# Gravity mapping satellites launched into space

BY SPACEFLIGHT NOW
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Two satellites designed to work in concert to map Earth's gravity field to an unprecedented accuracy were trucked into polar orbit today for a five-year mission that scientists hope will give new insight into global climate change.

Liftoff of the joint NASA/German Gravity Recovery And Climate Experiment mission, dubbed GRACE, took place aboard a Eurockot Rockot launcher at 0921:27 GMT (4:21:27 a.m. EST) from the snow-covered Plesetsk Cosmodrome in northern Russia, one day later than planned because of strong upper level winds.

The two craft -- nicknamed "Tom" and "Jerry" -- were deployed from the Breeze-KM upper stage about 85 minutes after launch. The satellites, orbiting

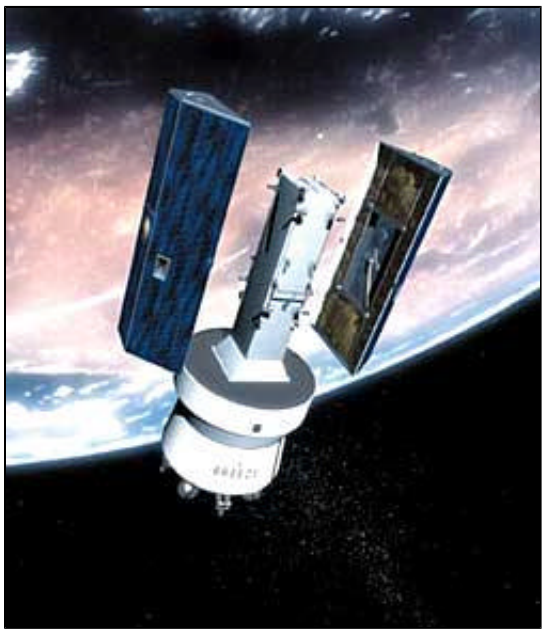
## Flight data file

**Vehicle:** Rockot/Breeze-KM
**Payload:** GRACE
**Launch date:** March 17, 2002
**Launch window:** 0921-0931 GMT (4:21-4:31 a.m. EST)
**Launch site:** LC-133, Plesetsk Cosmodrome, Russia

about 300 miles up, will be maneuvered to a distance of approximately 137 miles apart for the start of their tandem mission.

The 1,045-pound satellites will measure subtle changes in Earth's surface mass and the corresponding variations in the gravity field as they sail overhead. The data gathered will generate a global three-dimensional map that is irregular in shape, showing the small variations in mass and gravity around the planet.

The gravity maps produced during the GRACE mission are supposed to be 100 to 1,000 times better than the data currently available. This new accuracy is expected to allow scientists to better refine their instruments for studies in a broad range of scientific fields that include geodesy, oceanography, hydrology, geology and glaciology.



The Rockot booster launches from Plesetsk with the GRACE spacecraft. Bottom image is illustration of satellites being deployed from Breeze upper stage. Photos: DLR

"We are using space technology for the benefit of all of us on the Earth," said Ralf Huber, head of the German Aerospace Center's Washington office.

"GRACE will provide us with a new view of our home planet and help us to better understand climate change and its global impacts such as changes in sea level and the availability of water resources," said Ghassem Asrar, NASA associate administrator for Earth Science.

Specific applications for the GRACE data include tracking water movement on and beneath Earth's surface, monitoring the movement and changes in ice sheets, studying ocean currents near the surface and far beneath waves and tracking changes in the structure of the solid Earth.

"This will be the first time in the history of U.S. civilian remote sensing that we will be able to practically examine every aspect of the Earth from space," Asrar said.

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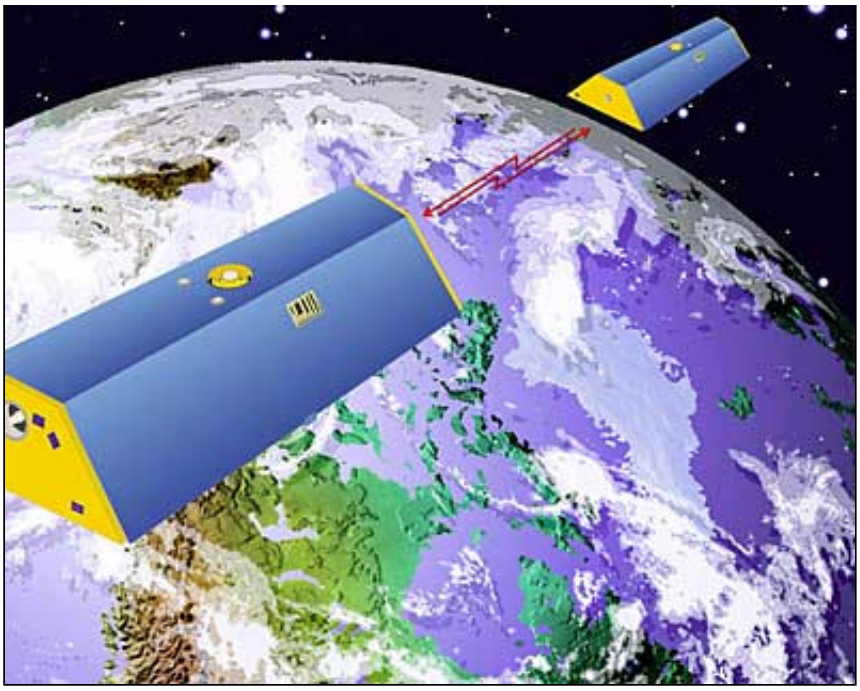
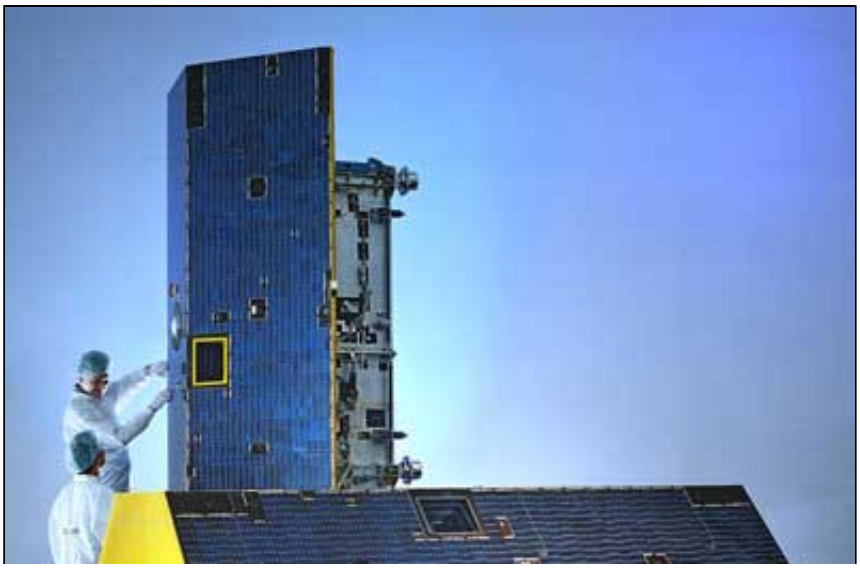


An artist's concept of GRACE satellites with ranging link between the two craft. Photo: NASA

GRACE will employ a cutting-edge microwave ranging system to accurately measure changes in the speed and distance between two identical Astrium-built craft as they circle Earth. NASA says the ranging system is so sensitive it can detect separation changes as small as 10 microns -- about one-tenth the width of a human hair over a distance of 137 miles.

Gravity not only varies from place-to-place, but also over time due to changes in mass at certain locations. GRACE will study both the place and time aspects of gravity, completing a new gravity map for comparison every 30 days throughout its multi-year mission.

Regions of slightly stronger gravity will affect the lead satellite first, pulling it slightly away from the trailing satellite. By measuring the constantly changing distance between the two satellites and combining that data with precise positioning measurements from Global Positioning System instruments, scientists will be able to construct a precise Earth gravity map.

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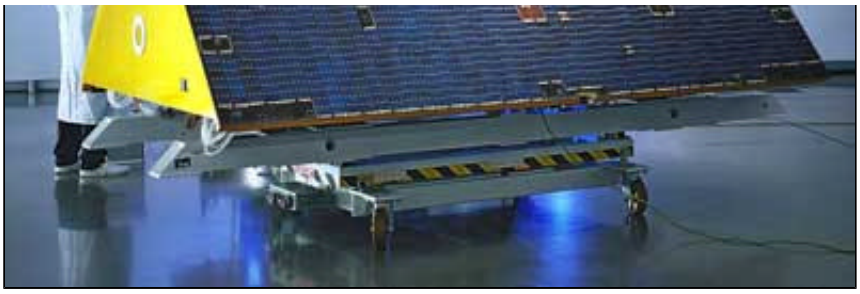

The twin GRACE satellites. Photo: Astrium

The concept behind GRACE dates back at least 30 years, during which time it has undergone countless studies and reviews. But only recently has it become possible for such a complex mission to take place at more reasonable costs.

The joint U.S.-German mission costs a total of $127 million, with $97 million paid for by NASA and $30 million by the German team. Launch costs amount to around $8 million.

Next up for the Rockot launch vehicle, which is based upon a two-stage Russian SS-19 ICBM, with an added Breeze-KM upper stage, is the summertime launch of two Iridium mobile communications satellites.