WISPER: Wafer Integrated SPectrometER.

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JHU/APL has teamed with professionals and cadets at the U.S. Air Force Academy (USAFA) in the area of Micro Electrical Mechanical systems (MEMS) to develop a spectrometer with the ability to detect ion trails emitted by spacecraft in geostationary orbit (GEO) and capable of being deployed on a micro satellite. An instrument assessment will take place with an on-orbit experiment scheduled to be conducted during USAFA's FalconSAT-5 mission. A WISPER instrument payload will be mounted near an ion thruster allowing for detailed measurements of the ions produced by such a thruster in the LEO environment. While in orbit, the WISPER instrument will make measurements of the energy distribution function of the bus-mounted ion thruster in a wide range of natural plasma background environments, and will also support the measurement of the temperature and density of background ionospheric ions, enabling greater understanding of the morphology of ionospheric variations in the upper atmosphere at low earth orbit (LEO) altitudes. The on-orbit data received will allow for a determination of the basic production mechanism of ions, and inferences to be made regarding the characteristic performance expectations of the instrument in geostationary orbits.

Operational Responsive Space (ORS) requires rapid turnaround in the development of space systems which respond to operational requirements. Use of micro scale components and sensors are a major bonus for ORS systems since the cost of the instrument (both in dollars, and in size) is so small that they can be incorporated in many missions. By design, MEMS sensors are suited for "mass production", meaning that they can be built in mass lots, and then reside in mission readiness status. WISPER is a demonstration of the aggressive miniaturization of instruments using MEMS fabrication techniques for a revolutionary size reduction. For this instrument, the approach to miniaturization is not just size reduction of existing designs; instead an aggressive miniaturization with new designs that maintain high performance metrics. Confidence of the potential for this approach to produce high payoff is derived from the work on the Flat Plasma Spectrometer (FlaPS) instrument for FalconSat-3, which was launched in 2007. In sum, WISPER is miniaturized and multi functional offering a host of advantages to the Operationally Responsive Space Program.

The Johns Hopkins University Applied Physics Laboratory is funded by the Naval Research Laboratory/Operationally Responsive Space in a collaborative effort with the United States Air Force Academy to design, build, and test two Wafer Integrated Spectrometers (qualification model, and proto-flight model) with the ability to detect ion trails emitted by spacecraft in GEO orbits.