New EDLS architecture for small Mars landers

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In order to verify the feasibility of near future exploration missions to Mars, such as Network Science, that are part of the enabling roadmap for subsequent manned missions on the red planet, a preliminary study has been carried out, aimed to define the optimal entry descent and landing system architecture.
Key driver for this study has been the maximum simplification of the entry, descent and landing systems, that means essentially limited GNC and avionics complexity, for a maximum entry mass target of 600 kg.
The study has been carried out considering entry parameters coming from a typical hyperbolic trajectory; in particular an entry velocity of about 5700 m/s and a flight path angle ranging from 12,5 to 13,5 deg was considered for a probe of 600 kg, having the probe a ballistic coefficient of about 79 kg/m^2.
The entry, descent and landing scenario can be summarized as follows:

1. After the hot entry phase (the parameters of which have been described above), at a regime of Mach 1,8, a dynamic pressure of about 700 Pa, an altitude of about 7000 m and a flight path angle of 25,1 deg, an 8 m diameter disc gap band parachute is mortar deployed.
2. After a deceleration of the probe in subsonic regime, at Mach 0,7 and dynamic pressure of 130 Pa, the probe back-shell is released, having the parachute still attached, and a 4 m diameter disc gap band parachute is static line deployed, stabilizing the probe and achieving the proper separation with respect to the previously released back-shell.
3. After 15 seconds the 4 m diameter parachute is released, acting as a pilot for the deployment of a 25 m diameter ring sail parachute, at a Mach regime of 0,6, a dynamic pressure of 110 Pa and an altitude of 3600 m.
4. After additional 15 seconds also the front shield is released at Mach 0,1 and an altitude of about 3000 m.
5. The main parachute is then released, after the inflation of a non vented airbag, at an altitude of 10 m and a vertical velocity of about 18 m/s.

The results of the 3DOF end to end trajectory analysis and the LS-Dyna impact analysis will be presented, demonstrating the feasibility of such mission; a detailed mass budget will be also presented, showing a useful lander mass (touchdown mass without airbag) of more than 150 kg.