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SENTINEL-1C&D SPACECRAFT UNCONTROLLED RE-ENTRY PREDICTIONS

Abstract

The Space Debris Mitigation (SDM) regulations requires minimization of debris production during satellite lifetime and limitation of in-orbit parking after EoM. The European Member States are called to apply the normative to new Spacecraft design for launches from 2020. The Copernicus Sentinel-1 is a project of the European Commission. The European Space Agency (ESA) acts as procurement agency on behalf of the European Commission, Thales Alenia Space Italy (TAS-I) is the prime contractor and Airbus DS GmbH (ADS) is the Synthetic Aperture Radar (SAR) Instrument contractor. The Sentinel-1 is a two SAR satellites constellation composed of the Sentinel-1A, Sentinel-1B, launched respectively in 2014 and 2016. Sentinel-1C and future Sentinel-1D, scheduled for launch from 2021 will replace S1A and B model, with an expected operational life until the end of the 2020ies or later. The S-1C and D satellite will be placed in the same Sun-Synchronous, near-polar, circular orbit of S-1A and B one. The spacecrafts, three axis stabilized spacecraft with a total mass of maximum 2300 kg (at time launch) and main dimensions in flight configuration of about 3.9 x 2.6 x 2.5 m, have near-identical technical capabilities. On the basis of S-1A and B uncontrolled re-entry analyses, which was found marginally non-compliant to the casualty risk requirement, new SDM technologies solutions have been adopted on S-1C and D with respect to S-1A and B baseline to meet compliance with space debris mitigation policies. Although most of the mass of the spacecraft is destroyed and rendered harmless, due to the mass of Sentinel spacecraft, it can be expected that still parts of the satellite will survive the re-entry into the Earth's atmosphere. To assess the new Spacecraft design in terms of on casualty re-entry risk and to verify compliance with SDM requirements TAS-I has committed to HTG the re-entry analyses by means of the dedicated spacecraft oriented software tool (SCARAB). This paper presents S-1C spacecraft's new design changes adopted to fulfill casualty risk requirement, the SCARAB modeling as well as S-1C uncontrolled re-entry analyses and results.