MISSION PLAN FOR THE MARS SURVEYOR 2001 ORBITER AND LANDER. J. J. Plaut and D. A. Spencer, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109. Jeffrey.J.Plaut@jpl.nasa.gov, David.A.Spencer@jpl.nasa.gov.

Introduction: The Mars Surveyor 2001 Project consists of two missions to Mars, an Orbiter and a Lander, both to be launched in the spring of 2001 for October 2001 (Orbiter) and January 2002 (Lander) arrival at Mars. The Orbiter will support the Lander mission primarily as a communications relay system; the Lander will not have direct-to-Earth communications capability. Science data collected from the Orbiter will also be used to aid in the geologic interpretation of the landing site, along with data from past missions. Combining the Orbiter and Lander missions into a single Project has enabled the streamlining of many activities and an efficient use of personnel and other resources at the Jet Propulsion Laboratory and at the spacecraft contractor, Lockheed Martin Astronautics.

Orbiter Mission: The 2001 Orbiter spacecraft inherits many design features from the 1998 Mars Climate Orbiter. The spacecraft is 3-axis stabilized, with reaction wheel attitude control. The High Gain Antenna is mounted on a 2-axis gimbal assembly to allow continuous Earth tracking during orbital operations. The payload consists of 3 science instruments: Gamma-Ray Spectrometer (GRS) for surface elemental composition mapping and neutron spectroscopy detection of H and CO2, Thermal Emission Imaging System (THEMIS), for mineralogical and thermophyscial mapping of the surface using multispectral thermal and visible imaging, and Martian Radiation Environment Experiment (MARIE), for characterization of the near-space radiation environment for assessment of potential risk to human explorers. On arrival at Mars a propulsive maneuver will place the Orbiter into a 25-hour capture orbit. Aerobraking will then be used over the next 76 days to achieve the 2-hour science orbit (400 km altitude, 2 hour period). The near-polar orbit will "walk" slightly less than 1° of longitude at the equator every 25 orbits, or 2 Mars sols. At the start of the Science Phase the local time of observation will be 3:30 p.m., optimized for THEMIS, but unsuitable for GRS. After 304 days, the local time will become too late for THEMIS observations. For the following 340 days, only GRS and MARIE will operate. On day 659 of the Science Phase, a maneuver will place the Orbiter in a sun-synchronous orbit that allows THEMIS to resume observations for another 227 days. The Science Phase of the mission will end after 917 days, or 1.33 Mars years. During the remainder of the second Mars year, the Orbiter will serve as a communications relay platform for surface elements launched in 2003.

Lander Mission: The design of the 2001 Lander system is based on the 1998 Mars Polar Lander (MPL), but with a larger science payload and new flexible solar arrays. The Lander will also carry and deploy a rover, Marie Curie, similar to the Mars Pathfinder rover Sojourner. The Entry-Descent-Landing (EDL) Phase of the mission is also similar to that of MPL, with the addition of aeromaneuvering to improve the landing accuracy to about 10 km. The EDL will proceed with parachute deployment, jettison of the heat shield, landing radar activation, terminal descent engine firing and soft landing. The payload of the lander consists of 4 major science packages: APEX, MARIE, MECA and MIP. APEX, Athena Precursor Experiment, includes elements of the Athena package that will be part of the Mars Sample Return mission in 2003. These are the rover-mounted Alpha Proton X-ray Spectrometer, the lander-mounted camera system PANCAM/Min-TES, and the robotic-arm-mounted Mossbauer Spectrometer. MARIE, similar to the Orbiter MARIE, is designed to characterize the radiation environment at the surface. MECA, Mars Environmental Compatibility Assessment, is a package of instruments for analyzing soil. Working with samples delivered by the robotic arm, the package includes a microscopy station, electrometer, wet chemistry laboratory and adhesion/abrasion plates. MIP, Mars In-situ Propellant Production Precursor, will use solar power to demonstrate the manufacture of oxygen fuel from the ambient carbon dioxide atmosphere. The Lander mission has a 21-sol phase for achieving primary success, to be followed by a 70-sol phase for achieving full mission success. The Lander will communicate with Earth via the Orbiter, using 2 contacts per sol. The late afternoon contact will be the primary opportunity for downlink of the collected data. The first portion of the Lander mission involves return of image panoramas, deployment of the robotic arm and of the rover (by the robotic arm), and initial check-out and operation of the instrument suite. The Lander mission plan will be guided by science themes or "Campaigns," focused on the integrated use of the instruments to attack scientific problems.