JPL

Jet Propulsion Laboratory

INTEROFFICE MEMORANDUM

DATE: 9/29/00
TO: Al Cangahuala and Distribution (Email)
FROM: Martin Lo
SUBJECT: LTool Version 1.0G Delivery Memorandum

LTool Delivery

LTool Version 1.0G was delivered on 9/22/00 to TMOD and the Genesis Project. This is the first delivery of LTool since the inception of the project in FY97. During an informal review given to Section 312 management on 9/21/00, the Genesis Trajectory Engineer, Dr. Roby Wilson, said that ***LTool 1.0G has reduced the time required to generate a single end-to-end trajectory for the Genesis Mission "from 6 weeks to a few hours".*** During the testing phase this summer, Caltech students Christian Thomas and James Turpin successfully found a free transfer from the Kuiper Belt to the Asteroid Belt mimicking the motions of comets using LTool. These two applications demonstrate the functionality, generality, and power of LTool 1.0G.

LTool 1.0G Salient Features and Capabilities

LTool is a general purpose multimission trajectory design tool; although LTool has specialized modules for the design of missions which use the dynamics of the Lagrange points. LTool is not a monolithic program. LTool is an interactive astrodynamic calculator similar in spirit to Matlab. LTool is designed with state-of-the-art object oriented technology which provides some unique features that greatly simplify the manipulation of trajectories. In particular, LTool provides an interactive, user programmable differential corrector with constraints. This permits the automatic computation of complex trajectories like the end-to-end trajectory for the Genesis Mission.

In LTool, the trajectory and derived quantities, such as the state transition matrix, are represented as continuous functions of time similar to SPK files for the ephemeris. However, LTool trajectories can be operated on algebraically globally without the specification of coordinates or units. Coordinates and units are automatically tracked by LTool through all of the calculations. When numeric quantities are required, users must explicitly specify the coordinates and units. Hence, opportunities for coordinates and units errors are greatly reduced, if not eliminated.

Acknowledgments

The LTool Team is extremely thankful to the TI Committee, the Genesis Project, TMOD/TMOT/TAP Management, the LTool Review Board, Section 312 Management, Division 31 and 36 Management, CSMAD, Charles Elachi, David Swenson, and Chuck Holmes for providing the support and guidance for the development of LTool. We also thank our university partners at Barcelona, Caltech, Michigan and Purdue without whose expertise, generosity, and co-funding LTool could not have been realized. We give special recognition to our Purdue partners whose tools and algorithms were prototypes for LTool and formed the basis of LTool's astrodynamics capabilities. Finally, we thank the Genesis Project Management and the Genesis Navigation and Mission Design Team for their tireless support and belief in LTool.