

Tracking non-cooperative low earth orbit objects using GNSS satellites as a multi-static radar

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Space debris is a growing hazard since space activity and the amount of space debris are both increasing. If the risks posed by space object collisions cannot be mitigated, this will hinder the future use of space. Accurate knowledge of the trajectory and behavior of satellites and debris is required to mitigate collision risks as the density of space objects increases. This requires space object tracking systems that are both affordable and scale well for very large numbers of objects under observation. Wide field of view, all-weather, passive systems scale well for reliable surveillance of very large numbers of objects. Global Navigation Satellite System (GNSS) satellites have been proposed as potential illuminators of opportunity to track Low Earth Orbit (LEO) debris, paired with ground-based receivers in a bistatic arrangement. In this paper, we discuss appropriate mathematical models, the signal characteristics used in these observations, the results of recent relevant laboratory-based experiments, simulation work performed in preparation for on-orbit experiments of these techniques, and our plans for the development of a system capable of tracking LEO debris to enhance space situational awareness.