## THEMIS: Tracking the health of the environment and missions in space

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Tracking the health of the environment and missions in space is fundamental to ensure the future sustainability of space activities. The THEMIS software tool is being developed by Politecnico di Milano and Deimos UK within a project funded by the European Space Agency. The aim is to assess the impact of a space mission on the space environment to measure the overall Space capacity and the contribution of each mission to it. As scientific developments, the project has devised a probabilistic continuum approach used for describing the evolution in space and time of the density of debris fragments resulting from explosions and collisions in space. This approach is applied on a grid on potential initial conditions to compute the effect that a mission, in case of breakup, has on the active spacecraft population. The THEMIS tool allows the computation of the space debris index of a mission described in mission phases, represented by a set of orbital elements, cross sectional area, mass and operational considerations such as collision avoidance manoeuvre efficacy and post mission disposal reliability. The mission can be inputted to the tool though a web user interface that allows describing different mission architectures such as constellations, launcher and spacecraft and single spacecraft missions. The output of the analysis, given in terms of space debris index per phase, per spacecraft, per end-of-life disposal options can be aggregated into a single mission score to allow the integration in life cycle assessment studies. As part of the ESA project, the DISCOS database is also expanded to be save the results of each analysis for future re-evaluation of the missions and for comparison with other missions. In this way, a comprehensive tool will be available for debris experts and spacecraft operators to evaluate easily the environmental impact of the mission. The paper will present the THEMIS tool implementation with some practical application scenarios.