OTC 18980

Jackup Operations: New Operational Recommended Practices

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Abstract

The 2005 U.S. Gulf of Mexico hurricane season validated the industry's practice of "shut-in and evacuate". Successful application of this practice resulted in no fatalities or serious injuries as well as limited pollution events related to Jackup operations. However, infrastructure (hull) losses in regards to the Jackup fleet were unprecedented and demanded operational alterations by industry in advance of the 2006 hurricane season.

Prior to the 2006 Hurricane Season, Jackup owner/operators did not have a consensus on a recommended practice or specification document to utilize in order to adhere to minimum operational requirements to mitigate hurricane damage. The International Association of Drilling Contractors' (IADC) Jackup Rig Committee has been diligently engaged in producing the Gulf of Mexico Annex to the Society of Naval Architects and Marine Engineers' (SNAME) Technical and Research Bulletin 5-5A, Guidelines for Site Specific Assessment of Mobile Jack-up Units [1]. The committee was not at a stage where scientific studies had been completed and a consensus had not been achieved, consequently the document was not available for general use. Because of this, an interim operational-based solution was necessary.

Shortly after the conclusion of the 2005 hurricane season, industry met with its government partners, Minerals Management Service (MMS) and U.S. Coast Guard to preliminarily determine the primary causes of the losses, the impact on the fleet population and to assess opportunities for performance improvement in advance of the 2006 Gulf of Mexico hurricane season. This strategic partnership led to the development of API Recommended Practice (RP) 95J, Interim Guidance for Jackup Operations in the Gulf of Mexico During Hurricane Season [2].

Use of the RP essentially became mandatory as the MMS adopted the operational recommendations and promulgated its Notice to Lessees (NTL) No. 2006-G09 [3] in advance of the 2006 hurricane season. The results of the operational alterations have not been tested as the 2006 Gulf of Mexico hurricane season was unusually mild. MMS has advised industry that it intends on reissuing the NTL in same or similar form for the 2007 Gulf of Mexico hurricane season.

Introduction

As reflected in Figure 1, hurricanes Katrina and Rita severely impacted the Central Gulf of Mexico, which contained much of this nation's offshore energy infrastructure, including the majority of the domestic Jackup fleet.

Historically, Jackup operators have sustained minimal hull losses due to hurricanes. Between 1992 and 2005, three (3) units lost stationkeeping in Gulf of Mexico hurricanes. In recent years, deeper prospects, increased drilling rig demands, customer demands, and jackup water depth working capacity have placed units in deeper water depths throughout the Gulf of Mexico area. In retrospect, this trend, in certain instances, placed jackups at or near their maximum water depth capacity and outdated metocean criteria, contributed to the loss of stationkeeping of eight (8) such units during the 2005 hurricane season.

Preliminary analysis of the losses to the Jackup fleet and those units that survived indicates the likely causes to be wave inundation and/or foundation failure leading to hull wave inundation. Additionally, these studies on the surviving fleet reflect many units experienced forces in excess of their design criteria. These studies further validate that structural design and assessment methodologies of jackups are usually conservative.

The metocean data previously utilized to assess site suitability also has now been determined to be suspect. A review of metocean criteria by industry experts was conducted in order to determine appropriate air gap to avoid wave impingement on the hull.

Additionally, bottom survey data and geotechnical data (soil conditions) as well as the unit's pre-loading procedures were also addressed in the new RP to improve stationkeeping.

Other operational enhancements were reviewed and incorporated into the RP including storm preparation and post-storm recovery and inspection recommendations.

Part 1: Site, Geotechnical and Metocean Data

RP 95J and its companion document, the MMS NTL, mandate exchange of critical data between the Operator (Lessee) and the drilling contractor. Site data, geotechnical data and metocean data are now required in advance of the

Jackup arriving on location in order for both parties to determine site suitability for the specific unit.

Site data includes but is not limited to the coordinates of the proposed location, seabed topography and water depth. The water depth should be referenced to a clearly specified datum, such as Lowest Astronomical Tide (LAT) or Chart Datum (CD). Appropriate bottom surveys should be conducted by the Operator in order to identify the location of all pipelines and debris that may interfere with the safe movement of the unit and its placement on location. Recent storm passage should also be considered as these events may displace pipelines and other debris. Previous employment of Jackups at the specific location should also be reviewed in order to ascertain if the previous unit's leg spacing differs from the unit currently being utilized.

Geotechnical data should include an appropriate evaluation of the soil to adequately predict leg penetration. The evaluation should be sufficient to determine the degree of load redistribution to the foundation via the spudcans. The geotechnical data should also be suitable for a shallow foundation assessment and of sufficient depth to capture relevant soil characteristics, such as sand lenses or layered systems. Additionally, the data should describe if the proposed location is in a mud slide/flow prone area that may adversely affect the foundation assessment.

In regards to metocean data, the RP recommends a site-specific analysis that includes the provision of wind, wave, current, storm surge and tide information. This analysis should be sufficient for the Jackup owner/operator to evaluate their units suitability for specified location and if suitable, the appropriate positioning on location and a proper determination of a minimum air-gap. New site-specific metocean guidance is provided in Appendix C of the RP. In lieu of site-specific metocean analysis, a generic metocean curve (expected crest height curve with an uncertainty factor) is provided in Appendix D, and may be utilized to calculate the minimum air-gap. Both the RP and the MMS NTL recommend the use of a site-specific metocean analysis. The site specific metocean data is more accurate and in some cases allows the use of a unit in deeper areas because the environmental criteria are less stringent than the generic crest curve.

Part II: Preloading Process

Proper preloading is critical to a unit's survival. The RP addresses several preloading recommendations in order to enhance this operational process and provide a minimum standard for both the Operator and Jackup owner/operator. The goal of the preloading recommendations is to attain the maximum leg reaction possible to ensure unit fixity.

Use of variable loading to supplement the unit's normal preload capacity and/or the implementation of individual leg preloading is encouraged to enhance fixity.

Preload should be applied to the soil for a sufficient length of time to consolidate the soil and ensure that leg penetration has ceased. Optimizing preload holding time will minimize the likelihood of additional penetration and provides a reasonable test of foundation strength. The Jackup owner/operator should review the site, geotechnical and metocean data in advance of the unit arriving on location and advise the Operator of the anticipated preload procedures and estimated holding time. Holding time is defined in the RP as time in hours from the last settling occurrence. Typically, this is in the range of one to two (1-2) hours. This duration may vary depending on the type of strata underlying the spudcans and the settling experience noted during initial preload cycles.

Part II: Air Gap

RP 95J describes two means of calculating a minimum air gap. The preferred method is site specific and the alternative is the use of the generic air gap curve.

A site specific minimum air gap should be derived from 100-year hurricane wave crest data plus an uncertainty allowance of 3 to 5 %. Additionally, an appropriate settling allowance applicable to the involved unit and soil conditions should be calculated and added to the wave crest and uncertainty allowance computation. The wave crest data should be derived from the site specific metocean data described under Part I. Potential storm settlement calculations should be based on a 100-year return period event or greater.

An alternative to the site specific method of air gap calculation is the use of the generic air gap curve located on Appendix A of the RP and depicted in Figure 2. This curve was derived from new metocean calculations and includes a crest uncertainty factor as well as a settlement factor of 4 feet.

Part IV: Unit Preparation and Evacuation

Prior to publication of RP 95J, inconsistencies existed in regards to the use of the Jackup to support and secure the well being drilled that may have placed the unit outside its storm survival mode criteria. The RP specifically recommends mandatory adherence to the unit's Flag State approved Marine Operations Manual (MOM) for storm and/or survival mode instructions. Such measures may include skidding the cantilever or drilling package back to the appropriate location, elevating the hull to the required minimum air gap and placing the unit in survival condition mode.

The RP next addresses the assessment of time necessary to secure the well, Jackup and safely evacuate the unit. Guidance includes assessing the time needed to suspend or complete discretionary well operations such as running casing or completing the drilling of a particular well section. Such operations may lengthen the time necessary to secure the well and potentially delay safe evacuation. Consideration should also be given to the time required for personnel, once ashore, to evacuate the coastal area that may be impacted by the storm.

Part V: Post Storm Recovery

Prior to publication of RP 95J, few if any of the Jackup fleet had a means of tracking movement/location in the event stationkeeping was lost. The subject RP recommends the use of satellite tracking devices to locate the unit if it goes adrift. Also, the RP recommends granting read-only access to appropriate governmental agencies to assist them, such as the U.S. Coast Guard, in locating and mitigating any environmental consequence of the storm potentially attributable to the adrift unit.

Part VI: Post Storm Inspections

RP 95J recommends the Jackup owner/operator initiate a post storm inspection program and an internal database to capture and collate jackup storm response parameters. The RP includes a form (Appendix B) that was developed to assist in evaluating each Jackup that encounters hurricane force winds. The RP recommends collection and recording any damage to the jackup's primary structural components, which include but are not limited to leg members, spudcans, elevating and/or fixation system, decks, bulkheads and jacking gear unit bracing structure.

Conclusion

RP 95J was developed as an interim recommended practice to enhance Jackup survivability and stationkeeping during Gulf of Mexico hurricanes. Industry studies are ongoing to assess metocean conditions during hurricanes and the IADC's Jackup Rig Committee's ongoing development of technical methodologies and solutions may require alteration, revision, reaffirmation or withdrawal of the Recommended Practice. Utilization of the RP and the MMS NTL, in combination with an understanding of the environment at a particular location (i.e. site, geotechnical and metocean), will enhance operational integrity of the Jackup unit during hurricane season.

Acknowledgements

The authors wish to thank their respective employers for the opportunity to publish this paper. Additionally, API, IADC, MMS and the U.S. Coast Guard deserve recognition for their respective leadership roles in the promulgation of the subject RP.

References

1. Society of Naval Architects & Marine Engineers Technical & Research Bulletin 5-5A, *Guidelines for Site Specific Assessment of Mobile Jack-up Units*, January 2002.
2. API Recommended Practice RP 95J, *Gulf of Mexico Jackup Operations for Hurricane Season-Interim Recommendations*, First Edition, June 2006.
3. Minerals Management Service (MMS) Notice to Lessees (NTL) No. 2006 G09, *Interim Guidelines for Jack-up Drilling Rig Fitness Requirements for the 2006 Hurricane Season*, Effective Date May 1, 2006.
4. Minerals Management Service (MMS) *Hurricane Recovery Status and Future of the Gulf*, by Chris Oynes at the Joint Industry Luncheon, December 13, 2005.

Figure 1 – Hurricanes Katrina and Rita Storm Tracks and Hurricane Force Winds Swath [4]

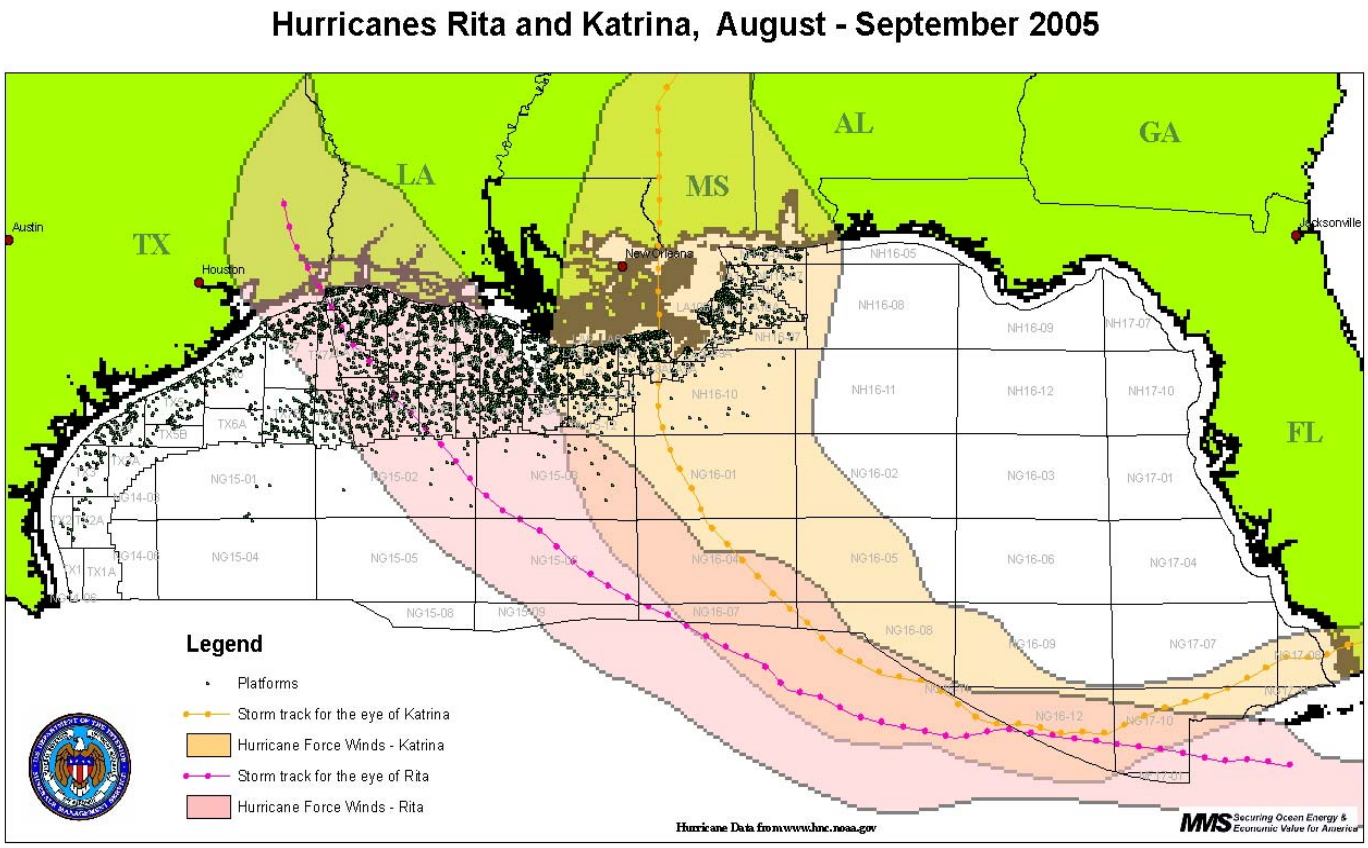

Figure 2 – Generic Air Gap Curve [2]