

SITAEEL

THOR

The simulation Tool for sHort and medium ORbital propagation (THOR), was developed in framework of the VEGA VV-01 by SITAEEL in collaboration with the University of Bologna (IT). The simulation tool was validated by means of a comparison in terms of output data with a propagation tool based on the Orbit Determination via Improved Normal Equations (ODIN) software of the European Space Agency. The simulation tool implements a 4th order Runge Kutta numerical integrator to propagate the launcher upper stage Euler rigid-body equations of motion and to reconstruct the orbital dynamics of the released payloads.



The spacecraft release from the upper stage is modeled through an initial Δv imposed by the separation system, that represents the initial conditions for the numerical integrator. The timing of the events and the release sequence is modeled by a finite state machine approach where each state represents a single instant of separation.

The software tool is suitable for batch and Monte Carlo statistical analysis to investigate the payload orbital propagation and pollution analysis with the main objective to provide an assessment of compliance with respect to the international space debris mitigation regulations. Hence THOR simulator is suitable to provide the initial orbital elements by means of the TLE format, in order to support the Flight Control department in early tracking operations.

The fully success of the VEGA VV-01 launch has qualified the THOR simulation tool by means of collision avoidance as prescribed by the international space debris mitigation guidelines.

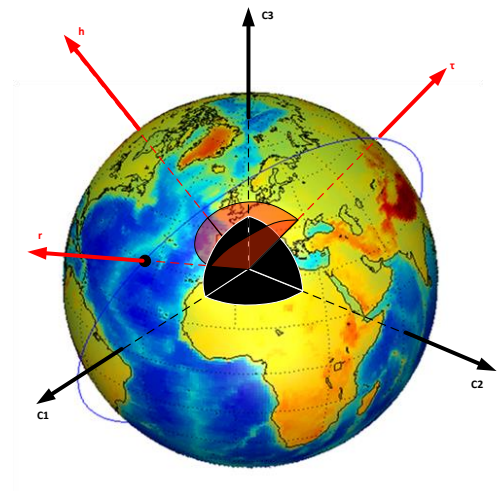
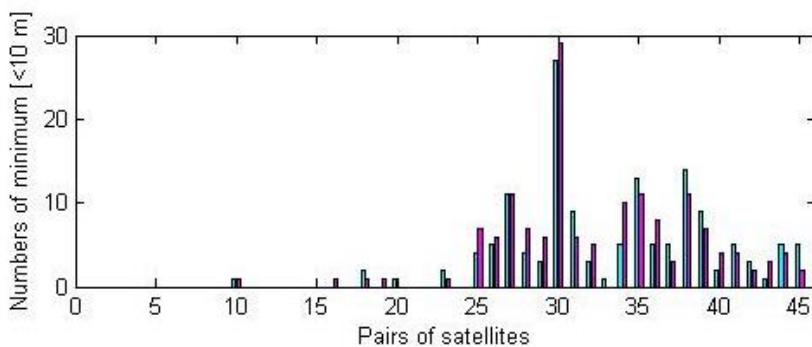
Technical Information

Environmental models:

- Gravity field perturbation model used is the JGM-3, up to degree and order 70th
- Aerodynamic perturbation based on NRLMSISE-00 model
- Solar radiation pressure

Post-Processing:

- Close approach and minimum distance of released object evaluation
- Impact energy statistical analysis
- TLE generation
- Numerical data export



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