Micro Newton Colloid Thruster System Development for ST7

Manuel Gamero-Castaño, Vlad Hruby, Douglas Spence,
Charles Gasdaska and Bill Connolly
Busek Co. Inc.
11 Tech Circle
Natick, MA 01760-1023
busek@busek.com
508-655-5565

Interest in colloid thrusters has been reactivated in recent years, mainly due to new types of space missions that need its unique propulsion characteristics. First, the expected proliferation of micro and nano-satellites, made possible by advances in electronics and micro-fabrication techniques, is currently handicapped by the lack of efficient micro-propulsion. Second, there are several scientific and formation flying missions in which the relative positions of spacecrafts need to be controlled with great precision. For example, the Laser Interferometer Space Antenna, among other specifications, requires the control of the spacecraft position within microns. Such requirements may be fulfilled via colloidal propulsion. In this context, the selection by NASA's New Millennium Program of the Disturbance Reduction System (DRS) as the Space Technology 7 represents a major boost for the development of colloid thruster technology. The DRS is designed to validate system-level technology required for two types of future missions: measurements of planetary gravity and of cosmic gravitational waves, and precision formation-flying interferometers. The DRS is based on the concept of a freely floating test mass contained within a spacecraft that shields the test mass from external forces. The test mass will ideally follow a trajectory determined only by the local gravitational field. The spacecraft position must be continuously adjusted to stay centered about the test mass, essentially flying in formation with the test mass. An array of colloid thrusters will control the position of the spacecraft.

In this article we present our ongoing research on colloid thruster, and which is aimed to developing the micro-thrusters that will be used by the Disturbance Reduction System. We use a torsional balance to prove the thrusting capability of a colloid thruster prototype, characterize the thrust noise through the beam current, and report initial data on the structure of the colloid plume.