Gemopt

GENERIC MANEUVER OPTIMIZATION SOFTWARE

The Generic Maneuver Optimization Software (***Gemopt***) is a software application intended to prepare, optimize, analyze, and visualize a generic maneuver planning for a space mission independently of the number of satellites or the orbital regime.

The software allows computing maneuver sequences for all the operational phases of a mission, from launch to decommissioning and disposal, such as station acquisition, station-keeping, slot relocation, recovery, and disposal/deorbiting maneuvers.

The software considers generic operational constraints during the design and the optimization of the maneuver sequence. Optimization constraints can be defined as absolute in mean orbital elements or relative to the target or reference orbit.

This software is based on the reuse of GMV's ***focussuite*** software. The computational layer of the software inherits all the capabilities and experience gained by GMV during the development of maneuver optimization software for many operational missions in the different orbital regimes.

Four main modes are available for the computation of maneuvers:

1. **Station-keeping**. LEO and GEO modes are available, where the typical orbital parameters for each one of these orbital regimes can be controlled, such as inclination, SMA, LTAN...
2. **GEOLEOP** mode: where the maneuvers needed for orbital transfer to GEO orbit can be computed.
3. **RELOC** mode: where the maneuvers needed for RELOCATION in any orbit can be computed.
4. **MANUAL**. Special expert mode where it is possible to define:
    a. Maneuver epoch: either by giving as input the precise maneuver date, the initial maneuver date as well as the repetition frequency or the condition in orbital parameters to trigger a maneuver (for example, when the SMA falls lower than a certain value).
    b. Maneuver magnitude: either by giving as input the precise dV of the maneuver in RTN reference frame, the target orbit to reach or the deltas in orbital parameters.

    This mode allows computation of all the different maneuver types but requires certain previous knowledge coming from the user.

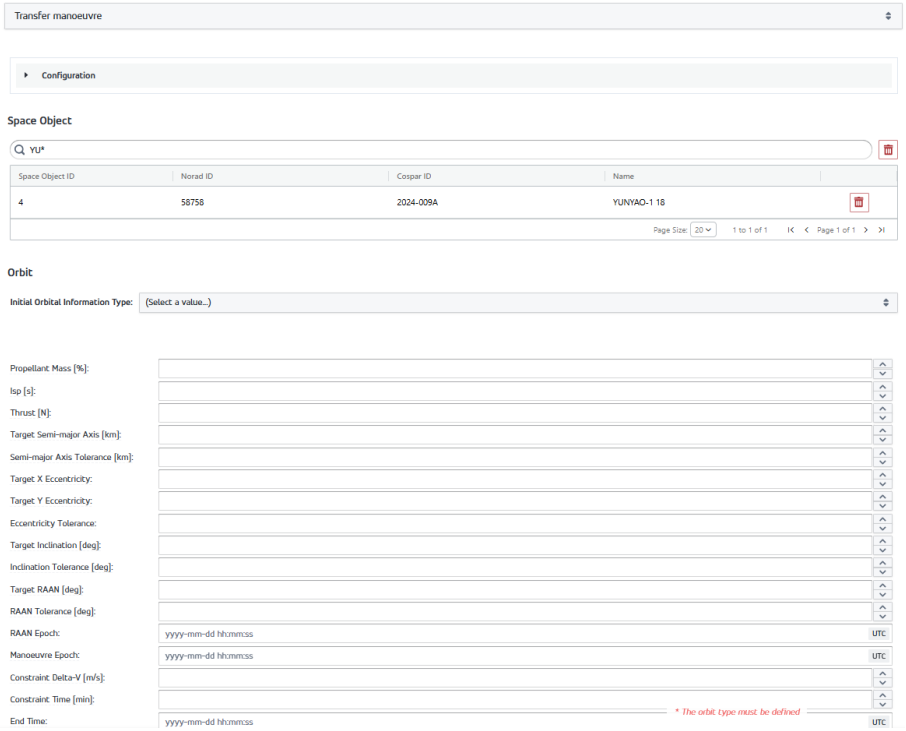

Figure 1: Example of configuration options for Transfer Manoeuvre mode from ***Gemopt***

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5. **SLOT** mode: it is used to generate the slots for a constellation of satellites. These slots can be used as target for any of the previous modes. The constellation slots can either be created manually (by providing the orbital parameters of each of the slots in the constellation) or as a Walker constellation (delta or star).
6. **Launch operations design** mode: design of a launch with a custom launch site, launcher and target orbit.

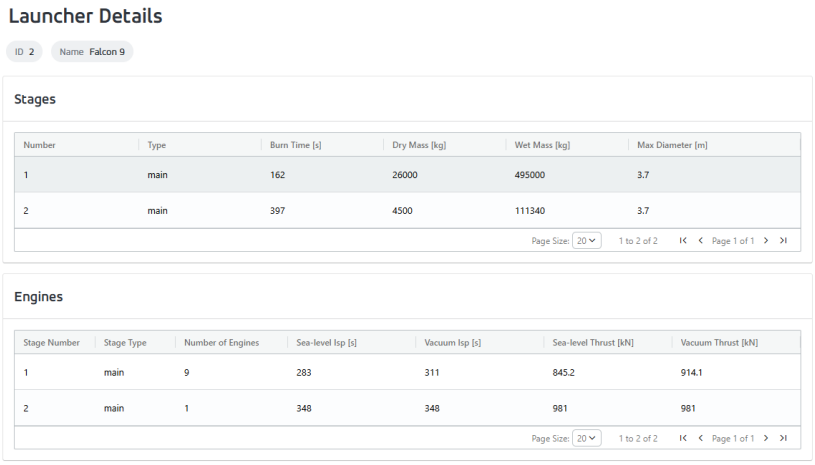

Figure 2: Example of Launcher details from ***Gemopt***

7. **Controlled reentry design** mode: design of a controlled reentry with the possibility to select a desired impact point on Earth together with a time window frame.

As outputs of the ***Gemopt*** tool, updated orbit files including the maneuver strategy computed in each case is generated in CCSDS format. Moreover, the mass history of the satellites is maintained. Evolution plots of the orbital parameters under control are also generated as well as a time plot of the maneuvers. Finally, 3D/2D visualization of the initial and target orbit together with the maneuvers can be shown.

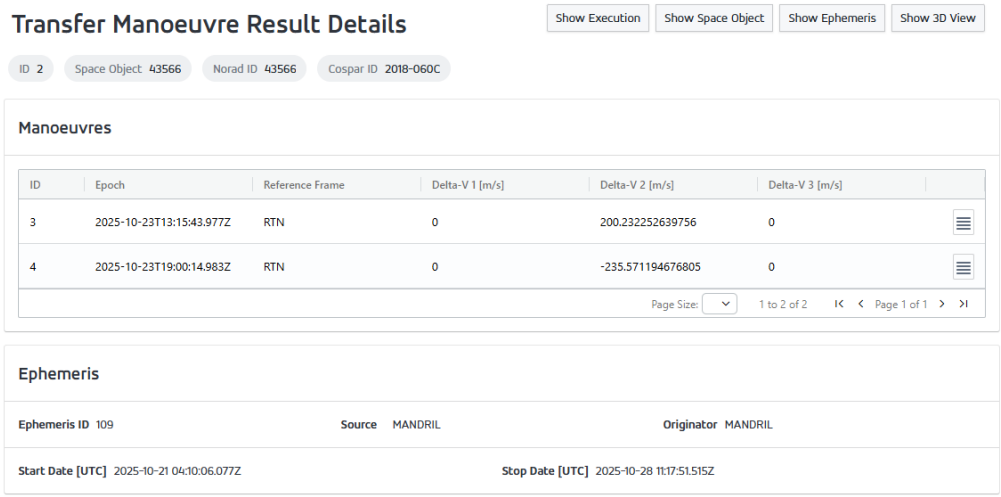

Figure 3: Example of Transfer Manoeuvre result page from ***Gemopt***

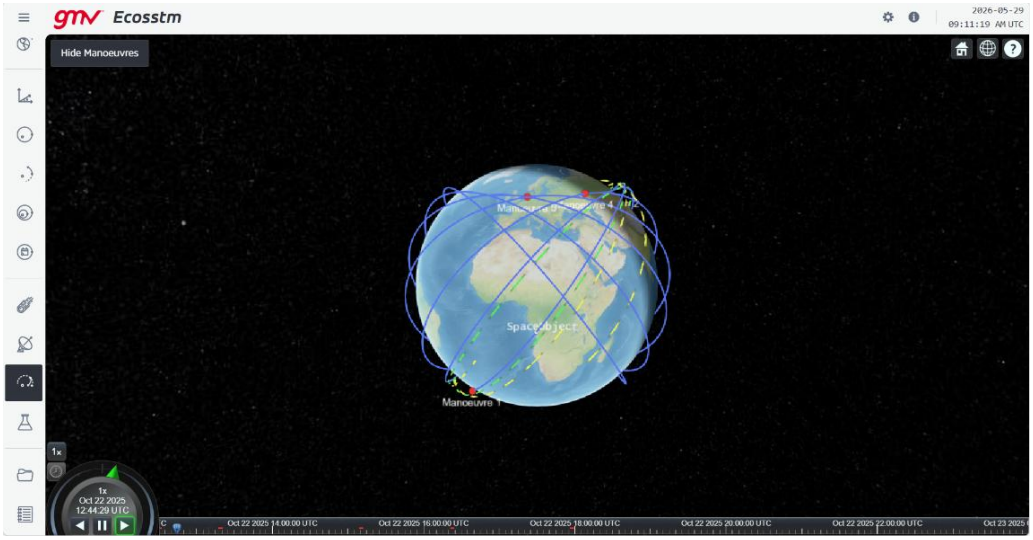

Figure 4: Example of 3D visualization of a Transfer Manoeuvre (initial orbit, yellow; final orbit, green) from ***Gemopt***

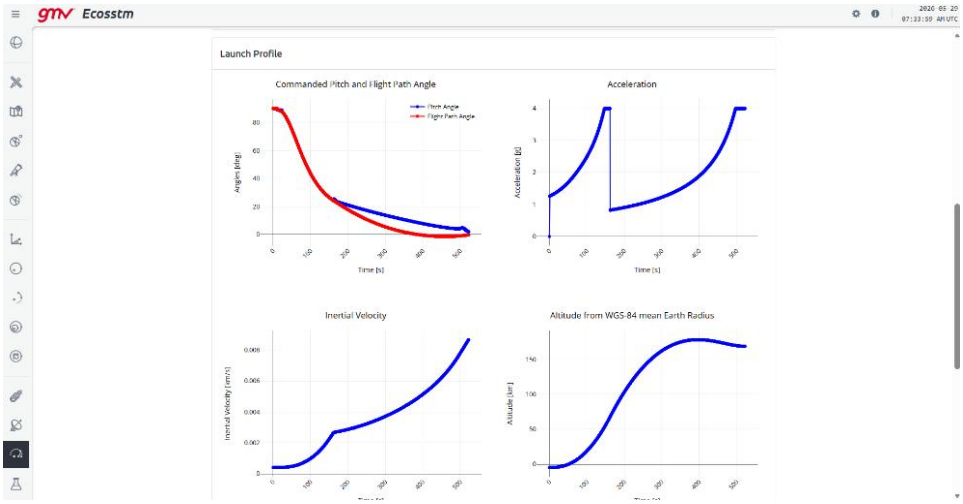

Figure 5: Example of launch profile from ***Gemopt***

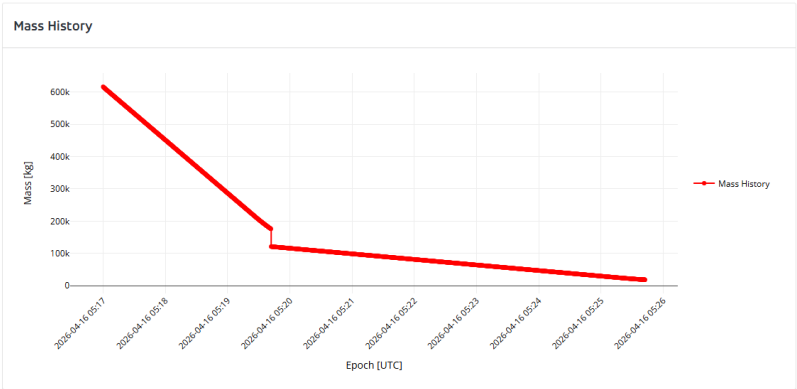

Figure 6: Example of mass evolution history from ***Gemopt***