

29th IAA SYMPOSIUM ON SPACE AND SOCIETY (E5)
Space Architecture: Habitats, Habitability, and Bases (1)

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ORDER: SPACE STATION FOR ORBITAL DEBRIS RECYCLING

Abstract

Since the launch of the Sputnik 1 in 1957 the presence of human-made objects in space has drastically increased. As of now, there are about 1900 active satellites orbiting around us, yet they amount to only 10% of artificial objects we currently track in proximity of our planet. The remaining 90% are considered space debris and are mostly the result of decommissioned satellites or upper rocket stages breaking apart after years in orbit. Additionally there are 160 million smaller debris pieces estimated among them, not trackable with present technology. Besides debris of any size posing an imminent risk to all current and future space missions, already in 1978 Donald J. Kessler proposed that once the debris population reaches a certain density, debris collisions could cascade into one another resulting in a distribution of debris in Earth's orbit that would render our satellite networks ineffective and make future spaceflight attempts nearly impossible. This paper outlines the architectural design proposal for a crewed space station that is able to capture and subsequently recycle space debris, viewing it as a potential resource. A mission concept is devised by researching and selecting suitable debris types, orbital regions, capture methods and assembly options. A recycling process and applications for the salvaged material are presented. The architectural emphasis lies on habitability, functionality and an efficient configuration.