Paper ID: 46610
oral

IAF EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Sensors and Technology (3)

Author: Prof. Craig Underwood
Surrey Space Centre, University of Surrey, United Kingdom

Mr. George Atkinson
University of Birmingham, United Kingdom
Mr. Alp Sayin
University of Birmingham, United Kingdom
Prof. Mike Cherniakov
University of Birmingham, United Kingdom
Dr. Michail Antoniou
University of Birmingham, United Kingdom
Mr. Alex Dyer
Surrey Space Centre, University of Surrey, United Kingdom

PASSAT: PASSIVE BI-STATIC RADAR IMAGING CONSTELLATION – AIRBORNE TRIALS AND IN-ORBIT DEMONSTRATOR DESIGN

Abstract

Persistent monitoring of large areas using spaceborne Synthetic Aperture Radar (SAR) is a challenging problem for various defence and civil applications. Despite the fact that spaceborne SAR from low Earth orbit (LEO) is a well-developed technology, in practice it cannot provide persistent monitoring of any particular geographical region, as any single satellite has a rather long revisit time. Geostationary Earth Orbit (GEO) SAR missions have been proposed, but here there are major engineering issues due the severe path loss across the distances involved. Indeed, path loss is even more severe in radar systems than it is in radio communications. To provide persistent (or near persistent) monitoring from LEO, a very large number of satellites (100) would be required to detect short-lived events. However, even though such a solution may be technically possible, a satellite constellation development of this scale may not be economically viable. The PASSAT project was proposed and undertaken by the University of Birmingham, under the sponsorship of the UK Defence Science and Technology Laboratory, to analyse the concept of a fully passive (receive only) spaceborne SAR system based on a constellation of microsatellites. By making use of terrestrial transmitters (we propose to use ground-based broadcasting systems, i.e. DVB-T, DAB, FM radio and similar as transmitters of opportunity), the problem of having to carry a high power pulsed radar transmitter on a microsatellite is eliminated. Instead, the satellite only need carry a suitable receiver, antenna and signal storage facility. It is expected that such a system will: (i) provide imaging of a monitored area with a potentially achievable resolution of 2-3 m in either direction; (ii) cover mainly populated parts of the Earth and, partly, littoral waters; (iii) its costs will be orders of magnitude less in comparison to an equivalent active spaceborne SAR constellation. In addition we may expect more information-rich images, as we are dealing with a multi-static, multi-frequency (VHF/UHF) system which effectively has no equivalent at present. In this paper, we report the results of a series of ground-based and airborne trials of the system, around Birmingham, Coventry and Bruntingthorpe Airfield, which make use of DVB-T transmissions from the Sutton Coldfield transmitter at ranges up to 46km. In the processed images, roads, wind turbines, hedgerows and trees are all clearly identified. We also discuss a proposed spaceborne demonstrator, based on a 12U CubeSat platform with a deployable high-gain UHF helical antenna.