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Interactive Presentations:26th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (IP)

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NANOFF: A 2U-CUBESAT FORMATION FLIGHT MISSION

Abstract

One of the main research topics of the Chair of Space Technology at TU Berlin is the miniaturization of satellites, its subsystems and components. For NanoFF this is taken to a new level. The NanoFF mission consists of two 2U-CubeSats, making it one of the smallest formation flight systems worldwide. Each satellite is equipped with a resistojet for orbit control and formation flying. The high-performance, fully redundant and almost complete single fault tolerant satellite bus will be supplemented by a camera system that produces scientifically usable data in 4 different narrowband spectral channels.
The main objective is to set up different formations bringing the satellites to a relative minimum distance of 20m. At this stage of the mission 4 different formations were chosen. A Helix-Formation, flown by TanDEM-X and TerraSAR-X, an In-Track and Along-Track formation orbit for earth observation applications and a Projected Circular Orbit, where one satellite will circle the other one.
There are two key subsystems besides the propulsion system to fulfill these objectives. The attitude control system must be accurate and reliable and the navigation solution, especially the relative distance between the two satellites needs to be known to submeter level. The attitude control system will have redundant reaction wheels for control and a sensor system will be implemented on different levels, with 3 in-house developed star trackers as the main sensors for attitude determination. For navigation, redundant GPS receivers will provide a navigation solution and via Inter Satellite Link the information is shared between the satellites for differential GPS calculations. Furthermore, the satellites will operate autonomously for certain formations.
The payload camera system holds 4, radiometrically calibrated, narrowband spectral channels. With slightly different optical filters on both satellites, a broader bandwidth of scientific data from VIS to NIR can be optained. Having a ground sample distance of 39m from 575km SSO, the system offers a swadth width of more than 160km. The generated data will be downloaded with a redundant X-Band transmitter. Additionally, foldable solar panels and a TM/TC communication system in S-Band, complementary to the common UHF system, will be flown for technology demonstration.