

Abstract Submitted  
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**The Gravity Probe B Drag-free and Attitude Control System<sup>1</sup>**

MICHAEL ADAMS, DANIEL DEBRA, Stanford University — The Gravity Probe B is first space vehicle provide active control of the vehicle's six degrees of freedom (DOF), three in translation and three in attitude. The Attitude and Translation Control (ATC) uses helium boil-off gas from the cryogenic system as a propellant for 16 proportional cold gas thrusters. Differential thruster operation provides forces and torques on the vehicle, common mode operation controls the net flow rate from the dewar that is used in turn to control the liquid helium bath temperature. The pointing system controls the pointing of the guide star tracking telescope to 30 marc-sec at the space vehicle roll period (77.5) and maintained roll phase to 40 arc-sec. The translation control system used acceleration measurements from one science gyroscope's suspension system to null out the effects of external forces from the on-orbit environment (solar wind, radiation pressure, etc). In this way, the vehicle was controlled to fly in a near-perfect gravitational orbit; transverse accelerations on the science gyroscopes were reduced to the  $5 \times 10^{-12}$  g level. The precise pointing and orbital geometry are essential for minimizing disturbances to the science gyroscopes, and the dewar control is important in maximizing the length of the data collection period..

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