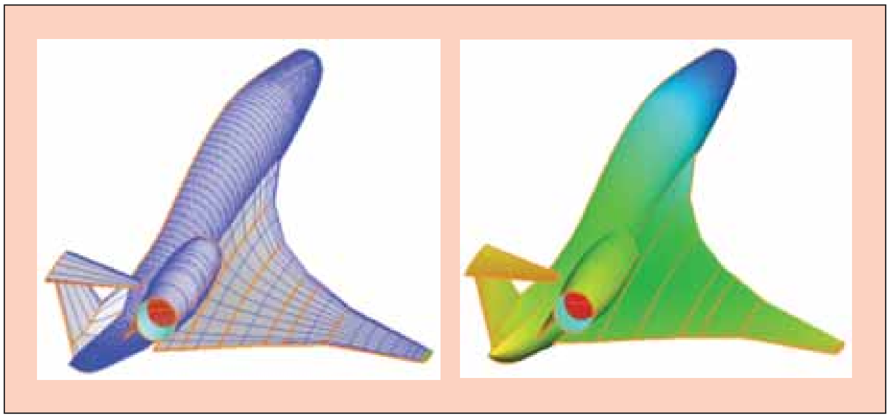


The **iPatch Computer Code** converts conceptual geometry (left) to coresponding CFD geometry (right).

section relationship defined in a geometry specification file. The intersection of two surfaces can be at a "conceptual" level. However, the intersection is directional (along either i or j index direction), and each intersecting grid line (or its spine extrapolation) on the first surface should intersect the second surface. No two intersection relationships will result in a common intersection point of three surfaces.

The output files of iPatch are IGES, d3m, and mapbc files that define the CFD geometry in VGRID format. The IGES file gives the NURBS definition of the outer mold line in the geometry. The d3m file defines how the outer mold line is broken into surface patches whose boundary curves are defined by points. The mapbc file specifies what the boundary condition is on each patch and the corresponding NURBS surface definition of each non-planar patch in the IGES file.

*This work was done by Wu Li of Langley Research Center. Further information is contained in a TSP (see page 1). LAR-17685-1*

# Stereo Imaging Tactical Helper

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

The Stereo Imaging Tactical Helper (SITH) program displays left and right images in stereo using the display technology made available by the JADIS framework, which was described in "JAVA Stereo Display Toolkit," *NASA Tech Briefs*, Vol. 32, No. 4 (April 2008), page 63. An overlay of the surface described by the disparity map (generated from the left and right images) allows the map to be compared to the actual images. In addition, an interactive cursor, whose visual depth is controlled by the disparity map, is used to ensure the correlated surface matches the real surface. This enhances the ability of operations personnel to provide quality control for correlation results, as well as to greatly assist developers working on correlation improvements. While its primary purpose is as a quality control tool for inspecting correlation results, SITH is also straightforward for use as a basic stereo image viewer.

There are two modes for the image display: stereo (left/right) through hardware or anaglyph, and adjacent, where the right image pane is placed to the right or bottom of the left image pane. The mode is switchable at runtime. The application displays with left and right images with an overlaid cursor per image. The positions of the image pane cursors will be related such that, given the coordinates of the cursor center on the left image, the position of the right pane cursor will be the mapped coordinates found in the disparity file. In stereo mode, this constitutes a stereo cursor.

In grid mapping, a flat grid is painted over the left image, and on the right, points from the left grid are mapped to the corresponding point on the right grid. This usually results in warping that indicates a higher-level view of the correlation result. As left and right images may not be adequately aligned such that they can be viewed comfortably, manual disparity controls exist to allow the right image to be shifted along the horizontal and vertical axes to produce stereo results that are easier for the user to view.

*This work was done by Nicholas T. Toole of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.*

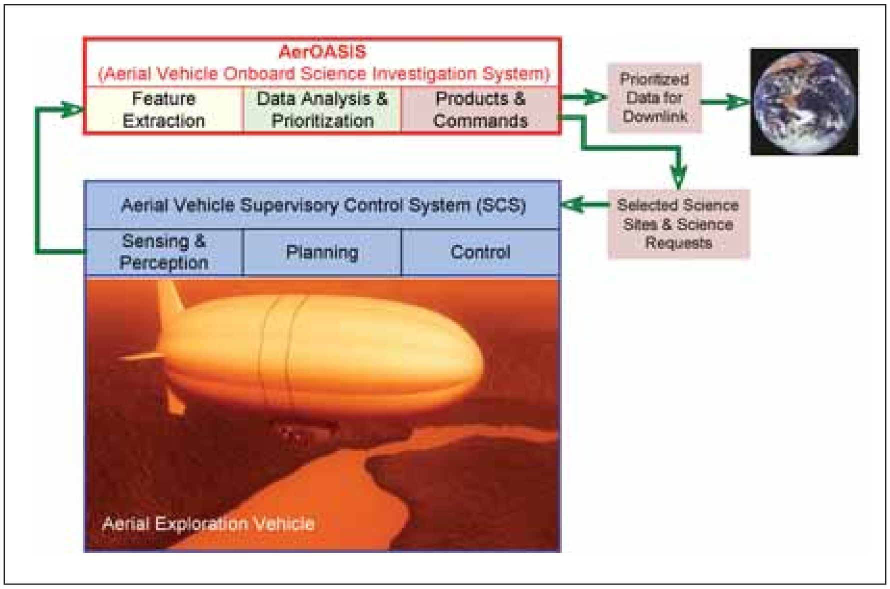
*This software is available for commercial licensing. Please contact Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-46669.*

# Planning and Execution for an Autonomous Aerobot

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

The Aerial Onboard Autonomous Science Investigation System (AerOASIS) system provides autonomous planning and execution capabilities for aerial vehicles (see figure). The system is capable of generating high-quality operations plans that integrate observation requests from ground planning teams, as well as opportunistic science events detected onboard the vehicle while respecting mission and resource constraints.

AerOASIS allows an airborne planetary exploration vehicle to summarize and prioritize the most scientifically relevant data; identify and select high-value science sites for additional investigation; and dynamically plan, schedule, and monitor the various science activities being performed, even during extended communications blackout periods with Earth.




The **AerOASIS** provides a number of functions in airborne planetary exploration.

AerOASIS system is composed of three main subsystems: Feature Extraction, which processes sensor imagery and other types of data (such as atmospheric pressure, temperature, wind speeds, etc.) and performs data segmentation and feature extraction; Data Analysis and Prioritization, which matches the extracted feature vectors against scientist-defined signatures. The results are used to detect novelty, perform science data prioritization, and summarization for downlink, and identify and select high-value science sites for *in-situ* studies; and Planning and Scheduling, which generates operations plans to achieve observation requests submitted from Earth and from onboard data analysis. These science requests can include low-altitude, high-resolution surveys, *in-situ* sonde deployment, and/or surface sample acquisition for onboard analysis.

*This work was done by Daniel M. Gaines, Tara A. Estlin, Steven R. Schaffer, and Caroline M. Chouinard of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.*

*This software is available for commercial licensing. Please contact Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-46895.*

# Real-Time Exponential Curve Fits Using Discrete Calculus

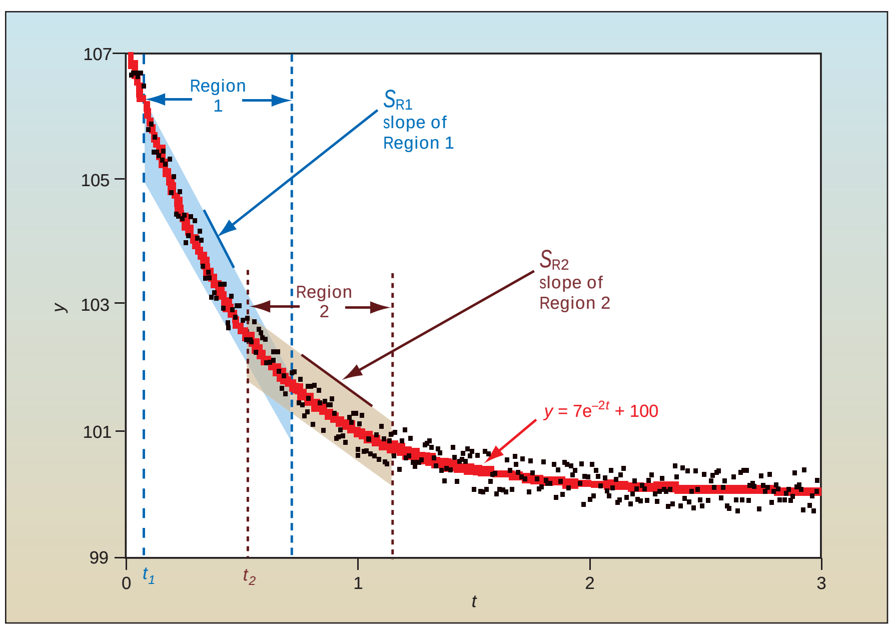
## Novel curve fitting solution removes the limits, is robust, and is faster.

*John F. Kennedy Space Center, Florida*

An improved solution for curve fitting data to an exponential equation ($y = Ae^{Bt} + C$) has been developed. This improvement is in four areas — speed, stability, determinant processing time, and the removal of limits. The solution presented avoids iterative techniques and their stability errors by using three mathematical ideas: discrete calculus, a special relationship (between exponential curves and the Mean Value Theorem for Derivatives), and a simple linear curve fit algorithm. This method can also be applied to fitting data to the general power law equation $y = Ax^B + C$ and the general geometric growth equation $y = Ak^{Bt} + C$.

This improved method offers several advantages over prior exponential-curve-fitting methods. The advantages are as follows:

- Speed: Iterative (non-linear) methods are 50 to 100 times slower. Previously, only iterative methods could be used when $C$ was not zero, or when all the samples were not zero or greater.
- Stability: No bad guesses. There is no chance of making a bad first guess as sometimes happens in iterative (non-linear) techniques. Sometimes the iterative techniques "blow up" when they start with a bad guess.
- Real-Time requires determinism: Being faster would allow this method to be used in real-time applications where non-linear methods take too much processing time. But, most real-time applications require determinism (a consistent processing time from




**Two Regions of Points** that overlap are shown. The slope ratios of these two regions are used in estimating $B$. In this example, $A = 7$, $B = -2$, and $C = 100$.