

awareness. The situational awareness ratings for the SV PFD were largely due to the egocentric view that gave pilots an immersed sense of terrain around them. Pilot awareness and the capability for avoiding hazardous conditions were significantly enhanced with the addition of

3D exocentric navigation display modes that allowed for a greater field-of-regard to confirm the presence of hazards along their planned routing. The combination of SV primary flight and navigation display concepts allowed pilots to make the best and quickest decisions re-

garding safety of their aircraft.

This work was done by Lawrence J. Prinzel III, Lynda J. Kramer, J.J. Arthur III, and Randall E. Bailey of Langley Research Center and Jason L. Sweeters of NCI Information Systems, Inc. Further information is contained in a TSP (see page 1). LAR-17354

Automated Camera Array Fine Calibration

NASA's Jet Propulsion Laboratory, Pasadena, California

Using aerial imagery, the JPL FineCalibration (JPL FineCal) software automatically tunes a set of existing CAHVOR camera models for an array of cameras. The software finds matching features in the overlap region between images from adjacent cameras, and uses these features to refine the camera models. It is not necessary to take special imagery of a known target and no surveying is required.

JPL FineCal was developed for use with an aerial, persistent surveillance platform. Synchronized images from an array of cameras are captured and stitched together into a single, very high-resolution image that is projected onto an elevation map of the ground. A GUI

(graphical user interface) tool allows the user to play a movie of any part of the imaged surface from any perspective.

JPL FineCal requires, as input, a set of CAHVOR camera models for the camera array. These models are typically developed on the ground using a calibration procedure requiring a known target at a short distance. JPL FineCal corrects the inaccuracy of the camera model extrinsic parameters resulting from the short target distance by using imagery, taken during flight, at an effective distance of infinity. It also makes small improvements to the intrinsic parameters.

JPL FineCal is an automated process that does not require the use of any

special targets, and which may be applied during normal flight operations. Thus, it makes it simple to retune the camera models to correct for small misalignments that occur due to changes in aperture settings, vibration, or thermal changes.

This work was done by Daniel Clouse, Curtis Padgett, Adnan Ansar, and Yang Cheng of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

The software used in this innovation is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-45715.

Multichannel Networked Phasemeter Readout and Analysis

NASA's Jet Propulsion Laboratory, Pasadena, California

Netmeter software reads a data stream from up to 250 networked phasemeters, synchronizes the data, saves the reduced data to disk (after applying a low-pass filter), and provides a Web server interface for remote control. Unlike older phasemeter software that requires a special, real-time operating system, this program can run on any general-purpose computer. It needs about five percent of the CPU (central processing unit) to process 20 channels because it adds built-in data logging and network-based

GUIs (graphical user interfaces) that are implemented in Scalable Vector Graphics (SVG).

Netmeter runs on Linux and Windows. It displays the instantaneous displacements measured by several phasemeters at a user-selectable rate, up to 1 kHz. The program monitors the measure and reference channel frequencies. For ease of use, levels of status in Netmeter are color coded: green for normal operation, yellow for network errors, and red for optical misalignment problems. Netmeter in-

cludes user-selectable filters up to 4 k samples, and user-selectable averaging windows (after filtering). Before filtering, the program saves raw data to disk using a burst-write technique.

This work was done by Shanti Rao 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 Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-45505.

MISR Instrument Data Visualization

NASA's Jet Propulsion Laboratory, Pasadena, California

The MISR Interactive eXplorer (MINX) software functions both as a general-purpose tool to visualize Multi-angle Imaging SpectroRadiometer (MISR) instrument data, and as a spe-

cialized tool to analyze properties of smoke, dust, and volcanic plumes. It includes high-level options to create map views of MISR orbit locations; scrollable, single-camera RGB (red-green-

blue) images of MISR level 1B2 (L1B2) radiance data; and animations of the nine MISR camera images that provide a 3D perspective of the scenes that MISR has acquired.

The plume height capability provides an accurate estimate of the injection height of plumes that is needed by air quality and climate modelers. MISR provides global high-quality stereo height information, and this program uses that information to perform detailed height retrievals of aerosol plumes. Users can interactively digitize smoke, dust, or volcanic plumes and automatically retrieve heights and winds, and can also archive MISR albedos and aerosol properties, as well as fire power and brightness temperatures associated with smoke plumes derived from Moderate Resolution Imaging Spectroradiometer (MODIS) data.

Some of the specialized options in MINX enable the user to do other tasks. Users can display plots of top-of-atmosphere bidirectional reflectance factors (BRFs) versus camera-angle for selected pixels. Images and animations can be saved to disk in various formats. Also, users can apply a geometric registration correction to warp camera images when the standard processing correction is inadequate. It is possible to difference the images of two MISR orbits that share a path (identical ground track), as well as to construct pseudo-color images by assigning different combinations of MISR channels

(angle or spectral band) to the RGB display channels.

This software is an interactive application written in IDL and compiled into an IDL Virtual Machine (VM) “.sav” file.

This work was done by David Nelson of Columbus Technologies and Services Inc.; Michael Garay of Raytheon; David Diner, Charles Thompson, Jeffrey Hall, Brian Rheingans, and Dominic Mazzoni 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 Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-45744.

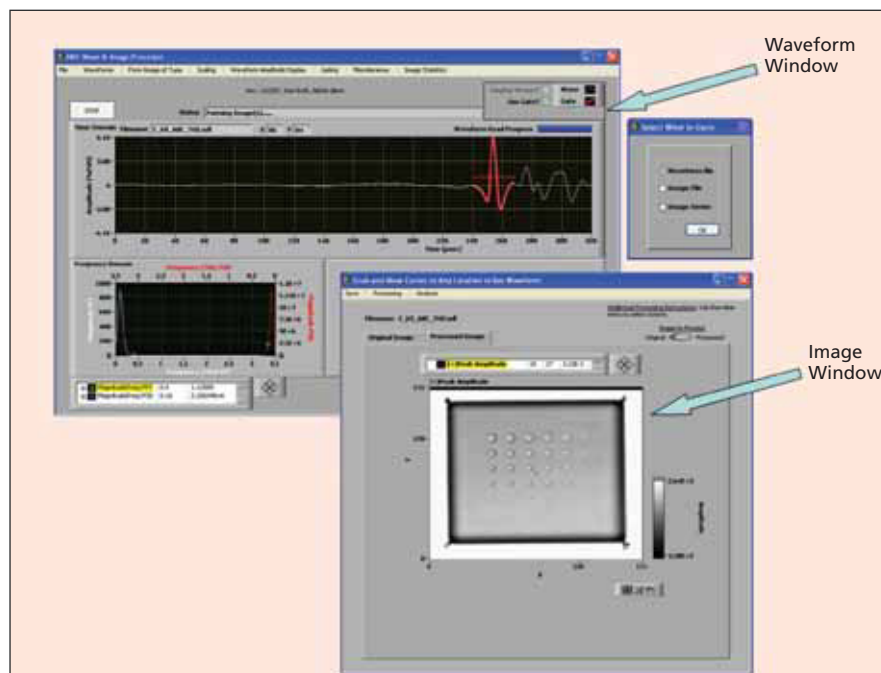
Platform for Postprocessing Waveform-Based NDE

John H. Glenn Research Center, Cleveland, Ohio

Taking advantage of the similarities that exist among all waveform-based non-destructive evaluation (NDE) methods, a common software platform has been developed containing multiple-signal and image-processing techniques for waveforms and images. The NASA NDE Signal and Image Processing software has been developed using the latest versions of LabVIEW, and its associated Advanced Signal Processing and Vision Toolkits. The software is useable on a PC with Windows XP and Windows Vista.

The software has been designed with a commercial grade interface in which two main windows, Waveform Window and Image Window, are displayed if the user chooses a “waveform file” to display. Within these two main windows (see figure), most actions are chosen through logically conceived run-time menus. The Waveform Window has plots for both the raw time-domain waves and their frequency-domain transformations (fast Fourier transform and power spectral density). The Image Window shows the C-scan image formed from information of the time-domain waveform (such as peak amplitude) or its frequency-domain transformation at each scan location. The user also has the ability to open an image, or series of images, or a simple set of X-Y paired data set in text format. Each of the Waveform and Image Windows contains menus from which to perform many user actions.

An option exists to use raw waves obtained directly from scan, or waves after deconvolution if system wave response is provided. Two types of deconvolution,



Graphical-User-Interface Windows are shown for NASA NDE wave and image processor.

time-based subtraction or inverse-filter, can be performed to arrive at a deconvolved wave set. Additionally, the menu on the Waveform Window allows preprocessing of waveforms prior to image formation, scaling and display of waveforms, formation of different types of images (including non-standard types such as velocity), gating of portions of waves prior to image formation, and several other miscellaneous and specialized operations.

The menu available on the Image Window allows many further image processing and analysis operations, some of which are found in commercially-avail-

able image-processing software programs (such as Adobe Photoshop), and some that are not (removing outliers, B-scan information, region-of-interest analysis, line profiles, and precision feature measurements).

This work was done by Don Roth 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: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18261-1.