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## ⚙️ Cryogenic Scan Mechanism for Fourier Transform Spectrometer

**This mechanism would be applicable to FTS use in forensic, scientific, medical, and defense industries.**

*Goddard Space Flight Center, Greenbelt, Maryland*

A compact and lightweight mechanism has been developed to accurately move a Fourier transform spectrometer (FTS) scan mirror (a cube corner) in a near-linear fashion with near constant speed at cryogenic temperatures. This innovation includes a slide mechanism to restrict motion to one dimension, an actuator to drive the motion, and a linear velocity transducer (LVT) to measure the speed. The cube corner mirror is double-passed in one arm of the FTS; double-passing is required to compensate for optical beam shear resulting from tilting of the moving cube corner.

The slide, actuator, and LVT are off-the-shelf components that are capable

of cryogenic vacuum operation. The actuator drives the slide for the required travel of 2.5 cm. The LVT measures translation speed. A proportional feedback loop compares the LVT voltage with the set voltage (speed) to derive an error signal to drive the actuator and achieve near constant speed. When the end of the scan is reached, a personal computer reverses the set voltage.

The actuator and LVT have no moving parts in contact, and have magnetic properties consistent with cryogenic operation. The unlubricated slide restricts motion to linear travel, using crossed roller bearings consistent with 100-mil-

lion-stroke operation. The mechanism tilts several arc seconds during transport of the FTS mirror, which would compromise optical fringe efficiency when using a flat mirror. Consequently, a cube corner mirror is used, which converts a tilt into a shear. The sheared beam strikes (at normal incidence) a flat mirror at the end of the FTS arm with the moving mechanism, thereby returning upon itself and compensating for the shear.

*This work was done by John C. Brasunas and John J. Francis of Goddard Space Flight Center. For further information, contact the Goddard Innovative Partnerships Office at (301) 286-5810. GSC-15556-1*

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## ⚙️ Piezoelectric Rotary Tube Motor

*NASA's Jet Propulsion Laboratory, Pasadena, California*

A custom rotary SQUIGGLE<sup>®</sup> motor has been developed that sets new benchmarks for small motor size, high position resolution, and high torque without gear reduction. Its capabilities cannot be achieved with conventional electromagnetic motors. It consists of piezoelectric plates mounted on a square flexible tube. The plates are actuated via voltage waveforms 90° out of phase at the reso-

nant frequency of the device to create rotary motion.

The motors were incorporated into a two-axis positioner that was designed for fiber-fed spectroscopy for ground-based and space-based projects. The positioner enables large-scale celestial object surveys to take place in a practical amount of time.

*This work was done by Charles D. Fisher, Mircea Badescu, and David F. Braun of Cal-*

*tech and Rob Culhane of New Scale Technologies for NASA's Jet Propulsion Laboratory. For more information about the motor and the positioner, visit the following sites:*

*[http://www.newscaletech.com/custom\\_overview.html#rotary](http://www.newscaletech.com/custom_overview.html#rotary)*

*[http://www.newscaletech.com/app\\_notes/7Cobra-JPL-article.html](http://www.newscaletech.com/app_notes/7Cobra-JPL-article.html)*

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