ther gives the operator a better view of the entry to the bus from the smaller vehicle. Control is passed over to the smaller vehicle and, using video feedback from the camera, it is driven up the ramp, turned oblique into the bus, and then sent down the aisle for surveillance.

The demonstrated vehicle was used to scale the steps leading to the interior of a bus whose landing is 44 in. (≈1.1 m) from the road surface. This vehicle can position the end of its ramp to a surface over 50 in. (≈1.3 m) above ground level and can drive over rail heights exceeding 6 in. (≈15 cm). Thus configured, this vehicle can conceivably deliver the smaller robot to the end platform of New York City subway cars from between the rails. This innovation is scalable to other formulations for size, mobility, and surveillance functions. Conceivably the larger vehicle can be configured to traverse unstable rubble and debris to transport a smaller search and rescue vehicle as close as possible to the scene of a disaster such as a collapsed building. The smaller vehicle, tethered or otherwise, and capable of penetrating and traversing within the confined spaces in the collapsed structure, can transport imaging and other sensors to look for victims or other targets.

This work was done by Michael J. Krasowski, Norman F. Prokop, and Lawrence C. Greer of 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-18673-1.

Automated Verification of Spatial Resolution in Remotely Sensed Imagery

Automated tool assesses image spatial resolution without the need for dedicated edge targets.

Stennis Space Center, Mississippi

Image spatial resolution characteristics can vary widely among sources. In the case of aerial-based imaging systems, the image spatial resolution characteristics can even vary between acquisitions. In these systems, aircraft altitude, speed, and sensor look angle all affect image spatial resolution. Image spatial resolution needs to be verified with estimators that include the ground sample distance (GSD), the modulation transfer function (MTF), and the relative edge response (RER), all of which are key components of image quality, along with signal-to-noise ratio (SNR) and dynamic range. Knowledge of spatial resolution parameters is important to determine if features of interest are distinguishable in imagery or associated products, and to develop image restoration algorithms.

An automated Spatial Resolution Verification Tool (SRVT) was developed to rapidly determine the spatial resolution characteristics of remotely sensed aerial and satellite imagery. Most current methods for assessing spatial resolution characteristics of imagery rely on pre-deployed engineered targets and are performed only at selected times within preselected scenes. The SRVT addresses these insufficiencies by finding uniform, high-contrast edges from urban scenes and then using these edges to determine standard estimators of spatial resolution, such as the MTF and the RER.

The SRVT was developed using the MATLAB® programming language and environment. This automated software algorithm assesses every image in an acquired data set, using edges found within each image, and in many cases eliminating the need for dedicated edge targets. The SRVT automatically identifies high-contrast, uniform edges and calculates the MTF and RER of each image, and when possible, within sections of an image, so that the variation of spatial resolution characteristics across the image can be analyzed. The automated algorithm is capable of quickly verifying the spatial resolution quality of all images within a data set, enabling the appropriate use of those images in a number of applications.

The SRVT has been validated against traditional techniques using IKONOS and QuickBird satellite imagery of NASA Stennis Space Center engineered edge targets. Preliminary comparisons of SRVT-estimated spatial resolution from naturally occurring edges against those obtained using traditional techniques show excellent agreement.

The SRVT can be used to evaluate the image quality of a single image, a product over time, and products from different systems. In addition to the above image quality metrics, the output of the SRVT could be used to estimate National Imagery Interpretability Rating Scale (NIIRS) values for panchromatic imagery, and serve as the basis for developing multispectral image-quality metrics.

This work was done by Bruce Davis of Stennis Space Center, Robert Ryan and Kara Holekamp of Science Systems and Applications, Inc., and Ronald Vaughn of Computer Sciences Corporation. For more information Contact the Office of the Chief Technologist at Stennis Space Center, (228) 688-1929. Refer to SSC-00339.

Electrical Connector Mechanical Seating Sensor

John F. Kennedy Space Center, Florida

A sensor provides a measurement of the degree of seating of an electrical connector. This sensor provides a number of discrete distances that a plug is inserted into a socket or receptacle. The number of measurements is equal to the number of pins available in the connector for sensing.

On at least two occasions, the Shuttle Program has suffered serious time delays and incurred excessive costs simply because a plug was not seated well within a receptacle. Two methods were designed to address this problem: (1) the resistive pin technique and (2) the discrete