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SWOT: AN AOCS ANSWERING TO HIGH PAYLOAD CONSTRAINTS

Abstract

The French-US SWOT (Surface Water and Ocean Topography) satellite launch is scheduled in 2021. Thanks to its wide-swath Ka-band radar interferometer, KaRin, developed by the NASA-JPL, it will offer a new opportunity for measuring the surface water height of lakes, river and flood zones, and for seeing mesoscale and sub-mesoscale circulation patterns of oceans. The platform, developed by Thales Alenia Space for CNES, is very large (satellite mass near 2 tonnes and power near 2 kWs) in order to satisfy the mission on a low earth orbit (altitude near 900 km, inclination of 78 degrees) with a local nadir and track compensation guidance. The first challenge of the SWOT life will be the deployment of the KaRin payload constituted of two radar antennas perched at the end of two 5-meters booms. A dedicated AOCS (Attitude and Orbit Control System) strategy has been implemented, in order to guarantee the robustness of this critical phase at both payload and platform level. As soon as the payload will be deployed, it will require a high dynamical stability, in order to achieve the foreseen precision. This stability is defined thanks to a criterion based on displacements of several points on the payload and a threshold expressed in terms of PSD (Power Spectral Density). It induces a specific approach in terms of AOCS tunings, in order to limit the excitation of given payload flexible modes for a wide range of frequencies. Another key parameter of the mission is the capacity to estimate very precisely the attitude on the ground. This estimation is based on the measurements of the star trackers used too by the platform AOCS, combined with the data provided by the gyros put inside the payload module. Due to the precision requirement expressed again with a PSD criterion, a specific approach had to be developed. The last dimensioning point in terms of AOCS is the end of life strategy: in order to satisfy the French law for space, the SWOT satellite shall achieve a controlled re-entry. This implies a dedicated AOCS architecture, especially in terms of propulsion capacity and of guidance at low altitudes. The paper will present for each subject the developed concepts and the strategy used for their validation, and will illustrate them by giving some results of simulations done during the development phases.