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MODU Ocean Express Disaster 1976

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1 ABSTRACT

The MODU Ocean Express was a self elevating mobile offshore drilling unit operating in the Gulf of Mexico East of Mustang Island off Corpus Christi Bay, Texas. On April 14th 1976, the Ocean Express was under tow to another drilling destination approximately 33 miles away executed by a third party barge mover and three assistance tugs. On the morning of April 14th the Ocean Express departed Block 803 for Block A-57 on what industry deemed a “short move” with an unaccounted for deadweight, decreased freeboard and a noticeable port list.

Near midnight on the 14th once the rig arrived and began jacking operations at the new site, the weather deteriorated and the seas worsened. The mat at the base of the jacking legs was held in a less-than-ideal intermediate position and the barge mover order the tugs to hold fast and wait out the weather. The heavy seas burst one tow line connecting the tug off the bow of the Ocean Express. Shifting weights on deck and lack of directional control from the tugs in combination with flooding due to boarding seas and possible grounding caused the developments of a starboard list and eventual capsizing of the platform late in the evening of April 15th.

The platform was successfully evacuated of all crew members including the barge mover; however the third of three survival capsules launched capsized, claiming the lives of 13 of the 20 crew aboard.

2 INTRODUCTION

The following case study is a detailed and factual account of the sinking of the MODU Ocean Express and an analysis of the risks of marine operations in elevated sea states. Concentration is placed on the role of risk management strategies and preventative measures that would have mitigated casualty in the Ocean Express disaster. Also investigated, is the contributory human error that played a role in the incident as well as the revision of common practices, design codes and licensing policies that occurred as a result of the loss of life.

3 PLATFORM DESCRIPTION

The Ocean Express is a self-elevating offshore drilling platform owned and operated by Odeco Drilling Inc. At the time of the sinking it was chartered by Marathon Oil Company for use off Mustang Island, Texas in the Gulf of Mexico. The general particulars can be seen below.

Table 1: Ocean Express General Particulars

Dimensions (ft)	Platform	Mat
Length	166	210
Beam	109	170
Depth	16	12

The Ocean Express was built in Beaumont, Texas in 1975 and was classed as a marine vessel by ABS due to the frequent nature of transit and de/construction. The barge-like platform was separated into two decks. The lower deck contains machinery, operational space and living quarters with various watertight doors and hatches. The main deck housed the control room, additional living quarters, two galleys, various production machinery, two pedestal cranes and the main derrick on the aft end of the hull. Located on the forward end of the platform is an extended helicopter landing platform. The main deck has capacity for up to 600 tons of drill pipe.

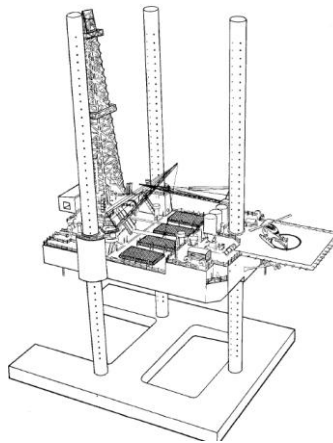


Figure 1: Sketch of Ocean Express

The platform hull is supported by three 12ft diameter cylindrical jack-up legs which rest on a steel mat that sits on the seabed. The mat has a total of 14 tanks; 6 of which are permanently flooded, 6

permanently buoyant and two cooling tanks. During transportation the mat is jacked up to a 2ft separation between it and the hull.

There were a number of noted observations in the seaworthiness of the Ocean Express Prior to departure for the new drill site. An undetected weight was present in the platform up to four months prior to the move. This weight caused an unexplained list to port and a difference in the observed and calculated freeboard values. When the barge mover boarded the Ocean Express he concluded that the lightship information may have been in error and is the cause in the port list, however a complete check of all tank liquids and weights aboard was never completed and it is more likely that the list stemmed from unknown tank levels and unaccounted for consumables on deck. The undetected weight and additional ballasting taken on contributed to the difference in freeboard. This contribution was small (on the order of 3in) however a significant factor in the decreased freeboard is additional production materials and ballasting that make up 19in of lost freeboard. Subtracting 22in from the 7'-5" freeboard the barge mover calculated yields a 5'-10" level which is in the range of the observed freeboard prior to departure.

The Ocean Express held a 29 man compliment on the morning of April 14th which increased to 35, as 6 crew members boarded from another vessel on the morning of the 15th. The Platform was due to be moved 33 miles East-Northeast from Block 803 to Block A-57 under full control of an Odeco appointed third party barge mover. The barge is able to be safely jacked down and moved so long as the sea state is at or below 5-7ft seas with accompanying wind. At the time of the capsizing the sea state significantly exceeded this limit.

4 SINKING AND LOSS OF LIFE

On 11th April 1976 Odeco Drilling Inc appointed a third party barge mover as the one in control of overseeing the transit operation of the Ocean express from Block 803, 33 miles to another drilling location Block A-57.



Figure 2-Approximate Charter from Block 803 to Block A-57

On the 13th April, the barge mover was transported to the platform in Block 803 and was in charge of contracting a tug fleet for the move and directing the towing operation. Once all checks were completed and sufficient calculations for trim, draft and stability were completed the barge began jack-down operations at 0700 on 14th April. The seas were 4-6ft and a southeast wind of approximately 10 knots. This reflected to National Weather System (NWS) forecast for this area and was trusted to be accurate. The three tugs that were due to assist in the move were the Gulf Explorer, Gulf Viking and

Gulf Knight situated on the starboard bow, port bow and starboard stern respectively; however the Knight was moved alongside the Viking prior to departure at 1100. The platform departed with all equipment the mat raised to a depth of 80ft, which for the barge owner was deemed safe and of sufficient ground clearance for the charted path. The sea state remained relatively calm throughout the move at 5-7ft with a 5knot increase in wind speed. At 2300 on the 14th, the barge mover was approximately one mile from Block A-57 when he began jack-up. Two hours later at 0100 on the 15th, the weather worsened at jacking was halted at an intermediate draft of 148ft while the Gulf Knight and Explorer were repositioned to the stern leaving the Viking on the bow. The Gulf Viking was ordered to turn into the sea and hold location. By 0630, the waves increased to twice the recommend height for safe jacking operations contrary to the NWS 5-8ft prediction. By this time, the six additional crew members had boarded from the M/V M. L. Levy. At 1000 the barge mover directed the two stern tugs to reposition to the bow to hold the rig on location at the weather continued to deteriorate. 1510 the Gulf Knight experienced inoperable failure in one of its engines; A relief tug was order for the 16th however the master of the Knight remained on scene to aid until the other vessel was due to arrive. The decrease in power left the Gulf Knight unable to maintain heading in the rough seas so it fell back to a trailing position.

At 1930, holding 25ft seas and 50-55knot winds, the towline connecting the Gulf Viking to the port bow of the Ocean Express burst. Three men went to the triangular bow deck to retrieve the broken line and heave another aboard the Viking but were prevented from doing so due to the large waves breaking over the deck knocking them down and slamming the watertight door behind them. A fourth crewmember attempt to aid the three but was unsuccessful. A final wave excessively flooded the nearby welding shop and the barge mover ordered the men to abandon the rescuing of the line and seal the watertight door. There is now only one tug in directional control of the Ocean express as the broken towline from the Viking was too heavy and difficult to manage for the crew. An anchor was available to drop which may have provided some station keeping assistance however amidst other urgent matters no attempt was made to drop it.

After the towline to the gulf Viking failed, drill pipe secured on the main deck broke loose due to wave action. Attempts were made to re-fasten the pipe but with the current motions of the platform it was deemed too dangerous. At this time the alarm to abandon rig was sounded without consulting the Toolpusher or the barge mover. The barge mover still maintained that the Ocean Express was in no danger of sinking. Around 2000, a coast Guard helicopter was order by the Marathon Oil representative on board. One hour later the derrick on the aft end of the platform broke loose in the heavy seas and shifted to the starboard side of the hull, initiating a very pronounced list. All crew had no entered the two starboard capsules in preparation for abandonment leaving the barge mover still on board. He remained there as he still believed he could save the rig from capsizing. Within 15 minutes the barge mover was rescued by the U.S Coast Guard from the Helipad moments before the Ocean Express was lost as she turned portside to the seas and capsized in 155ft of water. The pilot of the rescue helicopter observed a near 45degree list to starboard prior to sinking.

Survival capsule #1 was launched from the starboard bow with 14 crew members aboard. All men except for two were seating wearing seatbelts. The capsule landed in the water without incident however multiple attempts were made to release it from the guide wire connected to the rig. Once released, the capsule headed for a nearby spotted vessel, the Nicole Martin, amidst the smell of burnt paint and diesel fuel from an overheating engine, which the driver later shut down in fears off burn out. Once alongside the vessel at approximately 2145 the crew of the capsule secured the rope to the hooking mechanism on the top of the craft. Each member or the craft successfully boarded the rescue vessel. Capsule #2 was lost in heavy seas just before the capsizing of the Ocean Express, no men were aboard.

20 men boarded capsule #3. Most of the men had not yet been in the capsule for training or had any idea on how to operate it. The lowering of the capsule was a failure so one man exited the hatch and pulled the deadman pin and initiated the lowering process. The men encountered the same problem with released the guide cable as with capsule #1. During an extremely involved rescue attempt by the Gulf Viking the ropes fastened to the top of the survival capsule from the Viking became tight and induced a jerked motion, flipping the capsule while the hatch doors were still open. Men not wearing seatbelts fell to the low side of the vessel and increased the flip rate. The capsule then took on large amounts of water. The capsule was not evacuated immediately because the crew expected to be righted by the Viking; all attempted hereafter failed. What men were able escaped the capsule and were later rescued by the Viking and the Knight. 13 of the men aboard capsule #3 perished.

5 POST ANALYSIS

Many contributing factors lead the sinking of the Ocean Express once being held in position to wait out the poor weather. On top of the unexplained weight and decreased freeboard prior to transit, additional causes occurred on the 15th which lead to the loss of the Ocean Express. To build on the loss of freeboard issue, constant flooding occurred as a result of high seas on the 15th. It was noted that water was consistently leaking in through broken seals in hatches and doors while the rig was holding position as waves of 8-10 were recorded washing over the deck.

The position of the mat was a major factor in the loss of stability and subsequent sinking of the platform. The mat halting at a 148ft draft to wait out to rough seas had an adverse affect on the angular stability range and righting energy of the Ocean Express. Stability calculations were completed for a standard 23ft draft and the below table shows the deterioration of stability with the mat positioned as it was on April 15th with and without the 19" loss of freeboard.

	Mat at 2' separation (9' platform draft) (23' overall draft)	Mat lowered to 127' separation (9' plat- form draft) (148' over- all draft)	Combination of mat lowered to 127' separation and an approximate 19" loss of freeboard * (10.6' platform draft) (149.6' overall draft)
Range of positive stability	42 ^o	28 ^o	26 ^o
Total righting energy over full range of positive stability (foot-degrees)	182	75 (59% loss)	60 (67% loss)
Downflooding angle	12.8 ^o	14.5 ^o	12.1 ^o
Righting energy to downflooding angle (foot-degrees)	41	44 (7% incr)	32 (22% loss)
Maximum righting arm	7.3'	4.7'	3.8'
Angle of maximum righting arm	18 ^o	11 ^o	10 ^o
Percent excess area, righting moment curve to heeling moment curve, as per ABS intact stability criterion **	40%	11%	10%
Nominal wind speed as per ABS intact stability criterion **	100 KTS.	91 KTS.	89 KTS.

Figure 3-Table of Reduced Stability for Alternate Mat Position and Decreased Freeboard

As can be seen the effect of the mat in the intermediate position are significant to the platform's stability. The range of positive stability decreases from 42degrees to only 26degrees and there is a 67% loss in total righting energy. In addition, the maximum righting arm decreases 3.5ft. It is evident that the mat position played a major role in the loss of the Ocean Express during rough seas on April 15th.

The shifting of the weight on deck led to the starboard list which eventually capsized the platform. From crew testimony the following shifts occurred during the heavy seas.

Table 2: Shift of Weight during Sinking

Component	Weight (KIP)	Shift (ft-PORT/STBD)
Derrick	723.4	8-STBD
Drilling Collars	154	15-STBD
Drilling Pipe	120	5-STBD
Miscellaneous Pipe	42	5-PORT

Boarding seas also contributed to the overturning of the Ocean Express. Before the sinking, there was reportedly an extreme amount of green water on deck as 8-10ft waves “were boarding with such frequency that the decks did not have a chance to drain”. This plays on the effect of reduced freeboard. The boarding seas were coming broadside to the platform once it drifted beam on to the incoming waves immediately before sinking. Once the flooding waves washed over the platform, essentially submerging it, the effect of the starboard list was magnified. The boarding seas may have been what caused the final lack of stability and subsequent capsizing of the Ocean Express.

In addition to these factors the possibility of grounding also exists. Grounding of the Ocean Express would have caused a “tripping action” whereby the platform would have been more likely to capsize in the presence of all other factors and a constant heeling wind. The overall draft of the rig was confirmed at 148ft. The water depth in the area of sinking was gauged at 167ft. With the additional increase in draft due to the undetected weight and heel and trim due to flooding and shifting of weight considered, it is quite possible that the rig may have grounded prior to capsize.

6 RISK CONTROL STRATEGIES

The loss of the Ocean Express was a culmination of oversights and unprofessionalism on behalf of the barge operator and barge mover and classification society in conjunction with deteriorating weather conditions. Many risk control strategies could have been in place to mitigate the loss of life in the incident and possibly even save the vessel.

The predominant strategy that would have almost certainly saved lives would be proper training in evacuation procedures. When the men boarded the survival capsule, many were never inside and were completely unfamiliar with the arrangement and operation of the craft. Difficulty was found in releasing the both crafts from the lowering cable attached to the platform. One particular man lost a portion of a finger attempting to free the capsule. This continues to the crew member in charge during an evacuation situation. No one aboard the Ocean Express was aware of who was in charge in the event of an abandon ship. Some members of the crew were informed that they would be in charge of particular capsules however that was the extent of their evacuation readiness. Others took part in a practice launch prior to the casualty but did not receive any formal training. Had the men aboard capsule #3 been trained in rescue operations for the craft they may have had the opportunity to all be buckle into their chairs, preventing the capsizing of the capsule due to their shifting weight during the Viking’s rescue attempt. A lack of safe lashing points on the capsule also contributes to this effort.

Aboard the Ocean Express, there was very little room on the triangular deck onto which the crew could work to re-secure the towline to the Gulf Viking. This exposed area frequently swept the men off their feet due to the heavy seas and crashing waves. Hoisting the rope by hand made for an unsafe and dangerous environment that could have injured or taken the lives of the men attempting to throw the tow line back to the tug. More consideration into the risks associated with line handling should have

been taken by the designers such as a more sheltered deck area or the installation of a line gun. This would have reduced the risk of injury and loss of life when trying to secure a towline to support vessels.

Although the drill pipe and other equipment were secured to the satisfaction of the barge mover before departure from Block 803, a steadfast routine check should have been implanted so as to constantly monitor the integrity of the lashings for heavy equipment. This is particularly the case with the derrick and the drill pipe as they accounted for a large portion of the shifted weight.

7 LOSS PREVENTION MEASURES

Knowing all the events and happenings of April 15th, 1976 allows for hindsight in the identification of loss prevention measures that would have saved the platform and the lives of the 13 men.

The most significant measure that could have been exercised in an effort to save the Ocean Express was the position of the mat during the rough seas. The jack-up operation was halted mid depth during poor weather which greatly reduced the stability of the platform. The barge mover should have recognized this however there was no formal documentation citing the reduction in stability for various mat positions. In order to prevent this it would have been wise on behalf of the platform owner and classification society to produce data in the stability booklet outlining performance with the mat lower to levels other than the prescribed 2ft separation. This would have inclined the barge mover to act differently when facing a dangerous sea state while the mat was in an intermediate position. Had he been aware of the coming weather he may not have commenced jacking operations so as not to have the mat in a dangerous position in waves exceeding the maximum allowable height for transit. Efforts to understand the effect of mat position on stability may have avoided the loss of the rig and therefore the loss of life.

The platform should never have sailed with the decreased freeboard such as was observed prior to departing for Block A-57. Barge-like structures of this nature are highly susceptible to boarding seas and the undetected weight and decreased freeboard were factors in the loss of stability of the platform; especially when the rolling motion and green water on deck were essentially submerging the Ocean Express.

The survival capsules were the cause of the fatalities in this incident. Although the particular capsules were well designed and deemed fit for purpose, a lack of securing points on the craft forced the crew of capsule #3 to lash a rescue line onto the release mechanism on top of the craft. This created an overturning moment on the craft when the line pulled tight. This shortcoming should have been recognized long before the capsules were put to use in a survival situation. Had there been a proper lashing point affixed to the bow of the capsule, #3 may have been able to stay in tow behind the Gulf Viking until rescue was possible.

8 REVISION OF CODES, PRACTICES AND REGULATIONS

It is unclear as to the extent of which codes, regulations and general practices have been modified as a result of this incident. However, within the Marine Casualty Report submitted by the United States Coast Guard a number of recommendations specified revamping of regulatory procedures and licensing rules. Some notable changes are as follows:

1. The self-elevating class of vessels to fall under inspection laws of the U. S
2. A comprehensive list of all information required by the barge mover for transits with this particular type of vessel
3. Delete the law exempting the masters of tug boats servicing the operations in the oil and gas industry from being properly licensed
4. Implement a licensing program for barge movers and tug operators in which they are tested on situations regarding unsafe weather conditions
5. Requirement of weekly training and evacuation drills conducted for safety purposes by the barge operator
6. Modify the intact stability criterion of classification societies to analyze the survivability of a vessel in exceeding weather conditions
7. Adoption of a damaged stability standard

9 CONCLUSION

It was evident that a lack of knowledge and expertise on behalf of the barge mover and operator was the main factor owing to the loss of the Ocean Express. Inexperience on behalf of the barge mover led that individual to hold the rig in heavy waves in a condition which drastically reduced the stability of the platform. Had more care have been taken when minding the weather forecast and commencing the jack-up procedure, the barge would have had preserved much of its stability by holding the mat in a position that was known to be safe. The operator of the barge failed to provide its crew with appropriate and sufficient training in survival situations. This lack of training meant the men were unfamiliar with the survival capsule arrangement and had difficulty releasing the lowering mechanism. This was the case for both capsules. A lack of knowledge of vessel stability caused the loss of the Ocean Express on April 15th 1976 and insufficient training in evacuation procedures aboard survival capsules claimed the lives of 13 sailors. To this end it can be concluded that human error played a significant role in this incident; all of which stem from a lack of safety and failure to mitigate risk in marine operations.

WORKS CITED

- U. S Coast Guard. Marine Board of Investigation. *Ocean Express (Drilling Unit): Capsizing and sinking in the Gulf of Mexico on 15 April 1976 with Loss of Life*. U. S Coast Guard Marine Board of Investigation (USCG 16732/61865). 1 June 1978.