NOVA SCOTIA ENERGY
R&D CONFERENCE 2014
ENERGY FOR CHANGE

Abstract:

Chris L'Esperance, Dalhousie University
Research Advisor: Dr. Douglas Wallace & Dr. Mae Seto
Category: Environment

A Compact, Unattended Gas Chromatographic System for the Measurement of Dissolved Gases from an Unmanned Surface Vehicle

Measurements of dissolved gases in the ocean and other natural waters are routinely carried out by those engaged in climate research and environmental monitoring. A need to measure dissolved gases also arises in many industrial applications such as, natural gas exploration, wastewater treatment, the detection of leaks associated with subsea fluid-handling infrastructure, aquaculture, etc. The measurement of dissolved gases has also been used to support tracer/dye injection experiments; experiments carried out by those interested in the mixing of natural waters. In such experiments, a small amount of a substance, for which a highly sensitive detector exists, is injected at a point in a body of water; dispersion ensues due to a variety of fluid mixing phenomena. The distribution of the introduced tracer is then monitored over space and time. Knowing the rate at which the tracer diffuses away from its point of origin, aids in constraining the values of parameters which are essential to the operation of ocean circulation models. The practical applications of ocean circulation models are manifold, including the prediction of drift trajectories of people or objects lost at sea, prediction of the dispersion of oil and other introduced pollutants. Dissolved gas measurements associated with such tracer injection experiments, however, are typically made by manual water sampling from a research vessel and subsequent analysis on benchtop gas chromatography systems. Research vessel time is extremely costly and the manual analysis of samples is time-consuming. Both of these factors severely limit the resolution with which tracer concentrations can be made. Within the broader scope of the development of an operational protocol for the estimation of local ocean mixing parameters, the development of a compact, unattended gas chromatograph-based instrument is proposed. Unattended measurements will be realized by incorporating a novel membrane equilibration-based means of sample introduction to the gas chromatograph. The system will offer high sensitivity and dynamic range and will be integrated with the unmanned surface vehicle, Dorado in order to facilitate tracer concentration measurements at unprecedented temporal scales.