Ames Research Center

Virtual Planetary Analysis Environment for Remote Science

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All of the data for NASA's current planetary missions and most data for field experiments are collected via orbiting spacecraft, aircraft, and robotic explorers. Mission scientists are unable to employ traditional field methods when operating remotely. We have developed a virtual exploration tool for remote sites with data analysis capabilities that extend human perception quantitatively and qualitatively. Scientists and mission engineers can use it to explore a realistic representation of a remote site. It also provides software tools to "touch" and "measure" remote sites with an immediacy that boosts scientific productivity and is essential for mission operations.

Viz, the 3D visualization environment developed at Ames, was used by the Mars Exploration Rovers (MER) mission to enhance situational awareness and support decision making activities. Building on that experience and leveraging new technologies in graphics hardware and software, the AISRP Planetary Spatial Analyst project set out to build a prototype of a virtual planetary analysis environment for remote science. Our software was developed for four use cases: developing the walking capabilities of the lunar robot, ATHLETE, automated data assimilation and flight planning for multi-platform Earth observation missions, the Phoenix Mars Lander mission, and the Mars Reconnaissance Orbiter mission. The resulting prototype is an extensible software library called Mercator. It was developed in Java using the Eclipse Rich Client Platform and thus is compatible with NASA's Ensemble mission ground data systems software framework. Mercator is a multi-platform (PC, Mac and Linux) application that runs on nearly any computer with a capable graphics system, including most modern laptops.

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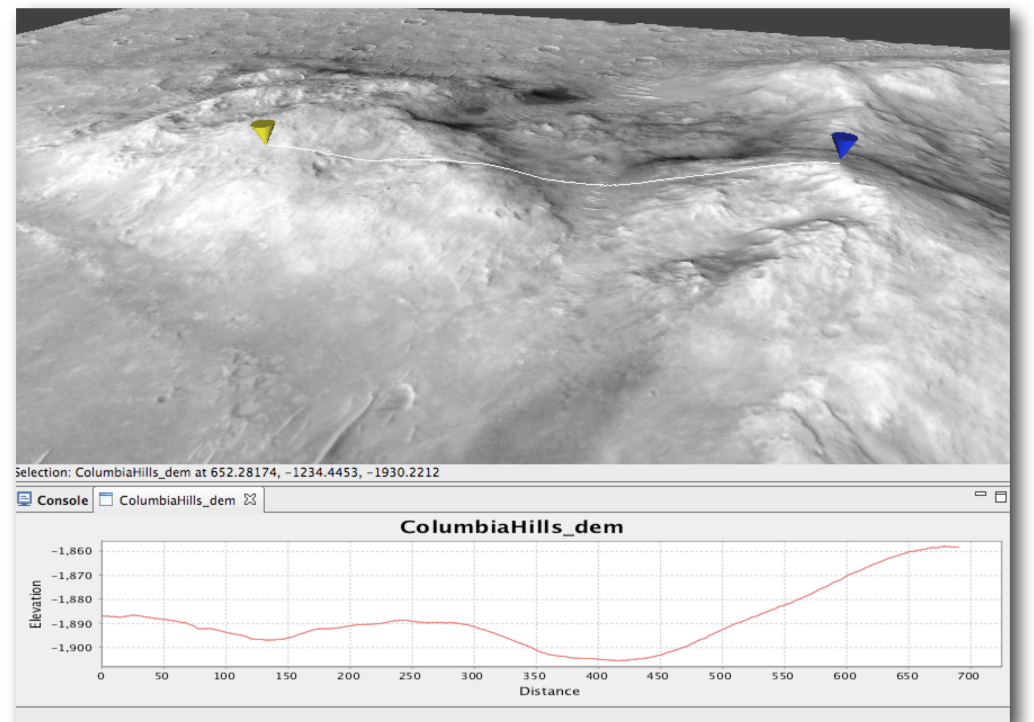
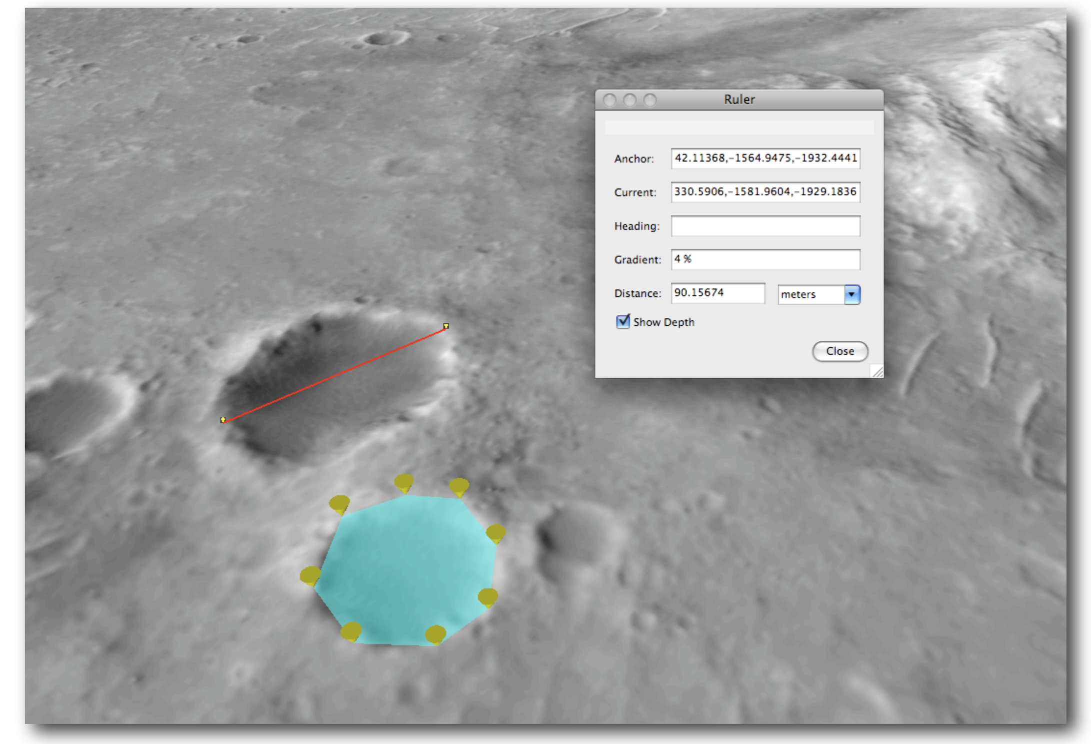
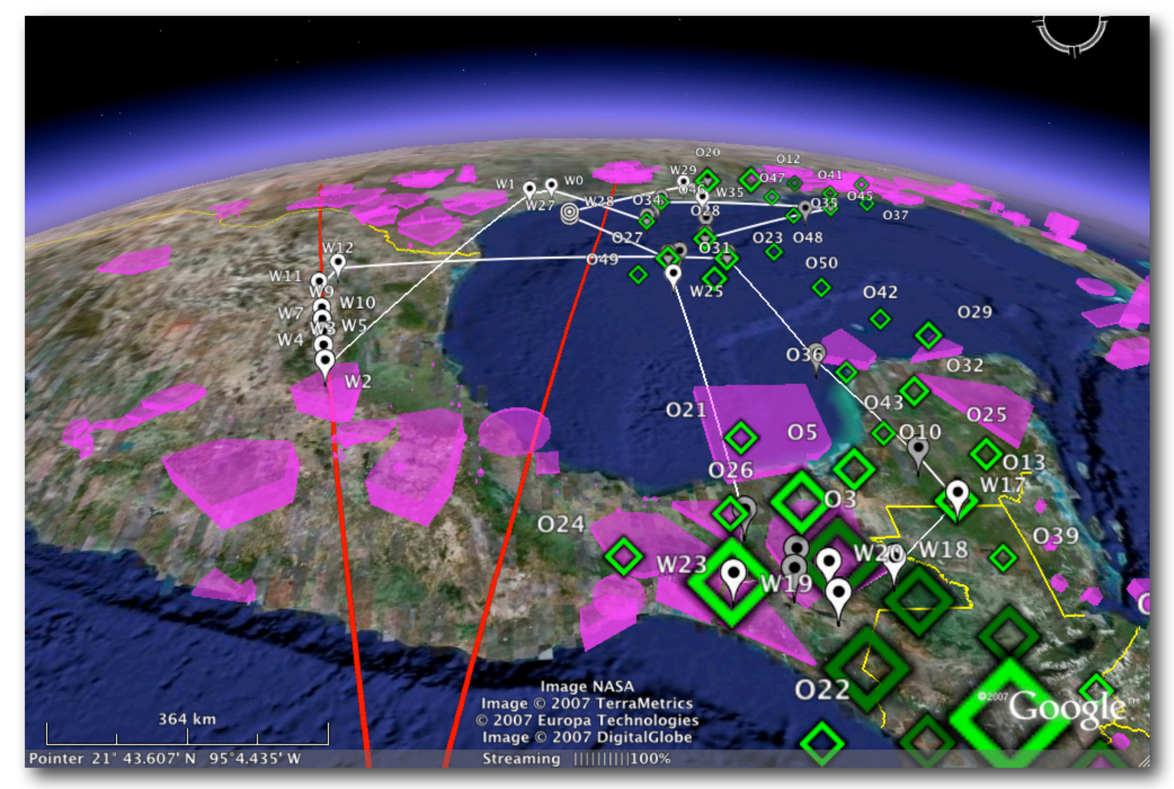
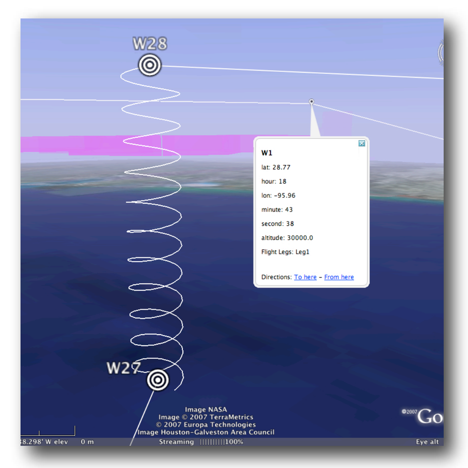


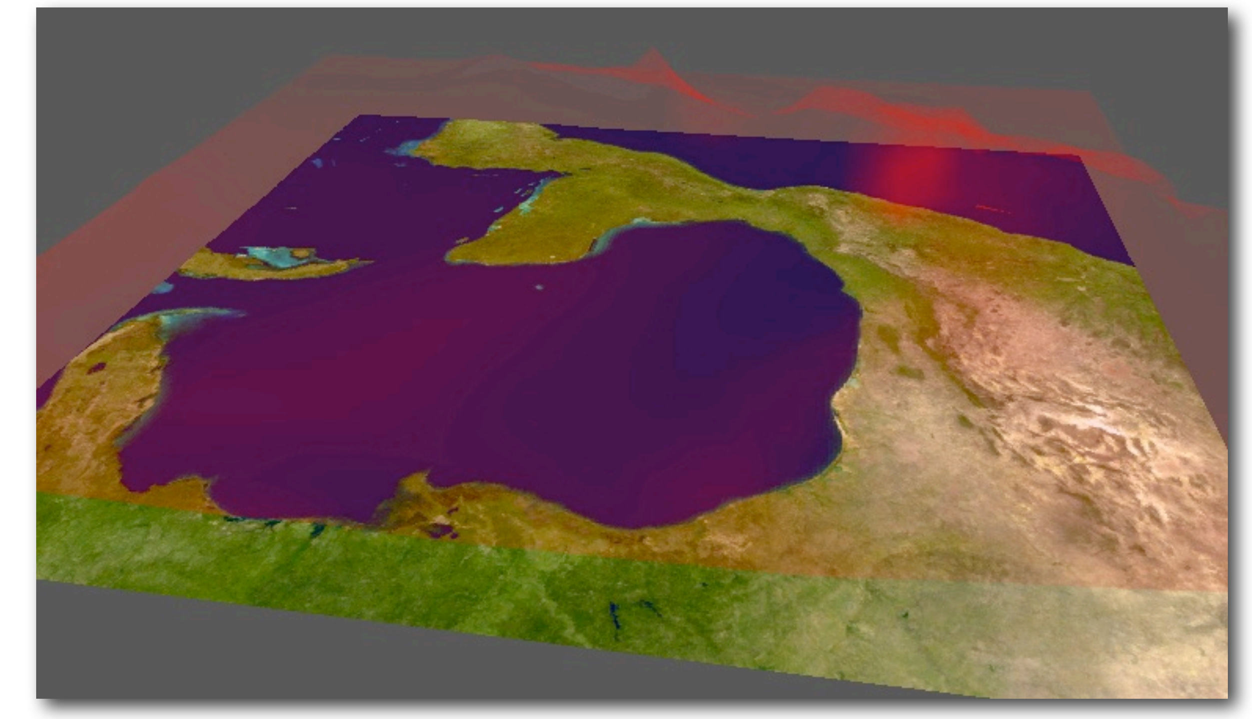


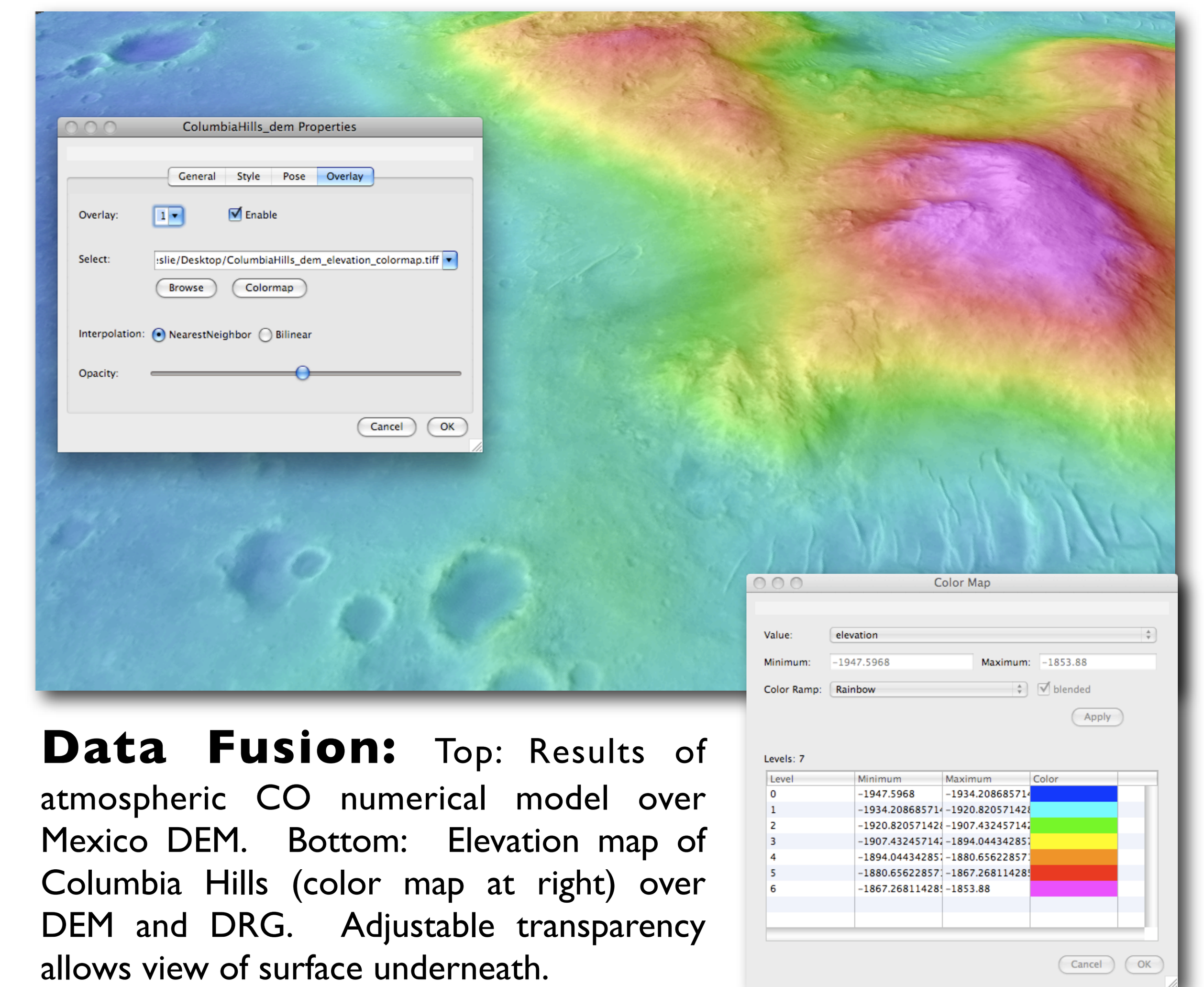
Measurement: Left: Terrain Profiler. Right: Ruler, and PointSet for surface area. Both displayed with HiRISE DEM of Columbia Hills. Points are movable and follow terrain or other underlying surface. Elevation, distance, and gradient are displayed in real-time.

Collaboration: Results of automated data mining and flight planning visualization ported to KML and viewed in Google Earth. Right: Special use air spaces (magenta), observation points (green), satellite ground track (red), and plan (white). Below: Close up of plan showing spiral leg and waypoint detail.

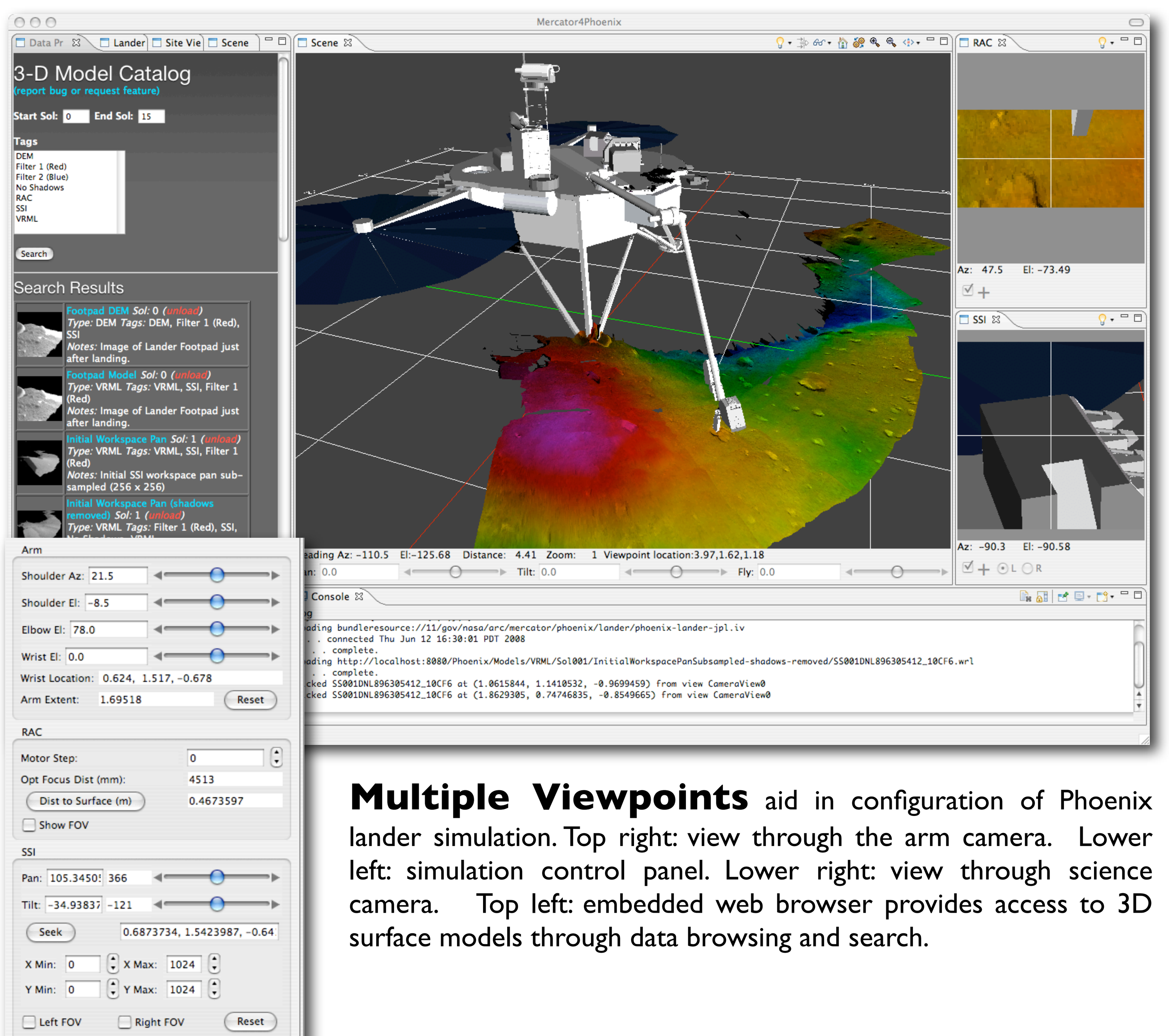




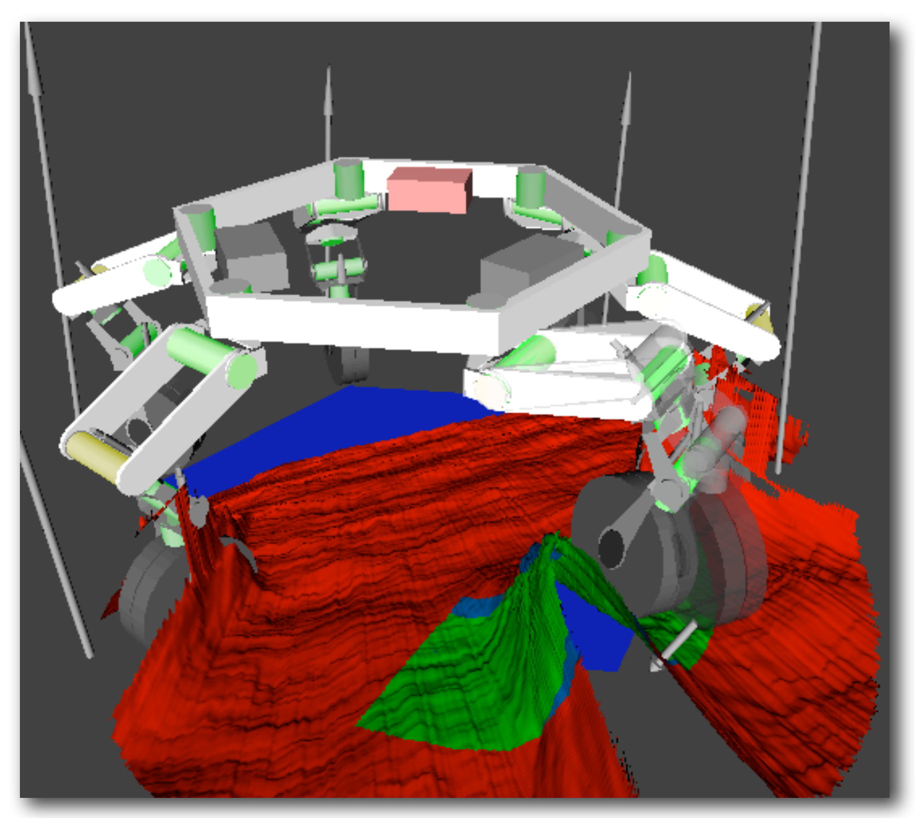


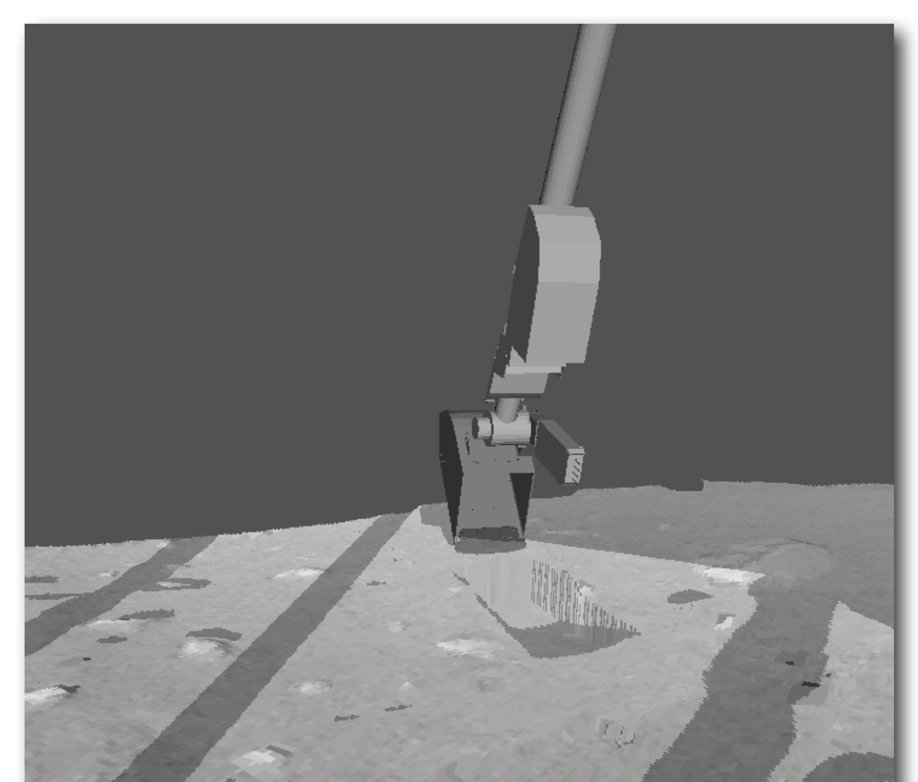


Data Fusion: Top: Results of atmospheric CO numerical model over Mexico DEM. Bottom: Elevation map of Columbia Hills (color map at right) over DEM and DRG. Adjustable transparency allows view of surface underneath.

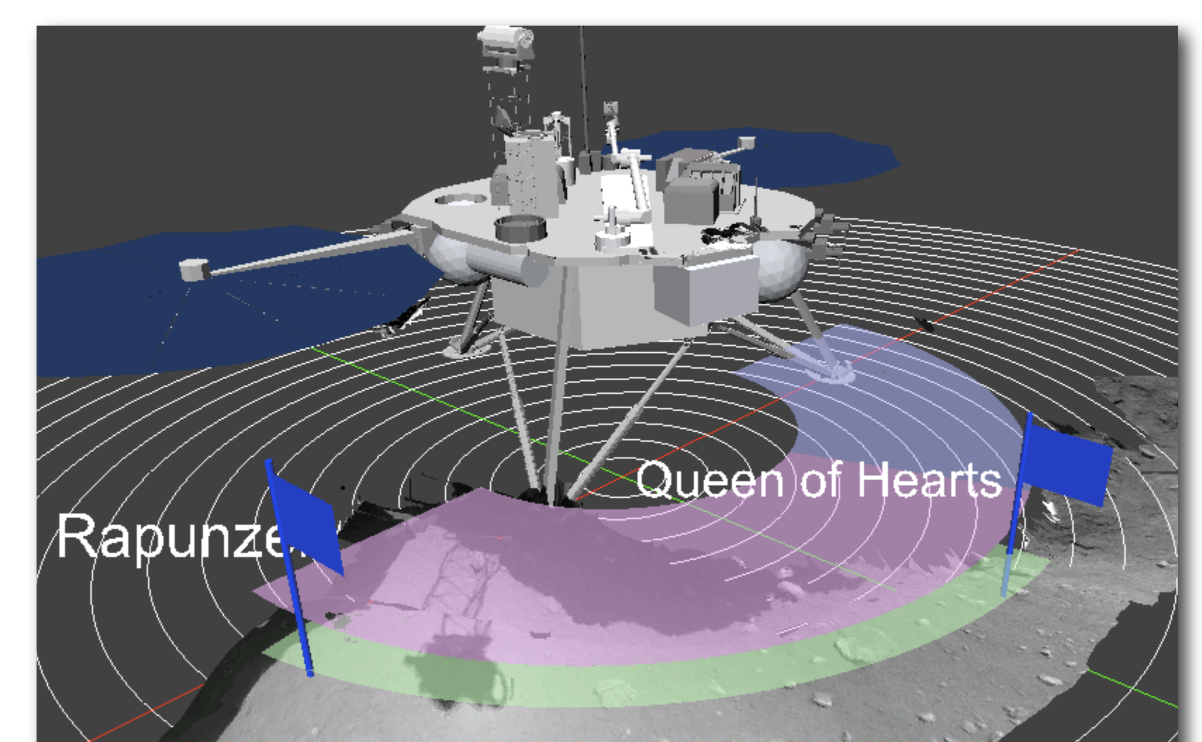


Multiple Viewpoints aid in configuration of Phoenix lander simulation. Top right: view through the arm camera. Lower left: simulation control panel. Lower right: view through science camera. Top left: embedded web browser provides access to 3D surface models through data browsing and search.





What If: Left: Ghost display of step candidate for ATHLETE with torque and force indicators. Right: View of estimated shadow coverage on proposed trench in Phoenix workspace.



Enhanced Situational Awareness: Arm reachability arcs, radial grid, and labeled feature locations along with Phoenix lander and workspace.