

# The DAVINCI spacecraft

October 6 2015, by Matt Williams

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NASA's latest round of Discovery Program missions envision sending craft to study Venus, near-Earth objects, and asteroids. Credit: NASA

It's no secret that there has been a resurgence in interest in space exploration in recent years. Much of the credit for this goes to NASA's

ongoing exploration efforts on Mars, which in the past few years have revealed things like organic molecules on the surface, evidence of flowing water, and that the planet once had a denser atmosphere – all of which indicate that the planet may have once been hospitable to life.

But when it comes to the future, NASA is looking beyond Mars to consider missions that will send missions to Venus, near-Earth objects, and a variety of asteroids. With an eye to Venus, they are busy investigating the possibility of sending the Deep Atmosphere Venus Investigation of Noble gases, Chemistry, and Imaging (DAVINCI) spacecraft to the planet by the 2020s.

Led by Lori Glaze of the Goddard Spaceflight Center, the DAVINCI descent craft would essentially pick up where the American and Soviet space programs left off with the Pioneer and Venera Programs in the 1970s and 80s. The last time either country sent a probe into Venus' atmosphere was in 1985, when the Soviet probes Vega 1 and 2 both orbited the planet and released a balloon-supported aerobot into the [upper atmosphere](#).

These probes both remained operational for 46 hours and discovered just how turbulent and powerful Venus' atmosphere was. In contrast, the DAVINCI probe's mission will be to study both the atmosphere and surface of Venus, and hopefully shed some light on some of the planet's newfound mysteries. According to the NASA release:

"DAVINCI would study the chemical composition of Venus' atmosphere during a 63-minute descent. It would answer scientific questions that have been considered high priorities for many years, such as whether there are volcanoes active today on the surface of Venus and how the surface interacts with the atmosphere of the planet."

These studies will attempt to build upon the data obtained by the Venus

Express spacecraft, which in 2008/2009 noted the presence of several infrared hot spots in the Ganis Chasma region near the shield volcano of Maat Mons (shown below). Believed to be due to volcanic eruptions, this activity was thought to be responsible for significant changes that were noted in the sulfur dioxide ( $\text{SO}^2$ ) content in the atmosphere at the time.



Model of the Vega 1 probe and landing apparatus at the Udvar-Hazy Center, Dulles International Airport, Chantilly, Virginia. Credit: [historicspacecraft.com](http://historicspacecraft.com)

What's more, the Pioneer Venus spacecraft – which studied the planet's

atmosphere from 1978 until its orbit decayed in 1992 – noted a tenfold decrease in the density of  $\text{SO}^2$  at the cloud tops, which was interpreted as a decline following an episode of volcanogenic upwelling from the lower atmosphere.

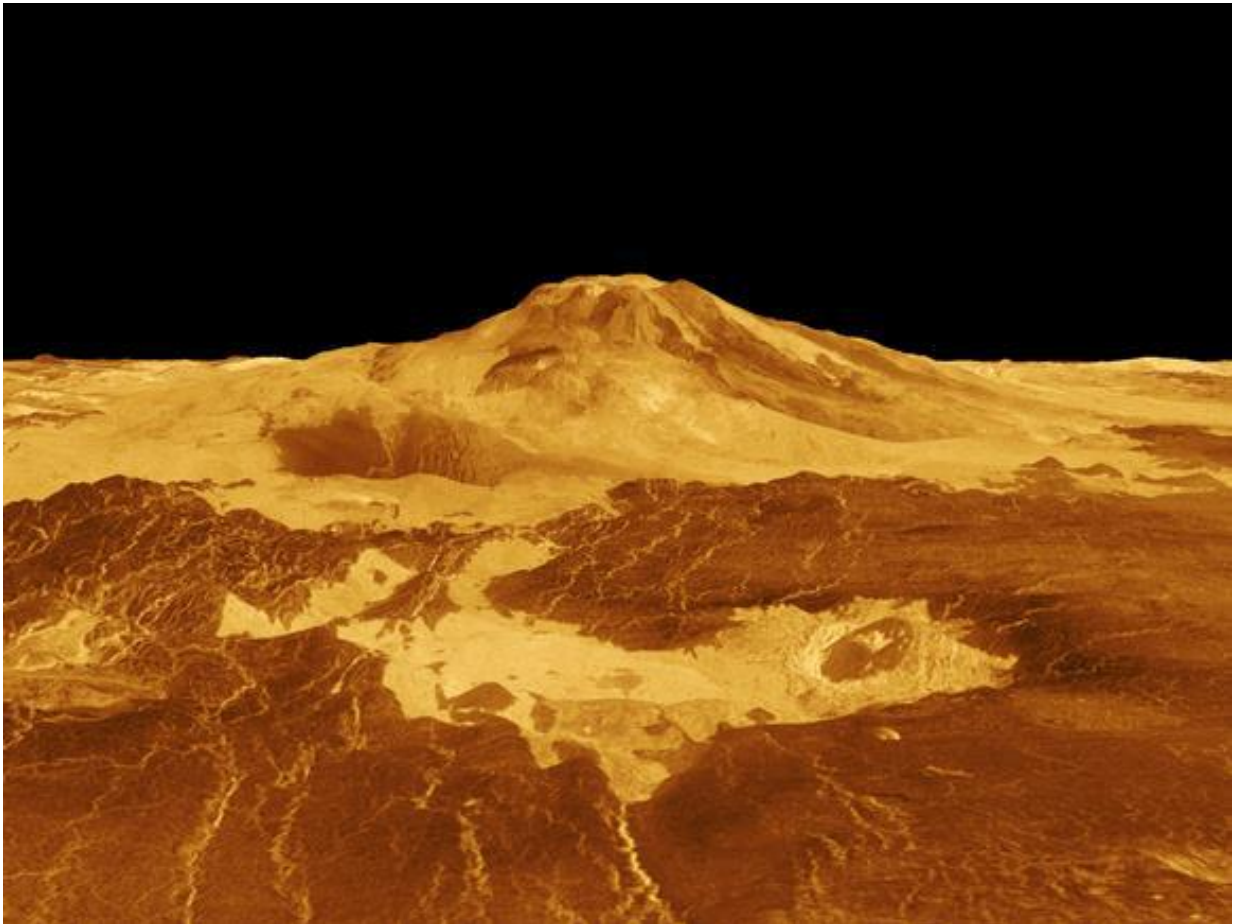
Commonly associated with [volcanic activity](#) here on Earth,  $\text{SO}^2$  is a million times more abundant in Venus' atmosphere, where it helps to power the runaway greenhouse effect that makes the planet so inhospitable. However, any  $\text{SO}^2$  released into Venus' atmosphere is also short-lived, being broken down by sunlight within a matter of days.

Hence, any significant changes in  $\text{SO}^2$  levels in the upper atmosphere must have been a recent addition, and some scientists believe that the spike observed in 2008/2009 was due to a large volcano (or several) erupting. Determining whether or not this is the case, and whether or not volcanic activity plays an active role in the composition of Venus's thick [atmosphere](#), will be central to DAVINCI's mission.

Along with four other mission concepts, DAVINCI was selected as a semifinalist for the NASA Discovery Program's latest calls for proposed missions. Every few years, the Discovery Program – a low-cost planetary missions program that is managed by the JPL's Planetary Science Division – puts out a call for missions with an established budget of around \$500 million (not counting the cost of launch or operation).

The latest call for submissions took place in February 2014, as part of the Discovery Mission 13. At the time, a total of 27 teams threw their hats into the ring to become part of the next round of space exploration missions. Last Wednesday, September 30th, 2015, five semifinalists were announced, one (or possibly two) of which will be chosen as the winner(s) by September 2016.





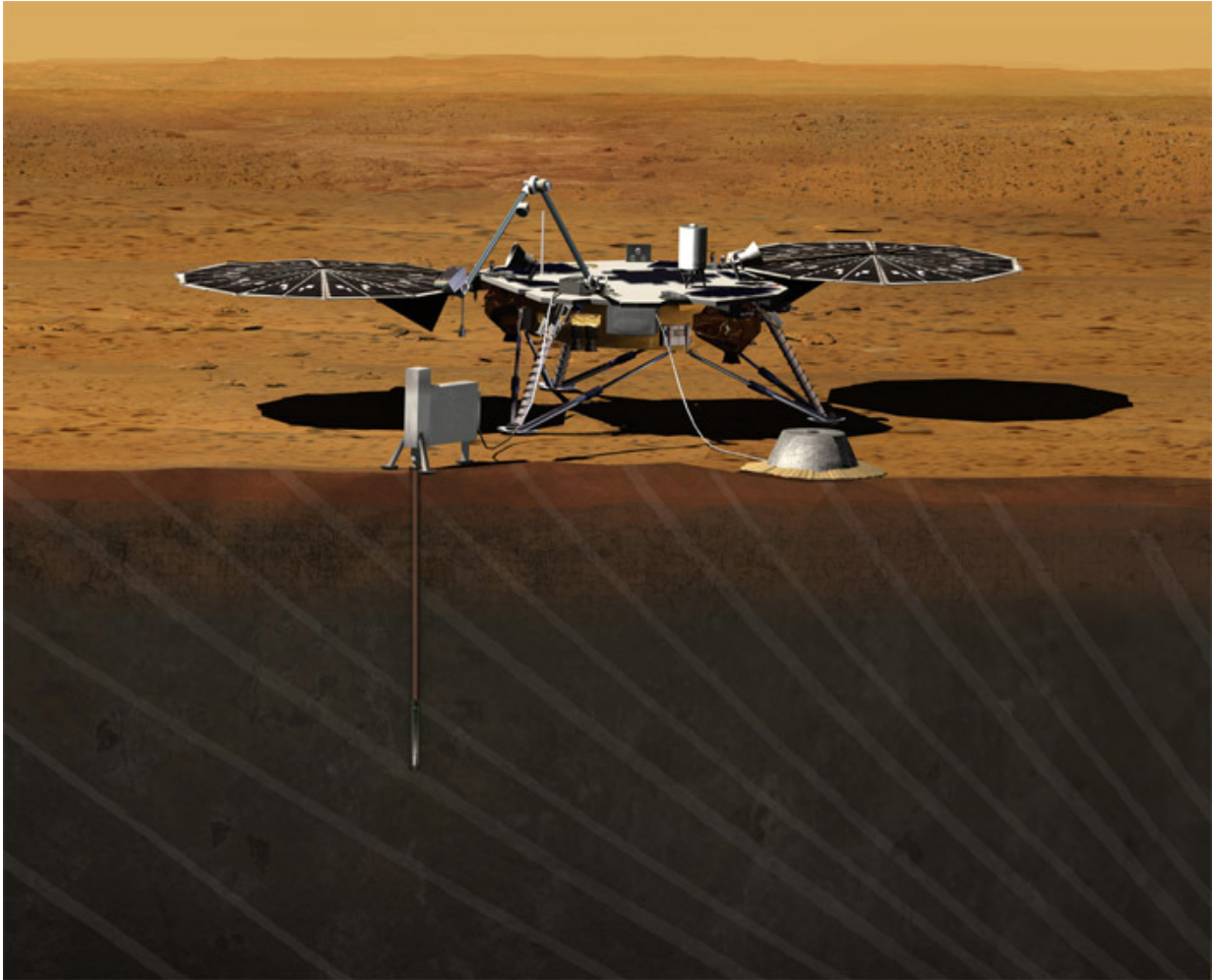
3-D perspective of the Venusian volcano, Maat Mons, generated from radar data from NASA's Magellan mission. Credit: NASA/JPL

These finalists will receive \$3 million in federal grants for detailed concept studies, and the mission (or missions) that are ultimately chosen will be launched by December 31st, 2021. The Discovery Program began back in 1992, and launched its first mission- the Mars Pathfinder – in 1996. Other Discovery missions include the NEAR Shoemaker probe that first orbited an asteroid, and the Stardust-NExT project, which returned samples of comet and interstellar dust to Earth.

NASA's MESSENGER spacecraft, the planet-hunting Kepler telescope,

and the Dawn spacecraft were also developed and launched under the Discovery program. The winning proposal of the Discovery Program's 12th mission, which was issued back in 2010, was the InSight Mars lander. Set to launch in March of 2016, the lander will touch down on the red planet, deploy instruments to the planet's interior, and measure its seismic activity.

NASA hopes to infuse the next mission with new technologies, offering up government-furnished equipment with incentives to sweeten the deal for each proposal. These include a supply of deep space optical communications system that are intended to test new high-speed data links with Earth. Science teams that choose to incorporate the laser telecom unit will be entitled to an extra \$30 million above their \$450 million cost cap.



Artist rendition of NASA's Mars InSight (Interior exploration using Seismic Investigations, Geodesy and Heat Transport) Lander, which was selected as part of the Discovery Programs 2010 call for submissions and will be launched by 2016. Credit: JPL/NASA

If science teams wish to send entry probes into the atmospheres of Venus or Saturn, they will need a new type of heat shield. Hence, NASA's solicitation includes a provision to furnish a newly-developed 3D-woven heat shield with a \$10 million incentive. A deep space atomic clock is also available with a \$5 million bonus, and NASA has offered to

provide xenon ion thrusters and radioisotope heater units without incentives.

As with previous Discovery missions, NASA has stipulated that the mission must use solar power, limiting mission possibilities beyond Jupiter and Saturn. Other technologies may include the NEXT ion thruster and/or re-entry technology.

Source: [Universe Today](#)

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