



## MAVEN

### Mars Atmosphere and Volatile Evolution Mission

The Mars Atmosphere and Volatile Evolution, or MAVEN, mission will orbit Mars to explore how the sun may have stripped Mars of most of its atmosphere, turning a planet once possibly habitable to microbial life into a cold and barren desert world. MAVEN will be the first spacecraft mission dedicated to exploring the upper atmosphere of Mars.

Previous missions to Mars have shown us that the atmosphere and climate have changed over time and found evidence of abundant liquid water on the surface in ancient times, though not today. Scientists want to know what happened to the water and where the planet's thick atmosphere went. The MAVEN mission will study the nature of the red planet's upper atmosphere, how solar activity contributes to atmospheric loss, and the role that escape of gas from the atmosphere to space has played through time.

#### MISSION OVERVIEW

MAVEN will launch from Cape Canaveral, Fla., during a 3-week period that begins on November 18, 2013. The trip to Mars takes 10 months, and MAVEN will go into orbit around Mars in September 2014. It will take 5 weeks for the spacecraft to get into its final science-mapping orbit, test the instruments, and test science mapping sequences. After this commissioning phase, MAVEN has a 1-Earth-year primary mission during which it will make its key measurements.



The MAVEN orbit will be elliptical. At its closest point to the planet, it will be 150 kilometers (93 miles) above the surface. At this altitude, the spacecraft will pass through the upper atmosphere on each orbit and can sample the gas and ion composition directly. At its highest point, it will be more than 6000 km (3728 miles) above the surface and can carry out ultraviolet imaging of the entire planet. This combination of detailed point measurements and global imaging is a powerful way to understand the properties of the upper atmosphere. The altitude in the MAVEN orbit will be lowered for five "deep-dip" campaigns during the mission. In each deep dip, the spacecraft will take measurements down to an altitude of about 125 kilometers (77 miles). These measurements will provide information down to the top of the well-mixed lower atmosphere, giving scientists a full profile of the top of the atmosphere.

NASAfacts

The MAVEN spacecraft will make measurements in all regions of “near-Mars” space. These measurements will allow scientists to characterize the current state of the upper atmosphere and ionosphere, determine the rates of loss of gas to space today, and extrapolate backward in time in order to determine the total loss to space through time.

## SCIENCE PAYLOAD

MAVEN will carry three instrument suites. The Particles and Fields Package (PFP), built by the University of California at Berkeley Space Sciences Laboratory, contains six instruments that characterize the solar wind and the ionosphere of the planet. Four of the instruments are built by the University of California at Berkeley Space Sciences Laboratory, one is built jointly with the University of Colorado at Boulder Laboratory for Atmospheric and Space Physics, and the Magnetometer is built by NASA’s Goddard Space Flight Center in Greenbelt, Md.

The PFP includes:

- Solar Energetic Particle (SEP)
- Solar Wind Ion Analyzer (SWIA)
- Solar Wind Electron Analyzer (SWEA)
- SupraThermal and Thermal Ion Composition (STATIC)
- Langmuir Probe and Waves (LPW)
- Magnetometer (MAG)

The Remote Sensing Package, built by the University of Colorado at Boulder Laboratory for Atmospheric and Space Physics, will determine global characteristics of the upper atmosphere and ionosphere. The Neutral Gas and Ion Mass Spectrometer (NGIMS), built by NASA Goddard, will measure the composition and isotopes of neutrals and ions.

## SPACECRAFT

The MAVEN spacecraft is being built by Lockheed Martin in Denver and builds on heritage from previous Mars orbiters. It is solar-powered, with a high-gain antenna that can be pointed to Earth for twice-weekly communications sessions.

Spacecraft specifications:

- Length: 11.43 meters (37 feet)
- Spacecraft Dry Mass: 903 kilograms max (1991 pounds)
- Wet (Fueled) Mass at Launch: 2550 kilograms max (5622 pounds)
- Power: 1135 watts (when Mars is furthest from the Sun)

## MAVEN PARTNERS

MAVEN is led by its Principal Investigator, Dr. Bruce Jakosky, from the University of Colorado. The university is building two science instruments, will conduct science operations, and leads education/public outreach. NASA’s Goddard Space Flight Center in Greenbelt, Md., manages the project and is building two of the science instruments. Lockheed Martin of Littleton, Colo., is building the spacecraft and will perform mission operations. The University of California at Berkeley Space Sciences Laboratory is building four science instruments for the mission. NASA’s Jet Propulsion Laboratory, Pasadena, Calif., provides program management via the Mars Program Office, as well as data-relay telecommunications hardware and operations, navigation support, and Deep Space Network operations.

National Aeronautics and Space Administration

**Goddard Space Flight Center**  
8800 Greenbelt Road  
Greenbelt, MD 20771

[www.nasa.gov](http://www.nasa.gov)

NASA Facts