection, and investigate thoroughly. A fully functional alarm system is essential for the safe operation of the main engine.
- Implement robust on board fuel and lubrication oil management systems.
- At regular intervals, carry out system checks of purifiers and filters for both fuel and lubrication oil systems.

The company states that:

- The follow up of all engine logs has now been improved, especially the understanding of the exhaust gas temperatures and their alarm levels.
- The scope of performance reporting between vessel and office will also be intensified in the future.
- The trend logging of reported performance parameters in shore manager's engine performance monitoring system has been implemented.
- Engineers will be sent on four stroke engine training courses.

10.2 Maintenance job lead to flooding of engine room

The engineers on a bulk carrier were carrying out scheduled maintenance on one of the ballast pumps. They had closed all the isolating valves to the ballast pump and put up notices about the job in the engine room and engine control room, but not on the bridge. They didn't finish the job on the first day, so continued the next day.

Preparing for port state inspection

The following day the Master asked an officer to print out the alarm list for the ballast water management system before arriving at the next port, as a port state inspection was expected. To get the list the officer had to start the ballast water management system, which he did.

The bilge high level alarm was suddenly activated in the engine room. An oiler checked the bilges and could see water pouring in, covering the tank top. An engineer turned off the power to the ballast water management system. He also found out that two ballast system valves were open from the main seawater crossover suction line. He closed these valves immediately to stop the ingress of the water. These valves had been opened automatically when the ballast water management system was started. The engineers pumped the water from the tank top into the bilge holding tank.

Water in the lubrication oil

One hour later the main engine bearing wear alarm – 'water level 50%', went off. The main engine system lubrication oil was found to have 0.09% water content. The second lubricating oil purifier was started. A couple of hours later the main engine bearing wear alarm went off once again. A second sample of the lubrication oil was taken, and it was found that the oil had 0.08% water in it.

The Chief Engineer decided to partially change 3,000 litres of lubrication oil in the system.

Afterwards a third sample was taken and the water content was 0.019%. The engine was stopped, and a full change of the lubrication oil was completed. A crosshead bearing was opened for inspection. No damage was found. However, one of the rubber diaphragm seals for draining the crankcase to the system lubricating oil tank was found to be defective. This had caused the water flooding into the engine room to contaminate the lube oil.

Severe engine problems through voyage

The main engine was restarted, and the voyage resumed. The main engine was an electronic controlled model i.e. the exhaust valves and fuel injection system were powered by hydraulics. The system lubrication oil was used as a hydraulic medium. The following day there were problems with some hydraulic components and the main engine had to be stopped. A couple of cylinder units and pumps had to be dismantled, cleaned and reassembled. The main engine could not be restarted because of low hydraulic pressure. It was decided that one of the cylinders had to be blanked off. The main engine was started and stopped several times over a number of days as the hydraulic system was leaking. Because the engine was running on low rpms, the scavenge trunking became fouled with oil deposits, so the engine had to be stopped several times and the trunking had to be cleaned.

Because water contaminated the lubrication oil there was serious damage to several crosshead bearings, crosshead pins, main engine cylinders, hydraulic pumps and main engine turbo charger bearings.

What can we learn?

- A proper risk analysis should always be carried out before any repairs/maintenance, especially if the affected system is complicated and can be controlled from different locations.
- It is also worth considering physically disconnecting power to components so they cannot be activated accidently during the repair/maintenance.
- It is essential that the bridge and engine crew discuss all jobs that can affect each other's department. If a job on the ballast system is planned, the bridge need to be informed and if the job is extended to the following day the OOW needs to be informed. The OOW has to ensure that this information is written clearly and discussed during the watch handover.
- If there are excessive quantities of water on the tank top there is a risk that this will enter the main engine sump tank via a defective diaphragm and subsequently contaminate the main engine lubricating oil system, resulting in severe damage to the main engine components.
- If heavy contamination of water is found in the system:

  (i) the lube oil in the sump tank must be transferred to a settling tank.

  (ii) the sump tank and crank case should be cleaned.

  (iii) a complete fresh oil change filled to the level recommended by the engine manufacturer.
- The design of both Wärtsilä and MAN Diesel lubricating oil outlet diaphragms are quite similar.

  (i) Wärtsilä recommends: Inspection/replace at 40,000 running hours or at dry dock.

  (ii) MAN Diesel recommends: Inspect the diaphragm sealing in the crankcase oil outlet every 32,000 hours of operation, and replace the diaphragm if indicated by the inspection.
- It is recommended that all diaphragms are replaced every five years in connection with the vessel's special survey.
- The exchange of rubber diaphragms should be included in the vessels PMS system.
- It is recommended to owners that spare diaphragms are kept on board at all times, in addition to enough system lubrication oil to completely replenish the system.

10.3 Machinery failure of the CPP caused heavy contact with lock gate

A vessel was berthed alongside the quay, waiting to proceed through a lock to another berth. The pilot called on the radio and asked the Master if it would be possible to depart in half an hour. Pre-departure checks were completed by the OOW, the radar was tuned and the ECDIS set up for departure. The OOW did not check the controllable pitch propeller (CPP) as the vessel had only been alongside for twelve hours and the OOW assumed everything should be OK. He also felt stressed about preparing everything for departure in such a short time. According to the company's SMS, the CPP should always be tested before departure.

Rapid handover

The Master came on the bridge accompanied by the pilot. The OOW carried out a quick handover and then proceeded to the forward mooring station. The Master and pilot had a short pilot briefing and afterwards the Master gave the order to let go all lines.

CPP not responding

The vessel proceeded towards the lock and was in the final approach when the Master realised that the CPP was not responding correctly and the vessel was rapidly approaching the lock. The Master attempted to recover control of the CPP system, but the pitch was stuck at approximately 40% ahead, causing the vessel to accelerate. The Master panicked and was unsure what to do, so he shouted on the radio to the mooring parties to get the lines ashore and stop the vessel. The forward mooring party managed to get the forward spring secured to a bollard but no other lines were attached. The pilot ordered the tug that was standing by beside the vessel, to push the vessel towards the quay. This caused the vessel to make heavy contact with the quay, but unfortunately did not slow it down enough. The vessel continued towards the lock at a speed of about three knots, the forward spring broke with a loud bang, and finally the vessel made heavy contact with the outer lock gate.

Forty seconds after the impact the Master pushed the emergency stop button for propulsion, after which the engine control room took control of propulsion.

Important evidence destroyed

Shortly after the incident the Chief Engineer and First Engineer inspected the CPP system to determine if something was wrong. Before any third party was able to investigate the CPP, the Chief Engineer cleared the system. This destroyed any evidence of what might have caused the failure. The vessel was boarded by port state and class inspectors. The vessel sustained damage to its bulbous bow, the tug sustained minor damage and the lock gates sank. Fortunately there were no injuries or pollution - however there were costly repairs to both the lock and vessel.

It was also discovered that the company had had four similar CPP near misses reported on sister vessels. The company had not made any changes to the PMS or sent any special instructions to the vessels in the fleet.

What can we learn?

- Ensure that the OOW understands why it is important to test all equipment as per the checklist, both for departure and arrival. This highlights the importance of carrying out the checks required by the SMS.

- The Master did not save the vessel's VDR – this was done by a port state inspector two hours after the incident. Always save the VDR, as soon as possible after an accident. It is important to have procedures that ensure that any evidence of what may have caused an accident is not removed or cleared in order to understand and learn why the accident happened.

- Always try to establish why an accident happened so it can be shared with the fleet. The near misses that had been reported to the company were never acted upon – there is no point in having a near miss reporting system if nothing is then done about the reports. Near misses and best practices should be shared within the fleet.

10.4 Routine job in the engine room caused grounding

A vessel was in ballast and sailing about seven miles from land on its way to the loading port in the NW Atlantic. It was early spring with heavy winds blowing and large waves. There was also some ice in the water, so the crew had to clear the lower starboard sea-chest which was blocked with ice. The crew changed to the upper intake and then removed the large cover from the lower sea suction filter, finding it choked with ice slush. While removing the ice the main sea water valve, located on the side shell plate, began to leak.

Excessive force applied

Whilst the crew were replacing the filter cover, one of the engineers applied a large valve wheel key to the actuator valve, in an attempt to stop the leakage. Too much force was applied damaging the gear mechanism that operates the valve spindle and water began leaking into the engine room at high pressure.

The crew made attempts to stop the leakage, but the pressure and volume of water were too great. Attempts to pump out the water entering the engine room were also unsuccessful as electric motors and control gear were splashed with sea water causing short circuits which disabled the bilge pumps.

Vessel began drifting

The vessel blacked out and began drifting in the severe weather conditions approximately 6-7 NM off the coast. The coast guard arrived at the scene and tried to attach a tow line, however the attempts failed. The vessel then dropped both anchors, but this did not stop the vessel from drifting. The vessel eventually grounded, and the crew was evacuated.

The following day a salvage team boarded the vessel by helicopter. They were assisted by two tugs. Wires were connected from the grounded vessel to the tugs. Fortunately the weather improved and the vessel was refloated and towed to the nearest port.

Cleaning operations

An underwater inspection revealed extensive damage to the vessel shell plating. Operations continued over the following days, cleaning the engine room spaces with high pressure hoses and removing the pollutant from the vessel.

What can we learn?

- When carrying out a critical job like cleaning the sea suction, it is important that there are clear procedures on how the job should be done and, as in any critical operation, it is best to have two people check to ensure that mistakes are detected.
- A job like this should require a work permit and risk assessment to be completed.
- It is also important to run drills on how to deal with a salvage operation, so the crew is prepared.

Glossary of common industry abbreviations

Term	Meaning
AB	Able seaman
AIS	Automatic identification system
ARPA	Automatic radar plotting aid
COLREGS	International Regulations for Preventing Collisions at Sea
COSWP	Code of Safe Working Practices for Merchant Seafarers
CPA	Closest point of approach
CSM	Cargo securing manual
ECDIS	Electronic chart display information system
ETA	Estimated time of arrival
GM	Metacentric height
GPS	Global positioning system
IHO	International Hydrographic Organization
IMDG Code	International Maritime Dangerous Goods Code
IMO	International Maritime Organization
IMSBC Code	International Maritime Solid Bulk Cargoes Code
ISM	International Safety Management Code
JRCC	Joint rescue coordination centre
MOU	Memorandum of understanding
NM	Nautical miles
OOW	Officer on watch
PA	Public address system
PMS	Planned maintenance system
SMS	Safety management system
SSAS	Ship security alert system
SSP	Ship security plan
STS	Ship-to-ship (transfer)
TML	Transportable moisture limit
UHF	Ultra high frequency (radio)
VDR	Voyage data recorder
VHF	Very high frequency (radio)
VTS	Vessel traffic serice

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