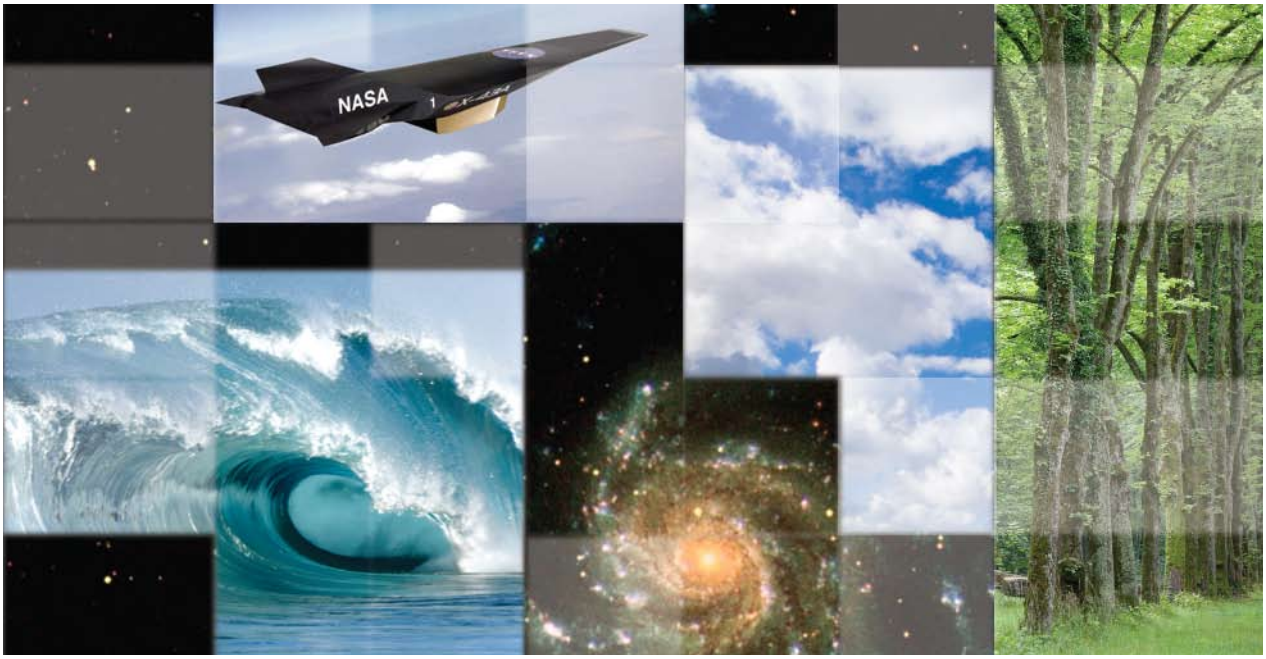
National Aeronautics and Space Administration

SBIR Advances Our Understanding of Clouds and the Carbon Cycle



Two NASA-funded Small Business Innovation Research (SBIR) contracts with Anasphere may enable researchers to better understand the water content of clouds and the carbon dioxide in Earth's atmosphere—helping to meet NASA mission needs while supporting this new business. One of the Phase 2 contracts has resulted in a set of miniaturized cloud-water sensors to be test flown on balloons from NASA Goddard Space Flight Center's Wallops Flight Facility in the summer of 2008, helping scientists determine how the sensor performs for measuring the water content of clouds and potentially the distribution of rain in a storm. The other SBIR Phase 2 contract is enabling Anasphere to develop a miniaturized carbon dioxide (CO_2) sensor for use on unmanned missions. If validation is favorable, NASA and Anasphere expect the sensor to be significant in enabling highly sensitive measurements of CO_2 sources and sinks in the atmosphere, leading to critical understanding of the carbon cycle and climate change.

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Benefits of Technology Transfer

- NASA will be able to use Anasphere's cloud-water sensor to gain more precise measurements for its Earth science research.
- Lower cost, unmanned missions to measure the water content of clouds will enable NASA to deploy missions globally, helping to better understand trends and improve forecasting.
- NASA may be able to use the CO_2 sensor to better understand Earth's "CO_2 budget" and distribution over oceans, marsh, and forest—providing valuable data sets that may help researchers better understand climate change.
- These miniaturized sensor technologies will enable unmanned missions into storms and over the arctic and vast oceans—conditions that could be more risky and costly for manned missions.
- Through these SBIR contracts, Anasphere is able to validate exciting new technologies that may provide commercial opportunities to support its business growth.

success

On the Record

"The SBIR experience with NASA has been wonderful. I've been really happy that we've found an agency to work with where our research interests and theirs can come together. We're on the same wavelength. Our technologies meet NASA needs." – *John Bognar, Anasphere*

About Anasphere

Located in Bozeman, Montana, Anasphere was created in 2002 to pursue the development of inexpensive and user-friendly instruments for atmospheric and environmental research. A major area of focus is atmospheric and meteorological profiling extending from surface and tethered systems through high-altitude balloons operating in the near-space environment. The company's primary mission is to improve current research, instrumentation, and education in the fields of atmospheric and environmental science. Anasphere's expertise encompasses a broad spectrum of fields, including chemistry, engineering, meteorology, physics, computer science, and education.

Understanding Clouds' Water Content

The water content of clouds, whether in liquid or ice form, is an important measurement with implications for weather forecasting, studies of radiation transfer, and even climate change. Currently available ground- and satellite-based sensors are expensive, heavy, and require too much power to be flown on Unmanned Aircraft Systems (UAS), balloons, and kites. Through its SBIR contract, Anasphere has developed and delivered a set of miniaturized cloud-water sensors capable of being flown on UAS, enabling NASA to deploy rain sensors on a broad scale. The sensors can even be flown into storms or conditions in which a piloted aircraft could be exposed to higher risks. Current NASA missions that may benefit from these sensors include the Tropical Rainfall Measurement Mission (TRMM), NASA's current precipitation satellite. Measurements taken by the sensor would be used to validate measurements taken via the satellite. In time, the sensors could be used to "fill in the data gaps" between what ground- and satellite-based systems are able to gather by flying directly to the source: the cloud itself.

Uncovering Critical Information about the Carbon Cycle

Another NASA need being addressed by Anasphere research is better understanding of Earth's "CO_2 budget." That is, where the sinks and sources of CO_2 reside in the environment and what their contributions are. Precise measurements of CO_2 distribution have critical implications for understanding the carbon cycle and climate change. Under its Phase 2 SBIR contract, Anasphere has developed and demonstrated a prototype of a novel CO_2 sensor that combines photocatalysis and microwave spectroscopy—resulting in precision sensing of CO_2. The company has also miniaturized the sensor, making it suitable for UAS missions to areas such as the South Pacific Ocean—a vast territory for manned missions. Whereas ground-based laboratory sensors can measure very small shifts of CO_2 in samples brought to the laboratory, Anasphere's technology—once validated—promises to detect small changes in CO_2 induced by trees or plants on location in the environment, leading to more detailed understanding of the impact of CO_2 shifts on climate.

Looking Ahead

With the cloud-water sensors completed, Anasphere and NASA researchers plan to fly sensors on balloons during the summer of 2008 to understand their performance. Vertical measurements will enable understanding of how well the sensor is able to validate satellite-based water-content data. Pending positive results, NASA may deploy the sensors on future UAS missions to gather distributed data.

Anasphere's work on its CO_2 sensor will also be tested on UAS missions flown from Wallops Island. The company is currently working to increase the sensitivity of the sensor while maintaining its miniature footprint. Once complete, NASA will begin testing to verify the sensor's performance. NASA's Orbiting Carbon Observatory (OCO), scheduled for launch in December 2008, will provide a "big picture view" of the global distribution of carbon dioxide; the new Anasphere sensor will help fill in the small details.

For More Information

Details about NASA's Small Business Innovation Research program are available online: http://sbir.nasa.gov

If you would like more information about the SBIR program and other technology transfer opportunities, please contact:

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