**Contribution to the ATD3 Free Flying Ring with MISTRAL-CFD**

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**ABSTRACT:**

These 10 last years, the prediction of the space debris survivability during their re-entry and the associated prospective risk on ground are more and more in the scope of scientific research due to its complex multi-physics modeling and its crucial industrial applications, setting-up a permanent trade-off between fidelity of results and CPU costs. The use of the so-called ”high-fidelity” CFD method able to accurately model the forces and heat fluxes is a major challenge. One of those codes is MISTRAL-CFD, developed by R.Tech over the past 20 years. While originally developed for non-destructive reentry simulations, it has recently been applied to a large number of shapes used in object oriented demise tools (boxes, cylinders, rings) etc. While geometrically simple, those object represent very interesting flow features that are though from a numerical viewpoint (attached shocks, unsteady phenomena etc). Therefore, it is necessary to validate such codes before applying them to such shapes. A campaign on free flying (aero) and fixed shapes (heat fluxes and pressures) was carried out in the VKI financed by CNES, in order to assess the uncertainties in the simulations on such shapes (hollow hemispheres, rings). The use free flight method used in Longshot has been continued since, and one of the runs has been proposed as a test case for ATD3. The test case is focusing on the aerodynamics coefficients on a ring in interaction with a cylinder. MISTRAL has been used to rebuild the experiments, and the results will be compared in terms of aerodynamic coefficients over time, and flow visualization (Schlieren).