Jettison Engineering Trajectory Tool

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The Jettison Engineering Trajectory Tool (JETT) performs the jettison analysis function for any orbiting asset. It provides a method to compute the relative trajectories between an orbiting asset and any jettisoned item (intentional or unintentional) or sublimating particles generated by fluid dumps to assess whether an object is safe to jettison, or if there is a risk with an item that was inadvertently lost overboard. The main concern is the interaction and possible recontact of the jettisoned object with an asset. This supports the analysis that jettisoned items will safely clear the vehicle, ensuring no collisions.

The software will reduce the jettison analysis task from one that could take days to complete to one that can be completed in hours, with an analysis that is more comprehensive than the previous method. It provides the ability to define the jettison operation relative to International Space Station (ISS) structure, and provides 2D and 3D plotting capability to allow an analyst to perform a subjective clearance assessment with ISS structures.

The developers followed the SMP to create the code and all supporting documentation. The code makes extensive use of the object-oriented format of Java and, in addition, the Model-View-Controller architecture was used in the organization of the code, allowing each piece to be independent of updates to the other pieces. The model category is for maintaining data entered by the user and generated by the analysis. The view category provides capabilities for data entry and displaying all or a portion of the analysis data in tabular, 2D, and 3D representation. The controller category allows for handling events that affect the model or view(s). The JETT utilizes orbital mechanics with complex algorithms. Since JETT is written in JAVA, it is essentially platform-independent.

This work was done by Mariusz Zaczek of Johnson Space Center; and Patrick Walter, Joseph Pascucci, Phyllis Armstrong, Patricia Hallbick, Randal Morgan, and James Cooney of the United Space Alliance. Further information is contained in a TSP (see page 1). MSC-25271-1

MPST Software: grl_suppdoc

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Due to the nature of the GRAIL mission, the GRAIL Mission Planning and Sequence Team (MPST) is required to generate ground and uplink products faster than ever done before. The existing correct_transmitter_min_dur tool that provides a similar function to grl_suppdoc lacks the ability to operate accurately or quickly enough to support the rapid turnaround required of the GRAIL MPST.

The GRAIL MPST was required to build this new tool to facilitate the ground and uplink generation processes to meet a tight sequence development timeline.

The grl_suppdoc tool enables the GRAIL MPST to generate automatically Deep Space Network (DSN) transmitter suppressions based on short uplinks that are found in the ground/modeled Predicted Events File (PEF).

The grl_suppdoc script automatically generates applicable DSN uplink suppressions in the form of a Spacecraft Activity Sequence File (SASF) to protect the GRAIL project from short DSN uplink windows, which can be cause for operator error at the DSN antennas. Currently, no software exists that provides this functionality at the efficiency required for GRAIL sequence team operations. Compared to a manual process, this script reduces human error and saves considerable man-hours by automating and streamlining the mission planning and sequencing task for the GRAIL mission.

This work was done by Jared A. Call and John H. Kwok of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.

This software is available for commercial licensing. Please contact Dan Broderick at Daniel.F.Broderick@jpl.nasa.gov. Refer to NPO-48659.

PredGuid+A: Orion Entry Guidance Modified for Aerocapture

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PredGuid+A software was developed to enable a unique numerical predictor-corrector aerocapture guidance capability that builds on heritage Orion entry guidance algorithms. The software can be used for both planetary entry and aerocapture applications. Furthermore, PredGuid+A implements a new Delta-V minimization guidance option that can take the place of traditional targeting guidance and can result in substantial propellant savings.

PredGuid+A allows the user to set a mode flag and input a target orbit's apoapsis and periapsis. Using bank angle control, the guidance will then guide the vehicle to the appropriate post-aerocapture orbit using one of two algorithms: Apoapsis Targeting or Delta-V Minimization (as chosen by the user).

Recently, the PredGuid guidance algorithm was adapted for use in skip-entry scenarios for NASA's Orion multi-purpose crew vehicle (MPCV). To leverage flight heritage, most of Orion's entry guidance routines are adapted from the Apollo program.

This work was done by Jarret Lafleur of Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-25199-1