The Bourbon Dolphin

Date: April 12th 2007

Details:
Eight people lost their lives and seven survived when the offshore oilrig support tug Bourbon Dolphin capsized and sank 85 miles west of Shetland. The ship was pulling a heavy anchor chain, which suddenly slid across the deck and dragged the vessel over. The main engines stopped and moments later, the vessel capsizes.

Key Issues:
A report by the Norwegian Justice did not identify a single cause for the incident but criticizes the Company for inadequately checking the vessel's stability following an earlier incident and not ensuring the Captain was sufficiently familiar with the vessel and its crew. The Captain was only given 90 minutes to familiarize himself. Neither the Company nor the operator ensured that sufficient time was available for the changeover of the crew.
The vessel was small, compact and uniting several requirements such as bollard pull, anchor handling demands, powerful winches, big drums and equipment for handling chain. The Company was un familiar with the design of the vessel and should have carried out more thorough critical assessments. The Company had not noticed the fact that the vessel had experienced an unexpected stability incident two months after delivery. The vessel did not have sufficient stability to handle lateral forces and the winch's pulling-power was over dimensioned in relation to what the vessel could withstand regarding stability. The Company itself had not researched whether the vessel was suitable for the operation it was to carry out. The ISM Code demands procedures for key operations. Despite anchor handling being the main function there was no vessel-specific anchor handling procedure. The Company did not follow the ISM Code requirements that all risks are identified and the Company did not make sufficient requirements for the crew's qualifications for demanding operations. The procedures demanded the use of two vessels operating in close proximity.

Result of Investigation:

The Norwegian Company that owned the Bourbon Dolphin was ordered to pay a 5m Kroner fine, (nearly £500,000) as the Company failed to give the ship's new Captain enough time to familiarize himself with the vessel, its crew and its complex operations.

STEAMSHIP MUTUAL

Bourbon Dolphin Case History

The Incident

On Friday 12th April 2007 the Anchor Handling Tug Supply (AHTS) vessel Bourbon Dolphin was engaged in anchor handling operations for the semi-submersible drilling rig Transocean Rather in the Rosebank oilfield to the west of the Shetland Islands.

The mooring system of the rig consisted of 8 mooring lines and anchors, with each mooring leg being made up of an anchor, 900m of 84mm chain, 920m of 76mm chain and 1725m of 96mm wire. This system had been decided on so as to ensure the rig maintained position in this exposed location on the edge of the Atlantic, with long lengths of chain used to ensure that there would be no uplift of the mooring from the seabed causing the anchor to be disturbed. A prelaid mooring system, where the anchors and lines are laid in advance of the rigs arrival, and then the rig is hooked up to each line in turn, was discounted due to problems being experienced previously with this system in this kind of exposed location

The semi-submersible drilling rig Transocean Rather was being moved onto the second drilling location in the Rosebank oilfield. The operation to anchor the rig at the previous location and the move to the new location had taken longer than expected, this was due to adverse weather conditions and difficulties encountered during the anchor recovery operation at the previous location. Mooring equipment and J hook chain chasers, which are basically a large metal hook for hooking onto submerged chain or wire, had been damaged. At one stage the Bourbon Dolphin was unable to break out an anchor by herself and the Olympic Hercules had to assist using a J hook, the anchor was eventually freed but the J hook and other equipment was damaged.

When the rig arrived at the second drilling location 4 anchors, known as the primary anchors, of the 8 fitted were deployed almost simultaneously to make the rig stable on location, then the remaining 4 anchors, known as the secondary anchors, were deployed in diametrically opposed pairs. The last pair to be laid were anchors 6, then 2.

The running of No. 6 anchor by the Olympic Hercules was fraught with difficulties.
The current experienced by the vessel whilst running the anchor out on to an anchor position bearing 160°(t) from the rig was believed to be over 2.5 knots, coupled with a wind of around 30-35 knots, both setting to the north north east / north east, and a significant wave height in the region of 3.5m, with a maximum of 7m. With these environmental forces acting against her the vessel ended up over 700m off the planned anchor track, and was not able to maintain station using her side thrusters alone. It was only after the Vidar Viking came to her assistance and grapnelled the chain and took some of the mooring weight, and the rig paid out some of the anchor wire, that the Olympic Hercules was able to execute a turn using her propellers, rudders and thrusters such that she could proceed back to the west towards the anchor drop point. It was reported that whilst this vessel executed her turn, that due to the weight of the mooring chain, its large angle of attack to the centreline of the vessel and the rapid turn into the current, that she heeled over 12°. Even earlier during the deployment of anchor no.3 by the Bourbon Dolphin as the primary vessel it was reported by that vessel that the weight of the chain on her gypsy during deployment was too great therefore the Vidar Viking was deployed to grapnel the chain between the Bourbon Dolphin and the rig whilst the chain was deployed and the anchor overboarded from the Bourbon Dolphin.

The Bourbon Dolphin was designated the primary vessel for the running of the final anchor no.2, with the Highland Valour to assist, on an anchor track of 340°(t) from the Transocean Rather in a

water depth of around 1100m, which as for anchor no. 6 was going to place the current on the vessels port side running towards the north north east / north east. For this task an 18t Bruce anchor was on the port side lashed to the crash rail on the Bourbon Dolphin's main deck.

The plan was for the rig to pass the end of her 920m x 76mm chain to the vessel which would secure it on deck, the rig would then pay out this chain while the vessel moved away along the anchor track, once this was all paid out the rig would then change to the 96mm wire. The vessel would then connect the 900m x 84mm wire in her chain locker to that from the rig and pay this out; once this was complete the anchor would be connected to the end of the 84mm chain, along with a chasing collar placed around the mooring chain and connected to the vessels work wire. The anchor would be lowered to the seabed whilst held in the chasing collar, with the vessel paying out the work wire while getting in position. Once the anchor had been landed on the seabed in position the vessel would move back towards the rig, heaving on the work wire and sliding the chasing collar along the rig chain and then rig wire prior to passing the pennant attached to the chasing collar to the rig where the end of the pennant would be secured on deck. During this operation the assisting vessel was to first grapnel the chain 300m from the Bourbon Dolphin to take the weight while she was overboarding the anchor, then move and grapnel the chain 300m from the connection to the rig wire whilst the anchor was being lowered to the seabed.

Whilst the Bourbon Dolphin was running out over the stern the chain insert from her rig chain locker, it was noted the vessel was drifting off the planned anchor track to the east, and was therefore instructed by the rig to move back towards the anchor track. The Bourbon Dolphin reported she was having difficulty manoeuvring back to the anchor track due to the weight of the mooring chain hanging from her stern. This, coupled with the prevailing environmental forces was limiting her manoeuvrability even though she was using her thrusters and main engines at near maximum capacity, therefore the 'Highland Valour' was instructed to assist by grapneling the chain and taking some of the weight. At this time it was reported that the engine room on the Bourbon Dolphin requested the bridge to reduce the load on the thrusters as these were starting to get hot, this request was made several more times but not granted.

At 14.45, all the anchor chain had been run out from the Bourbon Dolphin and the Highland Valour commenced grapneling to take some of the weight of the mooring from the Bourbon Dolphin so she could manoeuvre and proceed back to the anchor track as she was now 560m off track. The grapneling operation involves the vessel lowering a wire with a four pronged grapnel attached and fishing for the chain, so as to lift it vertically to reduce the weight of the mooring hanging from the stern of the other vessel, making it easier for that vessel to manoeuvre back to the planned anchor track. At the second attempt the Highland Valour managed to attached her grapnel to the mooring chain, upon which she experience high tension on her winch, whilst the Bourbon Dolphin noticed a reduction in the tension on hers, by this stage the vessel was 840m off her desired track. During this stage of the operation the Bourbon Dolphin and the Highland Valour had a near miss of only a matter of meters, and after taking action to avoid collision the latter vessel lost her grip on the chain. The rig then instructed the Highland Valour not to attempt to grapnel again for the chain as they were getting too close to the already laid anchor line no.3. The Highland Valour then proceeded to standby to the west of the Bourbon Dolphin. Around this time the Bourbon Dolphin recorded her maximum deviation from the anchor track of 1020m, and had a persistent list to port, even though it is believed that at this time she had the anchor chain between her starboard inner and outer tow pins. To correct this list water ballast was shifted from port to starboard to bring the vessel upright. The vessel was fitted with two pairs of towpins, these are pins surrounded with a rotating outer sleeve which are normally retracted into the deck, they are raised vertically and used to control the movement of chains and wires being worked during anchor handling and towing operations. Located on top of each pin is a plate such that as the pin

rises the plate is facing away from the other pin of the pair, but as the pin becomes fully raised the top rotates around to face the other pin, such then when the pins are both fully raised the plates lock together so the anchor or chain within cannot jump out from between them. One pair of tow pins is fitted to port of the centreline, and one to starboard, each pair is located behind a sharks jaw which is used to capture and hold chains and wires during anchor handling and towing operations.

In order to try and enable the vessel to turn to port so that she could be manoeuvred back on location the vessel was turned so that the chain on the stern was moved clear of the inner starboard tow pin against which it was resting, which was then retracted into the deck. The chain then moved sideways rapidly across the stern a distance of 2.7m until it was hard up against the port outer tow pin, the inner port tow pin having been retracted into the deck previously. The vessel subsequently listed dramatically up to 30 degrees to port, which lasted about 15 seconds, before the vessel righted herself. At this time the vessel briefly blacked out and the starboard engines stopped. The vessel then listed over to port a second time and then rapidly capsized at 17.08. Of the crew of 14, only 7 were saved, those that were lost included the Master and his 14 year old son.

Contributory Factors

As is often the case the contributory factors which combined on the 12th April 2007 and led to the capsize of the Bourbon Dolphin are many and varied, these are discussed below:

Design and Stability

The principal problem with the vessel appears to have been her stability, or in this case lack of it; After the incident the vessel was found to have a number of issues with her stability; Firstly she was found to have a lightship displacement of 3202t, while she was originally designed to be 2810t, this was reportedly due to poor weight control of component parts during her construction. This in turn contributed to a higher centre of gravity in the lightship condition. The KG (the distance from the keel to the centre of gravity) was initially calculated to be 7.17m, during the inclining experiment this was actually found to be 7.43m, giving the vessel a reduced GM of 0.29m (the GM is the distance from the centre of gravity to the metacentre, the point through which the centre of buoyancy will vertically act at small angles of heel. This is a measure of stability used when the vessel is upright or at small angles of heel). The minimum GM required under the loadline regulations is 0.15m, therefore basically, the larger the GM, the greater the initial stability of the vessel.

During sea trials of the vessel prior to delivery a test was conducted to measure the heel of the vessel while she was turned under prescribed conditions where she was ballasted such that she should have had an optimum GM of 0.98m; whilst the vessel was turning a heel angle of 17 degrees was measured. The test was later repeated using less engine power and a smaller rudder angle and then approved.
Subsequent to these tests the vessels stability was approved by the vessel flag state.

Although the vessel was only in service a short time before she was lost, operational experience found that the vessel had to operate with large quantities of bunker fuel onboard so as to maintain adequate stability, and had previously experienced a large unexpected angle of heel whilst engaged in a towing operation. All precursors to the fact that the stability of the vessel was an area of concern.
To calculate the stability condition on the vessel a load computer was fitted, however, this had not been checked and approved by the Classification society, and should not have been in use. The

documentation for the load calculator was subsequently found to be satisfactory after the incident, although it was never tested onboard to see if it was functioning correctly.

The instructions for Master in the Stability Book were found to generic and did not contain any instructions specific to the vessel, particularly the fact that the roll reduction tank should be empty during anchor handling operations. AHTS's are designed with a large beam in relation to their draft so as to give the vessel a large GM as they are designed with a very low freeboard aft to facilitate anchor handling operations. However, a large GM makes the vessel very stiff and prone to a more violent rolling motion, in order to reduce this a roll reduction tank is fitted to reduce the static stability. These tanks are usually the full width of the vessel and work by reducing the GM due to the large free surface effect of the water in this tank moving from side to side as the vessel rolls. This tank is believed to have been in use during the anchor handling operation, therefore reducing the GM.

In addition to the 18t anchor sitting on her main deck, the storage winch located high above the main deck, just below the level of the bridge was, at the time of the incident, loaded with 1700m of 77mm wire, therefore placing a heavy weight high above the deck, both of which raised the centre of gravity still further.

Analysis of the expected ballast condition based on all available evidence, including the presumption that the roll reduction tank was in use gives the vessel a GM of 0.89m, upon departure from Lerwick, however, she did not comply with all the load line stability requirements. After departure the stability condition changed due to the vessel deploying one of the anchors from her deck, deploying both chains from the chain lockers below decks, which had subsequently been filled with ballast, and she had also used bunkers and fresh water. At this stage the GM was calculated to be 0.95m, however the vessel still did not comply with the minimum stability requirements, even before any other factors, such as the heeling lever applied by the anchor chain, or dynamic movement due to environmental forces are taken into account.

Allowing for an angle of attack of the chain from the centreline of the vessel of 25° with a tension of 126t gives a GZ curve (the curve indicating the positive stability of a vessel) with a range of positive stability of 40° with deck edge immersion occurring at 15°. Even assuming the roll reduction tank was not in use the vessel is still not found to be comply with the minimum stability requirements in this condition. Once the starboard inner towing pin was retracted and the chain moved over to the port outer tow pin, and allowing for a tension of 126t at a 40° angle of attack the GZ curve has a range of positive stability of 34° with the vessel listed to 9°, with deck edge immersion occurring at 15°. Assuming a worse case scenario of a 60° angle between the anchor chain and the vessels centreline (which is what is believed to have been the angle at the time of her capsize as captured on footage from the rig), and a line tension of 180t. In this situation the vessel is listed to 12° with deck edge immersion occurring at 15° and a range of positive stability to only 31°. As can be seen, in a static situation the vessel has a very small amount of residual stability, however, in this case she was subject to dynamic forces whilst lying in a sea with a significant wave height of 3.5m, and as soon as water came on deck at 15° and the deck edge immersed, due to the large superstructure forward, as the deck of a supply vessel immerses the centre of buoyancy moves forward causing the vessel to trim by the stern, causing the vessels waterplane area to reduce and a further reduction in righting levers, leading to a rapid loss of stability and capsize.

Rig Move Planning

Several areas of concern were found in the planning of the rig move; principally the choice of mooring system selected and the installation method, the method used for calculating the necessary bollard pull and winch capacities, and also the lack of any Hazard Identification and Risk Analysis prior to operations commencing. The rig move procedure was also found to be lacking in that weather limitations were not specified in line with the requirements of interested parties. In addition no pre-rig move meeting was held prior to the operation where all interested parties were represented.

Although no pre-rig move meeting was held the rig move procedure was presented to each vessel individually, the meeting between the then Master of the Bourbon Dolphin and the representative from the company which had written the document lasted about 1 hour. The Master onboard at that time reported that he had stated that his vessel was not suitable for the operation due to the fact that a bollard pull of 194t had been calculated as being necessary to break out the anchors from the seabed, whereas the capacity of the vessel was only 180t. The Master therefore subsequently believed he would only be used as an assisting vessel engaged in grapnel work.

Vessel selection

Vessels are normally marketed in this industry with their maximum bollard pull, which for the Bourbon Dolphin was 194t, in reality her continuous bollard pull was only 180t.
The vessels propulsion machinery consisted of 4 main engines arranged in pairs driving 2 controllable pitch propellers. In addition the vessel was fitted with a single tunnel thruster and a retractable azimuth thruster forward, and two tunnel thrusters aft. Each propeller shaft was also fitted with a shaft generator to provide power to drive the thruster motors and the hydraulic system for the winches. Therefore although the vessel was rated at 180t bollard pull, excessive use of the thrusters would have put demands on the shaft generators that would have reduced the power available to the main propellers, possibly dropping the available bollard pull down to 125t. The bollard pull requirement for the weight of the mooring system alone in the rig move procedure was 160t. This was a great deal higher than the bollard pull available to the 'Bourbon Dolphin' as she battled to get the vessel back to the track using her thrusters and propellers. Therefore the vessel was chartered when at best her available bollard pull could have been considered as borderline for the task of anchor handling for this particular operation.
In addition, when vessels were being assessed for their suitability for the rig move it was found that the winch capacity specified was too low for the dynamic forces which could have been expected during the operation.

Other factors

The emergency release had been activated at the time of the incident but the speed of pay out was noted to be only about 12m/min, when it should have been up to 40m/min. Most personnel on anchor handling tugs are of the belief that these emergency release buttons will lead to an instantaneous release of the chain or wire, when that is not the case. Although it was activated on the Bourbon Dolphin, the wire and chain were only paid out at about 12 m/min, which was not enough to stop the vessel being capsized by the mooring line.

On the Bourbon Dolphin, the experience of the bridge team, particularly in deep water anchor handling work was found to be lacking. More experience on the part of the crew may well have helped to prevent the escalation of the events which led to the capsizing.

The handover between the outgoing Master and the new Master, who had not been on the vessel before, lasted only about 1 and a half hours. The vessel subsequently sailed for the 135 mile passage to the Transocean Rather to commence the rig move.

Previous external audits of the ISM system had not identified that there was no procedure in the Safety Management System for anchor handling, event though it is a requirement that the Safety Management System should have detailed procedures for all key operations.

It is debatable whether the running of No.2 anchor should have been started. Although the environmental conditions were marginal those involved did not believe they were such that operations should be suspended. However, due to the difficulties encountered by the larger more powerful vessel the Olympic Hercules whilst running No.6 anchor it could be argued that the running of the final anchor should have been delayed until conditions were more favourable. Once the Bourbon Dolphin started to have difficulties and was nearly upon the adjacent mooring line again, it could be argued that the operation could have been stopped and options for running the anchor assessed, possibly using a larger vessel or the operation suspended until conditions improved.

Recommendations

Following the investigation into the incident a number of recommendations were made to attempt to ensure that a similar incident does not occur in the future, these are detailed below.

1. A very probable development from this will be the inclusion in a vessels stability book of anchor handling specific stability conditions and situations that prove the stability of the vessel is adequate. In addition the vessel specific information in a stability book will be more specific to the actual vessel, rather than the standardised generic information which is provided to different vessel types at present, and therefore not truly reflecting the vessel specifically or communicating specific areas of concern.

2. Personnel involved in anchor handling operations should undergo more simulator training for these operations including feedback to the operator in the simulator regarding the consequence of actions undertaken during the operation. In addition maritime training establishments have been recommended to include anchor handling and towing stability concerns in the course of training.

3. Vessels bollard pull certificates should contain not just the continuous bollard pull, but also indicate the reduction in bollard pull due to the use of shaft generators at their full loading. Also it is recommended that there is a statutory requirement for a quick release function for winches for the crew to use when there is an evident danger of a casualty occurring.

4. In addition personnel involved in anchor handling and winch operators should undergo formal training, as at present there is no statutory requirement for this, and the possibility of certification for this training should also be looked into.

5. A further consideration that was raised was for an additional emergency exit from the engine room in the hull flat bottom, in addition to those that are already built on these vessels to the main deck; needless to say this would be a technically challenging concept to incorporate.

6. Due to the fact that only one liferaft was released automatically and reached the surface of the six fitted to the vessel, it was recommended that thought be given to how these could be fitted such that they would release and float free and inflate clear of the vessel in the event of a capsize. Likewise, the EPIRB which was mounted on the Monkey Island above the bridge did not release, and the stowage of this item also needs to be investigated to ensure that it releases and floats clear in the event of a capsize.

7. The mandatory requirement for the fitment of voyage data recorders on vessels of greater than 3,000 GRT should be extended to smaller vessels and rigs as such data would have been useful in this incident, especially the VHF radio conversations where there has been subsequent contention about what was said.

8. The length of time for the handover of personnel should be specified by operators in their Safety Management System, especially when crew are joining a vessel they are not familiar with, so as to ensure that they are sufficiently informed about the vessel and its characteristics prior to the departure of the relieved crew member.

9. Planning and the rig move plan should also be improved, with the plan being operation specific, provided to all parties well in advance of the operation and an onshore meeting help of all critical personnel. Risk assessments must also be conducted for the overall operation and also for the operations to be performed on each vessel. In addition the rig move plan should specify attention zones along planned anchor tracks, where if the vessel deviates from the track it is to be brought to the attention of the rig and the reasons explained why the vessel cannot remain within the zone, and suitable measures taken to rectify the situation. The lack of clear weather criteria in the rig move procedure was also criticised, as these did not agree with the industry standards for this part of the world or the requirements of the oilfield operator.

10. The risk assessments used onboard AHTS vessels for these operations mostly focus on the dangers of the anchor handling operation from the perspective of what is to be done on the working deck. Little attention is paid to the dangers affecting the actual vessel and it is recommended that this is addressed and included in pro-forma risk assessments used onboard prior to operations commencing.

If you have any questions or feedback in relation to this case history please contact the Clubs' Loss Prevention Department at loss.prevention@simsl.com