

# Department of Ocean & Resources Engineering

*Seminar*

## SMART SCUBA

by

**Terry Shimabukuro**

Sr. Mechanical Engineer

Structural Solutions

Aiea, Hawaii

Wednesday, November 29, 2000

3:30 PM

Holmes 247

### **Abstract**

Filament-wound composite cylinders are used in the marine and transportation industries for storing breathing gases (SCUBA, firefighter tanks) and gaseous fuels (vehicles). These cylinders offer light weight, corrosion resistance, dimensional stability, and the ability to store more gas than equivalent metal tanks. The design methodology currently used for composite tanks, however, cannot yet guarantee their safe operation. Accordingly, the U.S. Department of Transportation (DOT) is unable to issue full certification of filament-wound tanks. The composite tank industry desires to improve their safe use and to obtain full certification.

This presentation discusses the development of a fiber optic sensor system for structural health monitoring of a filament-wound composite SCUBA tank. Using a simple, low-cost optical fiber sensor embedded in the composite shell wall this "smart" SCUBA tank can be checked easily for structural integrity each time the tank is refilled. The opportunity to provide such continuity in structural health monitoring should have a significant positive impact on obtaining DOT certifications and extending product useful life, establishing buyer confidence and increasing sales. The design of the sensor system and the results of hydrostatic pressure tests of the first prototype will be presented.

This work was funded by the National Defense Center of Excellence for Research in Ocean Sciences (CEROS). CEROS is a part of the Natural Energy Laboratory of Hawaii Authority (NELHA), an agency of the Department of Business, Economic Development & Tourism, State of Hawaii. CEROS is funded by the Defense Advanced Research Projects Agency (DARPA) through grants to and cooperative agreements with NELHA. This report does not necessarily reflect the position or policy of the Government, and no official endorsement should be inferred.