

Title: Engineering Design: The View from Mars

Abstract

Engineering design presents many challenges, both immediate (e.g., How do I provide this function within the volume and mass constraints?) and deep (e.g., Is design fundamentally artistic in nature, or is there underlying structure to the process? How much modularity is beneficial in designs?)

Nowhere are these many challenges more urgently apparent than in the design of interplanetary exploration spacecraft. In this environment, there are not only all of the challenges of design for a terrestrial environment, but additionally our knowledge of the environment in which the spacecraft perform is incomplete, and the ability to prototype and test is extremely limited. Not only is there a full slate of unknowns (as with any design), but engineers designing for space must take account of "unknown unknowns": those hazardous conditions and failures that cannot be anticipated, and despite which the spacecraft must operate successfully.

In the face of these difficulties, NASA's Jet Propulsion Laboratory has a distinguished and rich (but not unblemished) history of success, including the successful landing of the Mars Pathfinder spacecraft and Sojourner Rover on July 4, 1997.

The Laboratory has now launched twin successors to the Pathfinder/Sojourner, and these two spacecraft and rovers will reach Mars in early January, 2004. This talk will present an overview of the engineering design of the Mars Exploration Rovers, and will include a simulation of the mission, from launch through landing and roving.