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ANALYZING LATEST SDA DATA TO HYPOTHETICALLY ALLOCATE NUMBER OF ON-GROUND AND IN-SPACE OPTICAL SENSORS PER COUNTRY/SECTOR THROUGH IMPLEMENTATION OF SMALL AND LONG ARC ORBIT DETERMINATION TECHNIQUE FOR DEVELOPMENT OF ACCURATE SPACE TRAFFIC

Abstract

The total number of Resident Space Objects (RSOs) is exponentially increasing with booming Commercial Space or Space 4.0. These RSOs can be categorized to the country and sector (government, agency, commercial) of origin. In this cluttered space environment, it is vital to ascertain the requisite number of on-ground and in-space Space Situational Awareness (SSA) sensors for the development of a safe Space Traffic Management (STM) system. This can be done using parametric analysis of the number of accountable anthropogenic space objects and attributing them to their country and sector of origin. This paper investigated the number of astrometric measurements needed for accountable RSOs in different orbital regimes using short and long arc orbital determination. Using the number of measurements, the number of sensors was modelled, considering the orbital characteristics of different orbital regimes. The sensors were then allocated into on-ground and in-space categories by analyzing the requisite number of passes needed overland through optical observatories and in space through SSA satellites. By combining on-ground (when RSO passes overland) and in-space (when RSO passes over oceans) astrometric measurements, initial/routine orbit determination was computed, thus yielding a preliminary model for an accurate and global STM system. Moreover, the number of sensors needed was allocated per country using a parametric approach to determine contributory share per country. Furthermore, the number of RSOs attributed to the government and the commercial sector would also be investigated to derive the requisite contribution of sensors from the sectors mentioned above. Lastly, the limitations of optical sensors were commented upon, and sensor fusion with radar, laser, and RF sensors will be proposed for future enhancement of the proposed global STM system.