

EARTH OBSERVATION SYMPOSIUM (B1)
International Cooperation in Earth Observation Missions (1)

Author: Dr. Pierluigi Silvestrin
European Space Agency (ESA), The Netherlands

Mr. Bernardo Carnicero Domínguez
European Space Agency (ESA), The Netherlands

Mr. Roger Haagmans
European Space Agency (ESA), The Netherlands

Mr. Luca Massotti
European Space Agency (ESA), The Netherlands

Mrs. Amanda Regan
European Space Agency (ESA), The Netherlands

Dr. Christian Siemes
European Space Agency (ESA), The Netherlands

SATELLITE FORMATIONS AND CONSTELLATIONS FOR SYNERGETIC MISSIONS: A
PARADIGM FOR INTERNATIONAL COOPERATION IN EARTH OBSERVATION

Abstract

Over the next few years a substantial number of new missions for long-term sustained Earth Observation (EO) will be launched and will add new capabilities to the satellites already deployed, for instance, for the purpose of operational meteorology and land monitoring. These new missions include the Sentinel series of the Copernicus programme (formerly GMES: Global Monitoring for Environment and Security), under development for the European Union (EU), and the new series of meteorological satellites in both low Earth orbit and geostationary orbit, under development for EUMETSAT.

These missions will provide free-and-open data streams that enable global, continuous and systematic observation of numerous Earth system parameters over decades. If additional missions are flown together with these operational missions then the possibilities for meeting new Earth science and application objectives can be far-reaching, e.g. filling observational gaps, multipoint measurements of geophysical phenomena, etc. These joint flights can be achieved by different means, ranging from constellations, tandem flights to (tight) formations.

In general, constellations and formations provide cost-effective opportunities for international cooperation yielding synergetic missions, as proven e.g. by the “A-train” constellation of satellites deployed by the space agencies of the USA, Japan and France. This cooperation approach can also mitigate certain risks affecting collaborations where multiple agencies contribute to realize a single satellite.

Some examples of future mission concepts under study at ESA in collaboration with partner agencies will be presented, including:

- concepts for land optical imaging, based on synergies between bands in different spectral regions, e.g. a thermal infrared imager flying in tandem with Sentinel-2;
- concepts for land radar imaging, e.g. a companion receive-only satellite flying in formation with a Synthetic Aperture Radar (SAR) mission in a bistatic configuration that enables novel observing techniques, such as tomographic interferometry;
- concepts for monitoring mass distribution and transport in the Earth system with gravity measurements, encompassing the next-generation gravity missions of ESA and NASA flying in a constellation

that optimally reduces space-time undersampling errors and so provides a rigorous case of mission where “the whole is greater than the sum of its parts”.