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# PROBA-3 MISSION: CREATING AN ARTIFICIAL SOLAR ECLIPSE EVERYDAY BY SPACECRAFT FLYING IN FORMATION

**Abstract**

Formation Flying (FF) is the cornerstone technology required for building in flight large "virtual structures or distributed observatories". Such application requires FF with high control accuracies. FF missions will avoid the need to pack and deploy large dimension systems, with the associated complexity and the large associated services. They will also improve the achievable relative position accuracy of the different components, with displacements smaller than the thermo-mechanic distortions present in large conventional structures in flight.

Proba-3 is ESA's precision formation flying space mission. Two satellites, to be launched by the end of this decade, will fly together as a "large virtually rigid structure" 150 m long while maintaining millimetre and arc second relative precision. And this will be achieved autonomously, without relying on support from the ground. In effect the paired satellites will be flying as a virtual giant satellite carrying an accurate Coronagraph to study the Sun's faint corona closer to the solar rim than has ever been achieved before.

The Coronagraph System is distributed over the two small satellites; one carrying the detector and the second one carrying the Sun occulter disk. Proba-3 spacecraft are named according to the part of the Coronagraph System they are hosting. The Coronagraph Spacecraft (CSC) hosts the coronagraph instrument and the Occulter Spacecraft (OSC) hosts the occulting disk. The OSC is designed to fly with the same face facing the Sun at all times. For the science operations it acts as an occulting disc, creating a stable eclipse and leaving only the solar corona visible to the Coronagraph instrument located in the CSC.

The two spacecraft will be launched into a high elliptic orbit with a period of 19.6 h. Coronagraphy observations will be exercised during the apogee phase, in fact creating a Sun eclipse once per day, approximately. Besides its scientific interest, the Coronagraph observations will be a perfect means to

measure the achievement of the precise positioning of the two spacecraft. Additionally, a broad range of state-of-the art technologies will be necessary to make Proba-3 a success.

The purpose of the paper is to present Proba-3 mission, currently about to start Phase D, as a showcase of how novel space mission architectures (i.e. formation flying) can be used to achieve relevant scientific goals with small satellites and within a tight programmatic context.