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Post Mortem Analysis of MODUs in Hurricanes Katrina and Rita

Malcolm Sharples, Offshore: Risk and Technology Consulting; John Stiff, ABSG Consulting

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Abstract

A number of hurricanes have passed through the Gulf of Mexico resulting in MODUs parting moorings or collapsing, but none have come close to the devastation caused by Hurricanes Katrina and Rita which came through the Gulf of Mexico in August and September 2005. 20 semi-submersible MODUs suffered some level of significant mooring impairment, and 8 jack-ups were declared total losses (with many more suffering additional settlement and other damage). While this was a severe outcome for the MODU fleet, which had previously experienced relatively few failures¹ due to storm overload, over 100 platforms were destroyed, and the hurricanes caused disasters and major regional devastation on land. This paper reviews the level of damage to the MODU fleet caused by the two hurricanes.

Much can be learned about the likelihood and consequences of future failures by studying past experience. Information on the location of where mooring component parted helps assess the consequences of those mooring lines parting, and the site details for the jack-ups help point towards the drivers for their survival. These can then be put into the perspective of other structures of the industry.

Semisubmersible MODUs in the Gulf of Mexico have changed their general usage since development of the API RP2SK [ref.1] to which their moorings are designed for individual locations. The consequences of MODUs drifting in an extreme hurricane are potentially much greater than in the past because of the recent development of the deep water, highly productive, platforms and their associated extensive subsea infrastructure. Damage to this highly productive infrastructure is detrimental to both the nation and industry.

In the aftermath of these hurricanes, which followed Hurricanes Lili, and Ivan, the industry re-examined and upgraded the standards for siting MODUs. An industry driven JIP was launched on moored semi-submersible MODUs which chronicled the incidents and provided guidance for the change in standards. The MMS commissioned a study on the jack-up failures and successes and industry developed a new standard for jack-ups, API RP 95J. Together with MMS-NTLs, these documents provide guidance for siting MODUs to avoid future multiple losses, minimize consequences of failure, and increase the probability of survival.

Overview of Hurricanes Katrina and Rita

In August 2005 Hurricane Katrina moved through the U.S. Gulf of Mexico (GoM). Within weeks, in September 2005, Hurricane Rita also tracked through the GoM. Katrina was the second Category 5 hurricane of the 2005 Atlantic season. The following is a description of Hurricane Katrina, as noted by the National Climatic Data Center (NCDC) of the National Oceanographic and Atmospheric Administration (NOAA) [ref. 2]:

Hurricane Katrina was one of the strongest storms to impact the coast of the United States during the last 100 years. With sustained winds during landfall of 125 mph (a strong Category 3 hurricane on the Saffir-Simpson scale) and minimum central pressure the third lowest on record at landfall (920 mb), Katrina caused widespread devastation along the central Gulf Coast states of the US. Cities such as New Orleans, LA, Mobile, AL, and Gulfport, MS bore the brunt of Katrina's force and will need weeks and months of recovery efforts to restore normality. Other storms have had stronger sustained winds when they made landfall including the following:

¹ The use of the word "failure" throughout this paper is intended to have the technical meaning rather than the legal definition, i.e. suggesting an opinion or criticism as to cause. The technical meaning is "A condition at which a structure reaches a limit state". A limit state is defined as being "A condition at which the structure (e.g. mooring system) begins to become unfit for use" [ref. "The Penguin Dictionary of Civil Engineering", John S. Scott]. For a semi-submersible the limit state may be, for example, a mooring lines parting or anchors dragging. For jack-ups it could be spudcan settlement or complete collapse.