Since 2001, this application has been used for pre-mission failure mode training for many Range Safety Scenarios. It contains range asset link analysis, develops look-angle data, supports sky-screen site selection, drives GPS (Global Positioning System) and IMU (Inertial Measurement Unit) simulators, and can support conceptual design efforts for multiple flight programs with its capacity for rapid six-degrees-of-freedom model development. Due to the assembly of various object types into one application, the application is applicable across a wide variety of launch range problem domains.

This work was done by Raymond J Lanzi of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15571-1

✿ Monitoring and Controlling an Underwater Robotic Arm

Lyndon B. Johnson Space Center, Houston, Texas

The SSRMS Module 1 software is part of a system for monitoring an adaptive, closed-loop control of the motions of a robotic arm in NASA's Neutral Buoyancy Laboratory, where buoyancy in a pool of water is used to simulate the weightlessness of outer space. This software is so named because the robot arm is a replica of the Space Shuttle Remote Manipulator System (SSRMS).

This software is distributed, running on remote joint processors (RJPs), each of which is mounted in a hydraulic actuator comprising the joint of the robotic arm and communicating with a poolside processor denoted the Direct Control Rack (DCR). Each RJP executes the feedback joint-motion control algorithm for its joint and communicates with the DCR. The DCR receives joint-angular-velocity commands either locally from an operator or remotely from computers that simulate the flight like SSRMS and perform coordinated motion calculations based on hand-controller inputs. The received commands are checked for validity before they are transmitted to the RJPs. The DCR software generates a display of the statuses of the RJPs for the DCR operator and can shut down the hydraulic pump when excessive joint-angle error or failure of a RJP is detected.

This work was done by John Haas and Brian Keith Todd of Johnson Space Center, Larry Woodcock and Fred M. Robinson of Oceaneering Space Systems, and Thomas (Jay) Costales of Raytheon Co. Further information is contained in a TSP (see page 1). MSC-24165-1

✿ Digital Camera Control for Faster Inspection

Lyndon B. Johnson Space Center, Houston, Texas

Digital Camera Control Software (DCCS) is a computer program for controlling a boom and a boom-mounted camera used to inspect the external surface of a space shuttle in orbit around the Earth. Running in a laptop computer in the space-shuttle crew cabin, DCCS commands integrated displays and controls. By means of a simple one-button command, a crewmember can view low- resolution images to quickly spot problem areas and can then cause a rapid transition to high- resolution images. The crewmember can command that camera settings apply to a specific small area of interest within the field of view of the camera so as to maximize image quality within that area.

DCCS also provides critical high-resolution images to a ground screening team, which analyzes the images to assess damage (if any); in so doing, DCCS enables the team to clear initially suspect areas more quickly than would otherwise be possible and further saves time by minimizing the probability of re-imaging of areas already inspected. On the basis of experience with a previous version (2.0) of the software, the present version (3.0) incorporates a number of advanced imaging features that optimize crewmember capability and efficiency.

This program was written by Katharine Brown, James D. Siekierski, Mark L. Mangieri, Kent Dekome, John Cobarruvias, and Perry J. Piplani of Johnson Space Center and Joel Busa of the Draper Laboratory. Further information is contained in a TSP (see page 1). MSC-24319-1/168-1

◉ Reaction Wheel Disturbance Model Extraction Software — RWDMES

Goddard Space Flight Center, Greenbelt, Maryland

The RMDMES is a tool for modeling the disturbances imparted on spacecraft by spinning reaction wheels. Reaction wheels are usually the largest disturbance source on a precision pointing spacecraft, and can be the dominating source of pointing error. Accurate knowledge of the disturbance environment is critical to accurate prediction of the pointing performance. In the past, it has been difficult to extract an accurate wheel disturbance model since the forcing mechanisms are difficult to model physically, and the forcing amplitudes are filtered by the dynamics of the reaction wheel. RDMES captures the wheel-induced disturbances using a hybrid physical/empirical model that is extracted directly from measured forcing data.

The empirical models capture the tonal forces that occur at harmonics of the spin rate, and the broadband forces that arise from random effects. The em-