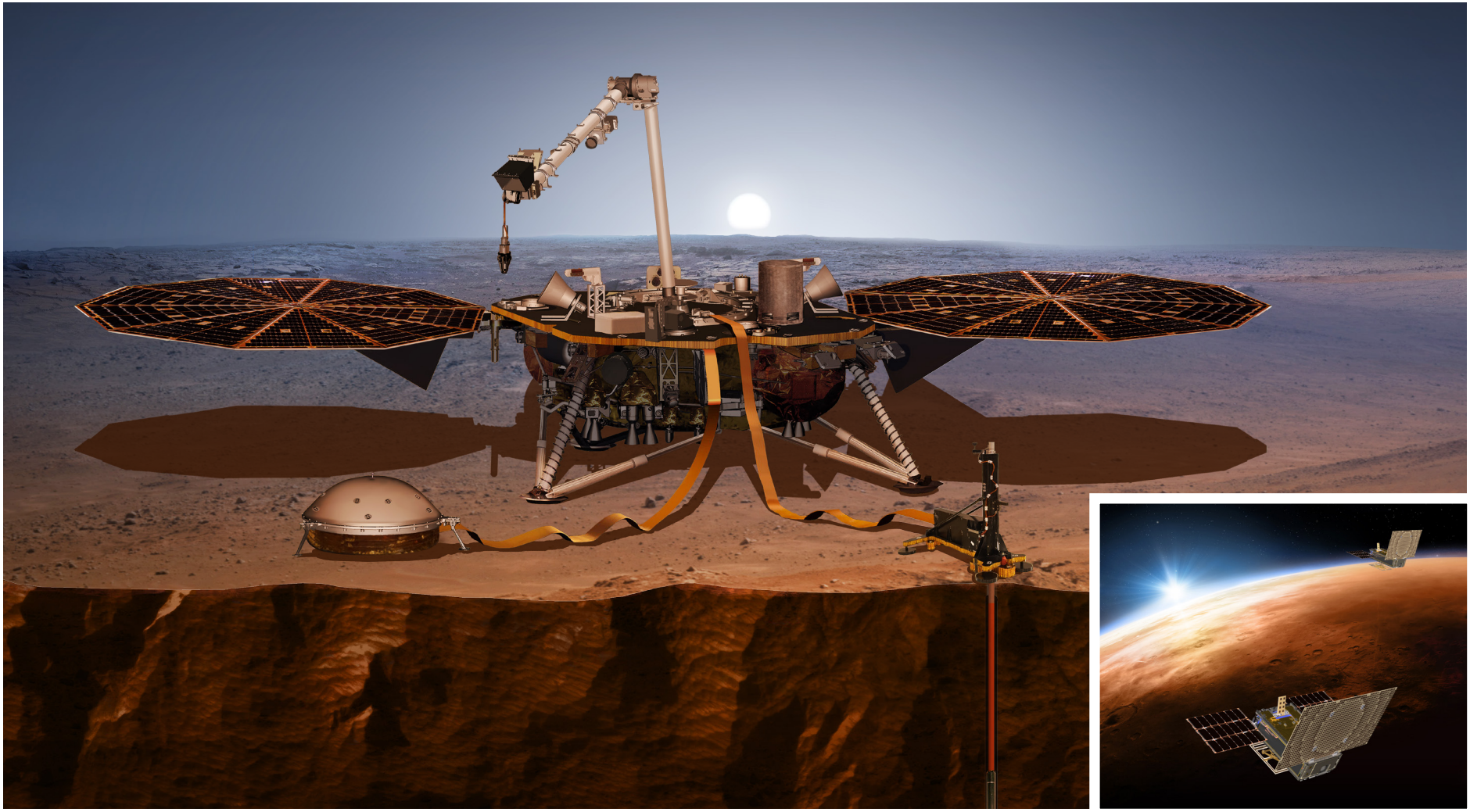
National Aeronautics and Space Administration



InSight (INterior Exploration using Seismic Investigations, Geodesy, and Heat Transport)
Inset: **MarCO** (Mars Cube One)

EXPLORE MARS

REVEALING HOW ROCKY PLANETS FORM

NASA's InSight mission is the first outer space robotic explorer to study in-depth the "inner space" of Mars: its crust, mantle, and core. Studying Mars' interior structure answers key questions about the early formation of rocky planets in our inner solar system—Mercury, Venus, Earth, and Mars—more than 4 billion years ago, as well as rocky exoplanets. InSight also measures internal temperature, tectonic activity, and meteorite impacts on Mars today.

WHY MARS?

After our solar system formed, convection in Mars' interior slowed dramatically or may have come to a complete stop, unlike here on Earth. The interior of Mars thus preserves a record of how the core, mantle, and crust of rocky planets form. Data on tectonic activity, the average composition of the mantle and core, and the rate at which heat escapes from the deep interior can reveal the structure of Mars today and the processes that acted on Mars in its first 100 million years.

THE LANDER AND ITS SCIENCE INSTRUMENTS

InSight relies on the successful design of NASA's Mars Phoenix lander. InSight's robotic arm is over 5.9 feet (1.8 meters) long. The arm lifts a seismometer and heat-flow probe from the deck and places them on the surface. The camera on the arm provides color 3D views of the landing site, instrument placement, and activities. Sensors measure weather and magnetic field variations. InSight's main instruments are:

- **A Seismometer (SEIS):** InSight measures seismic waves from "marsquakes" and thumps of meteorite impacts all over the planet. It is so sensitive, it can detect tremors as small as the size of a hydrogen atom! It can also detect tidal motions of the solid planet due to the Martian moon Phobos.
- **Heat Flow and Physical Properties Package (HP^3):** InSight uses a self-hammering, spike-shaped probe ("the mole") to dig up to 16 feet (5 meters) below the surface. Prior Mars missions have excavated to depths of less than 1 foot (0.3 meters). As it descends, the "mole" pulls a ribbon-shaped cable behind it. Sensors in the ribbon measure underground temperatures to detect the amount of heat rising from the interior.
- **An X-band Radio for Precision Doppler Tracking (RISE):** Since the lander is in a fixed place on Mars, precise tracking of it from Earth can measure small variations in the planet's rotation, revealing how Mars wobbles as it rotates on its axis. This measurement tells scientists about the size and composition of the core and how much it has cooled.

QUICK FACTS

InSight Objectives

- Uncover how a rocky body forms and evolves to become a planet by investigating the interior structure, temperature, and composition of Mars
- Determine the rate of Martian tectonic activity and meteorite impacts

InSight Instruments

SEIS—Seismometer (Seismic Experiment for Interior Structure)

HP^3—Temperature Probe (Heat Flow and Physical Properties Package)

RISE—Precision X-Band Radio (Rotation and Interior Structure Experiment)

Environmental Sensors—Pressure, Ground and Air Temperature, and Wind; Magnetic Field Variations

Cameras—Color Medium-Resolution Camera and Color Fish-Eye Camera

InSight Lander

Length—19 feet 8 inches (6.0 meters) long with solar panels deployed ("wingspan")

Width—5 feet 1 inch (1.56 meters) wide (lander deck diameter)

Deck Height—33 to 43 inches (83 to 108 centimeters)

Weight—794 pounds (360 kilograms)

Electrical Power—Two solar panels, about 7 feet (2.2 meters) each in diameter

InSight Mission Details

Launch—May 5, 2018, from Vandenberg Air Force Base on an Atlas V-401 rocket.

Cruise to Mars—About 6 months.

Landing—Nov. 26, 2018. A saucer-shaped "aeroshell" slows down descent. Parachutes and retro-rockets bring it to a soft Mars landing.

Landing Site—Elysium Planitia, a broad, smooth plain with about 16-32 feet (5-10 meters) of loose soil and rocks overlying ancient lava flows.

Prime Mission—A little over 1 Mars year (~ 2 Earth years); 709 Mars days, or 728 Earth days.

MARCO (MARS CUBE ONE)
Paving the Way for Small Spacecraft

Two low-cost briefcase-sized NASA/JPL CubeSats hitched a ride on InSight's launch vehicle before separating and flying behind the lander on its cruise to Mars. This technology takes a bold step in demonstrating the first interplanetary CubeSat, a class of small, low-cost spacecraft. The twin CubeSats will fly by Mars and can relay InSight's entry, descent, and landing data back to Earth in real time. InSight's mission success does not depend on MarCO, since there is also communications with the Mars Reconnaissance Orbiter spacecraft. The MarCO demonstration will allow for exploration of new destinations in the solar system for lower cost.

Size—Twin spacecraft are, 14.4 inches by 9.5 by 4.6 inches (36.6 by 24.3 by 11.8 centimeters) each when stowed for launch.

MORE INFORMATION

mars.nasa.gov/insight
www.jpl.nasa.gov/cubesat/missions/marco.php
Facebook.com/NASAInSight
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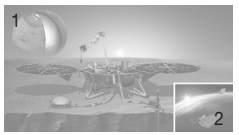
JPL, a division of Caltech in Pasadena, California, manages InSight and MarCO for NASA's Science Mission Directorate. InSight is part of NASA's Discovery Program, managed by the Marshall Space Flight Center. Lockheed Martin Space built the lander and supports flight operations. International participation includes the space agencies of France (CNES), Germany (DLR), Switzerland (SSA), Poland (CBK), and the United Kingdom (UKSA), as well as Spain's Centro de Astrobiología (CAB).



1. Artist's concept of InSight
2. Artist's concept of MarCO

Credit: NASA/JPL-Caltech