The GRACE Mission: Technical Challenges

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The Gravity Recovery and Climate Experiment (GRACE) Mission is scheduled for launch in June 2001. Within the first year of the GRACE Mission, the Project has a minimum science requirement to deliver a new model of the Earth's static geoid with an error of less than 1 cm. to spherical harmonic degree seventy (70). However, the performance of the GRACE Mission is designed to exceed this minimum requirement by more than a factor of 25. For spherical harmonic degrees up to 40, we expect to improve the current knowledge of the gravity field by one thousand (1000x). The GRACE Mission uses the satellite-to-satellite tracking (SST) technique. The twin GRACE satellites are the instrument that measures the non-uniformity's in the Earth's gravity field. Non-uniformity's in the gravity field cause the relative distance between the centers-of-mass of the two satellites to vary as they fly over the Earth. Atmospheric drag is the largest non-gravitational disturbing force. Drag is measured and will be used to correct changes in the satellite-to-satellite range measured by a SST microwave link. The microwave link will measure changes in the range between the two GRACE satellites with an error approaching 1 micron. We will discuss how these instrumentation requirements affect the configuration, the mass balance, thermal control and aerodynamic design of the satellites and the design of the microwave SST link and the accelerometer. Finally, the impact of errors in these components on the overall accuracy of the gravity models will be addressed.

The GRACE Mission, which was selected as one of the first two missions to be conducted under NASA's Earth System Science Pathfinder Program, is implemented as a joint colloboration between NASA and the Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR).