PEDALS: EVOLVED DESIGN OF EDL ARCHITECTURES

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Following a number of studies in the use of meta-heuristic methods for space applications, we present a simple development of a hybrid genetic algorithm that can 'design' EDL architectures and implicitly perform trade-off studies. To focus the application of such a tool, a secondary objective was to implement a prototype system that could possibly identify concepts for high-altitude landing on Mars, each of which would then need further study using more conventional analysis. Any EDL architecture representable within our study is captured as a list of parameters that includes objective inputs (*e.g.* landed system mass, location), physical measurements (*e.g.* parachute diameter), times (*e.g.* of deployment, release, *etc.*), ordered sequences, and derived parameters (*e.g.* instantaneous descent rate).

Given the limited availability of the POST tools, this short research activity is a case study in the effectiveness of simple low-cost tools, and establishing whether evolutionary algorithms have any place in the mission designer's toolkit. The resulting PEDALS tool concept is a direct coupling of a trajectory simulator with a customised genetic algorithm, implemented in Perl and F90. The trajectory simulator is known to be a coarse approximation, and does not consider variable bank angle or 6DOF effects. The modular design of the tool has however allowed the incorporation of MOLA data for altitude targeting, and Mars-GRAM for more realistic atmospheric flight simulation. The results are compared with prior EDL architectures and with the NASA Entry, Descent and Landing Systems Analysis (EDL-SA) 2008 study as presented at IPPW-7, which are adopted as a family of reference designs. The presentation concludes with recommendations for future steps in this type of work.