The CAA includes a notebook computer that controls the rest of the system and can be used to process the data upon playback. The CAA software includes components that separately capture the video, audio, and position data streams and store them in files on the hard drive of this computer. Alternatively or in addition, the data can be stored on one or more external hard drive(s) or on a digital videodisk. Data can be played back from any of these storage media. The CAA can store data for an observation interval as long as two weeks.

In addition to the video image data, the video-data-storage software component records the times of individual frames from each camera, enabling synchronization of the video data with the audio and position data during playback and analysis. The position-data-storage software component reads data from the six Cricket listener units, calculates the three-dimensional positions of the Cricket beacons according to the principle described above, and saves these positions in a text file. The position-data-storage software component also creates, reads, and writes a Cricket calibration-data file.

The CAA software further includes components for playback and analysis of the recorded data. One of these software components provides capabilities for searching and playback using the video, audio, and position data files as well as files that describe rectangular areas of interest (AOIs) on the floor as defined by the user with the help of another software component. Several other components perform a variety of analyses of image data. Still another software component reads the position and AOI data files and generates reports on activities of interest represented in the data (e.g., it generates histograms of occupation of AOIs by crew members). The data in the reports can be saved in a format suitable for export to a spreadsheet program.

This work was done by James Murray and Alexander Kirillov of Foster-Miller, Inc. for Ames Research Center. Inquiries concerning rights for the commercial use of this invention should be addressed to Judith Gertler, Division Manager, Foster-Miller Inc. at (781) 684-4270. Refer to ARC-15162-1.

Distributing Data to Hand-Held Devices in a Wireless Network

Lyndon B. Johnson Space Center, Houston, Texas

ADROIT is a developmental computer program for real-time distribution of complex data streams for display on Web-enabled, portable terminals held by members of an operational team of a spacecraft-command-and-control center who may be located away from the center. Examples of such terminals include personal data assistants, laptop computers, and cellular telephones. ADROIT would make it unnecessary to equip each terminal with platform-specific software for access to the data streams or with software that implements the information-sharing protocol used to deliver telemetry data to clients in the center.

ADROIT is a combination of middleware plus software specific to the center. (Middleware enables one application program to communicate with another by performing such functions as conversion, translation, consolidation, and/or integration.) ADROIT translates a data stream (voice, video, or alphanumerical data) from the center into Extensible Markup Language, effectuates a subscription process to determine who gets what data when, and presents the data to each user in real time. Thus, ADROIT is expected to enable distribution of operations and to reduce the cost of operations by reducing the number of persons required to be in the center.

This program was written by Mark Hodges and Layne Simmons of TenXsys, Inc. for Johnson Space Center. For further information, contact the JSC Innovative Partnerships Office at (281) 483-3809.

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

TenXsys, Inc.
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Refer to MSC-24152-1, volume and number of this NASA Tech Briefs *issue, and the page number.*

Reducing Surface Clutter in Cloud Profiling Radar Data

Radar data can be processed to study clouds closer to the surface.

NASA's Jet Propulsion Laboratory, Pasadena, California

An algorithm has been devised to reduce ground clutter in the data products of the CloudSat Cloud Profiling Radar (CPR), which is a nadir-looking radar instrument, in orbit around the Earth, that measures power backscattered by clouds as a function of distance from the instrument. Ground clutter contaminates the CPR data in the lowest 1 km of the atmospheric profile, heretofore making it impossible to use CPR data to satisfy the scientific interest in studying clouds and light rainfall at low altitude.

The algorithm is based partly on the fact that the CloudSat orbit is such that the geodetic altitude of the CPR varies continuously over a range of approximately 25 km. As the geodetic altitude changes, the radar timing parameters are changed at intervals defined by flight software in order to keep the troposphere inside a data-collection time window. However, within each interval, the surface of the Earth continuously "scans through" (that is, it moves across) a few range bins of the data time window. For each radar profile, only few samples [one for every range-bin increment (Δr = 240 m)] of the surface-clutter signature are available around the range bin in which the peak of surface return is observed, but samples in consecutive radar profiles are offset slightly (by amounts much less than Δr) with respect to each other according to the relative change in geodetic altitude. As a consequence, in a case in which the surface area under examination is homogenous (e.g., an ocean surface), a sequence of consecutive radar profiles of the surface in that area contains samples of the surface response with range resolution ($\Delta\rho$) much finer than the range-bin increment ($\Delta\rho << \Delta r$).

Once the high-resolution surface response has thus become available, the profile of surface clutter can be accurately estimated by use of a conventional maximum-correlation scheme: A translated and scaled version of the high-resolution surface response is fitted to the observed low-resolution profile. The translation and scaling factors that optimize the fit in a maximum-correlation sense represent (1) the true position of the surface relative to the sampled surface peak and (2) the magnitude of the surface backscatter.

The performance of this algorithm has been tested on CloudSat data acquired over an ocean surface. A preliminary analysis of the test data showed a surface-clutter-rejection ratio over flat surfaces of >10 dB and a reduction of the contaminated altitude over ocean from about 1 km to about 0.5 km (over the ocean). The algorithm has been embedded in CloudSat L1B processing as of Release 04 (July 2007), and the estimated flat surface clutter is removed in L2B-GEOPROF product from the observed profile of reflectivity (see CloudSat product documentation for details and performance at http://www.cloudsat.cira.colostate.edu/dataSpecs.php?prodid=1).

This work was done by Simone Tanelli, Kyung Pak, Stephen Durden, and Eastwood Im of Caltech for NASA's Jet Propulsion Laboratory.

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-44873.

MODIS Atmospheric Data Handler

Stennis Space Center, Mississippi

A number of science data sets are derived from the observations of the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument onboard NASA's Terra and Aqua satellites. These data typically contain information on retrieval techniques, quality-control flags, and geo-referencing information. These datasets, distributed in HDF (Hierachical Data Format), must be further processed to extract relevant information for weather analysis studies and numerical models input. The MODIS-Atmosphere Data Handler software converts the HDF data to ASCII format, and outputs: (1) atmospheric profiles of temperature and dew point and (2) total precipitable water. Quality-control data are also considered in the export procedure.

The package currently consists of programs to process the MOD05 and MOD07 data products from MODIS. The software is written using the C programming language and contains Makefiles for easier compilation and installation. The MODIS-ADH software helps ease the overhead involved in data processing so that the numerical modelers may concentrate on their science and modeling tasks rather than manipulating data for their models.

This program was written by Valentine Anantharaj and Patrick Fitzpatrick of the Northern Gulf Institute at Mississippi State University for Stennis Space Center.

Inquiries concerning rights for its commercial use should be addressed to:

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Refer to SSC-00267, volume and number of this NASA Tech Briefs *issue, and the page number.*

Multibeam Altimeter Navigation Update Using Faceted Shape Model

The model is applicable to a body having almost any complex shape.

NASA's Jet Propulsion Laboratory, Pasadena, California

A method of incorporating information, acquired by a multibeam laser or radar altimeter system, pertaining to the distance and direction between the system and a nearby target body, into an estimate of the state of a vehicle upon which the system is mounted, involves the use of a faceted model to represent the shape of the target body. In the original intended application, the vehicle would be a spacecraft and the target body would be an asteroid, comet, or similar body that the spacecraft was required to approach. The method could also be used in navigating aircraft at low altitudes over terrain that is rough and/or occupied by objects of significant structure.

Fundamentally, what one seeks to measure is the distance from the vehicle to the target body. The present method is the product of a generalization of a prior method of altimetry, in which the target body has a simple shape represented by a spherical or ellipsoidal model. In principle, the estimate of distance or altitude obtained by use of a multibeam altimeter can be more robust than that obtained by use of a single-beam altimeter, but if the surface of the target body has a complex and/or irregular shape, then it becomes more difficult to define the distance and compute the distance from readings of a multi-beam altimeter.

The faceted shape model of the present method facilitates the definition and computation of distance to a target object having almost any shape, no matter how irregular and complex. The use of faceted shape models to represent complex three-dimensional objects is com-