Technology Focus: Data Acquisition

Hand-Held Ultrasonic Instrument for Reading Matrix Symbols

All necessary functions would be performed within a compact package.

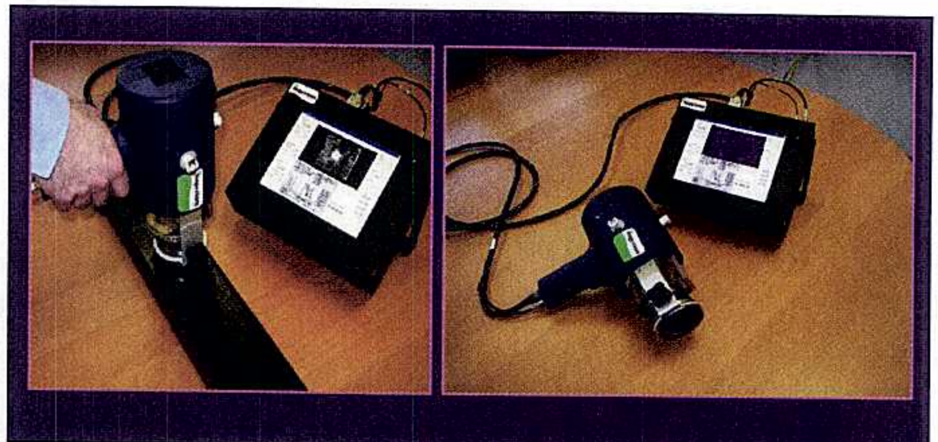
Marshall Space Flight Center, Alabama

A hand-held instrument that would include an ultrasonic camera has been proposed as an efficient means of reading matrix symbols. The proposed instrument could be operated without mechanical raster scanning. All electronic functions from excitation of ultrasonic pulses through final digital processing for decoding matrix symbols would be performed by dedicated circuitry within the single, compact instrument housing.

The instrument (see figure) would be placed on a selected area on an object of interest believed or suspected to contain a matrix symbol (hereafter denoted, simply, the target). Intimate contact for the purpose of coupling of low-energy ultrasound would be ensured by use of either a flexible membrane camera face or a replaceable gel pad. Ultrasound pulses would be transmitted from a transducer, through the membrane or gel pad, into the target. A portion of each ultrasonic pulse, as modified by any matrix symbol present in the target, would be reflected through the membrane or gel pad to an ultrasound-imaging integrated-circuit chip, which would convert the resulting spatial variation of ultrasound pressure to voltages that could be used to construct a video image of the matrix symbol (if any).

A set of circuit boards above the ultrasound-imaging chip converts the output of the chip into a useful video format and would coordinate timing between the transducer pulses and the acquisition and processing of image data. The system is fully portable and battery powered. The instrument includes the following other boards:

- A pulser board would control the current pulses that drive the acoustic transducer.
- A board comprising a liquid-crystal display unit and its driver circuitry would enable display of the video image in the future. It could include a decoder board that would translate the video image of a matrix symbol into a recognizable set of binary data. This board would be identical to that used in a commercial bar-code reader. Upon observing a matrix symbol in the video display, the operator would press a trigger switch to activate the decoder. The output of the decoder could be made available to a data-collection system for recording of the information in the matrix symbol.



An **Ultrasonic Camera** and associated electronic circuitry would generate and decode a video image of a matrix symbol hidden below the surface of the target.

This work was done by Harry F. Schramm of Marshall Space Flight Center; Robert S. Lasser and John P. Kula of Imperium, Inc.; and John W. Gurney and Ephraim D. Lior formerly of Imperium, Inc. For more information, contact Sammy Nabors, MSFC Commercialization Assistance Lead, at sammy.a.nabors@nasa.gov. MFS-31782-1

Visual Data Analysis for Satellites

Stennis Space Center, Mississippi

The Visual Data Analysis Package is a collection of programs and scripts that facilitate visual analysis of data available from NASA and NOAA satellites, as well as dropsonde, buoy, and conventional *in-situ* observations. The package features utilities for data extraction, data quality control, statistical analysis, and data visualization.

The Hierarchical Data Format (HDF) satellite data extraction routines from NASA's Jet Propulsion Laboratory were customized for specific spatial coverage and file input/output. Statistical analysis includes the calculation of the relative error, the absolute error, and the root mean square error. Other capabilities include curve fitting through the data points to fill in missing data points between satellite passes or where clouds obscure satellite data.

For data visualization, the software provides customizable Generic Mapping Tool (GMT) scripts to generate difference maps, scatter plots, line plots, vector plots, histograms, time-series, and color fill images.

This program was written by Yee Lau, Sachin Bhate, and Patrick Fitzpatrick of the GeoResources Institute at Mississippi State University for Stennis Space Center.

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Refer to SSC-00266-1, volume and number of this NASA Tech Briefs *issue, and the page number.*

Two-Camera Acquisition and Tracking of a Flying Target

An unanticipated moving target can be automatically spotted and tracked.

NASA's Jet Propulsion Laboratory, Pasadena, California

A method and apparatus have been developed to solve the problem of automated acquisition and tracking, from a location on the ground, of a luminous moving target in the sky. The method involves the use of two electronic cameras: (1) a stationary camera having a wide field of view, positioned and oriented to image the entire sky; and (2) a camera that has a much narrower field of view (a few degrees wide) and is mounted on a two-axis gimbal. The wide-field-of-view stationary camera is used to initially identify the target against the background sky. So that the approximate position of the target can be determined, pixel locations on the image-detector plane in the stationary camera are calibrated with respect to azimuth and elevation. The approximate target position is used to initially aim the gimballed narrow-field-of-view camera in the approximate direction of the target. Next, the narrow-field-of-view camera locks onto the target image, and thereafter the gimbals are actuated as needed to maintain lock and thereby track the target with precision greater than that attainable by use of the stationary camera.

Figure 1 shows a prototype of the apparatus. The stationary, wide-field-of-view camera includes a fish-eye lens that projects a full view of the sky (the full 360° of azimuth and the full 90° of elevation) onto a 512×512-pixel image detector of the active-pixel-sensor type. The gimballed narrow-field-of-view camera contains a charge-coupled-device (CCD) image detector. The apparatus also includes circuitry that digitizes the image-detector outputs and a computer that processes the image data and generates gimbal-control commands.

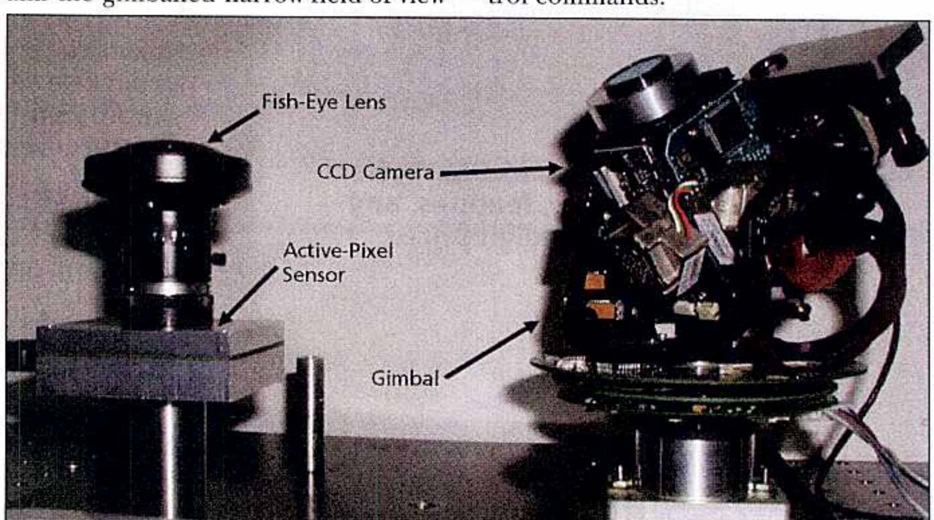

Figure 1. This **Prototype Apparatus** was built and tested, yielding the images shown in Figure 2.