3. DIFFERENTIAL DIELECTRIC SENSOR (DDS©) FOR MULTIPHASE SEPARATION PROCESS MEASUREMENT AND CONTROL

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INTRODUCTION:

The deep-water oil industry increasingly demands accurate and stable continuous measurement of the percent water in crude oil production streams (watercut) over the entire 0 to 100% range. High accuracy and stability are also required to support niche applications such as control of processes, which remove trace amounts of oil and particulates from produced water prior to disposal. Differential dielectric sensors (DDS©) have been developed by Chevron for watercut measurement as independent measurement tools for process control and in connection with multiphase meters. Existing watercut tools predominantly depend on empirical data and correlations that are sensitive to fluid properties. Correlation methods are therefore limited in their general applicability and require frequent re-calibration.

OBJECTIVE:

The main objective of this project is to expand the capability of the current DDS allowing automatic and self-calibration. Mathematical models for the DDS are needed to be developed to take into consideration the fluid properties, sensor geometry and operational conditions. These models should be validated by laboratory experimentation and numerical simulations.

PROGRESS:

Several mathematical models for DDS configured as rectangular and circular waveguides have been completed. Finite element analysis (FEA) simulation and preliminary experimental investigation are conducted for validation of the sensor models.

Analytical Models	90%
FEA Simulation	95%
Experiments	50%
Literature Review	100%
Dissertation	70%

DELIVERABLES:

- Analytical Model and FEA Simulation Results for rectangular DDS
- Analytical Model and FEA Simulation Results for circular DDS
- Experimental results of DD Sensor
- MATLAB computer code for analytical model of DDS

EXPECTED COMPLETION DATE: May 2007