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Mitigation and Standards (4)

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SPACECRAFT DESIGN EVOLUTION TOWARDS SPACE ENVIRONMENT PROTECTION

Abstract

The Space Debris Regulation requires minimization of debris production during Satellite lifetime and limitation of in-orbit parking after EoM. The European Member States are called to strictly apply the Normative to new Spacecraft design for launches from 2020. Large System Integrators are assessing impacts at all levels during Spacecraft Design Phases. In the frame of Italian Space Agency and Ministry of Defense Programmes Thales Alenia Space Italy (TASI) performed a Micrometeoroids and Orbital Debris (MMOD) risk assessment for COSMO Seconda Generazione (CSG) Satellites, to define the potential risks induced by MMOD impacting onto CSG Satellites. The MMOD impact risk analysis calculates the debris ux impinging on the Satellite structure to determine the probability for the Spacecraft to be severely damaged or to lose its control such that a nominal disposal strategy cannot be performed at EoL. Another important topic is the SC disposal at EoL, namely SC passivation and de-orbiting by uncontrolled or controlled re-entry strategy, with related casualty re-entry risk minimisation on-ground. CSG already foresees strategies for EoL passivation: depletion burns to minimize the on board propellant; battery discharge by minimization of the solar power provision (i.e. rotation of the Solar Arrays to minimize the solar incidence on their surface); deactivation of actuators (e.g. pyros) and removal of energy from AOCS actuators. For the next SC generation (launch from 2020) TASI is studying the potential application of technologies in Spacecraft Design that could allow improvements in uncontrolled and controlled re-entry. Uncontrolled re-entry enabling technologies for Propulsion and Power Passivation are under trade-off for TASI PRIMA Platform Satellites as well as D4D improvements aimed at reduction of the number of re-entering fragments on ground can be obtained by System level solutions (e.g. anticipated separation of SC parts) or S/S and equipment level solutions (e.g. improved technologies implementation). For controlled re-entry dedicated Spacecraft functions are aimed at reducing the casualty area to a confined and known zone over the Ocean, by improvement of capabilities in propulsion, AOCS (e.g. bigger or additional tanks, actuators apt to control the Spacecraft in all manoeuvre phases) and at mission and operations level (i.e. communication with ground and on-board autonomy).