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METHODOLOGY AND RESULTS OF HIGH ENTHALPY WIND TUNNEL AND STATIC DEMISABILITY TESTS FOR EXISTING S/C STRUCTURAL JOINING TECHNOLOGIES

Abstract

The recently introduced discipline of design-for-demise (D4D) is looking for technical solutions on different levels to promote the atmospheric demise of spacecraft and respective components in order to reduce the casualty risk on ground. Previously performed studies revealed that opening the outer satellite structure during re-entry as early as possible helps to improve the overall demise. Therefore, technologies to open and/or release external structural elements and spacecraft modules are needed.

In order to get a better understanding of the behavior during reentry of current structural joining technologies, tests have been performed in high enthalpy wind tunnel and static heat chambers. These were set up to be representative of a number of joining configurations utilised within satellite designs. Samples representing a broad range of options were prepared and tested in both chambers. An overview of test procedures and findings are presented here along with early conclusions and future activities. The samples exhibited a broad range of phenomena and it was seen that a number of different failure scenarios are possible dependent upon joining technology used along with heat flux profile and mechanical loads

applied, among other influencing factors.

The results from these tests will feed into the development of new demisable joining technologies for bread-boarding development and assist in designing similar tests in the near-future. These on-ground activities will help to raise the current understanding of satellite demise and the role that joining technologies play, therefore leading to more informed decisions regarding the ways to increase satellites' break-up altitude in the future reducing the on-ground casualty risk.