NRL brings inertia of space to robotics research

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Precision honed to within +/-0.0018 inches tolerance across its surface, the Gravity Offset Table (shown right) will allow scientists to emulate the inertia of space in the laboratory using full-size spacecraft and robotic arms like the Front-End Robotic Enabling Near-Term Demonstration (FREND) arm pictured center. Credit: US Naval Research Laboratory

The U.S. Naval Research Laboratory Spacecraft Engineering Department's space robotics research facility recently took possession of a one-of-a-kind 75,000 pound Gravity Offset Table (GOT) made from a single slab of solid granite.

To emulate the classical mechanics of physics found in space on full-scale replica spacecraft on Earth requires not only a hefty amount of air to 'float' the object, but a precision, frictionless, large surface area that will allow researchers to replicate the effects of inertia on man-made

objects in space.

"We accomplish this by floating models of spacecraft and other resident space objects on air bearings –similar to the dynamics of an upside-down air hockey table," said Dr. Gregory P. Scott, space robotics scientist. "Based on the inertia of the 'floating' system, a realistic spacecraft response can be measured when testing thrusters, attitude control algorithms, and responses to contact with other objects."

Currently, the grappling, or capture, of spacecraft in orbit is accomplished by specifically engineered pre-configured couplers and mating mechanisms. To capture and service a 'free-flying' orbiting spacecraft that has no conventional coupling mechanism, researchers must first be able to demonstrate minimal rates of error in a cost effective and efficient manner using many spacecraft configurations here on Earth.

Honed by Precision Granite® to federal 'AAA' specifications, the 20 feet by 15 feet, 1.5-foot thick single piece of granite is within +/- 0.0018 inches flat across its surface. The precision GOT will allow NRL researchers to precisely simulate the frictionless motion of objects in space and understand the dynamics of docking and servicing satellites on-orbit — a function of increasing importance as rising launch costs and the addition of new orbiting spacecraft can be offset by the repair or updating of assets already in Earth orbit.

Quarried from the Raymond Granite Quarry, Clovis, Calif., the 450 cubic-foot, 37.5 ton GOT slab is thought to be the largest, single slab, precision granite table in the world with tolerances capable of allowing engineers to simulate service of full-scale satellite spacecraft with significant structural flexibility to a degree of accuracy unmatched by any other space robotics facility.

Provided by Naval Research Laboratory