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HOBOCOP - A DISTRIBUTED NETWORK OF SMALL SATELLITES TO STUDY THE SUN

Abstract

The Heliocentric Orbiting Baseline-Optimized Cosmos Observation Paradigm (HOBOCOP) is a mission concept that uses a network of small satellites to study the Sun's magnetosphere and the Solar wind. By distributing sensors to conduct remote and in-situ measurements, more comprehensive solar monitoring can be accomplished than by any monolithic satellite system.

Two basic satellite concept designs were examined. The first carries either a magnetometer, a fast particle analyzer, or both, and uses a heat shield to survive close passes near the Sun. The second has an option for a vector field magnetograph (VFM) but does not carry a heat shield. Sets of satellites are launched from a near-Earth orbit at different times of the year so the entire set passes through perihelion simultaneously to sample the solar wind and magnetic field at different latitudes of the Sun. Satellites carrying a VFM also have the option to go to higher inclinations by leveraging Earth flybys for gravity assists, and sets of these satellites observe opposite sides of the Sun simultaneously. Communications with these small satellites occurs during periodic intervals throughout the year since a certain level of autonomy is assumed.

The Responsive Systems Comparison (RSC) method was used compare hundreds of thousands of possible designs for this network. Additionally, optional satellite relays were included in some of the designs to show how value could be added by communicating with the satellites more frequently to mitigate potential data losses due to inevitable satellite failures. The results from the RSC method showed that the designs that leverage heterogeneous combinations of both concept designs achieved the highest utility satisfaction scores because of how they leveraged several unique emergent capabilities of distributed satellites.