MARS NEXT MULTIPLE LANDER TARGETING TRAJECTORY COMPUTATION AND NAVIGATION (IPPW-7)

DANIEL GARCÍA YÁRNOZ*, JOSÉ MANUEL SÁNCHEZ PÉREZ

GMV
e-mail: *Daniel.Garcia@esa.int*

ESA/ESOC OPS-GFA
e-mail: *Jose.Manuel.Sanchez.Perez@esa.int*

ABSTRACT

The MarsNEXT mission is a technology demonstrator precursor to a future Mars Sample Return mission in the context of the Aurora program. One of its objectives is the targeting and deployment of a number of small landers to the surface of Mars.

This paper provides a brief description of the algorithms implemented for the generation of trajectories consecutively deploying multiple landers, and finally inserting an orbiter around Mars. It also summarizes the results of a targeting and navigation analysis of three landers up to the Entry Interface Point (EIP). The two cases presented are representative of MarsNEXT current mission design.

The results of the analysis show:

- Errors in the lander release mechanism induced ΔV establish a minimum error in flight path angle (FPA) for each separation date, as no control or corrections of the lander trajectory after separation is assumed. This limits the earliest day that the first lander can be released. Retrograde trajectories present smaller errors in FPA than posigrade ones.
- Execution errors of the retargeting deterministic manoeuvres are the biggest contributors of errors in FPA at EIP. A cleanup trajectory correction manoeuvre (TCM) after each retargeting manoeuvre and before next lander separation is required to reduce FPA errors to acceptable levels.
- An effective measure to mitigate the effect of these errors and increase the accuracy of the TCMs is the planning of daily ΔDOR measurements after retargeting manoeuvres to quickly recover the knowledge. The inclusion of daily ΔDOR measurements from two baselines should be a requirement during the approach, release of landers and insertion at Mars.

Most of these results apply to a generic MarsNEXT multiple landers deployment problem, and two particularly attractive deployment sequences have been presented and analysed in more detail.