Images courtesy of NASA JPL

CUSTOMER:
NASA Jet Propulsion Laboratory (JPL)

INDUSTRY:
Aerospace

PROJECT NAME:
Mars Science Laboratory Touchdown Simulation Support

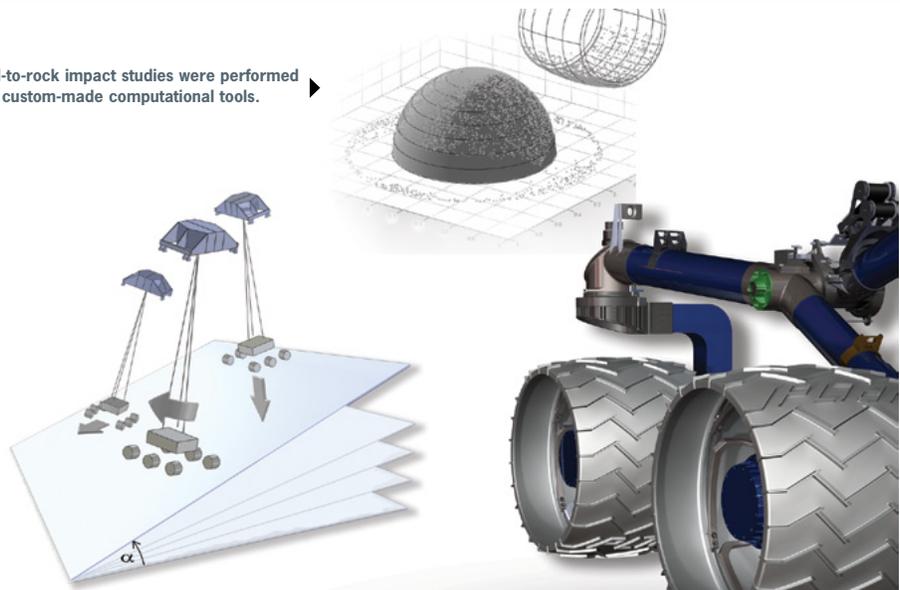CUSTOMER LOCATION:
Pasadena, California

OVERVIEW

The Mars Science Laboratory (MSL) is NASA's next-generation rover, launched in 2011 with the unique directive of investigating whether ancient conditions on Mars could have supported the existence of microbial life. This rover represents the Jet Propulsion Laboratory's largest and most advanced rover to date, requiring an all-new landing manuever. Unlike any of its predecessors, MSL is to land on the same six-wheel mobility system that it will use to traverse the red planet. It will use the Skycrane maneuver to accomplish this, in which the rover will be lowered from a slowly descending rocket-controlled stage via a system of bridles. ATA Engineering, Inc., (ATA) provided analysis and test support for verification of the viability of this challenging touchdown maneuver.

ATA SUPPORT INCLUDED:

▷ Design of a rover test chassis for use in a full-scale touchdown testing program.

▷ Test support and analytical modeling of progressively more complex rover tests: static loading, simple wheel drop, horizontal touchdown, and sloped touchdown. Model assessment and correlation work.

▷ Updates and enhancements of the Skycrane system model to capture key performance characteristics of elements such as rover bridles, mobility joints, and wheel representations. Development of means to disperse the kinematics of the Skycrane model to allow probabilistic assessment of system performance at touchdown.

▷ Creation and execution of AutoSim, a script capable of managing and executing tens of thousands of Monte Carlo simulations across multiple servers, with customized algorithms for solution convergence confirmation, error checking, and file organization to facilitate rapid data exchange and examination.

▷ Development of a methodology for rover rock strike simulations, including creation of a statistical rock placement algorithm and postprocessing/visualization tools.

Wheel-to-rock impact studies were performed using custom-made computational tools. ▶

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