

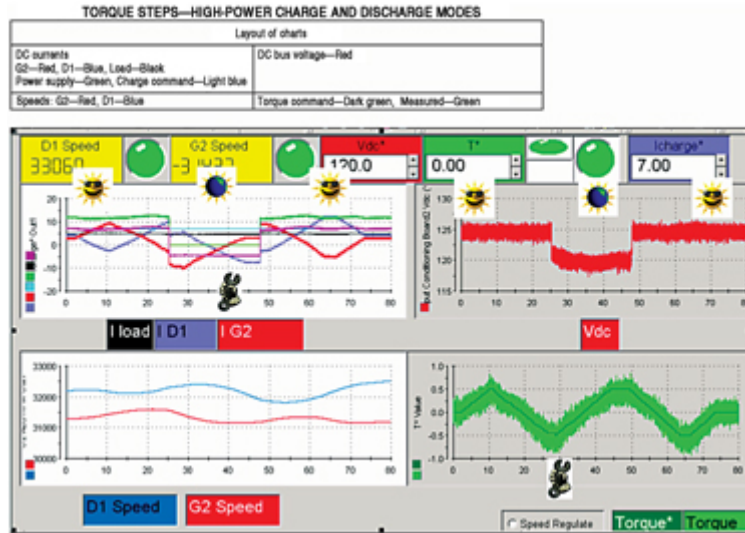
# Integrated Power and Attitude Control System Demonstrated With Flywheels G2 and D1



*Test hardware for Integrated Power and Attitude Control System..*

On September 14, 2004, NASA Glenn Research Center's Flywheel Development Team experimentally demonstrated a full-power, high-speed, two-flywheel system, simultaneously regulating a power bus and providing a commanded output torque. Operation- and power-mode transitions were demonstrated up to 2000 W in charge and 1100 W in discharge, while the output torque was simultaneously regulated between  $\pm 0.8$  N-m.

The G2 and D1 flywheels--magnetically levitated carbon-fiber wheels with permanent magnet motors--were used for the experiment. The units were mounted on an air bearing table in Glenn's High Energy Flywheel Facility. The operational speed range for these tests was between 20,000 and 60,000 rpm. The bus voltage was regulated at 125 V during charge and discharge, and charge-discharge and discharge-charge transitions were demonstrated by changing the amount of power that the power supply provided between 300 and 0 W. In a satellite system, this would be the equivalent of changing the amount of energy that the solar array provides to the spacecraft. In addition to regulating the bus voltage, we simultaneously controlled the net torque produced by the two flywheel modules. Both modules were mounted on an air table that was restrained by a load cell. The load cell measured the force on the table, and the torque produced by the two flywheels on the table could be calculated from that measurement. This method was used to measure the torque produced by the modules, yielding net torques from -0.8 to 0.8 N-m. This was the first Glenn demonstration of the Integrated Power and Attitude Control System (IPACS) at high power levels and speeds.



*IPACS power and torque profile.*

**Find out more about this research:**

Aerospace Flywheel Development at <http://space-power.grc.nasa.gov/ppo/projects/flywheel/>

Glenn's Structural Mechanics & Dynamics Branch at <http://structures.grc.nasa.gov/5930/>

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