OSD Foreign Comparative Test – Magellan GPS

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Product: GPS-Based Satellite Orbit Determination in Signal-Sparse Environments

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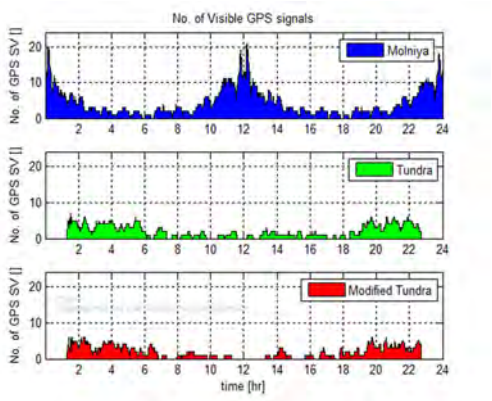

Short Description: Satellite orbit determination solution that is resilient to intermittent or jammed external GPS reference signals.

Technology Readiness Level (fielded, lab tested, operational test): TRL 4. Laboratory demonstration with representative single frequency (L1) GPS receiver.

Countries Using This Product: None operationally. R&D was supported by funding from the Canadian Space Agency (CSA).

Application: (the so what?) Satellites in low Earth orbit frequently use the GPS constellation for autonomous real-time orbit determination. To secure space pre-eminence, satellites that use GPS must continue to be able to navigate even if the GPS signal is intermittent or jammed. Such a capability would also enable satellites in highly elliptical orbit, such as those for communications and SIGINT applications, to use GPS for orbit determination despite variations in viewing geometry and signal quality from being above the GPS constellation for most of its orbital period.

Science (how it works): The problem of utilizing intermittent GPS signals for orbit determination can be solved with flight software based on an extended Kalman filter (EKF) approach driven by intermittent GPS measurements augmented with communications-based ranging and high-fidelity gravity models. Being software based, this navigation solution would be agnostic to the GPS receiver hardware and could interface with the satellite's flight software architecture using host specific interface modules with the required drivers for the selected GPS receiver.

Data (key tested performance metrics):
Lab demonstration using single frequency (L1) GPS receiver achieved RMS positional uncertainty of ±75 m for a notional satellite in a highly elliptical Earth orbit (HEO).

U.S. Partners: None

Previous Work with DoD: None