

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

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DESIGN AND PROOF OF CONCEPT TESTING OF A PASSIVE IMAGING RADAR
CONSTELLATION FOR NEAR-PERSISTENT EARTH OBSERVATION - PASSAT**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, the emphasis is on the PASSAT space segment investigation and the experimental results of passive SAR imaging with DVB-T transmissions undertaken at the University of Birmingham using a local DVB-T transmitter. Both aspects finalise the PASSAT proof of concept. Various spacecraft platforms are studied, ranging from CubeSats to small 50kg microsattellites, and the advantages and disadvantages of various constellation configurations are given.