available resources. By using a fast, incremental algorithm, goal selection can be postponed in a "just-in-time" fashion allowing requests to be changed or added at the last minute. Thereby enabling shorter response times and greater autonomy for the system under control.

This work was done by Gregg R. Rabideau and Steve A. Chien of Caltech for NASA's Jet Propulsion Laboratory.

This software is available for commercial licensing. Please contact Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-46503.

∑ AutoGNC Testbed

A simulation testbed architecture was developed and implemented for the integration, test, and development of a TRL-6 flight software set called Auto-GNC. The AutoGNC software will combine the TRL-9 Deep Impact AutoNAV flight software suite, the TRL-9 Virtual Machine Language (VML) executive, and the TRL-3 G-REX guidance, estimation, and control algorithms. The Auto-GNC testbed was architected to provide software interface connections among the AutoNAV and VML flight code written in C, the G-REX algorithms in MAT-LAB and C, stand-alone image rendering algorithms in C, and other Fortran algorithms, such as the OBIRON landmark tracking suite.

The testbed architecture incorporates software components for propagating a high-fidelity "truth" model of the environment and the spacecraft dynamics, along with the flight software components for onboard guidance, navigation, and control (GN&C). The interface allows for the rapid integration and testing of new algorithms prior to development of the C code for implementation in flight software.

This testbed is designed to test autonomous spacecraft proximity operations around small celestial bodies, moons, or other spacecraft. The software is baselined for upcoming comet and asteroid sample return missions. This architecture and testbed will provide a direct improvement upon the onboard flight software utilized for missions such as Deep Impact, Stardust, and Deep Space 1.

This work was done by John M. Carson III, Andrew T. Vaughan, David S. Bayard, Joseph E. Riedel, and J. Balaram of Caltech for NASA's Jet Propulsion Laboratory.

The software used in this innovation is available for commercial licensing. Please contact Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO 46557.

∑ Optical Imaging and Radiometric Modeling and Simulation

OPTOOL software is a general-purpose optical systems analysis tool that was developed to offer a solution to problems associated with computational programs written for the James Webb Space Telescope optical system. It integrates existing routines into coherent processes, and provides a structure with reusable capabilities that allow additional processes to be quickly developed and integrated. It has an extensive graphical user interface, which makes the tool more intuitive and friendly.

OPTOOL is implemented using MATLAB with a Fourier optics-based approach for point spread function (PSF) calculations. It features parametric and Monte Carlo simulation ca-

pabilities, and uses a direct integration calculation to permit high spatial sampling of the PSF. Exit pupil optical path difference (OPD) maps can be generated using combinations of Zernike polynomials or shaped power spectral densities. The graphical user interface allows rapid creation of arbitrary pupil geometries, and entry of all other modeling parameters to support basic imaging and radiometric analyses.

OPTOOL provides the capability to generate wavefront-error (WFE) maps for arbitrary grid sizes. These maps are 2D arrays containing digital sampled versions of functions ranging from Zernike polynomials to combination of sinusoidal wave functions in 2D, to functions generated from a spatial frequency power spectral distribution (PSD). It also can generate optical transfer functions (OTFs), which are incorporated into the PSF calculation.

The user can specify radiometrics for the target and sky background, and key performance parameters for the instrument's focal plane array (FPA). This radiometric and detector model setup is fairly extensive, and includes parameters such as zodiacal background, thermal emission noise, read noise, and dark current. The setup also includes target spectral energy distribution as a function of wavelength for polychromatic sources, detector pixel size, and the FPA's charge diffusion modulation transfer function (MTF).

This work was done by Kong Q. Ha of KDA Engineering; Michael W. Fitzmaurice of Swales Aerospace; and Gary E. Moiser, Joseph M. Howard, and Chi M. Le of Goddard Space Flight Center. Further information is contained in a TSP (see page 1).GSC-15720-1