

14TH IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Operations in Space Debris Environment, Situational Awareness (7)

Author: Mr. Andrea Pietropaolo
Thales Alenia Space Italia, Italy, andrea.pietropaolo@thalesaleniaspace.com

Dr. Giuseppe Francesco De Luca
Italian Space Agency (ASI), Italy, giuseppefrancesco.deluca@asi.it

Mr. Claudio Portelli
Italian Space Agency (ASI), Italy, claudio.portelli@asi.it

Mr. Scorzafava Edmondo
ASI, Italy, edmondo.scorzafava@asi.it

Dr. Michelangelo L'Abbate
Thales Alenia Space Italia, Italy, michelangelo.labbate@thalesaleniaspace.it

SPACE AWARENESS SYSTEMS FOR SSA/SST AND SPACE IMAGING

Abstract

Thales Alenia Space Italia is active in the design of technologies for Small Satellites, since requirements for short term mission applications (e.g. SIGINT, Early Warning, Meteorology, Earth Observation, Space Exploration, etc) will leverage on system and spacecraft operational responsiveness, flexibility in re-configuration, low cost and formation flying, to improve system revisit/response time and to implement innovative sensing techniques. One of the most promising application fields of the Space Situational Awareness (SSA) is the Space Debris detection and monitoring in Low Earth Orbit. Ground based space debris detection suffers from limits related to temporal and spatial observation constraints, atmospheric hindrances, and detection performance especially w.r.t. debris with size smaller than 10 cm; space-borne detection may complement ground based surveillance assets for SSA in terms of faster and more accurate/precise debris characterisation. On this regard TAS-I is carrying on studies concerning radar and optical observation techniques. The radar will be aimed at detecting different classes of debris targets within a specific Cell Under Test (CUT) defined by the radar Field of View and related signal processing capabilities at a given reference distance. On the other hand, optical observations can fruitfully support the determination of the orbit of debris. The generated data can provide debris position information and allow the initialization of the algorithms of calculation of the orbit.

Space-based debris detection missions can be developed around a mini or micro satellite concept with optical or radar instruments, likely injected into polar orbits at around 1000 km altitude. The key features of such system would be: 1- High revisit rate over the selected orbits, w.r.t. Earth based observations 2- Front-down looking configuration preferable for optical instruments; 3- Side looking configuration preferable for radar instruments; 4- Radar operating at closer distances from the objects to be monitored.

Coverage and revisit performances can be improved by a constellation approach. This could allow to pursue simultaneous missions objectives/concepts : • Global LEO Surveillance as part of and SST system in SSA frame, aiming to integrate its data with the existing one coming from other sensors of the network and observing the LEO; • Protection of specific space assets in specific orbits/sectors (e.g. National systems), providing early warning data to support possible collision avoidance manoeuvres, focusing the observation to smaller areas and hence reducing the number of needed Microsatellites.