National Aeronautics and Space Administration

SBIR Funding Yields Sensor to Better Understand Cloud Characteristics

Through a Phase 2 Small Business Innovation Research (SBIR) contract funded by NASA, researchers at Stratton Park Engineering Company (SPEC, Inc.) have developed prototypes of miniaturized cloud sensors for use on small, Unmanned Aircraft Systems (UAS) and tethered blimps/balloons. Pending testing of the sensors, SPEC expects the technology to provide critical *in situ* cloud data that will help environmental scientists better understand the impact that clouds have on climate. The *in situ* cloud data can be compared with data from ground-based and satellite-borne remote sensors, thereby improving the retrievals that the remote sensors use to characterize clouds. In turn, improving satellite retrievals of cloud properties is critical for refining and validating numerical models that predict global climate change.

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Benefits of Technology Transfer

- NASA will be able to use the sensor to gain precise characterizations of cloud particles using lower cost, lower risk, longer endurance unmanned missions.
- Lower cost missions to characterize clouds will enable NASA to deploy missions globally, helping to better understand climate trends and the impact of clouds on the atmosphere as well as aiding weather forecasting.
- Miniaturized sensor technology will enable unmanned missions into storms and over the arctic and vast oceans—conditions that could be riskier and more costly for manned missions.
- Through its SBIR contract, SPEC is able to validate its sensor technology and support commercial opportunities for business growth.

success

On the Record

"For us, being involved with any study of clouds, climate, weather forecasting, and basic cloud physics research is a benefit. The SBIR work with NASA gives us the opportunity to do that." — *Paul Lawson, Stratton Park Engineering Company*

"The SBIR program is the only avenue open to small business for development of innovative instruments for climate research." — *Paul Lawson*

About SPEC, Inc.

Founded in 1979, SPEC, Inc., has been involved in the design, fabrication, and installation of innovative instruments on research aircraft for more than 25 years. Located in Boulder, Colorado, the company designs and builds sensors and data acquisition systems for universities, institutes, and government agencies in the U.S. and abroad.

Understanding Cloud Characteristics

NASA's Earth Observing System (EOS), a constellation of satellites equipped to remotely measure our planet's surface and atmospheric properties, is helping scientists understand the role of clouds and aerosols in climate change. But because these measurements are taken at a great distance, researchers currently can only gain "big picture" cloud data. While manned aircraft are capable of taking closer images of clouds with large sensor instruments, unmanned missions may use smaller planes and balloons and, therefore, smaller (yet still highly sensitive) sensors. Now, SPEC, Inc., is helping to make *in situ* measurements possible on unmanned missions through SBIR-funded development of a cloud sensor small and light enough to be flown directly into the clouds via UAS and tethered balloons. This sensor can image cloud particles continuously for up to 30 hours. *In situ* measurements can both validate satellite- and ground-based sensor data as well as fill in the details. For example, cirrus clouds high above the troposphere are very thin and difficult (if not impossible) to measure from the ground. By using a sensor within the clouds, scientists can accurately characterize their properties.

SPEC, Inc., is making this possible by significantly reducing the power and weight of its proven sensor technology. The goal is to fly unmanned missions to characterize the size of water drops and shape of ice crystals contained within clouds and cloud systems. The true miniaturization achieved with SPEC's sensor is essential for unmanned missions, which are particularly critical for longer studies over vast oceans or in polar regions where a piloted mission would be difficult. The data collected on these UAS missions will certainly have widespread implications for weather forecasting. It may also shed light on the impact that clouds have on solar and long-wavelength radiation, which may lead to a better understanding of climate change.

Looking Ahead

Now in Phase 2 of its SBIR contract, SPEC plans to fly its sensor prototype on a tethered balloon test mission in Spitzberg, Norway, in the summer of 2008. Further testing aboard a UAS is also in planning stages. Pending validation of the sensor's performance, NASA and SPEC anticipate use by NASA research missions as well as commercial opportunities. Placing the cloud sensor aboard several globally deployed UAS would enable distributed measurements to look at variation of cloud particles over many areas at once, helping researchers better understand the impact of these particles on the atmosphere as well as how they change over time. In addition, the *in situ* data gathered by the sensor may be used to validate and augment data gathered by CloudSat and Calipso, NASA's recently launched cloud satellite measurements systems.

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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