SPACE SYSTEMS SYMPOSIUM (D1)
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VIDEOSAT – A CONTINUOUS OBSERVATION CONSTELLATION

Abstract

This paper describes the system architecture for a small satellite constellation called VideoSat that achieves near-continuous daytime observation of any sub-polar region with a limited number of launches and an affordable program cost.

The advance of electronics in general and CMOS photodetectors in particular has enabled high resolution electro-optical imaging satellites with a relatively low material cost and mass resulting in a reduced price on orbit. This provides the possibility of constellations of these high resolution satellites generating realtime video from space that will allow continuous daytime monitoring of the many issues that face the modern world.

Until recently the only viable option for continuous observation has been to place a large imaging satellite in geostationary orbit. This has the limitations of reduced resolution and large development and launch costs. In order to provide global sub-polar coverage, such a constellation would require a number satellites in high demand geostationary slots. Such satellites exist, but they have mainly been used for weather monitoring.

The objective of the VideoSat mission is to provide near-continuous, near-realtime, high resolution daytime observation of any particular region of interest. The coverage that a constellation can provide depends on the number of satellites in the constellation and their spread in orbital planes. The challenge is to find the optimal number of satellites that can image a selected point of interest continuously with a usable image resolution. The proposed VideoSat constellation consists of a number of small satellites in low earth sun-synchronous orbits which addresses the mission requirement while minimizing satellite and launch costs. A challenge exists in minimizing the satellite size while still maintaining image quality, especially at the large off-nadir angles (low 'grazing angles') necessary for mission feasibility.

VideoSat satellites will make use of an Attitude and Orbit Control System (AOCS) for combined attitude and orbit control. The VideoSat constellation requires significant propulsion capability. The purpose is to maintain the phase separation between satellites and the separation between the orbital planes, for consistent coverage. Modern high performance "green" propulsion systems enable this capability in a small satellite. Agile attitude control allows slewing between targets within the region of interest for a rapid response.

This paper covers the high level design and performance of the VideoSat satellite together with the constellation design trade-off and the resulting constellation composition, achievable coverage and launch strategy.