

## Deep-C Consortium

*Studying deep sea to coastal communities  
in the northeastern Gulf of Mexico*

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*This research was made possible by a grant from BP/The Gulf of Mexico Research Initiative to the Deep-C Consortium.*

**Deep-C Members Institutions:** Florida State University (lead), Dauphin Island Sea Lab, Georgia Institute of Technology, Naval Research Laboratory at Stennis Space Center, Norwegian Meteorological Institute, SAIC, University of Miami RSMAS, University of South Florida, University of West Florida, Woods Hole Oceanographic Institute.

The Deep-C Consortium is investigating the environmental consequences of petroleum hydrocarbon (oil) on living marine resources and ecosystem health in the northeastern Gulf of Mexico. Consortium members seek to increase understanding of the fundamental physical, chemical, and biological connections between the deep sea, continental slope, and coastal waters and their linkages to critical habitats and ecological functions.

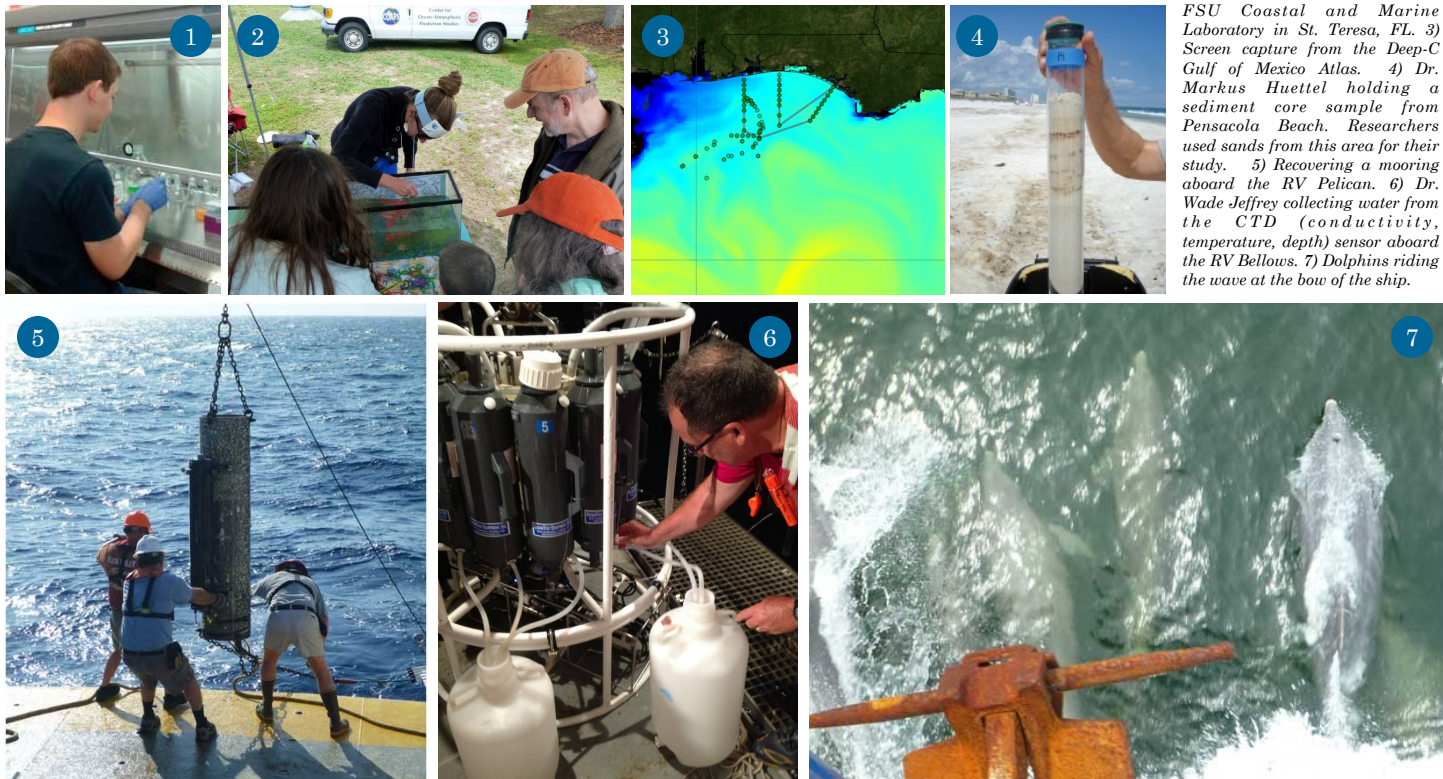
More than 100 scientists and students at 10 academic and research institutions in the United States and Norway are participating in Deep-C. Activities include mapping the sea floor; analyzing water and sediment samples; studying how oil-related toxins may affect wildlife; and determining how currents and other ocean processes transport oil.

Data is collected by hand, boat, plane, and satellite and is analyzed and used in model studies to support improved responses to possible future oil spills. Through computer simulations of possible oil spill scenarios, Deep-C is producing projections of changes in ecosystem services that can support enhanced decision making and forecasting of potential socioeconomic outcomes.

Deep-C seeks to engage students, policy makers, and the general public in the process of scientific discovery and to encourage a sense of stewardship for the Gulf. Our outreach efforts include experiential internships; educational workshops; special events; multimedia production; and social networking.

## IMAGES FROM THE FIELD

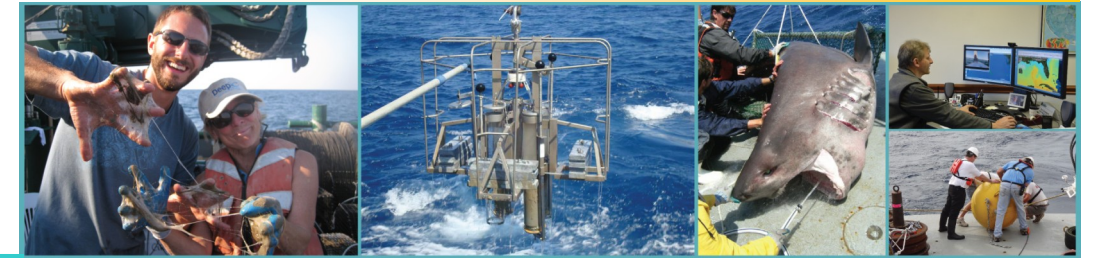
Spring 2013



1) Summer intern Curtis Okolovitch working in the Kostka Lab at Georgia Tech. 2) Ocean science educator Amelia Vaughan demonstrating neutral buoyancy at an open house sponsored by the FSU Coastal and Marine Laboratory in St. Teresa, FL. 3) Screen capture from the Deep-C Gulf of Mexico Atlas. 4) Dr. Markus Huettel holding a sediment core sample from Pensacola Beach. Researchers used sands from this area for their study. 5) Recovering a mooring aboard the RV Pelican. 6) Dr. Wade Jeffrey collecting water from the CTD (conductivity, temperature, depth) sensor aboard the RV Bellows. 7) Dolphins riding the wave at the bow of the ship.

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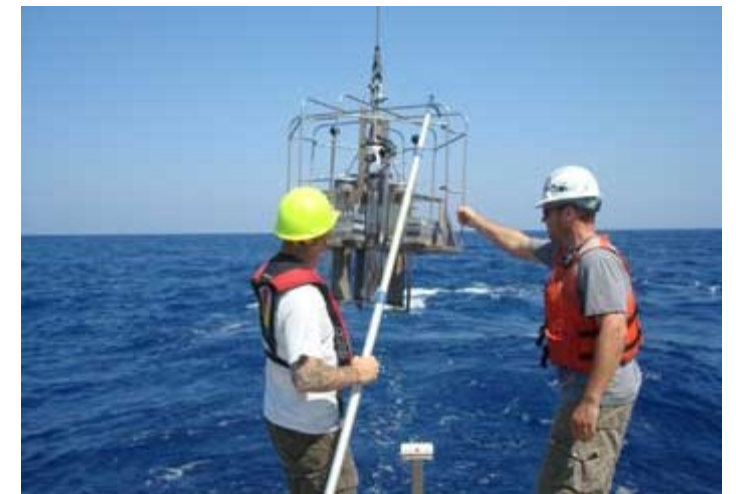


# CHRONICLES

## Third Anniversary of Oil Spill

*An Update on Scientific Research in the Gulf of Mexico*

Nearly three years ago, in the wake of an explosion on the Deepwater Horizon drilling rig, thousands of barrels of crude oil were flowing into the ocean daily from a damaged well about 40 miles southeast of the Louisiana coast. Eleven individuals lost their lives on April 20, 2010 and the flow of oil continued for nearly three months while scientists and engineers worked to cap the Macondo well. The disaster would eventually become the largest accidental marine oil spill in history.



*Sediment samples collected by Deep-C scientists from the seafloor using a multi-corer are subjected to a full suite of hydrocarbon and isotopic analyses. Photo credit: Jeff Chanton, FSU.*

*“One of the outcomes of the 2010 spill is research concentrated in the Gulf of Mexico that is enabling us to better understand the environmental complexity of the Gulf and therefore more accurately predict the impact of an event like an oil spill.”*

— Dr. Eric Chassignet

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### Facts about the Gulf...

- The Gulf of Mexico is the ninth largest body of water in the world.
- It contains 50% of all U.S. wetlands.
- Most oil and natural gas produced in the U.S. is from the Gulf.

“When the oil spill occurred in 2010, we needed to be able to predict what would happen to the oil as it was released and moving through the Gulf of Mexico, from the deep sea to the coast. But our understanding of the biological and chemical processes was limited,” notes **Dr. Eric Chassignet**, director of the Deep-C Consortium and the Florida State University Center for Ocean-Atmospheric Prediction Studies (COAPS). “One of the outcomes of the 2010 spill is research concentrated in the Gulf of Mexico that is enabling us to better understand the environmental complexity of

the Gulf and therefore more accurately predict the impact of an event like an oil spill.”

The Deep-C (*Deep Sea to Coast Connectivity in the Eastern Gulf of Mexico*) Consortium was one of eight research consortia funded in 2011 by Gulf of Mexico Research Initiative to investigate the fate of petroleum in the environment, the impacts of the spill, and the development of new tools and technology for responding to future spills and improving mitigation and restoration. Deep-C member institutions include

the Dauphin Island Sea Lab, Florida State University, Georgia Institute of Technology, Naval Research Laboratory at Stennis Space Center, Norwegian Meteorological Institute, SAIC, University of Miami Rosenstiel School of Marine and Atmospheric Science, University of South Florida, University of West Florida, and Woods Hole Oceanographic Institution.

*For more information visit the Deep-C website at <http://deep-c.org/news-and-multimedia/in-the-news/third-anniversary-of-oil-spill>*



## Student team working on experimental radar unit

Project by FAMU/FSU engineering seniors to enhance oil spill detection

Early and accurate detection of an oil slick can help locate the source and contain the extent of its damage. A team of students from the Florida A&M University (FAMU)/Florida State University (FSU) College of Engineering is working to enhance oil spill detection methods by characterizing the physical properties of different oil-water emulsion ratios on a radar signal. This is crucial for accurate interpretation of radar imagery from satellites when they are being used to detect oil spills.

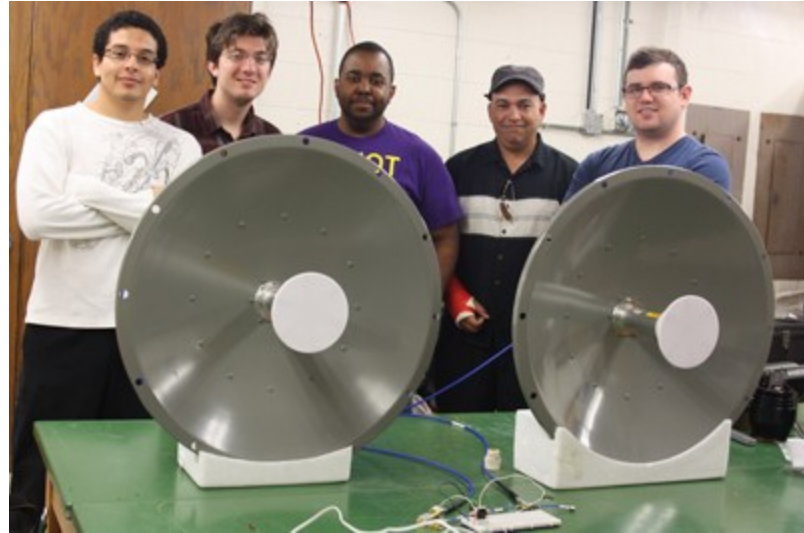
"This team of engineering seniors is fabricating an experimental radar unit that will be used to measure oil thickness under laboratory conditions," explains **Dr. Ian MacDonald**, Professor of Oceanography in the Department of Earth, Ocean and Atmospheric Science at FSU and an advisor to the group. "This will help to calibrate satellite measurements and could lead to the development of field instruments."

The project involves the design and implementation of a laboratory scale directional radar system that can effectively determine the density of oil at various incident angles for use in the calibration of Synthetic Aper-

ture Radar (SAR). SAR is often used to determine oil spill boundaries on water. The potential of SAR to enhance detection of oil emulsions is a pioneer mission that this team has undertaken.

During the Deepwater Horizon oil spill, intense efforts were made to mitigate and control thick patches of oil drifting freely on the ocean. Some of the coordinated response operations included skimming, burning, and application of dispersants over thick oil.

"The project has the potential to significantly improve coordinated response operations during an oil spill. If we are able to validate our lab measurements with the satellite data, we will be able to provide valuable information to the U.S. Coast Guard and NOAA during a crisis, allowing them to coordinate these contingency operations more effectively," explains **Dr. Oscar Garcia-Pineda**, a geophysicist at FSU has been an advisor and works closely with the group.



Members of the Radar Team (pictured left to right): Juan Alvarez Z., Drew Hale, Roman Cooks, Dr. Oscar-Garcia-Pineda (Advisor), and Jonathan Logan (Photo credit: Diana Villa)

The system designed by the student team is comprised of a pair of receiver and transmitter antennas, a C-band frequency signal generator circuit, a digital signal processor built on field programmable gate array (FPGA) technology, and a database server. The 3-foot (0.9144m) parabolic antennas are highly directional with a large frontal transmission lobe. The wave tank being used in the testing is approximately 2 feet wide so a transmitter with C-Band frequency (~5.4 GHz) capabilities was selected to allow for adequate radar beam width coverage. All active devices are powered by a 5 to 6 volt source in the transmitter.

**Additional Specifications:** To handle the signal processing side of the system, an Altera DE2 FPGA board was selected in order for easy connectivity with an Analog to Digital Converter (ADC) and to a computer system. A high speed ADC about around 150 megasamples will be used to read in the mixed signal from the receiver and convert it to a digital value. A web database done in a PHP scripting language can be accessed by a computer system that takes data off the DSP system and performs time averaging of the received

power signal for the purpose of quantifying the amount of oil in the tank. The computer system can be any device that can access the system's online server. This feature allows for easy access for many users at the same time.



**Dr. Ian MacDonald** is a professor at FSU and an oceanographer of deep ocean extreme communities. The physical settings include natural hydrocarbon seeps, gas hydrates, and mud volcano systems. In his work, he uses satellite remote sensing to locate natural oil releases on the ocean surface.

**Dr. Oscar Garcia-Pineda** is a geophysicist and a scientist at FSU. His main research has focused on the development of semi-automated image processing algorithms to map coastal and oceanographic processes. As a geoscientist, he has been working to integrate satellite remote sensing data with geophysical data for exploration of hydrocarbons and energy resources in the deep marine environment.

For more information about the radar unit project visit our website at <http://deep-c.org/news-and-multimedia/in-the-news/student-project-may-lead-to-oil-detecting-radar-system>

Assembling the electronic circuits for the signal amplifier of the radar antenna. (Photo credit: Diana Villa)

These are the radar antennas that will produce the same signal than the SAR Satellite RADARSAT (5.6 cm, C-Band). (Photo credit: Diana Villa)

## The Deep-C SailBuoy Project

New Marine Device Used for Scientific Observations in the Gulf of Mexico

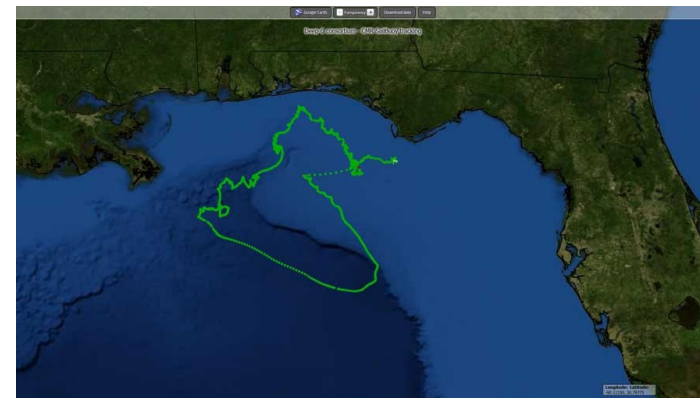
The Deep-C SailBuoy is an unmanned sailing vessel currently deployed in the northeastern Gulf of Mexico. It is self-powered, wind-propelled, and it navigates the oceans autonomously.

The SailBuoy is similar to a surfboard in shape and size, two meters in length and under prime wind conditions has an average speed of 1-2 knots. It is equipped with two-way satellite communication for real-time data streaming and waypoint updates and transmitted data to the Deep-C Operations Center at regular intervals along a planned course.

The Deep-C Sailbuoy is part of a new generation of vehicles designed for marine observations that are enabling scientists to expand and intensify the study of our seas and oceans. It can keep station or travel from point to point, and is a technology owned by the Norwegian company CMR.

### The SailBuoy's mission and what we will learn

The mission of Deep-C's SailBuoy is to gather scientific data throughout the northeastern Gulf of Mexico. A number of sensors have been mounted on the SailBuoy, allowing us to monitor seawater parameters, such as temperature, salinity and dissolved oxygen.



This image was created using the map viewer function of the Deep-C Gulf of Mexico Atlas which can be found on our website at [www.deep-c.org/data](http://www.deep-c.org/data). The Atlas is a web-based interface that provides access to meta data and data being collected by Deep-C scientists.



Collection and analysis of this data will help Deep-C scientists better understand how particles and dissolved substances (such as oil) are transported from the deep Gulf to the shelf waters in the northeastern Gulf across the continental shelf and the DeSoto Canyon — an erosional valley that cuts through the continental shelf in the northern part of the Gulf. Another objective of Deep-C's SailBuoy project is to investigate and better understand the "Mississippi River plume" — a

plume caused by fresh sediment-rich rainwater runoff entering the Gulf of Mexico via the Mississippi River. This plume is visible, nutrient rich sediment that spreads out from the coastline, forming a kind of cloud in the water.

### More about Deep-C and the SailBuoy Project

The SailBuoy project is a collaborative effort between researchers at FSU and the Norwegian Meteorological Institute — both members of the Deep-C Consortium. Deep-C is a long-term, interdisciplinary study investigating the environmental consequences of petroleum hydrocarbon release in the deep Gulf of Mexico on living marine resources and ecosystem health. The Consortium focuses on the geomorphologic, hydrologic, and biogeochemical settings that influence the distribution and fate of the oil and dispersants released during the Deepwater Horizon accident, and is using the resulting data for model studies that support improved responses to possible future incidents.

For more information about the SailBuoy project, visit the Deep-C website at <http://deep-c.org/sailbuoy>

The SailBuoy Project leader is Dr. Lars R. Hole of the Norwegian Meteorological Institute (Met.no) in close collaboration with Dr. Nico Wienders of FSU. The Sailbuoy was developed by CMR Instrumentation, in Bergen, Norway by senior scientist David Peddie and his group. More information can be found at [www.sailbuoy.no](http://www.sailbuoy.no).

Met.no provides weather forecasts for Norway and Norwegian waters as well as more specialized services such as ice monitoring, oil spill search and rescue forecast services. One of their core activities is the operation, data collection and the transmission of national and international observational data. They are a world leader in oil spill prediction.

**Dr. Lars Hole** is a senior scientist in Met.no's Department of Operational Oceanography and Marine Meteorology specializing in applications of micro-meteorological measurements, climate change effects, atmospheric transport and deposition of pollutants to vegetation and snow, trend analysis, snow characterization, sound propagation in the atmosphere, marine meteorology and oil drift modeling.

**Dr. Nico Wienders** is a research faculty at Florida State University and holds a PhD in physical oceanography from France in 2000. Dr. Wienders spends half of his time in the field, preparing instruments and collecting data. He recently went several times to Antarctica for the DIMES project. Within Deep-C, Dr. Wienders dedicates his time to the mooring, SailBuoy, and float experiments. Time on land is spent working with supercomputers and very high resolution model simulations.