Danish Maritime Accident Investigation Board

MARINE ACCIDENT REPORT
April 2013

SKULD

Contact damage on 28 June 2012

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The marine accident report is available from the website of the Danish Maritime Accident Investigation Board www.dmaib.com

The Danish Maritime Accident Investigation Board

The Danish Maritime Accident Investigation Board is an independent unit under the Ministry of Business and Growth that carries out investigations with a view to preventing accidents and promoting initiatives that will enhance safety at sea.

The Danish Maritime Accident Investigation Board is an impartial unit which is, organizationally and legally, independent of other parties

Purpose

The purpose of the Danish Maritime Accident Investigation Board is to investigate maritime accidents and to make recommendations for improving safety, and it forms part of collaboration with similar investigation bodies in other countries. The Danish Maritime Accident Investigation Board investigates maritime accidents and occupational accidents on board Danish merchant and fishing vessels as well as accidents on foreign ships in Danish territorial waters.

The investigations of the Danish Maritime Accident Investigation Board procure information about the actual circumstances of accidents and clarify the sequence of events and reasons leading to these accidents.

The investigations are carried out separate from the criminal investigation. The criminal and/or liability aspects of accidents are not considered.

Marine accident reports and summary reports

The Danish Maritime Accident Investigation Board investigates about 140 accidents annually. In case of very serious accidents, such as deaths and losses, or in case of other special circumstances, either a marine accident report or a summary report is published depending on the extent and complexity of the accident.

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1. Summary

In the morning of 28 June 2012 the tugboat SKULD was one of five tugs engaged in berthing the oil rig ENSCO 72 in Esbjerg, Denmark. While changing position in the tow with the towline still attached, SKULD collided with the rig. The collision caused a severe flooding of SKULD which brought the vessel close to foundering. With the assistance of another tug the crew succeeded in bringing the vessel alongside berth and, by means of external pumps brought to the vessel by shore authorities, in stabilizing the situation. During the collision a fuel oil tank was damaged and an estimated 20 m^3 of marine diesel oil was leaked to the water.

This report does not contain any safety recommendations.

2. FACTUAL INFORMATION

2.1 Photo of the ship

Figur 1: Tugboat SKULD
Source: www.shipspotting.com / Jan Oesterboer

2.2 Ship particulars

Name:	SKULD
Ship type:	Azimuth Stern Drive Tug
Nationality:	Danish
Home port:	Fredericia
Call sign:	OZGY2

Year of build:	1996
Ship yard:	Svendborg Værft
Classification society:	Lloyds Register
Length overall:	33.80 metres
Breath overall:	10.75 metres
Gross tonnage:	485 GT
Maximum draft:	5.25 metres
Engine rating:	2940 kW
Hull material:	Steel

2.3 Voyage particulars

Port of departure:	Esbjerg, Denmark
Port of call:	Esbjerg, Denmark
Type of voyage:	Rig move from Danish North Sea sector to Esbjerg
Manning:	5
Number of passengers:	0

2.4 Weather data

Wind:	Calm
Sea state:	0
Visibility:	Good
Light/Dark:	Daylight
Current:	1.5-2.0 kt inbound current

2.5 Marine casualty or incident information

Type of marine casualty/incident:	Collision
IMO classification:	Serious
Date and time:	28 June 2012 at 0817
Position and location:	55 29.1N/008 22.7E, Port of Esbjerg
Ship's operation, Voyage segment:	Manoeuvring, arrival
Place on board:	Port side, amidships, below the waterline
Consequences:	Severe flooding. Loss of propulsion and control

2.6 External assistance and resources used

Involved parties:	Danish Emergency Management Agency Falck fire department, Esbjerg Esbjerg police Port of Esbjerg
Used resources:	External pumps, external receiving facilities for sludge water, floating anti-pollution booms
Respond time:	30 minutes

2.7 The ship's crew

Master:	34 years of age. Master mariner, no limitations. Employed in the company since 2006. Serving on the vessel since 2010. Promoted to master on board the vessel in February 2012.
Chief officer:	30 years of age. Master's examination, no limitations. Certificate as junior maritime officer (dual purpose). Employed in the company since April 2012. Serving on the vessel since April 2012.

3. NARRATIVE

3.1 Series of events

SKULD departed Esbjerg on 21 June 2012 at approximately 0500 in the morning bound for the TYRA-W oil field in the Danish sector of the North Sea. Together with the offshore support vessel BOURBON ORCA and the tug FENJA, SKULD was chartered for a rig move of the oilrig ENSCO 72. The rig had completed work at the TYRA-W CHARLIE platform and was bound for Esbjerg for maintenance work.

When arriving at the ENSCO 72 position, SKULD was informed that the weather did not permit the rig move operation, and the vessel was instructed to be stand-by in the area. On 21 June 2012 at 1738, SKULD therefore anchored near the rig at a water depth of approximately 30 metres.

The weather deteriorated and in the early morning of 22 June 2012 the wind had increased to a strong breeze and the wave height was estimated to 3-4 metres. At 1035, the anchor chain broke. After having lost an anchor, SKULD was slow steaming upwind and downwind close to the TYRA-W oil field.

In the morning of 27 June 2012 the weather had improved, and it was decided to commence the rig move. At 0533, SKULD was connected to the starboard shoulder of ENSCO 72. The lead tug BOURBON ORCA was connected to the bridle and FENJA to the port shoulder.

At 0555, ENSCO 72's jack-up legs were clear of the seabed, and at 0600, the rig had moved 15 metres away from the TYRA-W CHARLIE platform. At 0615, the rig left the 500 meter zone of TYRA-W CHARLIE and the tow towards Esbjerg was commenced.

On 28 June at 0400, the tow arrived in the area outside the Esbjerg pilot boarding ground. The tow was joined by the tugs SVITZER HELIOS and BOA BALDER which were chartered to assist in the berthing of ENSCO 72. SKULD remained on her position on the starboard shoulder and BOURBON ORCA remained connected to the bridle as the lead tug. The other tugs were arranged as shown in figure 2 below.

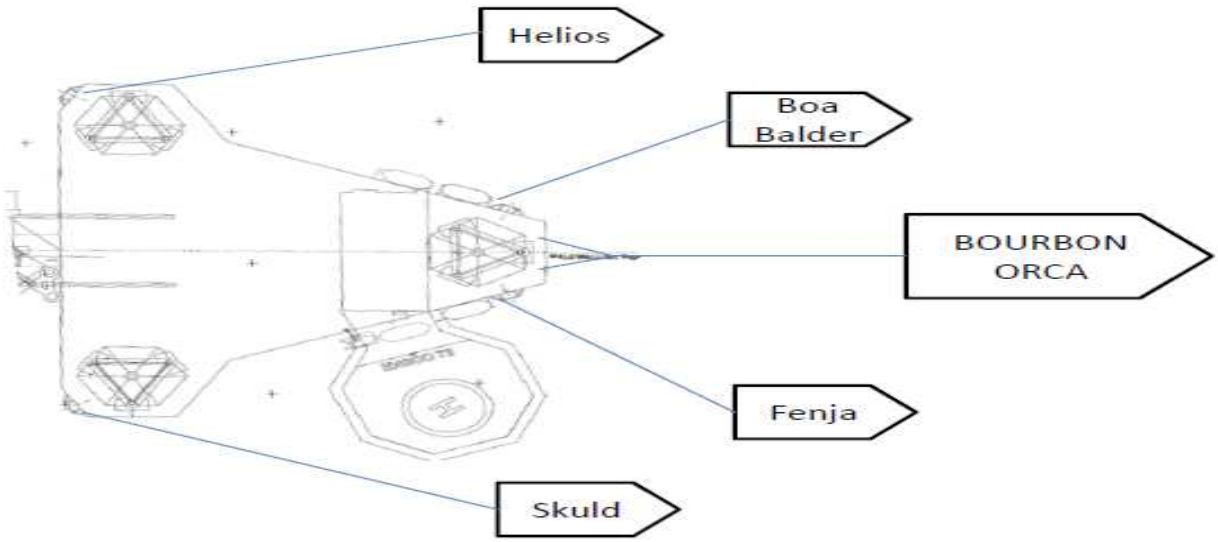

Figure 2: Initial tug set-up when entering Grådyb
Source: Lead pilot / Danpilot

Rearranging the tugs was completed at 0505, and the tow then slowly proceeded to the pilot boarding area awaiting berthing pilots. Pilots boarded BOURBON ORCA and ENSCO 72 at 0635. During navigation through Grådyb (the dredged fairway leading to Esbjerg as seen in figures 3 and 4 below), the tow was directed by the pilot on board BOURBON ORCA. Until buoy No 15A the transit through Grådyb went without any incidents. At buoy No 15A, control of the tow was taken over by the lead pilot on board ENSCO 72.

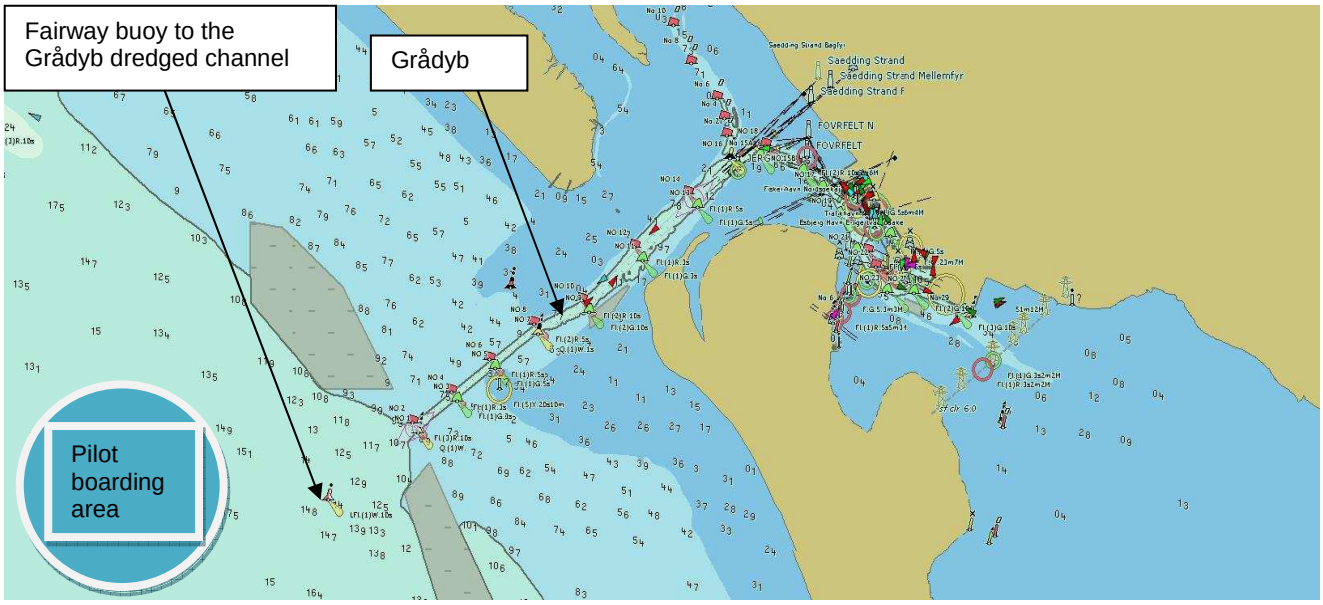

Figure 3: Grådyb dredged channel
Source: DMA land based AIS system

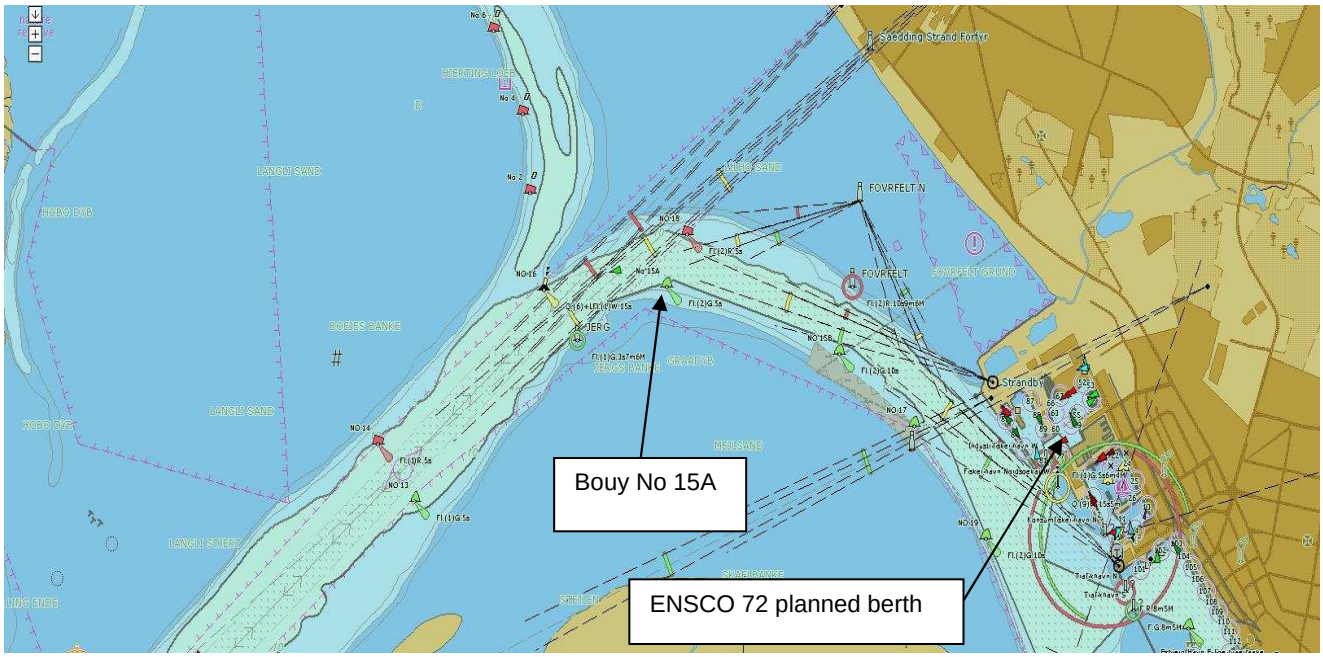

Figure 4: Detailed extract of Grådyb
Source: DMA land based AIS system

When entering Grådyb, the length of SKULD's tow wire was approximately 200 metres. When the vessels came close to the nearly 90° turn to starbo ard at Esbjerg, all vessels reduced the tow wire to their minimum. For SKULD this meant that the tow wire was approximately 35 metres. However, the length of the tow wire was continuously adjusted in order to remain clear of FENJA and the helicopter deck.

At 0826, immediately after having taken over control of the tow, the lead pilot instructed the tugs SVITZER HELIOS and SKULD to change their position in order for them to pull astern thereby stopping the forward movement of the rig.
As per figure 5 below, for SKULD this meant that the vessel had to change position to starboard, falling down to a position aft of the rig with an opposite heading.

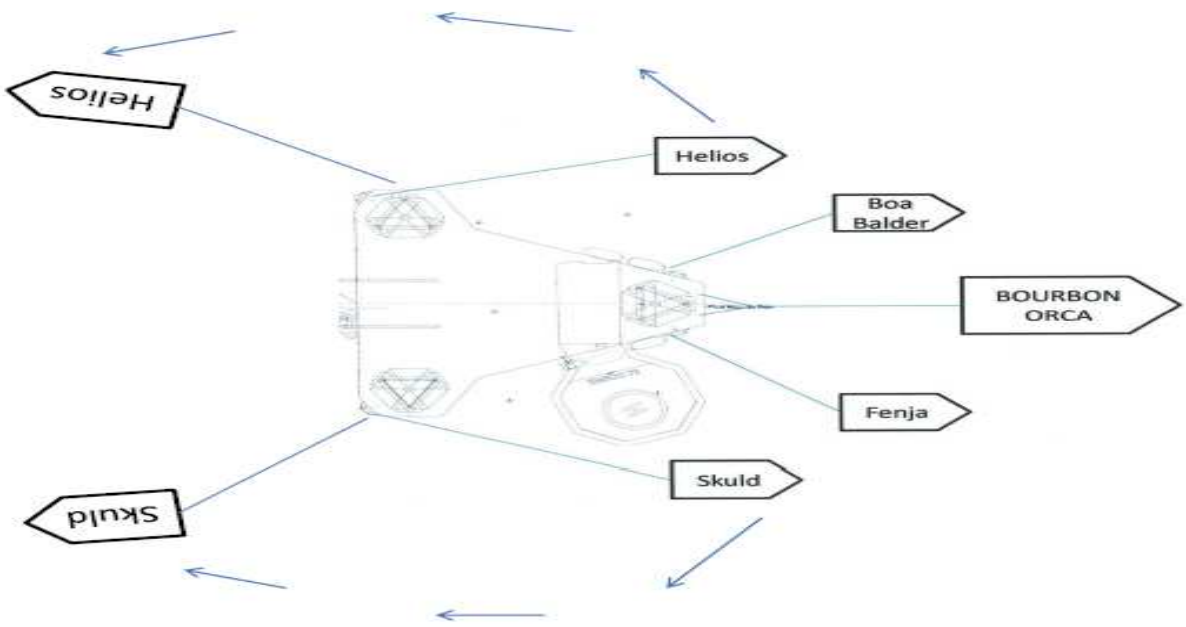

Figure 5: Intended manoeuvre when instructing SKULD and SVITZER HELIOS to change position in the tow
Source: Lead pilot / Danpilot

When SKULD tried to execute this instruction, the port side azimuth was set to giving thrust to port and the starboard azimuth was kept giving thrust aft. Thrusting to port moved the stern of the vessel to starboard thereby initiating a fast movement to port. The crew on board SKULD immediately realized the mistake, but due to the speed of the movement to port and the time it would take to turn the azimuth thrusters, they could not stop the movement towards the rig. When swinging towards the rig, the crew on board SKULD registered that they would pass very close to ENSCO 72's helicopter platform, which was level with SKULD's bridge. In an attempt to pass forward of the helicopter platform, the crew increased the power of the azimuth thrusters. The crew on the bridge of SKULD estimated that the vessel cleared the helicopter platform by approximately 1 metre. However, the increased power also increased the severity of the collision. As seen in figure 6 below, when colliding SKULD hit the rig on the starboard forward side of ENSCO 72.

When colliding SKULD was trapped along the starboard, forward corner of the rig as seen in figure 6 and 7 below. When the two vessels collided, the other vessels in the tow put their engines to zero pitch (stop). Initially SKULD was not able to manoeuvre clear of the rig, but as the forward speed of the rig was reduced, it became possible for SKULD to manoeuvre free of its position alongside the rig and fall down to the intended position aft of the rig.

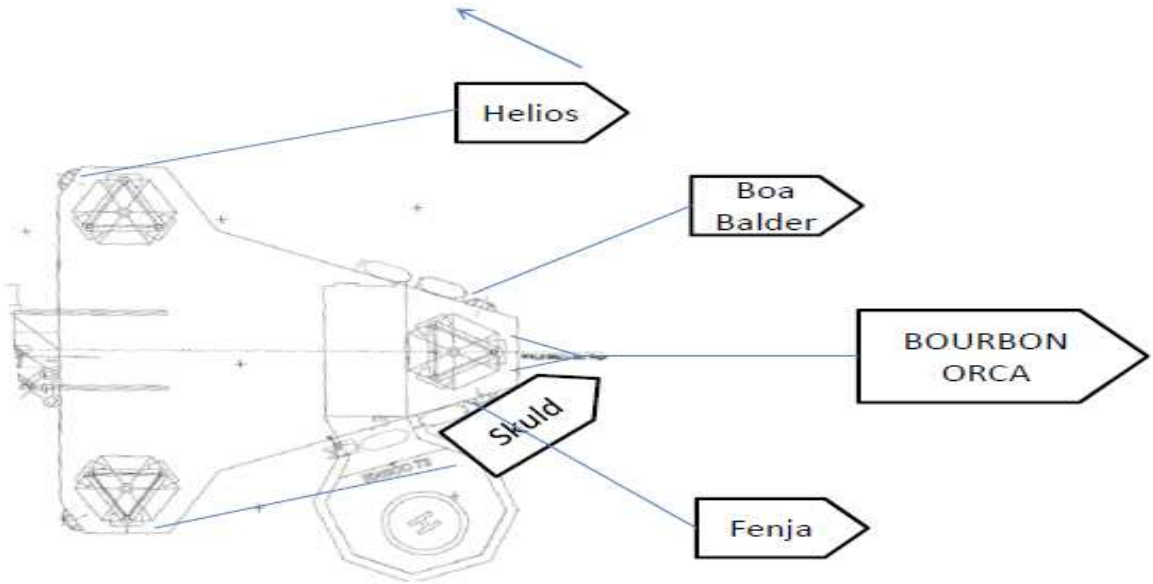

Figure 6: SKULD when colliding and caught alongside ENSCO 72
Source: Lead pilot / Danpilot

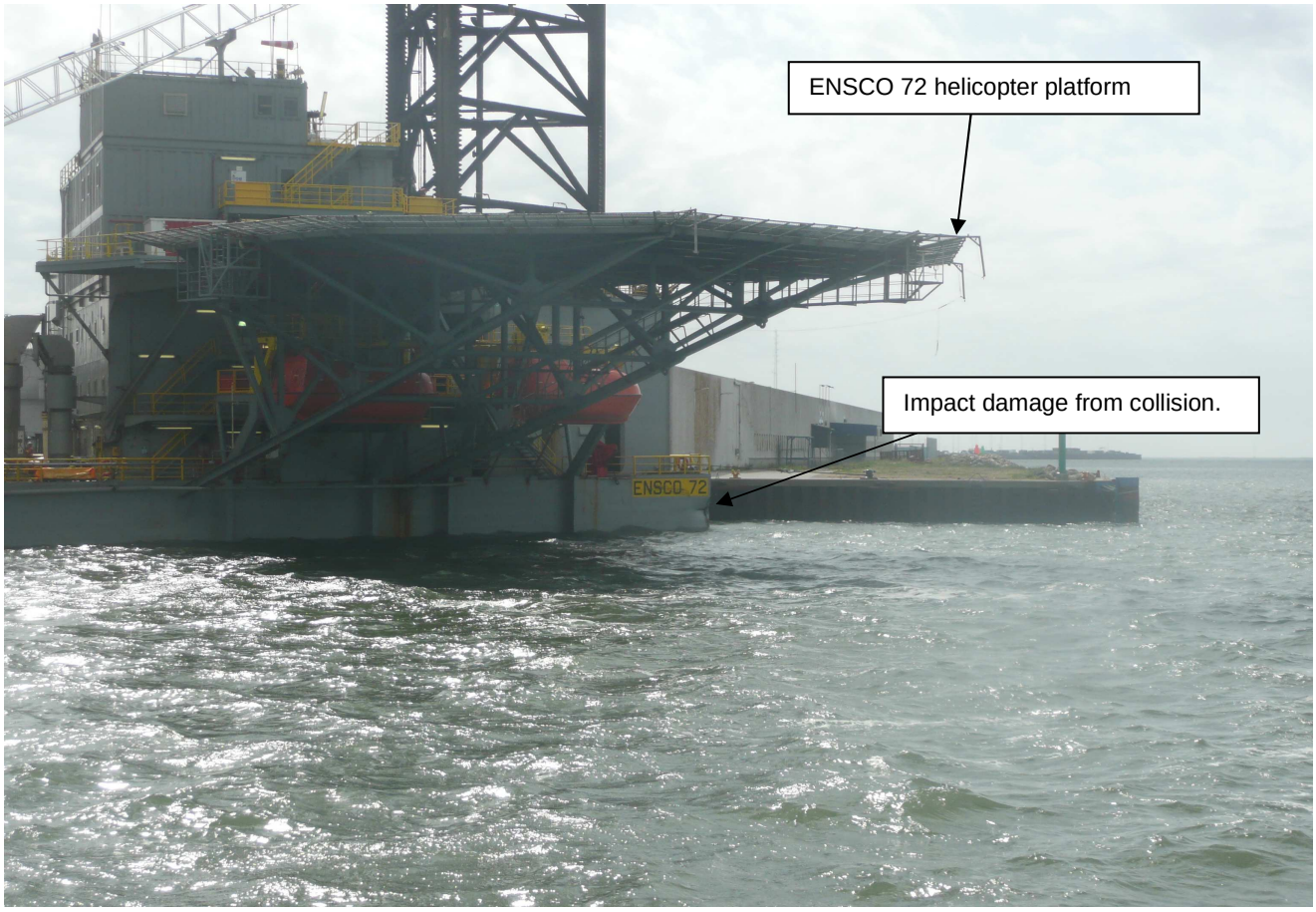

Figure 7: Collision area of ENSCO 72
Source: DMAIB

As seen on figure 7 above the collision caused damage to ENSCO 72 above the waterline. Additionally, below the waterline the collision caused a leak to a water ballast tank.

Following the collision, it was immediately clear that SKULD had been damaged. Oil was observed on the water and when the crew responded to alarms from the engine, sea water and oil were observed in the engine room, and the crew quickly had to leave the area.

Due to the obvious damages to SKULD, the crew quickly requested that the vessel be released from the tow. However, the lead pilot needed to stop the forward movement of ENSCO 72 due to another oil rig which was jacked-up further south in the fairway awaiting tugs for its own rig move. The pilot therefore instructed SKULD to assist in stopping the rig before being released. Having stopped the rig's forward movement, the pilot first ordered the tug FENJA released in order for this vessel to be ready to quickly relieve SKULD when this vessel was released from the rig. Then SKULD was released and FENJA took over the position on the starboard aft corner of the rig.

Because of a developing list, the oil on the water surrounding the vessel and the large amount of alarms from the engine, it was obvious to the crew that SKULD had serious problems and needed to come to shallow waters and alongside berth as fast as possible. With the Esbjerg harbour office it was agreed that the vessel could berth in the nearby Trafikhavnen. When closing to the berth, approximately 20 metres from being alongside, direction control of the azimuth stern drives was lost. Only control of propeller revolutions (RPM) remained. The RPM was set to zero, and the nearby tug EMS was requested to assist SKULD in getting alongside. At this time SKULD had developed a severe list and in an attempt to prevent the list from increasing further, EMS was requested to remain alongside and by using the tow rope and additional mooring ropes fastened on SKULD's starboard side, EMS countered SKULD's tendency to increase the starboard list.

Thanks to an impressive effort by SKULD's master and crew, assisted by a local diver and personnel, external pumps and other equipment from the Danish Emergency Management Agency, the crew subsequently succeeded in stopping the water ingress and stabilising the situation, thereby saving the vessel.

3.2 The damages to SKULD

The collision with ENSCO 72 caused an approximately 30 cm x 40 cm hole in SKULD's port side below the waterline. The damage is seen in figure 6 below. The hole involved the port side wing tank and tank no 2, which were both fuel oil tanks. Additionally, from the wing tank, a part of the hole, approximately 5 cm x 10 cm in size, gave the water free access to the engine room. The main damage is shown on figure 8 below.

Figure 8: The damage to SKULD's port side
Source: Svitzer.

At the time of the collision, the fuel oil tanks contained approximately 25 m3 of diesel oil. From these tanks it is estimated that between 1 m35 m3 diesel oil leaked to the water following the collision. Due to the light nature of the diesel oil, it was not possible to pump the diesel oil from the water surface. Instead it is estimated that the diesel oil evaporated from the surface within the first few days after the accident.

The water ingress in the engine room caused the auxiliary engines 1 and 2 to shut down. The main switchboard therefore lost its power supply which lead to the loss of directional control of the azimuth stern drives and all other equipment not supplied by the emergency switchboard.

3.3 Education and training

At the time of the accident, the deck officer manoeuvring the vessel had been in the company as a deck officer for approximately six years. During these years he had experience from four different types of vessels in the company.

He was promoted to master in February 2012, i.e. four months prior to the accident.

According to the company's experience, it typically took between two to three years to train a chief officer (the starting rank in company tugboats) from beginning in the company to a level of proficiency where the chief officer was deemed ready for promotion to master.

However, when chief officers were deemed ready for promotion, there was not necessarily a need for additional masters in the company. Therefore it was not uncommon to be chief officer for several years after being deemed ready for promotion.

Prior to signing on the first time as a master, a newly promoted master would be going through simulator training in the company's own simulator in Gothenburg, Sweden. During this training the newly promoted master's proficiency level would be ascertained and he would receive further training preparing him for taking command.

3.4 Manoeuvring on SKULD

SKULD was mainly stationed in Esbjerg and had been so since the master first signed on the vessel. In Esbjerg the vessel was mostly employed in harbour tug duties, i.e. assisting vessels on their arrivals, departures and shiftings. Almost all these duties were conducted using the vessel's bow winch and therefore with the bow heading towards the vessel being assisted and the crewmember manoeuvring the tug using the bridge's forward manoeuvring position.

However, the tow of ENSCO 72 was done using SKULD's stern tow winch, and the crewmember manoeuvring therefore used the bridge's aft manoeuvring position while looking aft.

This was the master's first rig move, but not his first job working with the stern winch while manoeuvring the vessel using the controls on the aft bridge.

Compared to traditional tugs manoeuvred using propeller, helm and possibly thrusters, the use of azimuth stern drives enables the tug to work over the bow in addition to the traditional approach of working over the stern. When working over the bow, the necessary manoeuvring inputs to obtain a certain manoeuvre will be the opposite of the inputs used when working over the stern for the same manoeuvre.

3.5 Rest and fatigue

When arriving at the TYRA-W CHARLIE platform where ENSCO 72 was positioned, the crew expected to commence the rig move on arrival. However, due to the weather conditions the operation was put on hold and the vessel told to go on stand-by.

During the period on stand-by, the master and the chief officer established a 6 on/6 off watch schedule. Due to SKULD's normal service as a harbour tug in Esbjerg, the crew did not normally work for prolonged watchkeeping periods. However, according to the crew the watch routine was quickly established and it was not seen as a problem.

During the days waiting for the rig move to commence, the crew in general had no problems sleeping when off duty. When changing watches after the anchor chain had broken, the vessel was, as far as possible, turned heading downwind with the sea coming from aft. This reduced the vessel's movements severely and according to the crew there was no problem falling asleep when being relieved from the watch.

Therefore when the rig move was commenced on 27 June 2012 in the early morning, the crew felt well rested and ready for the job.

During the tow towards Esbjerg, the master and chief officer continued the 6 hours on/6 hours off watch schedule. In the morning of 28 June 2012 when the tow arrived at the pilot boarding area off Esbjerg, the master had been relieved at midnight. He was awakened shortly before 0400, in the morning when the tow arrived off Esbjerg and started to rearrange the tug set-up prior to entering the Grådyb fairway.

3.6 The azimuth stern drives

SKULD was equipped with two Aqua master azimuth stern drives which were controlled individually by using two separate levers on the forward or aft part of the bridge. Whether the forward or aft control levers were used depended on whether the tugboat was using the forward or the aft towing winch. These two propulsion units were powered by two main engines with a total engine rating of 2940 kW. At 450 or more revolutions per minute of the propeller, the directional turning time for the azimuth thrusters was 20 seconds for turning the azimuth 360°.

In addition to the azimuth stern drives, SKULD also had a bow thruster of 200 kW, but this thruster was only secondary when manoeuvring the vessel.

The manoeuvring by azimuth stern drives (ASD) is the one feature giving SKULD and other ASD tugs the great manoeuvrability which is their characteristics

3.7 The azimuth orders given

When SKULD was instructed to change position in the tow by moving aft of the rig, the master, who was manoeuvring throughout the manoeuvres close to and when in Grådyb, gave the thrust orders to the azimuth thrusters as seen in figure 9 below. The port azimuth was set to thrust to port. The starboard azimuth was set to maintain thrust directly aft. The thrust to port pushed the stern to starboard thereby initiating a port turn that developed very fast until colliding with ENSCO 72.

The master and chief officer on SKULD's bridge immediately became aware of the undesired manoeuvre and the movement towards ENSCO 72.

However, it was also immediately apparent that SKULD's bridge and accommodation were in danger of hitting the rig's helicopter platform. Therefore, instead of positioning the thrusters in an attempt to stop the turn to port, the master instinctively chose to direct all the available thrust aft in an attempt to pass forward of the helicopter platform.

The attempt to avoid hitting the helicopter deck was successful, and although SKULD came very close, it did not hit the helicopter deck.

To fall down to one side in order to change position like instructed by the lead pilot on the day of the accident was and is a very common manoeuvre for a tugboat. It was a manoeuvre the master had performed again and again

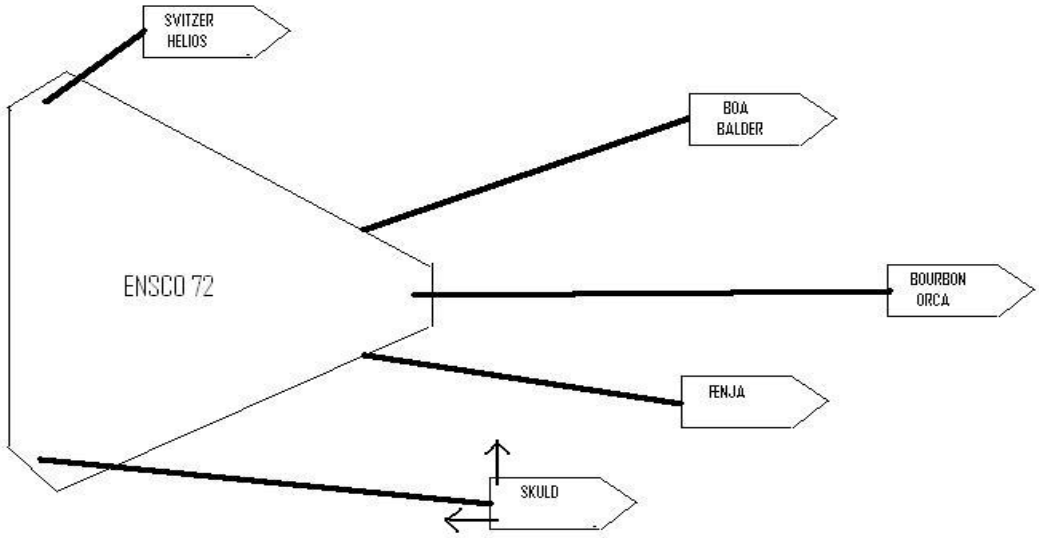

Figure 9: Thrust orders given when changing position to aft of the rig
Source: Master SKULD / Svitzer (Drawing by DMAIB)

4. ANALYSIS

4.1 Manoeuvring during operations

As indicated above a typical time frame for training a new chief officer to the proficiency required for becoming a master on the company's tug vessels is between two and three years. The master on the day of the collision had been in the company's fleet of tugboats for approximately six years on the day of the accident. He was promoted to master in February 2012 when an opening as master became available.

SKULD normally used the bow winch when working as a harbour tug. This meant that the crew member manoeuvring the vessel used the forward manoeuvring position while looking forward.

When employed in a tug operation, the need for manoeuvring the tug may occur very quickly, and the manoeuvring and the knowledge of which manoeuvring input to use has to be instinctive and second nature. Because of the very large forces involved in towage operations, the potential consequences of wrong manoeuvres can be very serious. Therefore obtaining this level of proficiency is the most important qualification for aspiring deck officers in their training prior to their own promotion to master.

There is no indication that the accidental events was caused by the lack of qualification or training.

During operation as a tug, the manoeuvres are made with the vessel being assisted as the reference point, and manoeuvres are made in order to change position relative to this vessel. This is the basis for the tug navigator's evaluation of the situation. The required manoeuvring inputs in order to obtain a desired change of position relative to the vessel being assisted are different depending on whether the navigator is looking aft from the aft manoeuvring station (when using the aft winch) or forward from the forward manoeuvring station (when using the forward winch). Manoeuvring the vessel from different manoeuvring positions on the bridge can be challenging for the officer's spatial orientation.

4.2 Operation of the azimuths

Mainly due to the short tow wire and the additional aft thrust given in order to avoid the helicopter deck, the unintended movement to port progressed very fast, and within seconds the tug collided with the rig.

Even if an attempt to position the azimuth drives to stop the movement to port had been made, it is the assessment of the investigation board that because of the speed of the movement and the time it would have taken to reposition the azimuths it would not have been possible to stop the movement to port once it had been initiated.

Furthermore, the investigation board believes that had the thrust available been used for an attempt to stop the turn to port, and avoid colliding with the rig, it is very likely that the bridge and the accommodation would have hit the helicopter platform with potentially very severe consequences for the crew on board SKULD (see figure 7 above for an impression of the dimensions and construction of the helicopter deck).

5. CONCLUSIONS

Be it a harbour towage of a ship or a barge or assistance during a rig move, a towing operation is a very dynamic operation. The tugs involved will continuously have to adjust the settings for their manoeuvring gear in order to either maintain or change their position in relation to the vessel they are assisting. This naturally requires constant concentration and attention from the deck officer manoeuvring the vessel.

For a long period the most common operations of SKULD had been as a harbour tug working almost exclusively over the bow. Over time this may well have influenced the master's instinctive way of reacting in order to obtain a certain manoeuvre.

Had the bow winch been used on the day of the accident, the azimuth thrust settings actually used would have been the correct settings to be used in order to follow the instructions given by the lead pilot.

It is the assessment of the investigation board that the most probable cause for the wrong manoeuvre being initiated was the master in the deciding seconds when initiating the manoeuvre instinctively reacting as if the tug was working over the bow as was the most common operational pattern for the vessel.