

Field Campaign Underway at SGP

Phase 2 of Orbiting Carbon Observatory - Fourier Transform Spectrometer Validation

The Orbiting Carbon Observatory, or OCO, is a National Aeronautics and Space Administration (NASA) Earth System Science Pathfinder (ESSP) mission designed to make precise, time-dependent global measurements of atmospheric carbon dioxide from an Earth-orbiting satellite. Starting in July and lasting through 2010, the ACRF Southern Great Plains (SGP) site is hosting the mobile laboratory for the OCO science team's ground-based solar-viewing Fourier transform spectrometer (FTS). The FTS measures the near-infrared region of the solar spectrum at very high resolution, allowing scientists to calculate the concentration of greenhouse gases in the atmosphere. This campaign is the next phase of the ongoing OCO field campaign that began in 2006 at the ACRF site in Darwin, Australia. Measurements from the FTS at both sites will continue through the end of the OCO mission in 2010, helping the OCO science team to validate carbon dioxide measurements obtained via satellite.



A camera, weather station, and sun tracker with a protective dome are located on the roof of the fully automated FTS mobile laboratory. Inside the shelter, the spectrometer receives the reflected solar beam from the sun tracker, while the main computer system operates all the instruments and acquires the data (ARM photo).

After one year of side-by-side tests at NASA's Jet Propulsion Laboratory with the OCO flight instrument and the FTS, installation of the FTS mobile laboratory at the SGP site began this summer. In preparation for the satellite validation field campaign, operations staff installed a concrete pad for the laboratory and completed hookups for the equipment, data, and communication links. The OCO science team arrived in July to set up the instrumentation and peripherals. For the next several months, the science team will measure carbon dioxide and related gases, including methane and carbon monoxide, in preparation for the OCO satellite launch in January 2009.

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Technical Contact: Brad W. Orr
Phone: 630-252-8665
Email: brad.orr@anl.gov
Editor: Donna J. Holdridge
Contributor: Lynne Roeder
Website: <http://www.arm.gov>

After the launch, scientists will analyze measurements from the spectrometers onboard the OCO satellite against the FTS data to improve our understanding of the natural processes and human activities that regulate the abundance and distribution of this important greenhouse gas.

The OCO science team is leveraging the ACRF's expertise and infrastructure in ground-based and in-situ sampling of atmospheric aerosol properties and carbon cycle trace gases to aid in this high-profile ESSP mission. Knowledge gained from this campaign will enable more reliable forecasts of future changes in the abundance and distribution of carbon dioxide in the atmosphere, and the effect that these changes may have on the Earth's climate. This collaboration between DOE and NASA represents a significant contribution to the interagency Carbon Cycle Science Initiative of the U.S. Global Change Research Program.

Contract Awarded for Second ACRF Mobile Facility

The U.S. Department of Energy's Office of Science has awarded Argonne National Laboratory a \$2.6 million per year contract to design, build, and operate a mobile laboratory for obtaining cloud and atmospheric property measurements around the world. Extending the current measurement capabilities of the DOE's Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF), the new ARM Mobile Facility will further DOE's efforts to improve scientific data and models in support of global climate studies.

Building from the concept for ACRF's first mobile observatory, now in China on its fourth deployment, the second mobile facility, or AMF2, will include additional capabilities to support ocean-based deployments. Oceans cover the majority of the Earth's surface and, as such, are a critical component of climate change. They are, however, critically under-sampled relative to land-based measurements.

"This new capability is critical for our Climate Change Research Program to achieve its long-term performance measure—namely, to deliver improved scientific data and models about the potential response of the Earth's climate and terrestrial biosphere to increased greenhouse gas levels," said Dr. Wanda Ferrell, ACRF Program Director in the Office of Environmental and Biological Research.

Instrumentation for the AMF2 will be similar to the original AMF and the ACRF fixed sites, with enhancements mandated for a variety of ship and marine deployments—a central design criteria for the new facility. Principle among these will be motion-stabilizing platforms for many of the position-sensitive instruments. Instrumentation to obtain water-specific measurements, such as temperature, salinity, current speed and ocean surface state (e.g., calm or rough) will also be included to help characterize the atmosphere/ocean interface.

With the possibility of a dispersed ship-based deployment, all components, including the data system, will be highly modular and capable of being distributed widely about a ship. To minimize safety concerns caused by power and data cables and to reduce set-up time, the AMF2 will use wireless technology as a primary means of communication. This principle will also allow for even more flexibility during land deployments.

In addition, to reduce set-up time and the overall size of the AMF2, instrument operating systems will leverage ongoing ACRF efforts to utilize "virtual machines." This approach is intended to accommodate many instrument data systems on a single computer or server rather than a separate laptop or computer for each instrument.

The first two years of the contract will be for the design and build phase, with initial deployment of the facility scheduled in 2010. Argonne will be aided in the design and build effort by scientists from Woods Hole Oceanographic Institution and the National Renewable Energy Laboratory. As part of the subcontract with Woods Hole, the research vessel Connecticut, operated by the University of Connecticut, will be used for testing the AMF2 instrumentation.



The research vessel Connecticut will be used to test the design and operation of a sea-going climate research facility for the Department of Energy (Photo courtesy of James Edson, University of Connecticut).

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“Argonne is excited about the opportunity to participate in this expansion of ACRF and provide a means to improve our understanding of climatologically important processes, particularly over the Earth’s oceans,” said Brad Orr, Argonne’s staff scientist and SGP Site Manager who will co-lead the AMF2 team along with Argonne Scientist and Meteorologist Dr. Richard Coulter.