The Advanced Cockpit Evaluation System (ACES) includes communication, computing, and display subsystems, mounted in a van, that simulate the out-the-window views to approximate the views of the outside world as it would be seen from the cockpit of a crewed spacecraft, aircraft, or remote control of a ground vehicle or UAV (unmanned aerial vehicle). The system includes five flat-panel display units arranged approximately in a semicircle around an operator, like cockpit windows. The scene displayed on each panel represents the view through the corresponding cockpit window. Each display unit is driven by a personal computer equipped with a video-capture card that accepts live input from any of a variety of sensors (typically, visible and/or infrared video cameras).

Software running in the computers blends the live video images with synthetic images that could be generated, for example, from heads-up-display outputs, waypoints, corridors, or from satellite photographs of the same geographic region. Data from a Global Positioning System receiver and an inertial navigation system aboard the remote vehicle are used by the ACES software to keep the synthetic and live views in registration. If the live image were to fail, the synthetic scenes could still be displayed to maintain situational awareness.

This work was done by Jeffrey Fox, Eric A. Boe, and Francisco Delgado of Johnson Space Center; James B. Secor II of Barrios Technology, Inc.; Michael R. Clark and Kevin D. Ehlinger of Jacobs Sverdrup; and Michael F. Abernathy of Rapid Imaging Software, Inc. Further information is contained in a TSP (see page 1).

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Wide-Range Temperature Sensors With High-Level Pulse Train Output
John H. Glenn Research Center, Cleveland, Ohio

Two types of temperature sensors have been developed for wide-range temperature applications. The two sensors measure temperature in the range of −190 to +200 °C and utilize a thin-film platinum RTD (resistance temperature detector) as the temperature-sensing element. Other parts used in the fabrication of these sensors include NPO (negative-positive-zero) type ceramic capacitors for timing, thermally-stable film or wire-wound resistors, and high-temperature circuit boards and solder. The first type of temperature sensor is a relaxation oscillator circuit using an SOI (silicon-on-insulator) operational amplifier as a comparator. The output is a pulse train with a period that is roughly proportional to the temperature being measured. The voltage level of the pulse train is high-level, for example 10 V. The high-level output makes the sensor less sensitive to noise or electromagnetic interference. The output can be read by a frequency or period meter and then converted into a temperature reading.

The second type of temperature sensor is made up of various types of multivibrator circuits using an SOI type 555 timer and the passive components mentioned above. Three configurations have been developed that were
The need for autonomous navigation and intelligent control of unmanned sea surface vehicles requires a mechanically robust sensing architecture that is water-tight, durable, and insensitive to vibration and shock loading. The sensing system developed here comprises four black and white cameras and a single color camera. The cameras are rigidly mounted to a camera bar that can be reconfigured to mount multiple vehicles, and act as both navigational cameras and application cameras. The cameras are housed in watertight casings to protect them and their electronics from moisture and wave splashes.

Two of the black and white cameras are positioned to provide lateral vision. They are angled away from the front of the vehicle at horizontal angles to provide ideal fields of view for mapping and autonomous navigation. The other two black and white cameras are positioned at an angle into the color camera's field of view to support vehicle applications. These two cameras provide an overlap, as well as a backup to the front camera. The color camera is positioned directly in the middle of the bar, aimed straight ahead. This system is applicable to any sea-going vehicle, both on Earth and in space.

This work was done by Eric A. Kulczycki, Lee J. Magnone, Terrance Huntsberger, Hrand Aghazarian, Curtis W. Padgett, David C. Trotz, and Michael S. Garrett of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.

NPO-46372

Terminal Descent Sensor Simulation
NASA’s Jet Propulsion Laboratory, Pasadena, California

Sulcata software simulates the operation of the Mars Science Laboratory (MSL) radar terminal descent sensor (TDS). The program models TDS radar antennas, RF hardware, and digital processing, as well as the physics of scattering from a coherent ground surface. This application is specific to this sensor and is flexible enough to handle end-to-end design validation. Sulcata is a high-fidelity simulation and is used for performance evaluation, anomaly resolution, and design validation.

Within the trajectory frame, almost all internal vectors are represented in whatever coordinate system is used to represent platform position. The trajectory frame must be planet-fixed. The platform body frame is specified relative to arbitrary reference points relative to the platform (spacecraft or test vehicle). Its rotation is a function of time from the trajectory coordinate system specified via dynamics input (file for open loop, callback for closed loop). Orientation of the frame relative to the body is arbitrary, but constant over time.

The TDS frame must have a constant rotation and translation from the platform body frame specified at run time. The DEM frame has an arbitrary, but time-constant, rotation and translation with respect to the simulation frame specified at run time. It has the same orientation as sigma0 frame, but is possibly translated. Surface sigma0 has the same arbitrary rotation and translation as DEM frame.

This work was done by Curtis W. Chen of Caltech for NASA’s Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

This software is available for commercial licensing. Please contact Karina Edmunds of the California Institute of Technology at (626) 395-2322. Refer to NPO-46161.