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MULTISTATIC SMALL SATELLITE NETWORK FOR OIL MONITORING IN NIGERIA

Abstract

The requirement for more sophisticated methods for monitoring the widespread oil resources within Nigeria has been evident. The use of Synthetic Aperture Radar (SAR) systems is particularly appealing since this payload unaffected by adverse weather conditions and independent of sunlight for its operation. The all-weather capability of SAR makes it the most suitable remote sensing platform for monitoring environmental disasters such as oil spillage which could be highly "elusive" to optical sensors such as NigeriaSat-2. The application of interest for this proposed mission is detection of oil spillage and oil bunkering within and around the Gulf region. In this paper, we discuss aspects of the mission design, including the mission objectives and brief satellite design. The user requirement of high resolution SAR images, near-real-time data, low revisit time and low mission cost are the main drivers of the mission. Paper also describes the analysis involving selection of SAR frequency, consistent with providing high resolution images and low spacecraft mass. A discussion on the trade-off analysis between a near polar orbit and near equatorial orbit for reduced revisit time is presented. Altitude selection as a function of available pulse repetition frequency (PRF), consistent with range and azimuth ambiguities is also highlighted. Furthermore, to meet coverage and revisit time requirements with due consideration for cost of the mission, an optimised system consisting of a few number of small SAR satellites is described. Satellites within the constellation will fly in close formation and maintain fixed across track and radial baseline distances that enable possible interferometric applications. Finally, the paper will conclude with a brief description of the small SAR network system operating solely with equatorial region, for monitoring oil spillage disaster and oil bunkering activities within and around the Gulf of Guinea.