

IAF SYMPOSIUM ON SECURITY, STABILITY AND SUSTAINABILITY OF SPACE ACTIVITIES
(E9)

Interactive Presentations - IAF SYMPOSIUM ON SECURITY, STABILITY AND SUSTAINABILITY
OF SPACE ACTIVITIES (IP)

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ASSESSING THE SPACE SUSTAINABILITY RATING OF THE SWISSCUBE MISSION

Abstract

The importance of new frameworks for space debris mitigation is no longer solely discussed from a pure pragmatic environmental standpoint. Emerging services, dedicated to space security and sustainability such as situational awareness providers or entities supporting the establishment of space debris mitigation plans are becoming more tangible. Fifteen years ago, the existence of these services was not evident.

On February 10, 2009, the Iridium-Cosmos collision, involving an active commercial satellite, occurred at an altitude of 776 km with a relative collision velocity of 11.6 km/s. This debris creating event sounded the alarm, highlighting that collisions in space were a tangible threat with potentially severe consequences not only for the objects directly involved but also for all others operating in close orbital regions and lower altitudes. In the same year, in September 2009, a 1U CubeSat named SwissCube was launched into a Sun-Synchronous near-circular orbit at 720 km. During this time, space debris mitigation measures were not routinely implemented for all missions, and the emergence of CubeSats without propulsion capabilities was relatively new. SwissCube was launched in 2009 without a disposal strategy, other than relying on natural decay.

Fifteen later, SwissCube is still in orbit and will remain in space for about 20 more years, hence exceeding best practises for orbital clearance. In the meantime, new regulatory frameworks, norms, standards and incentive mechanisms emerged. As such, the Space Sustainability Rating (SSR), a labelling system evaluating space missions' level of compliance with space debris mitigation best practises, norms, standards, and regulations was created and started operating in 2022. This work depicts SwissCube mission's Space Sustainability Rating assessment.

While SwissCube is a small spacecraft, resulting in a low collision avoidance probability over a fixed time period, its orbital lifetime will exceed the disposal practises recommended by most standards, norm and regulations. As such, an emphasis on the mission index of the rating of SwissCube is presented. This study focusses on understanding how the operational practises for SwissCube, which was launched 15 years ago, compares with current best-practises and how it impacts the SSR evaluation. All rating criteria for the SwissCube will be detailed to detail how the mission would score under an evaluation performed by the Space Sustainability Rating, if launched today. As a prospect, additional analysis regarding what score the mission would achieve if it were larger (smallsat, large satellite) are performed and discussed.