

building on existing investments in *in situ* space geodetic networks, and improving timeliness, quality, and science value of the collected data.

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*This software is available for commercial licensing. Please contact Dan Broderick at Daniel.F.Broderick@jpl.nasa.gov. Refer to NPO-48556.*

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## Ionospheric Specifications for SAR Interferometry (ISSI)

*NASA's Jet Propulsion Laboratory, Pasadena, California*

The ISSI software package is designed to image the ionosphere from space by calibrating and processing polarimetric synthetic aperture radar (PolSAR) data collected from low Earth orbit satellites. Signals transmitted and received by a PolSAR are subject to the Faraday rotation effect as they traverse the magnetized ionosphere. The ISSI algorithms combine the horizontally and vertically polarized (with respect to the radar system) SAR signals to estimate Faraday rotation and ionospheric total electron content (TEC) with spatial resolutions

of sub-kilometers to kilometers, and to derive radar system calibration parameters. The ISSI software package has been designed and developed to integrate the algorithms, process PolSAR data, and image as well as visualize the ionospheric measurements.

A number of tests have been conducted using ISSI with PolSAR data collected from various latitude regions using the phase array-type L-band synthetic aperture radar (PALSAR) onboard Japan Aerospace Exploration Agency's Advanced Land Observing Satellite mission,

and also with Global Positioning System data. These tests have demonstrated and validated SAR-derived ionospheric images and data correction algorithms.

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## Implementation of a Wavefront-Sensing Algorithm

*Goddard Space Flight Center, Greenbelt, Maryland*

A computer program has been written as a unique implementation of an image-based wavefront-sensing algorithm reported in "Iterative-Transform Phase Retrieval Using Adaptive Diversity" (GSC-14879-1), *NASA Tech Briefs*, Vol. 31, No. 4 (April 2007), page 32. This software was originally intended for application to the James Webb Space Telescope, but is also applicable to other segmented-mirror telescopes.

The software is capable of determining optical-wavefront information using,

as input, a variable number of irradiance measurements collected in defocus planes about the best focal position. The software also uses input of the geometrical definition of the telescope exit pupil (otherwise denoted the pupil mask) to identify the locations of the segments of the primary telescope mirror. From the irradiance data and mask information, the software calculates an estimate of the optical wavefront (a measure of performance) of the telescope generally and across each primary

mirror segment specifically. The software is capable of generating irradiance data, wavefront estimates, and basis functions for the full telescope and for each primary-mirror segment. Optionally, each of these pieces of information can be measured or computed outside of the software and incorporated during execution of the software.

*This program was written by Jeffrey S. Smith, Bruce Dean, and David Aronstein of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15399-1*

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## Sally Ride EarthKAM — Automated Image Geo-Referencing Using Google Earth Web Plug-In

*NASA's Jet Propulsion Laboratory, Pasadena, California*

Sally Ride EarthKAM is an educational program funded by NASA that aims to provide the public the ability to picture Earth from the perspective of the International Space Station (ISS). A computer-controlled camera is mounted

on the ISS in a nadir-pointing window; however, timing limitations in the system cause inaccurate positional metadata. Manually correcting images within an orbit allows the positional metadata to be improved using mathematical regres-

sions. The manual correction process is time-consuming and thus, unfeasible for a large number of images.

The standard Google Earth program allows for the importing of KML (key-hole markup language) files that previ-

ously were created. These KML file-based overlays could then be manually manipulated as image overlays, saved, and then uploaded to the project server where they are parsed and the metadata in the database is updated. The new interface eliminates the need to save, download, open, re-save, and upload the KML files. Everything is processed on the Web, and all manipulations go directly into the database. Administrators also have the control to discard any single correction that was made and validate a correction.

This program streamlines a process that previously required several critical steps and was probably too complex for the average user to complete suc-

cessfully. The new process is theoretically simple enough for members of the public to make use of and contribute to the success of the Sally Ride EarthKAM project.

Using the Google Earth Web plug-in, EarthKAM images, and associated metadata, this software allows users to interactively manipulate an EarthKAM image overlay, and update and improve the associated metadata. The Web interface uses the Google Earth JavaScript API along with PHP-PostgreSQL to present the user the same interface capabilities without leaving the Web. The simpler graphical user interface will allow the public to participate directly and mean-

ingfully with EarthKAM. The use of similar techniques is being investigated to place ground-based observations in a Google Mars environment, allowing the MSL (Mars Science Laboratory) Science Team a means to visualize the rover and its environment.

*This work was done by Paul M. Andres of Caltech, Dennis K. Lazar of Purdue University, and Robert Q. Thames of Loyola Marymount University 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 Dan Broderick at Daniel.F.Broderick@jpl.nasa.gov. Refer to NPO-48800.*

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## Trade Space Specification Tool (TSST) for Rapid Mission Architecture (Version 1.2)

*NASA's Jet Propulsion Laboratory, Pasadena, California*

Trade Space Specification Tool (TSST) is designed to capture quickly ideas in the early spacecraft and mission architecture design and categorize them into trade space dimensions and options for later analysis. It is implemented as an Eclipse RCP Application, which can be run as a standalone program. Users rapidly create concept items with single clicks on a graphical canvas, and can organize and create linkages between the ideas using drag-and-drop actions within the same graphical view. Various views such as a trade view, rules view, and architecture view are provided to help users to visualize the trade space.

This software can identify, explore, and assess aspects of the mission trade space, as well as capture and organize

linkages/dependencies between trade space components. The tool supports a user-in-the-loop preliminary logical examination and filtering of trade space options to help identify which paths in the trade space are feasible (and preferred) and what analyses need to be done later with executable models. This tool provides multiple user views of the trade space to guide the analyst/team to facilitate interpretation and communication of the trade space components and linkages, identify gaps in combining and selecting trade space options, and guide user decision-making for which combinations of architectural options should be pursued for further evaluation.

This software provides an environment to capture mission trade space ele-

ments rapidly and assist users for their architecture analysis. This is primarily focused on mission and spacecraft architecture design, rather than general-purpose design application. In addition, it provides more flexibility to create concepts and organize the ideas. The software is developed as an Eclipse plug-in and potentially can be integrated with other Eclipse-based tools.

*This work was done by Yeou-Fang Wang, Mitchell Schrock, Chester S. Borden, and Robert C. Moeller 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 Dan Broderick at Daniel.F.Broderick@jpl.nasa.gov. Refer to NPO-48158.*

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## Acoustic Emission Analysis Applet (AEAA) Software

*John H. Glenn Research Center, Cleveland, Ohio*

NASA Glenn Research and NASA White Sands Test Facility have developed software supporting an automated pressure vessel structural health monitoring (SHM) system based on acoustic emissions (AE). The software, referred to as the Acoustic Emission Analysis Applet (AEAA), provides analysts with a tool that can interrogate data collected on Digital Wave Corp. and Physical Acoustics Corp. software

using a wide spectrum of powerful filters and charts. This software can be made to work with any data once the data format is known. The applet will compute basic AE statistics, and statistics as a function of time and pressure (see figure). AEAA provides value added beyond the analysis provided by the respective vendors' analysis software. The software can handle data sets of unlimited size.

A wide variety of government and commercial applications could benefit from this technology, notably requalification and usage tests for compressed-gas and hydrogen-fueled vehicles. Future enhancements will add features similar to a "check engine" light on a vehicle. Once installed, the system will ultimately be used to alert International Space Station crewmembers to critical structural instabilities, but will have lit-