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The Capsize of the Drillship Seacrest

David M. Mannion
Memorial University of Newfoundland
St. John's, NL A1C 5S7
dmannion@mun.ca

ABSTRACT

The Drillship Seacrest capsized on November 3rd, 1989, in the Platong Gas Field in the Gulf of Thailand, during Typhoon Gay. There was no distress signal heard nor were any of the lifeboats found. This case study will explore the direct and indirect causes that lead to the loss of the Seacrest. Since the incident occurred 24 years ago, information about the incident will be recovered using reports and article written after the event during that time.

1 THE SEACREST

The drillship Seacrest was operating in the Platong Gas Field, in the Gulf of Thailand in November of 1989. November 3rd, Typhoon Gay swept through the region, capsizing the ship and killing 91 of its 97 crew. This report is intended to inform you of the direct cause of, and the sequence of events leading to, the capsize of the Seacrest. [1]

The Seacrest was owned by the Seacrest Drilling Company, and operated by the Great Eastern Drilling and Engineering Company, for Unocal, which later merged with Chevron. It was 362 feet long, 70 feet on the beam, and 24 feet deep. It was built in 1977 by Far East Levingston Shipbuilding Ltd in Singapore, and was classed by the American Bureau of Shipping, with an A-1 Drilling Unit class. It was registered in Panama. The Seacrest began drilling gas wells for Unocal in the Gulf of Thailand in 1981. On October 23rd, 1989, the Seacrest made its final rig move. [2]

While drilling, the Seacrest was moored by eight anchors distributed around the ship. Each anchor weighed 30 000 lbs. and was connected to the ship by 2 inch wire rope. All of the cables were replaced during the summer of 1989. [2]

Figure 1: The Seacrest

2 THE MODIFICATION

Between September and October of 1988, the Seacrest underwent a modification to install a VARCO Top Drive Drilling System, consisting of a DC drilling drive motor assembly that connected directly to the drill string. The old Byron Jackson Dynaplex hook was removed and the derrick was extended by ten feet and reinforced at several places. The top drive modification induced less than a 0.5 percent change in the lightship weight of the ship. The center of gravity of the ship was raised by one percent of its initial vertical position. These changes did not significantly affect the stability of the ship, but Great Eastern decided to counterbalance the top drive anyway. In December 1988, the No. 3 center ballast tank was converted from a mentor oil tank into a permanent ballast tank utilizing 296 LT of drill water. The No.3 port and starboard voids were converted to mentor oil tanks to compensate. The overall stability of the ship was improved after the second modification. This is according to a report prepared for Unocal, by Failure Analysis Associates Inc. [2]

According to another source, the ship experienced problems after the installation of the top drive, but before the ballast conversion. The former chief engineer who was not on the ship when it capsized testified,

> *"…the vessel leaned over heavily when we had to make a turn…and it took a very long time for the vessel to straighten up again…a clear indication that the vessels [sic] stability had been seriously compromised." [3]*
>
> *"Personally I was outraged when we left the port of Satahip without performing a simple inclination test. We had to leave without knowing anything about the altered stability of the vessel." [3]*

This chief engineer, as well as the relief captain, was removed from the crew of the vessel after the next normal crew change after both had made insistent inquiries into the compromised stability of the ship. Shortly thereafter, the ballast modification took place. [3] According to the FAA report, the sum total of all modifications to the vessel including small modifications by the crew did not change the lightship or center of gravity enough to necessitate a new inclining experiment. The ABS rules require a new inclining experiment to be done when there is a change in lightship of one percent or a change in VCG of half a percent of the length of the vessel. According to the FAA, this criterion was not exceeded, so no new inclination was required.

The Seacrest was issued a safety certification by Panama, which requires the ship to comply with the International Maritime Organization's (IMO) Code for the Construction and Equipment of Mobile Offshore Drilling Units (MODU). The Seacrest did comply with that standard, but had only half the number of lifeboats and Emergency Position-Indicating Radio Beacons (EPRIB) required by the IMO's Safety Of Life At Sea (SOLAS) code, which is a baseline standard normally required by marine organizations. If the Seacrest had been registered in the US, it would have been required to comply with this code. [2]

3 THE TYPHOON

A typhoon, also called a hurricane, is a vertical heat engine powered by a low pressure center. It takes a large amount of energy to create this low pressure center, and once it stabilizes, it allows the formation of a vertical wind shear and catalyzes the condensation of seawater. This effectively siphons off the warm seas below the storm, creating clouds charged with lightning from the vertical shear. A hurricane does not always form when the necessary conditions are present, however. It is a highly complex system caught in a positive feedback loop, and exists only as long as it can siphon energy from the sea below. This makes forecasting a typhoon very difficult because not only do they not always form when the conditions are present, but the direction they take depends on the strongest prevailing winds, and the coriolis force on the air column due to the rotation of the earth. They are unpredictable and are often only categorized as hurricanes after they have fully formed. The center of a typhoon is called the eye, and is an area devoid of clouds about which the rest of the storm circulates. The edges of this clear area are called the eye wall, and are the driving force of the entire system, forcing warm air up to supply the storm front. Inside a typhoon's eye there is no more wind than a gentle breeze. But the eye wall contains the fiercest wind and waves.

Typhoon Gay was a category five typhoon, which means it had wind speeds upwards of 252 km/hr or 136 knots. It was the first typhoon seen in the Gulf of Thailand in eighteen years, and the first hurricane to form in the Gulf of Thailand in forty. Significant wave heights near the Seacrest were estimated at nineteen feet. It started out as a mild depression, and was originally forecast to miss the Seacrest altogether. However, during the night of November 2nd, 1989 the depression rapidly intensified and its direction of travel veered north towards the Seacrest. At this point Unocal realized that the weather was much more serious than anticipated and began to prepare for a storm with very little time to spare. There were several oil developments in the Gulf of Thailand and they were all taken by surprise. Every ship that the storm passed over reported stronger winds and lower pressure than the last. Between 1130 and 1200, the eye of the storm passed over the Platong Living Quarters, which reported hurricane force winds, and that the eye was headed for the Seacrest. At 1217 the eye passed over the Seacrest. While in the eye of the storm, the Seacrest was able to make a report. There was only one anchor out of eight remaining after the first pass of the eye wall, and the ship was taking on water in its mud room. Minutes later all communications ceased and the Seacrest disappeared from radar.

Five hours later the storm was officially upgraded to typhoon status, by the Thai Meteorological Department. [2]

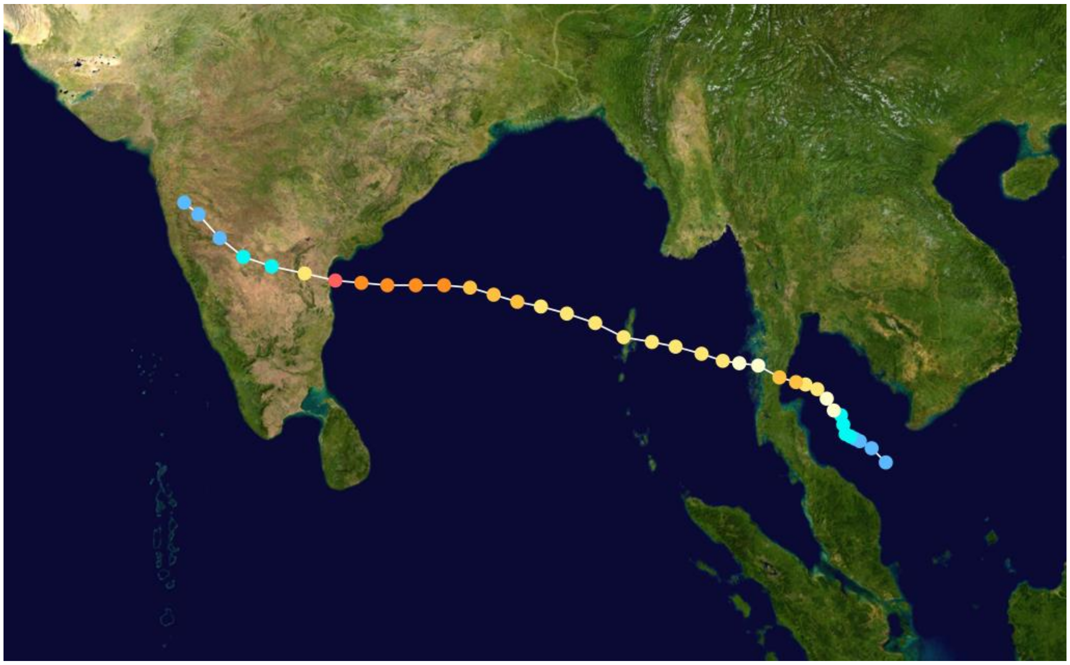

Figure 2: The Path of Typhoon Gay (1989) [4]

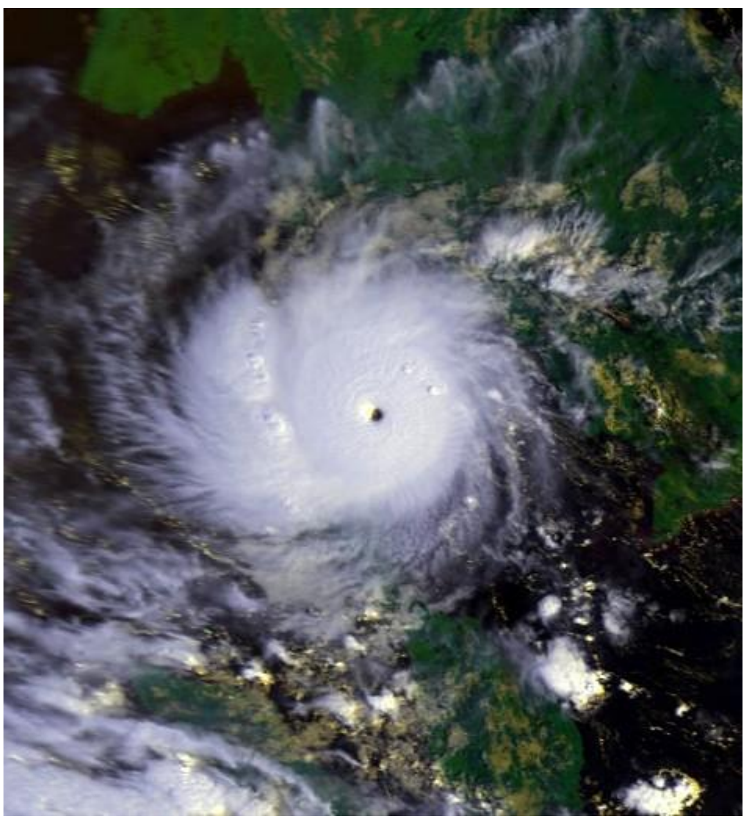

Figure 3: Typhoon Gay (1989) [4]

4 POST DISASTER ANALYSIS

The final report on the Seacrest included a static and dynamic stability analysis of the ship in many different loading conditions. It takes into account the drill pipe on the deck, the top drive, the water ballast, and the water taken in the mud room. The report uncovered a flaw in the original dynamic stability analysis by the shipyard. The wind heeling arms used were 30% lower and did not meet the ABS criteria on which they were based. Subsequently, this means that if the ship had ballasted for a storm before the Top Drive modification, it would not have fulfilled the ABS criteria for dynamic stability. But because the modification actually improved the ship's stability by lowering its center of gravity, the ship was operating with a safe loading condition at the time of its capsize. In fact the stability analysis based on wind and wave data recorded by other vessels could not justify the capsize. The report suggests that the vessel must have broken free of its anchor and drifted until 1350, at which point the action of steady waves and gust winds would have been enough to capsize the ship. The study on the pattern of wreckage on the sea bottom also suggested that the ship drifted for a time before capsizing. [2]

The sources of information for the reports on the stability of the vessel are not stated, and it is most likely that the analyses use assumed loading conditions with assumed corrections for the modifications to the hull since, according to the crew, there was no inclination test or lightship check after the modifications.

5 CONCLUSION

In conclusion, the primary cause of the capsize of the Seacrest was a poorly predicted category five typhoon. There is confusion as to whether the loss was exacerbated by the stability of the ship. It is known that there were errors in the original stability analysis for the ships, and that a modification to the ship reportedly improved the stability of the ship, but the actual stability of the ship at the time of capsize is not known.

The most important factor in this incident, the poor storm prediction, would be of high important to oil rig operators on the risk that they place on their crew by choosing to continue operations to the last possible moment in the presence of a potentially disastrous storm, but modern weather tracking and prediction are far superior to those available in 1989, and so it can be argued that this type of faulty prediction could not happen in modern times.

The secondary factor, the questionable stability of the ship at capsize, should be a lesson to all operators on the importance of knowing the exact stability of a ship at all times.

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Note: A copy of the Failure Analysis Associates report is hosted at:
http://www.thaiwreckdiver.com/documents/seacrest_drillship_sinking_investigation_1989.pdf