Recent Satellite Data Inconclusive on Climate Change, Prompts New Mission

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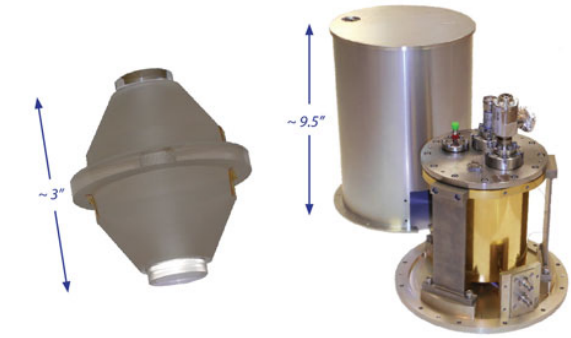

Slated for launch in 2017, NASA's GRACE Follow-On mission will use satellite technology to further advance the study of the earth's gravity and climate change. Right: The prototype laser cavity, made using glass with a low coefficient of thermal expansion in order to maintain a constant distance between end mirrors. Middle: The prototype assembly and thermal enclosure for the cavity.
Image credit: NASA

[Satellite TODAY 07-15-13] **NASA's** gravity field satellite mission GRACE has provided nine years worth of data about changes in Earth's gravity field. The analysis of the data from the two satellites on the mission was published in the Nature Geoscience Journal, which looks at the melting of our Earth's ice sheets.

Although the results of the analysis have concluded that the Earth's ice sheets are melting at the alarming rate of 300 billion tons per year, the report indicates that satellite data obtained of the Antarctic and Greenland ice sheets is insufficient to determine whether the acceleration of the melting ice will continue at the same rate, resulting in the need for more satellite analysis.

As a result, NASA is planning the GRACE follow-on mission slated for launch from Baikonur, Kazakhstan in August of 2017, according to Frank Webb, earth science program manager with **NASA's Jet Propulsion Laboratory.**

During an exclusive interview with *SatelliteTODAY.COM*, Webb said although a formal contract has yet to be executed, the order for the two new satellites will stem from **Astrium** and the German government will assist with the launch.

The 2017 launch will provide additional satellite data with next-generation K- and Ka-band satellite technology to better understand climate change. "With this project we are going to continue GRACE's record which is very valuable in understanding climate change," Webb said.

Post-doctoral researcher Bert Wouters from the **University of Bristol,** who is currently a visiting researcher at the **University of Colorado**, led the study of GRACE's original data. While Wouter's findings raise questions about future climate change, one certainty remains: satellite technology will continue to play an integral role in climate change studies. "The results highlight the need for a continuous monitoring of the ice sheets with satellites," said Wouters in a written statement.

The original GRACE project consists of two satellites launched in March 2002, which have led to discoveries about gravity and Earth's natural systems, according to the **University of Texas** (UT). "These discoveries could have far-reaching benefits to society and the world's population," UT's website states.

Space Systems Loral (SSL) provided the high-precision K/Ka-band Microwave Assemblies (MWAs) that played an integral role in the ranging system that makes the GRACE mission work, said Gerrit van Ommering, executive director, technology programs, with SSL during an exclusive interview with *SatelliteTODAY.com*.

"As the two satellites orbit the Earth about 220 km apart, their MWAs continuously communicate with each other by transmitting and receiving microwave signals, from which they derive a signal that reflects tiny changes, as small as one-tenth the width of a human hair, in the distance between the satellites. Subsequent

processing of the data computes the small local gravity variations that cause these distance changes, over time leading to GRACE's highly detailed gravity maps of the Earth," van Ommering said.

According to NASA's Jet Propulsion Laboratory at the **California Institute of Technology,** "these measurements, in conjunction with other data and models, have provided observations of terrestrial water storage changes, ice-mass variations, ocean bottom pressure changes and sea-level variations."

Although the mission was only slated to last five years, it has gone well beyond that – but not without challenges. Back in 2005 GRACE's operators switched the positions of the leading and trailing satellites near the middle of the mission lifetime to avoid loss of thermal control, which would have impacted signal. "During this [position switching] maneuver the trailing satellite will cross and take over the leading satellite in order to eliminate any risk of collision. The relative motion characteristics were analyzed and an optimum time was chosen such that there will be a minimum guaranteed distance between them at the point of closest approach," a UT website states.

In 2010 the batteries on GRACE started to show their age not being able to retain a full charge. "In order to extend the battery life, data is not collected when GRACE is eclipsed and cannot collect solar energy; when GRACE is not eclipsed it collects data normally," NASA's website states.

But overall the data has helped provided scientists with valuable insights. "We are getting a better understanding of our measurement systems and just how much we can trust our numbers," said Lee-Lueng Fu, of NASA's Jet Propulsion Laboratory in a written statement.

GRACE flight operations are a joint effort between NASA and the **German Space Operations Center (GSOC)**, with funding support from the **German Aerospace Center (DLR)** and **German Research Center for Geosciences (GFZ)**, which operates the satellites from its facilities in Oberpfaffenhofen, Germany. GFZ also uses its antenna at the Ny Alesund artic research monitoring station for satellite monitoring and real-time radio occultation analysis, UT's website states.

The mission forged a new partnership more recently in 2011 when the **European Space Agency (ESA)** jumped on board and has been supporting the ground segment operations at GSOC. Under this partnership, GRACE will also create more accurate profiles of atmospheric pressure, temperature and humidity leading to improved weather forecasts. Operations team members come from JPL, SSL**, UTCSR**, **Astrium** and the GSOC. SSL and Astrium could not be reached prior to publication.

While NASA's aging GRACE mission continues, newer ESA satellites have already demonstrated their power in providing far greater precision mapping of the northern hemisphere's biomass of forests and in assisting with the process of analyzing the Earth's future climate, as previously reported by *SatelliteTODAY.com*. The Biomass satellite will also deliver radar measurements at a wavelength of around 70 cm to delve below the treetops, an ESA statement said.