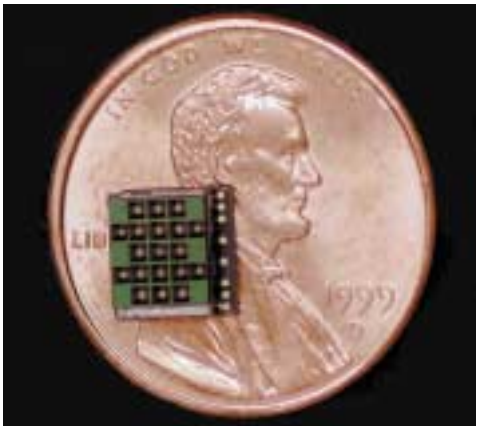

This tiny chip, included in a shuttle experiment and shown against a penny, contains 19 microthrusters, each of which acts like a rocket engine. Designed and built in an Aerospace lab, the thrusters could be used to orient a nanosatellite.

prototyping of new devices for space system application. In July our Microtechnology Testbed flew successfully aboard the shuttle Columbia, carrying three experiments in the first systematic testing of MEMS (microelectromechanical systems) devices during launch and spaceflight.

Microthruster Test and Evaluation Propulsion is an enabling technology for the deployment and operation of constellations of nanosatellites. Micropropulsion development requires new capabilities for thruster test and evaluation. A "microthruststand" requires the accurate measurement of impulses about one-thousandth of even the smallest conventional satellite thrusters. Aerospace scientists constructed a system that advanced the state of the art by more than a factor of 100 in thrust sensitivity. Our absolute calibration system has enabled us to test thruster design and propellant chemistry with great accuracy and to characterize the performance of solid-propellant microthruster arrays for planned rocket tests.

Picosatellites In an effort sponsored by the Defense Advanced Research Projects Agency, Aerospace scientists and engineers have collaborated with Rockwell Science Center and Stanford University to develop miniature low-cost space platforms to validate microsystems for space applications and advance the development of mass-producible, fully functional nanosatellites. Aerospace supported preflight activities for an experiment involving two tiny satellites—each 1-by-3-by-4 inches and weighing less than half a pound—to be deployed from Stanford University's OPAL satellite after launch by the new Air Force Orbital Suborbital Program Space Launch Vehicle. The picosats are tethered to emulate formation-flying within the range of low-power radios. A picosat mounted on a 50-meter ground antenna forms the third element of a rudimentary constellation. MEMS radio-frequency switch arrays are also to be tested on this mission. The tether has built-in radar targets to aid in acquisition and tracking.

We also provided broad systems engineering support for tracking and communications with the picosats from the large 50-meter dish operated by SRI International in Palo Alto, California. We led the development of spiral search algorithms, which model potential dispersions, to enable tracking at the SRI dish. The spiral search algorithms help facilitate acquisition and track maintenance even if radar tracking by the Space Surveillance Network is unable to acquire the vehicle.

Space Assets for Environmental Monitoring Aerospace scientists and engineers have developed and are using a multisatellite ground station at our El Segundo facilities, the A8 Research Center, to study the use of Defense Department surveillance satellites for environmental monitoring, such as the