

version — Loci-STREAM version 0.9 — includes an interface with the Portable, Extensible Toolkit for Scientific Computation (PETSc) library for access to enhanced linear-equation-solving programs therein that accelerate convergence toward a solution. The name “Loci” reflects the creation of this software within the Loci computational

framework, which was developed at Mississippi State University for the primary purpose of simplifying the writing of complex multidisciplinary application programs to run in distributed-memory computing environments including clusters of personal computers. Loci has been designed to relieve application programmers of the details of

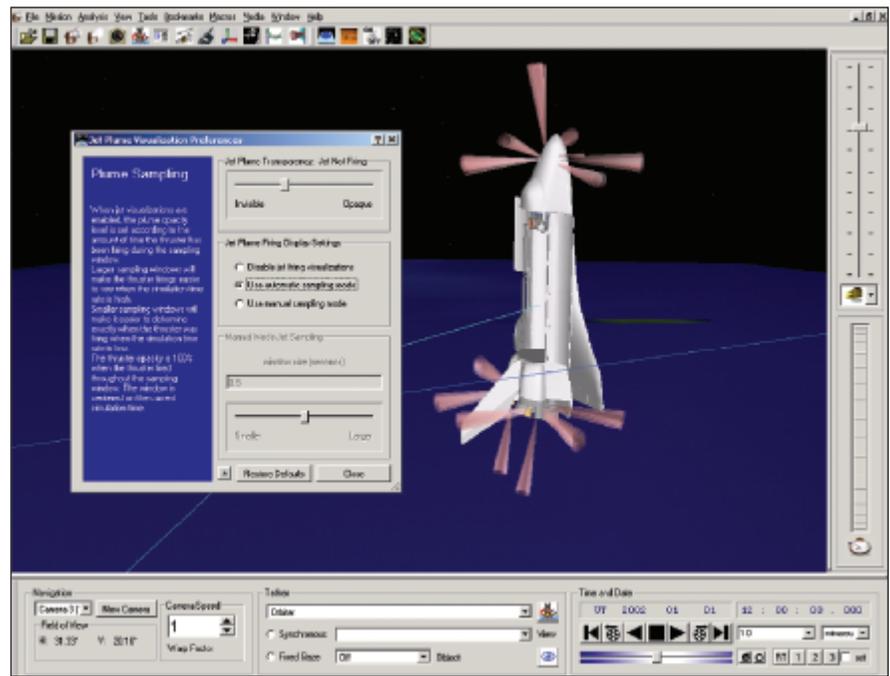
programming for distributed-memory computers.

*This program was written by Jeffrey Wright and Siddharth Thakur of Streamline Numerics, Inc. for Marshall Space Flight Center. Further information is contained in a TSP (see page 1).  
MFS-32303-1*

## The Synergistic Engineering Environment

*Langley Research Center, Hampton, Virginia*

The Synergistic Engineering Environment (SEE) is a system of software dedicated to aiding the understanding of space mission operations. The SEE can integrate disparate sets of data with analytical capabilities, geometric models of spacecraft, and a visualization environment (see figure), all contributing to the creation of an interactive simulation of spacecraft. Initially designed to satisfy needs pertaining to the International Space Station, the SEE has been broadened in scope to include spacecraft ranging from those in low orbit around the Earth to those on deep-space missions. The SEE includes analytical capabilities in rigid-body dynamics, kinematics, orbital mechanics, and payload operations. These capabilities enable a user to perform real-time interactive engineering analyses focusing on diverse aspects of operations, including flight attitudes and maneuvers, docking of visiting spacecraft, robotic operations, impingement of spacecraft-engine exhaust plumes, obscuration of instrumentation fields of view, communications, and alternative assembly configurations. The SEE continues to undergo development at Langley Research Center.



Plumes of Jet Firings can be displayed by the SEE. The user can turn off the firing visualization without disabling the visualization of the location.

*This program was written by Jonathan Cruz of Langley Research Center and Scott Angster of Analytical Mechanics Associ-*

*ates, Inc. Further information is contained in a TSP (see page 1).  
LAR-16842-1*

## Reconfigurable Software for Controlling Formation Flying

*Goddard Space Flight Center, Greenbelt, Maryland*

Software for a system to control the trajectories of multiple spacecraft flying in formation is being developed to reflect underlying concepts of (1) a decentralized approach to guidance and control and (2) reconfigurability of the control system, including reconfigurability of the software and of control laws. The software is organized as a modular

network of software tasks. The computational load for both determining relative trajectories and planning maneuvers is shared equally among all spacecraft in a cluster. The flexibility and robustness of the software are apparent in the fact that tasks can be added, removed, or replaced during flight. In a computational simulation of

a representative formation-flying scenario, it was demonstrated that the following are among the services performed by the software:

- Uploading of commands from a ground station and distribution of the commands among the spacecraft,
- Autonomous initiation and reconfiguration of formations,