Songa Mercur
King Post Failure

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DrillSafe Forum
Brisbane
3 Dec 2009

King Post Failure

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The Songa Mercur

Songa Mercur History

2006	Purchased in USA
2006	Shipyard in Singapore
2007	Arrived in Australia
2007	Commenced work
2 June 09	Date of incident

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The Incident

How did it happen?

The Starboard King Post Rear Stay Base Plate separated from the wing deck

This caused the King Post to fall forward and outboard under the weight of the Flare Boom

Starboard Flare Boom

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The Incident

What happened?

The Starboard King Post failed causing the Flare Boom to fall into the sea

Failed Starboard King Post

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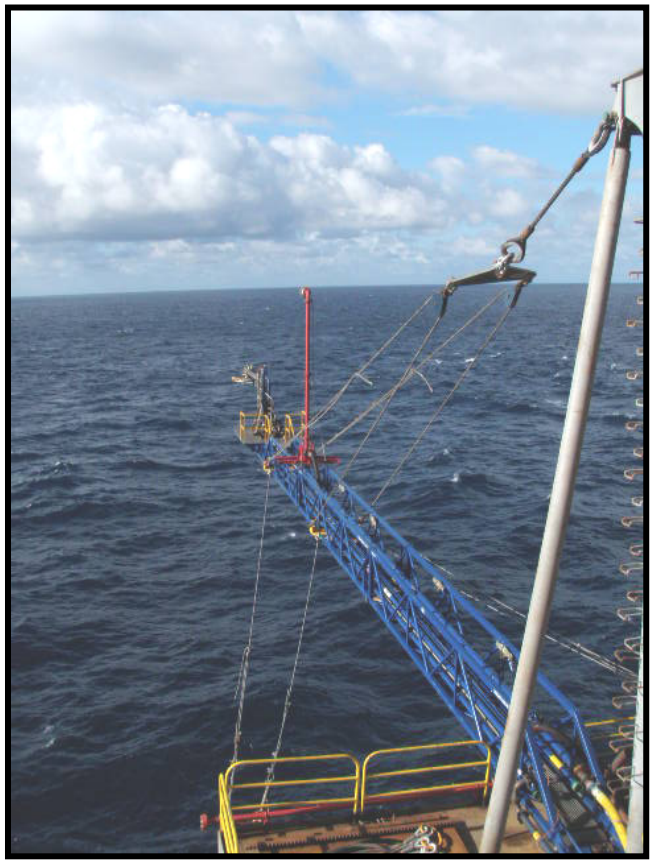
The Incident



Before

Recovery

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Background to the Incident

Engineering change to flaring installation

- The original rig flaring installation was on the aft of the rig, but in 2007 was relocated to the midship's wing decks
- The relocation of the flare booms required structural engineering of the:
  - wing decks
  - king posts
- An engineering company was contracted to complete the engineering modification based on a King Post design from the supplier of the Flare Boom assembly
- Prior to the installation off the King Posts, project management was handed over to Songa who carried out the tasks of:
  - strengthening the wing decks
  - installing the king posts & also flare boom cradles

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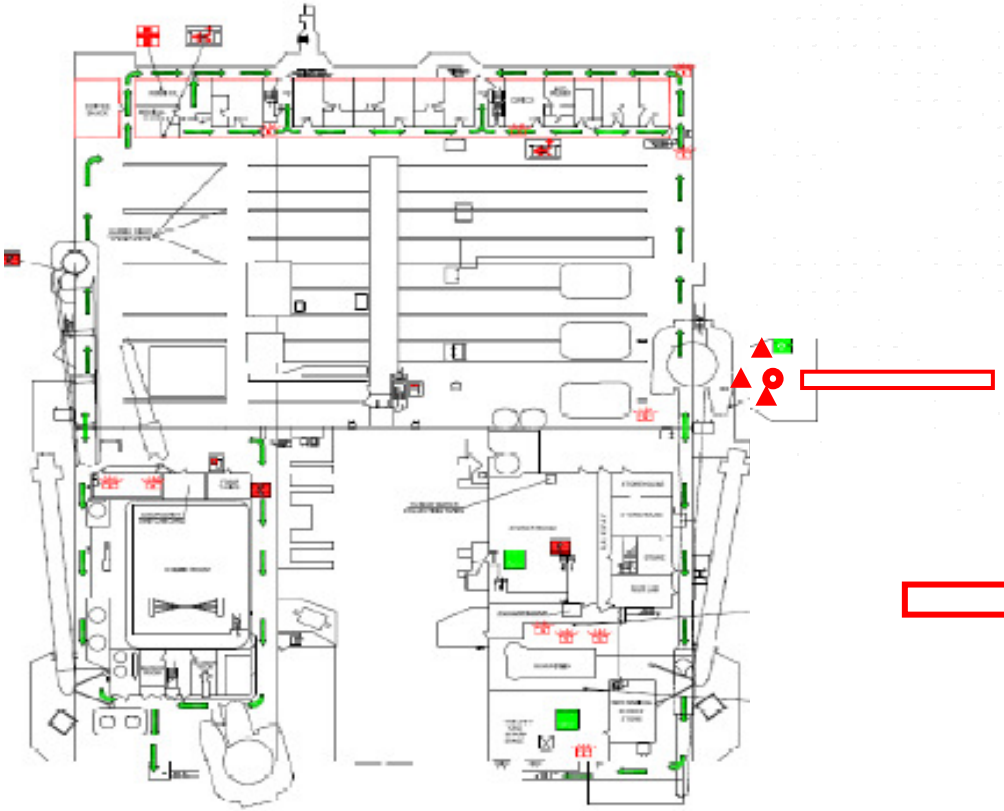
Background to the Incident

Layout of rig illustrating the relocated position of the Starboard Flare Boom



Legend

- Flare boom
- King post
- Stay base plates

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Background to the Incident

Events immediately prior to the incident

- Well testing operations were being conducted which required the installation of flare booms
- An 85′ long Flare Boom was fitted to the pre-existing boom turntable on the the Port Wing Deck
- An 85′ long Flare Boom was fitted to the pre-existing boom turntable on the Starboard Wing Deck
- When both Flare Booms had been fitted, additional heat suppression equipment was installed on both Flare Booms
- The Starboard Flare Boom was left extended for 64 hours before hydrocarbons were flared for 15 minutes using the Starboard Burner Head
- Three hours later the incident occurred

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The Consequence

Actual

Significant damage to flare boom

Potential

Personnel: serious injury or loss of life

Environment: hydrocarbon spill

Equipment: extensive damage to flare boom

Facility: possible fire

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The Investigation

A Taproot incident investigation was conducted by a multi disciplined team lead by Songa Offshore which followed 2 lines of investigation:

1. Technical analysis
2. Systems & process analysis

150 x items of evidence were collected

10 x interviews were conducted

In addition, an independent technical study was conducted which included:

- Metallurgical forensic analysis
- Engineering design review

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The Investigation

Technical Analysis - Root Cause

Root Cause
The original design did not anticipate that the weld to the rear stay base plate was not uniformly loaded This was due to the pad eye being located over the caisson wall and deck stiffener creating hard points to weld, resulting in only a fraction of the weld being effective

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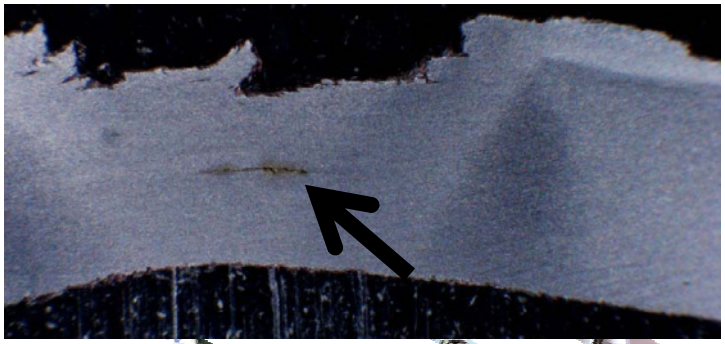
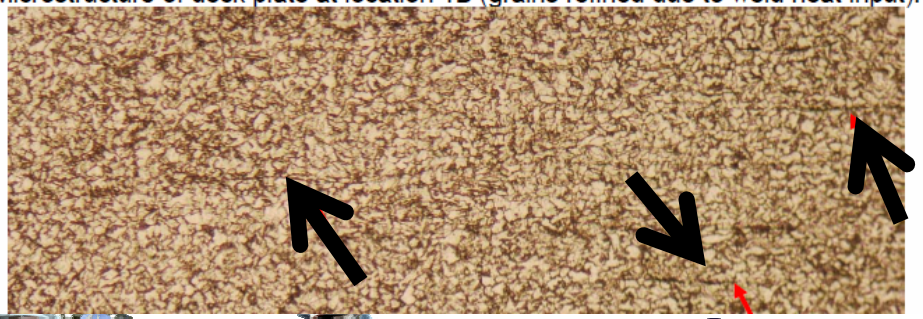
The Investigation

Technical Analysis – Other significant events

- Weld design caused lamellar cracking in the welding zone
- Extra load was added to the flare boom without a MOC
- Weld design assumed a deck thickness of 8 mm not 6 mm
- Project management responsibilities changed without adequate handover process
- Formal updates were held with NOPSA throughout the investigation



Microstructure of deck plate at location 1B (grains refined due to weld heat input).



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The Investigation

Technical Analysis - Corrective Actions

1.	Redesign the starboard and port king post bracing using the American Institute of Steel Stress Design – 1989 AISC principles
2.	Ensure that future design scopes for engineering projects *(rated as high risk)* include in the design submission an independent review of methodology and calculations
3.	Ensure all MoC submissions include a project risk assessment
4.	Circulate a Technical Safety Alert re incident
5.	Audit all previous MoC documentation
6.	Recommend findings promulgated to industry

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The Investigation

Systems & Process Analysis - Opportunities for Improvement

Opportunity	Recommended Action
1. Project Management needs improvement.	Consider the development of a Project Management process that includes the development of procedures and guidelines
2. Lack of detail in ongoing maintenances program.	Add deck pad eyes to the lifting register and include inspection and maintenance routines

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Conclusion

The incident highlighted the importance of:

- having an effective MoC & technical review process
- ensuring that all modifications that pose a significant consequence need to be considered for review by an external specialist

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