Data Distribution System (DDS) and Solar Dynamic Observatory Ground Station (SDOGS) Integration Manager

The DDS SDOGS Integration Manager (DSIM) provides translation between native control and status formats for systems within DDS and SDOGS, and the ASIST (Advanced Spacecraft Integration and System Test) control environment in the SDO MOC (Solar Dynamics Observatory Mission Operations Center).

This system was created in response for a need to centralize remote monitor and control of SDO Ground Station equipments using ASIST control environment in SDO MOC, and to have configurable table definition for equipment. It provides translation of status and monitoring information from the native systems into ASIST-readable format to display on pages in the MOC.

The manager is lightweight, user friendly, and efficient. It allows data trending, correlation, and storing. It allows using ASIST as common interface for remote monitor and control of heterogeneous equipments. It also provides failover capability to back up machines.

This work was done by Kim Pham and Thomas Bialas of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-16020-1

Eclipse-Free-Time Assessment Tool for IRIS

IRIS_EFT is a scientific simulation that can be used to perform an Eclipse-Free-Time (EFT) assessment of IRIS (Infrared Imaging Surveyor) mission orbits. EFT is defined to be those time intervals longer than one day during which the IRIS spacecraft is not in the Earth's shadow. Program IRIS_EFT implements a special perturbation of orbital motion to numerically integrate Cowell's form of the system of differential equations. Shadow conditions are predicted by embedding this integrator within Brent's method for finding the root of a nonlinear equation. The IRIS_EFT software models the effects of the following types of orbit perturbations on the long-term evolution and shadow characteristics of IRIS mission orbits:

- Non-spherical Earth gravity,
- Atmospheric drag,
- Point-mass gravity of the Sun, and
- Point-mass gravity of the Moon.

The objective of this effort was to create an in-house computer program that would perform eclipse-free-time analysis of candidate IRIS spacecraft mission orbits in an accurate and timely fashion. The software is a suite of Fortran subroutines and data files organized as a "computational" engine that is used to accurately predict the long-term orbit evolution of IRIS mission orbits while searching for Earth shadow conditions.

The core algorithms of this software product have been used to solve a variety of unique orbital mechanics and targeting problems. Past applications include lunar shadow requirements for Chandra, perigee decay of geosynchronous transfer orbits due to third-body point-mass perturbations, and prediction of orbital lifetime and decay of Earth satellites.

This work was done by David Eagle of a.i. solutions Inc. for Kennedy Space Center. For additional information, contact David Eagle at (321) 867-8913. KSC-13519

Automated and Manual Rocket Crater Measurement Software

An update has been performed to software designed to do very rapid automated measurements of craters created in sandy substrates by rocket exhaust on liftoff. The previous software was optimized for pristine lab geometry and lighting conditions. This software has been enhanced to include a section for manual measurements of crater parameters; namely, crater depth, crater full width at half max, and estimated crater volume. The tools provide a very rapid method to measure these manual parameters to ease the burden of analyzing large data sets.

This software allows for rapid quantization of the rocket crater parameters where automated methods may not work. The progress of spreadsheet data is continuously saved so that data is never lost, and data can be copied to clipboards and pasted to other software for analysis. The volume estimation of a crater is based on the central max depth axis line, and the polygonal shape of the crater is integrated around that axis.

This work was done by Philip Metzger of Kennedy Space Center and Christopher Immer of ASRC Aerospace Corp. Further information is contained in a TSP (see page 1).KSC-13386

MATLAB Stability and Control Toolbox Trim and Static Stability Module

MATLAB Stability and Control Toolbox (MASCOT) utilizes geometric, aerodynamic, and inertial inputs to calculate air vehicle stability in a variety of critical flight conditions. The code is based on fundamental, non-linear equations of motion and is able to translate results into a qualitative, graphical scale useful to the non-expert.

MASCOT was created to provide the conceptual aircraft designer accurate predictions of air vehicle stability and control characteristics. The code takes as input mass property data in the form of an inertia tensor, aerodynamic loading data, and propulsion (i.e. thrust) loading data. Using fundamental non-linear equations of motion, MASCOT then calculates vehicle trim and static stability data for the desired flight condition(s). Available flight conditions include six horizontal and six landing rotation conditions with varying options for engine out, crosswind, and sideslip, plus three take-off rotation conditions. Results are displayed through a unique graphical interface developed to provide the non-stability and control expert conceptual design engineer a qualitative scale indicating whether the vehicle has acceptable, marginal, or unacceptable static stability characteristics. If desired, the user can also examine the detailed, quantitative results.

This work was done by Sean P. Kenny of Langley Research Center and Luis Crespo of the National Institute of Aerospace. Further information is contained in a TSP (see page 1). LAR-17483-1

Patched Conic Trajectory Code

PatCon code was developed to help mission designers run trade studies on launch and arrival times for any given planet. Initially developed in Fortran, the required inputs included launch date, arrival date, and other orbital parameters of the launch planet and arrival planets at the given dates. These parameters include the position of the planets, the eccentricity, semi-major axes, argument of periapsis, ascending node, and inclination of the planets. With these inputs, a patched conic approximation is used to determine the trajectory.

The patched conic approximation divides the planetary mission into three parts: (1) the departure phase, in which the two relevant bodies are Earth and the spacecraft, and where the trajectory is a departure hyperbola with Earth at the focus; (2) the cruise phase, in which the two bodies are the Sun and the spacecraft, and where the trajectory is a transfer el-