03/4103 Assessment of mission design including utilisation of libration points and weak stability boundaries

Type of activity: Fast Study (2 months, 15 KEUR)

Recent studies on restricted three- and four-body problems have paved the way to innovative type of transfer trajectories within the solar system exploiting the dynamics of Lagrangian points. These points can be actually seen as gateways for the exploration of the solar system or as stationary points in space that can be exploited effectively for interesting applications.

A complete and clear understanding of all potential utilisations of libration points and weak stability boundaries in relation to their dynamical characteristics is still missing. An assessment at mission design level is required to identify the most interesting uses of these regions either as gateways or as stationary points. In fact the convenience of locating a spacecraft in orbits around a libration point or of exploiting WSB for escape or capture could be limited in relation to other mission requirements (as transfer time or launch window extension) though the cost in terms of propellant consumption could be reduced with respect to other designs.

In summary the study aims at:

- Identification of the most interesting uses of libration points either as gateways for interplanetary missions or as stationary points
- Assessment, from a mission design point of view, of the actual convenience (time, launch window, cost, complexity, etc…) of using libration points

References

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[2] Gomez G.,Koon W.s., Lo M.W., Marsden J.E., Masdemont J., Ross S.D. Invariant Manifolds, the Spatial Three-Body Problem and Space Mission Design AAS/AIAA Astrodynamics Specialist Meeting, Qubec City, Canada, August 2001, Paper AAS 01-301.
[3] Mendell W.W. A Gatway for Human Exploration of Space? The Weak Stability Boundary. Space Policy 00, 2001