Active Mirror Predictive and Requirements Verification Software (AMP-ReVS)

This software is designed to predict large active mirror performance at various stages in the fabrication lifecycle of the mirror. It was developed for 1-meter class powered mirrors for astronomic purposes, but is extensible to other geometries. The package accepts finite element model (FEM) inputs and laboratory measured data for large optical-quality mirrors with active figure control. It computes phenomenological contributions to the surface figure error using several built-in optimization techniques. These phenomena include stresses induced in the mirror by the manufacturing process and the support structure, the test procedure, high spatial frequency errors introduced by the polishing process, and other process-dependent deleterious effects due to light-weighting of the mirror. Then, depending on the maturity of the mirror, it either predicts the best surface figure error that the mirror will attain, or it verifies that the requirements for the error sources have been met once the best surface figure error has been measured.

The unique feature of this software is that it ties together physical phenomenology with wavefront sensing and control techniques and various optimization methods including convex optimization, Kalman filtering, and quadratic programming to both generate predictive models and to do requirements verification. This software combines three distinct disciplines: wavefront control, predictive models based on FEM, and requirements verification using measured data in a robust, reusable code that is applicable to any large optics for ground and space telescopes.

The software also includes state-of-the-art wavefront control algorithms that allow closed-loop performance to be computed. It allows for quantitative trade studies to be performed for optical systems engineering, including computing the best surface figure error under various testing and operating conditions. After the mirror manufacturing process and testing have been completed, the software package can be used to verify that the underlying requirements have been met.

This work was done by Scott A. Basinger 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 Daniel Broderick of the California Institute of Technology at daniel@caltech.edu. Refer to NPO-47667.

Navigation/Prop Software Suite

Navigation (Nav)/Prop software is used to support shuttle mission analysis, production, and some operations tasks. The Nav/Prop suite containing configuration items (CIs) resides on IPS/Linux workstations. It features lifecycle documents, and data files used for shuttle navigation and propellant analysis for all flight segments. This suite also includes trajectory server; archive server; and RAT software residing on MCC/Linux workstations.

Navigation/Prop represents tool versions established during or after IPS Equipment Rehost-3 or after the MCC Rehost.

This work was done by Tomas Bruchmiller, Sanh Tran, Mathew Lee, Scott Bucker, Catherine Bupane, Charles Bennett, Sergio Cantu, Ping Kwong, and Carolyn Propst of the United Space Alliance for Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809.

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act (42 U.S.C. 2457(f)), to The Boeing Company. Inquiries concerning licenses for its commercial development should be addressed to:

Terrance.Mason@Boeing.com or Phone No.: (562) 797-9034
Refer to Boeing ID No. 10-0614 & MSC-24971-1, volume and number of this NASA Tech Briefs issue, and the page number.

Pressure Ratio to Thermal Environments

A pressure ratio to thermal environments (PRatTlE.pl) program is a Perl language code that estimates heating at requested body point locations by scaling the heating at a reference location times a pressure ratio factor. The pressure ratio factor is the ratio of the local pressure at the reference point and the requested point from CFD (computational fluid dynamics) solutions.

This innovation provides pressure ratio-based thermal environments in an automated and traceable method. Previously, the pressure ratio methodology was implemented via a Microsoft Excel spreadsheet and macro scripts. PRatTlE is able to calculate heating environments for 150 body points in less than two minutes.

PRatTlE is coded in Perl programming language, is command-line-driven, and has been successfully executed on both the HP and Linux platforms. It supports multiple concurrent runs. PRatTlE...