

# IAA Study Group Status Report

**Responsible Commission: 4**

**Study Number and Title:**

## **4.21 Distributed, Networked, Smart, Cooperating Small Satellite Formations**

**Short Study Description** (repeat from Study Group Proposal):

Networked distributed systems promise interesting potential for multiple small satellites, taking advantage of significant baseline distances. Sensor Networks opened in terrestrial applications very interesting perspectives. But also distributed data processing systems introduced a significant evolution of modern computing during the last 30 years, from traditional mainframe computers towards today's miniaturized networked systems. Similar technology trends can currently be observed in the spacecraft design context. Here miniaturisation enables at similar cost frames systems of several small satellites. Related advantages in comparison to traditional multifunctional large satellites include an improved temporal and spatial resolution, as well as graceful degradation in case of defects.

Nevertheless many classical approaches to realize spacecraft subsystems cannot easily be scaled to the size of pico-satellites, therefore related technologies need to be developed. Cooperating multiple satellites for joint observations are typically realized today by constellations, where each satellite is individually controlled from the ground control station, while in a formation a closed control loop based on relative navigation techniques has to maintain an appropriate topology between the spacecraft. In this context federated, fractioned or fragmented spacecraft topics are discussed, where also computational and storage resources are shared over several spacecraft. The significant increase of pico-satellite activities in the last years advanced in a fast way innovative miniature subsystems, instruments and components.

The state-of-the-art for the relevant subsystems and payloads will be reviewed and roadmaps to promote the related developments will be identified. This should encourage the initialisation of mission realisations and set up contacts in a related scientist community.

Practical benefit of this study group is to promote further growth of small satellite activities by clarifying the detailed definition and requirements of cooperating small satellites.

**Progress in past six months:**

Inputs for the table of contents were consolidated from the different team members and alternative persons for filling the remaining gaps. There were meetings with the contributors in 2018 during the Paris meetings and at the IAC 2018 in Bremen.

Unfortunately the planned Progress Meeting during the Paris meetings has to be postponed due to illness. We will schedule a virtual electronic meeting instead.

**Website Study Information update:** (please give any update regarding Study Group Membership, documents, Study Plan and Schedule):

<http://iaaweb.org/content/view/642/848/>

**Issues requiring resolution?** (recommend approach):

No. Springer Verlag expressed interest to publish this report. Will this also be supported by IAA ?

**Product Deliveries on Schedule?** (If modified explain rationale):

Small delays. Different chapters of the planned report are in different realization stages. We try to catch up with the delayed chapters and chapters in early stage.

**Study Team Member Changes?** (List any Study Team Members that you wish to discontinue, and provide names plus contact coordinates of any Members you wish to add on the second page of this Study Update form.) Note: Complete contact information including email, tel. and fax must be provided for all additions. Only Members with complete contact information will be listed and receive formal appointment letters from the IAA Secretariat.)

This is work in progress. In the delayed chapters we consider additional authors.

**Name of person providing Study Group Status** (Study Group Chair or Co-Chair):  
Prof. Dr. Klaus Schilling

**Status Report Date:** 30.8.2019