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DEVELOPMENT STRATEGIES AND MISSION STUDIES FOR TAIWAN'S NEW SMALL EARTH
OBSERVATION SATELLITE CONSTELLATION

Abstract

On January 15, 2019, the Taiwan government officially approved her The Third Phase National Space Technology Development Long-Term Plan (2019-2028). During the next decade, NSPO will develop 3 different types of Earth observation satellites, including high-resolution optical Earth observation satellites, ultra-high-resolution optical Earth observation satellites and synthetic aperture radar satellites, to form a complete satellite constellation to meet Taiwan's needs.

Among them, the first satellite project to be implemented is the high-resolution optical Earth observation satellite program. Based on the design heritage of FORMOSAT-5 and Triton Satellite, NSPO is going to develop a light-weight, cost-effect small satellite platform with a one-meter resolution optical remote sensing instrument. The high-resolution optical Earth observation satellite program is planned to launch 6 small satellites within 10 years and the first satellite is scheduled to launch in 2022. Based on the design life of satellites and their launch schedules, 3 to 4 satellites will be expected to orbit around the Earth at the same time. Therefore, NSPO has to consider the overall satellite constellation in the mission design phase.

In general, high revisit rate and global coverage are two equally important major requirements for a remote sensing satellite constellation design. However, NSPO is a government-funded public organization, so that the priority of mission requirements for remote sensing satellites developed by NSPO has different consideration. For Taiwan's users, a satellite constellation to have higher image acquisition times around Taiwan area is more important than a satellite constellation to capture images globally. General speaking, most of remote sensing satellites select sun-synchronous orbits mission orbits. However, some remote sensing satellites adopt low-inclination orbits as mission orbits to increase the number of images taken for particular regions.

In addition to describing the development strategies and current status of Taiwan's new small satellite platform developed by NSPO, this paper will focus on mission studies on the high-resolution optical small satellite constellation, including a trade analysis of sun-synchronous orbits and low-inclination orbits, orbit selection and satellite constellation design and an estimation of minimum propellant required for orbit adjustment due to insertion accuracy, orbit maintenances, and de-orbit operation.