Public Executive Summary

Title: Robotic Magnetic Flux Leakage (MFL) Sensor for Monitoring and Inspection of Deepwater Risers

Name of Offeror: Rice University

Project Manager: Don Richardson
Principal Investigator: Satish Nagarajaiah

Additional participants: iTRobotics

Solicitation Number: RFP2007DW1603d (07121-1603d)

Project Start Date: October 16, 2008
Project End Date: October 31, 2011

Total Estimated Cost:	$	150,000.00
RPSEA Maximum Share:	$	120,000.00
Rice University Cost Share:	$	30,000.00

Goal

This project seeks to advance the development of inspection robots and nondestructive evaluation sensors for the on-site inspection of risers used in deepwater offshore platforms. The new idea in this study is to model, develop and test promising nondestructive testing (NDT) technologies such as magnetic flux leakage (MFL), that can be incorporated into tether-less, mobile, remotely operated robots to detect defects and fatigue cracks inside installed risers, in real time. The project will also develop new damage detection algorithms and correlate the results of the MFL technique with the results of existing techniques.

Background

As water depths in excess of 3000 meters are reached, the task of designing deepwater riser systems faces unique challenges. Serving as the conduit between the subsea wellhead and the production topside platform, for production, gas lift or water injection purpose, riser systems can be either rigid or flexible. Riser types include vertical top tensioned risers, steel catenary risers, and flexible pipe risers, each with their own potential failure modes. Calculating fatigue life is a very complex problem, especially when considering factors such as corrosion. The analysis and measurement of deepwater riser response is complex due to vessel motions, vortex induced vibrations, and soil-structure interaction.

Risers have to be designed for high pressure loads and dynamic loading due to current, waves, vessel motion. In addition, risers in the Gulf of Mexico are subjected to extreme storms which produce large vessel offset, tilt and heave. They are also subjected to fatigue loading due to loop and eddy currents that produce vortex induced vibrations. The overall limited number of deepwater riser developments have necessitated the evaluation of component failure risks using real-time monitoring and instrumentation systems that are designed to provide feedback on performance, alert operators of adverse conditions for appropriate corrective action, and ensure that the risers operate without failure.

The traditional approach to offshore riser monitoring is through measurement of vessel motions and the application of complex theoretical models to estimate the riser shape and response. However, for ultra-deepwater risers, new techniques of monitoring, inspection and repair are needed. Steel catenary risers and flexible risers are difficult to inspect and repair on-site, but the consequences of failure in ultra-deepwater fields will worsen.

Deliverables for this project will include a series of reports on the tasks as they are completed and a final report integrating the results of the project.

Potential Impacts
Development of the on-site inspection robots and nondestructive techniques for riser inspection will serve as a preventative maintenance measure for ensuring the stability and extending the life of deepwater riser systems. This will serve to help prevent costly downtime or accidents from occurring, leading to the avoidance of lost production and a reduction in the risks of environmental damage.

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