visualized by off-the-shelf long-wave and mid-wave cameras.

The opportunity to test this theory presented itself over the last year as the Launch Complex 39 hydrogen tank was taken out of service in order to complete weld repairs.

The ability to detect insulation voids prior to filling with cryogen will save money and time, eliminating the expense of losing cryogen and the months required for chilling down and warming up the tank if a void is discovered after the cryogen is introduced into the system. Potential savings could be in the millions if large voids are detected early.

This work was done by Ellen Arens and Robert Youngquist of Kennedy Space Center. Further information is contained in a TSP (see page 1). KSC-13575

✿ Crush Test Abuse Stand

This technology can be used in most applications for the performance of battery testing.

Lyndon B. Johnson Space Center, Houston, Texas

The purpose of this system is to simulate an internal short on battery cells by causing deformation (a crushing force) in a cell without penetration. This is performed by activating a hydraulic cylinder on one side of a blast wall with a hydraulic pump located on the other. The operator can control the rate of the crush by monitoring a local pressure gauge connected to the hydraulic cylinder or a load cell digital display located at the hydraulic pump control area. The internal short simulated would be considered a worst-case scenario of a manufacturer's defect. This is a catastrophic failure of a cell and could be a very destructive event.

Fully charged cells are to have an internal short simulated at the center of the length of the cell (away from terminals). The crush can be performed with a ¼- to 1-in. (≈0.6- to 2.5-cm) rod placed crossways to the cell axis, causing deformation of the cell without penetration. The OCV (open-circuit voltage) and temperature of the cells, as well as the pressure and crushing force, are recorded during the operation. Occurrence of an internal short accompanied by any visible physical changes such as venting, fires, or explosions is reported. Typical analytical data examined after the test would be plots of voltage, temperature, and pressure or force versus time.

The rate of crushing force can be increased or decreased based on how fast the operator pumps the hydraulic pump. The size of cylinder used to compress the battery cell can be easily changed by adding larger or smaller fittings onto the end of the hydraulic cylinder based on the battery/cell size being tested. The cell is crushed remotely and videotaped, allowing the operator to closely monitor the situation from a safe distance.

This work was done by Jacob Collins, Judith Jeevarajan, and Mike Salinas of Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809. MSC-23700-1

◉ Test Generator for MATLAB Simulations

Goddard Space Flight Center, Greenbelt, Maryland

MATLAB Automated Test Tool, version 3.0 (MATT 3.0) is a software package that provides automated tools that reduce the time needed for extensive testing of simulation models that have been constructed in the MATLAB programming language by use of the Simulink and Real-Time Workshop programs. MATT 3.0 runs on top of the

MATLAB engine application-program interface to communicate with the Simulink engine. MATT 3.0 automatically generates source code from the models, generates custom input data for testing both the models and the source code, and generates graphs and other presentations that facilitate comparison of the outputs of the models and the

source code for the same input data. Context-sensitive and fully searchable help is provided in HyperText Markup Language (HTML) format.

This program was written by Joel Henry of the University of Montana for Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-14861-1

◎ Dynamic Monitoring of Cleanroom Fallout Using an Air Particle Counter

Goddard Space Flight Center, Greenbelt, Maryland

The particle fallout limitations and periodic allocations for the James Webb Space Telescope are very stringent. Standard prediction methods are complicated by non-linearity and monitoring methods that are insufficiently responsive. A method for dynamically predicting the particle fallout in a cleanroom using air particle counter data was determined by numerical correlation.

This method provides a simple linear correlation to both time and air quality, which can be monitored in real time. The summation of effects provides the program better understanding of the

cleanliness and assists in the planning of future activities.

Definition of fallout rates within a cleanroom during assembly and integration of contamination-sensitive hardware, such as the James Webb Space Telescope, is essential for budgeting purposes. Balancing the activity levels for assembly and test with the particle accumulation rate is paramount. The current approach to predicting particle fallout in a cleanroom assumes a constant air quality based on the rated class of a cleanroom, with adjustments for projected work or exposure times. Actual cleanroom class can also depend on the number of personnel present and the type of activities.

A linear correlation of air quality and normalized particle fallout was determined numerically. An air particle counter (standard cleanroom equipment) can be used to monitor the air quality on a real-time basis and determine the "class" of the cleanroom (per FED-STD-209 or ISO-14644). The correlation function provides an area coverage coefficient per class-hour of exposure. The prediction of particle accumulations provides scheduling inputs for activity levels and cleanroom class requirements.

This work was done by Radford Perry of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-16108-1

Enhancement to Non-Contacting Stress Measurement of Blade Vibration Frequency

John H. Glenn Research Center, Cleveland, Ohio

A system for turbo machinery blade vibration has been developed that combines time-of-arrival sensors for blade vibration amplitude measurement and radar sensors for vibration frequency and mode identification. The enabling technology for this continuous blade monitoring system is the radar sensor, which provides a continuous time series of blade displacement over a portion of a revolution. This allows the data reduction algorithms to directly calculate the blade vibration frequency and to correctly identify the active modes of vibration.

The work in this project represents a significant enhancement in the mode identification and stress calculation accuracy in non-contacting stress measurement system (NSMS) technology when compared to time-of-arrival measurements alone.

This work was done by Michael Platt and John Jagodnik of Mechanical Solutions for Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steven Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW- 18602-1.