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ARIANE 4 H10 TARGET ORBITAL THERMAL ANALYSIS AND IR RECOGNITION

Abstract

Ariane 4 H10 Upper Stage has been considered as reference target for several studies in the frame of active debris removal (ADR) mission design. During close approach and capture phases, it is necessary that the chaser spacecraft is equipped with IR cameras in order to ensure a proper target recognition in every lighting condition. Therefore, temperature gradients expected onto different H10 parts shall be then compared with analysis data, for an accurate target model reconstruction. Temperature detection on target's surfaces is also important for design of an effective capture mechanism. In fact, both mechanical gripping systems and foam concepts are quite sensible to surface's thermal properties. This paper primarily aims to provide the results of different thermal cases, corresponding to four orbital conditions, where the H10 target is expected to be found. In view of future ADR missions, capture versatility w.r.t. different targets is a key driver indeed, thus the four H10 orbital positions have been selected with the aim of covering the broadest range of possibilities: three GTO conditions with three different eccentricities and one LEO condition with the characteristic inclination of 98 degrees. After building an accurate geometry model from heritage data, the ESATAN-TMS orbital module was employed to simulate all orbital cases and heat flux inputs. Transient analyses were finally run in order to obtain a thermal profile for the four different cases. The study then proceeded to analyze extreme temperature conditions expected on H10 Upper Stage surfaces, identifying hot spots and cold spots, assumed as reference areas for IR detectors devices. Moreover, target's surface temperature data will aid in the capture mechanism optimal trade-off and design.