

Vortex-Induced Vibration Seminar for MMS Engineers

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FINAL REPORT

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Executive Summary

MMS engineers are faced with approving a variety of projects that can be influenced by Vortex-Induced Vibrations (VIV). Examples include deepwater drilling, production, and export risers subjected to strong currents, and offshore pipeline spans over irregular bottom topography subjected to strong bottom currents. MMS engineers need to be aware of the potential for VIV to damage such structures and various options that can be useful in mitigating VIV. The MMS asked OTRC to prepare and deliver a seminar to MMS engineers to provide MMS engineers with a basic understanding of VIV as well as practical information related to VIV occurrence and mitigation strategies.

OTRC discussed the seminar needs with MMS, and developed a scope for the seminar that focused on three areas:

- VIV Fundamentals
- VIV and Deepwater Risers
- VIV and Marine Pipelines

We were fortunate to be able to engage the following individuals with VIV expertise to develop and present the seminar materials:

- Charles Dalton - Dr. Dalton is a Professor in the Mechanical Engineering Department at the University of Houston who has conducted extensive research on flow around cylindrical shapes and VIV. Dr. Dalton handled the seminar section on VIV Fundamentals.
- Steven Leverette - Dr. Leverette is Manager of TLP Technology for Atlantia Offshore Limited, and is an experienced as both a researcher and designer in offshore floating structures, particularly TLPs, and has dealt extensively with VIV challenges for risers and tendons. Dr. Leverette handled the section on Deepwater Risers.
- R.J. Brown – Mr. Brown is President of RJ Brown Deepwater Inc. (part of the Technip Offshore Group), and is very experienced in developing pipeline technology as well as designing and installing many challenging pipelines around the world. Mr. Brown handled the section on Deepwater Pipelines.

The two day seminar was held in New Orleans on December 2-3, 2003. The seminar materials are presented in the presentation files included on this CD. An outline of the presentation files follows.

SESSION 1 - FUNDAMENTALS OF VIV- DALTON

Dr. Dalton used the following series of questions to discuss VIV and develop a comprehensive description of what VIV is, why and when it occurs, and how VIV can be controlled.

- What is VIV?
- What are the details of steady flow past a stationary cylinder?
- How and why does VIV occur?
- What kinds of VIV are there?
 - self-excited oscillations
 - forces oscillations
- How do you eliminate VIV?

SESSION 2 – VIV AND DEEPWATER RISERS & TENDONS - LEVERETTE

Dr. Leverette's seminar material was presented in three sections.

Section 2a – VIV Applications to Deepwater Risers

Dr. Leverette presented a comprehensive description of VIV relative to risers (and tendons) following the outline below. His presentation included contributions from a number of industry and academic sources.

- Introduction (Risers and Tendons)
- Ocean Environment
- Riser Response to Currents
- Fatigue
- Tendons
- VIV Control
- Analysis Methods & Programs
- Model Tests & data Sets
- Other Issues
- Areas of R&D
- Industry Experience
- Conclusions

Section 2b – Analysis of TLP VIV Responses to Eddy Currents - Leverette

Dr. Leverette presented his OTC paper "Analysis of TLP VIV Responses to Eddy Currents", which describes the field data and analysis of VIV of the tendons on the Allegheny SeaStar mini –TLP due to currents associated with Millennium Eddy.

Section 2c – A High Mode Number Field Experiment - Leverette

Dr. Leverette presented a description of “A High Mode Number Field Experiment”, an ongoing field research experiment on VIV that is attempting to gather full scale data on riser VIV in currents. This research experiment is being sponsored by the DeepStar consortium.

SESSION 3(a and b) – VIV APPLICATIONS TO DEEPWATER PIPELINES – BROWN

Mr. Brown presented a comprehensive discussion of VIV on pipelines. He focused on VIV suppression and practical issues that must be faced during the construction and installation of pipelines, and illustrated these through discussions and photographs of a number of projects that he has have been completed by his firm.

- Factors Affecting Pipeline VIV
- Evolution Of Strakes For Suppressing VIV
- Early Observations Of Pipeline Instabilities & Forces On Pipelines
- Offshore Pipeline Installation Procedures
- Offshore Riser Installation Procedures(as illustrated by an extensive physical model)
- Typical Installation Of Strakes On Pipelines And Risers Prior Offshore Installation
- Typical Installation Of Strakes On Pipeline Spans After Offshore Installation
- Methods Of Trenching To Avoid Pipeline VIV

The seminar material is presented in two sections (3a and 3b) due to file size.

Due to a lack of video file support, some of the video presentations could not be included on the CD.