

NEXT GENERATION PENETRATOR – METNET FOR MARS

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ABSTRACT

A new kind of planetary exploration mission for Mars is being developed in collaboration between the Finnish Meteorological Institute (FMI), Lavochkin Association (LA), Space Research Institute (IKI) and Instituto Nacional de Técnica Aeroespacial (INTA). The Mars MetNet mission is based on a new semi-hard landing vehicle called MetNet Lander (MNL).

The main idea behind the MetNet landing vehicles is to use a state-of-the-art inflatable entry and descent systems instead of rigid heat shields and parachutes as earlier semi-hard landing devices have used. This way the ratio of the payload mass to the overall mass is optimized, and more mass and volume resources are spared for the science payload. The vehicle decelerates its entry speed using the inflatable structure and final landing sequence includes a cone headed body penetrating the Martian soil

The MNL atmospheric descent process by convention can be partitioned into two phases: 1. Aerodynamic braking phase and 2. The phase of the MNL descent on the additional IBU.

At the first stage braking is executed by use of the inflatable braking device of torus shape. At this stage the main vehicle speed reduction takes place from hypersonic speed at the atmospheric entry moment to the speed, which is acceptable for the additional IBU deployment. For MNL braking at the second, final, stage of descent in atmosphere, the additional inflatable braking is used. In putting of additional IBU into operation (filling) the aerodynamic braking device is separated from the MNL. The separation of the aerodynamic braking device and the penetrated part with the filled AIBD is provided due to a difference of ballistic parameters.

The scientific scope of the MetNet Mission is eventually to deploy several tens of MNLs on the Martian surface using inflatable descent system structures. The MNL will have a versatile science payload focused on the atmospheric science of Mars. The scientific payload of the MetNet Mission encompasses separate instrument packages for the atmospheric entry and descent phase and for the surface operation phase.

The MetNet prototype has been developed and the critical subsystems have been qualified for Martian environmental and functional conditions. The first mission step in the MetNet Mission is to have a MetNet Precursor Mission with a few MNLs deployed to Mars. The MetNet-type of mission is what the Martian atmospheric science currently needs. The MetNet mission will provide the logical next mission tool in the field of Martian atmospheric science.