Review

Giant Success for NASA when the InSight Probe has Reached "Safety" on Mars

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Abstract: InSight-Studying the 'Inner Space' of Mars. InSight, short for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport, is a Mars lander designed to give the Red Planet its first thorough checkup since it formed 4.5 billion years ago. It 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 tectonic activity and meteorite impacts on Mars today. The lander uses cutting edge instruments, to delve deep beneath the surface and seek the fingerprints of the processes that formed the terrestrial planets. It does so by measuring the planet's "vital signs": Its "pulse" (seismology), "temperature" (heat flow) and "reflexes" (precision tracking). This mission is part of NASA's Discovery Program for highly focused science missions that ask critical questions in solar system science.

Keywords: NASA, InSight, Red Planet, Mars lander, Mercury, Venus, Earth and Mars

Introduction

Launching InSight was also a completely separate NASA technology experiment: Two spacecraft called Mars Cube One or Marco. These CubeSats, actually having office dimensions, flew down the road to Mars behind InSight.

Their main purpose was to test new miniaturized communication equipment. Upon arriving on Mars, twin markers successfully transferred InSight data when they entered the Martian atmosphere and landed (Fig. 1). This was the first test of CubeSat miniaturized technology on another planet, a fully-fledged test that strengthened researchers' hopes by giving them new capabilities for future missions.

The InSight mission first seeks to discover how a rocky body forms and evolves to become a planet, investigating the structure and especially the inner composition of Mars. The extremely important mission will also determine the rate of Martian tectonic activities and the impact of a meteorite.

The InSight Mars terminal has two major scientific objectives that support mission objectives:

Formation and evolution: Understanding the formation and evolution of terrestrial planets by investigating the structure and inner processes of Mars.

Tectonic activity: Determining the current level of tectonic activity and the meteorite impact rate on Mars.

Why Mars?

The moon would have been the first target as the distance from Earth, but obviously a larger planet capable of hosting life in the future and providing at least a real basis for mankind is the Martian planet, under the current conditions.

It should be noted that cruise speeds of land-based ships have increased significantly and will continue to grow so that reaching a planet within our solar system is done in a timely manner.

Mars is not only the closest planet in our solar system but also a welcoming one compared to the others that are either too cold or gaseous or too hot those in the immediate vicinity of the sun so Mars is really the first option when we seriously think of an immediate extraterrestrial base for mankind and then even follow the Mars planet.

Previous Martian activities have investigated the history of the red surface of the plant by examining features such as mugs, volcanoes, stones and soil. However, the signatures of planet formation can only be found by feeling and studying "vital signs" far below the surface.

Fig. 1: InSight touched down on Mars at 11:52:59 a.m. PT (2:52:59 p.m. ET) on Nov. 26, 2018

Mars is far from being our favorite when it comes to exploring the possibility of life or the possibility of life on a planet other than the Earth, but an immediate one that allows us in time to achieve these major goals and aspirations for humanity.

Mars is very close to Earth and has many features similar to our planet. It is one of the few planets of our solar system with a convenient sunshine position, not too close to melting everything but too distant to be an unhealthy cold planet.

Compared to other terrestrial planets, Mars is neither too big nor too small. This means tracking training and providing information about planets on the ground.

It is a perfect laboratory to study the formation and evolution of rocky planets. Scientists know that Mars has low geological activity, but a Lander like InSight can reveal as long as Mars is active (Aversa *et al*., 2017a; 2017b; 2017c; 2017d; 2017e; 2016a; 2016b; 2016c; 2016d; 2016e; 2016f; 2016g; 2016h; 2016i; 2016j; 2016k; 2016l; 2016m; 2016n; 2016o; Mirsayar *et al*., 2017; Petrescu and Petrescu, 2013a; 2013b; 2013c; 2012; 2011; Petrescu, 2018; 2015a; 2015b; 2012; Petrescu *et al*., 2016a; 2016b; 2016c; 2017a; 2017b; 2017c; 2017d; 2017e; 2017f; 2017g; 2017h; 2017i; 2017j; 2017k; 2017l; 2018a; 2018b; 2018c; 2018d; Petrescu and Calautit, 2016a; 2016b; Daud *et al*., 2008; Taher *et al*., 2008; Zulkifli *et al*., 2008; Pourmahmoud, 2008; Pannirselvam *et al*., 2008; Ng *et al*., 2008; El-Tous, 2008; Akhesmeh *et al*., 2008; Nachiengtai *et al*., 2008; Moezi *et al*., 2008; Boucetta, 2008; Darabi *et al*., 2008; Semin and Bakar, 2008; Al-Abbas, 2009; Abdullah *et al*., 2009; Abu-Ein, 2009; Opafunso *et al*., 2009; Semin *et al*., 2009a; 2009b; 2009c; Zulkifli *et al*., 2009; Ab-Rahman *et al*., 2009; Abdullah and Halim, 2009; Zotos and Costopoulos, 2009; Feraga *et al*., 2009; Bakar *et al*., 2009; Cardu *et al*., 2009; Bolonkin, 2009a; 2009b; Nandhakumar *et al*., 2009; Odeh *et al*., 2009; Lubis *et al*., 2009; Fathallah and Bakar, 2009; Marghany and Hashim, 2009; Kwon *et al*., 2010; Aly and Abuelnasr, 2010; Farahani *et al*., 2010; Ahmed *et al*., 2010; Kunanoppadon, 2010; Helmy and El-Taweel, 2010; Qutbodin, 2010; Pattanasethanon, 2010; Fen *et al*., 2011; Thongwan *et al*., 2011; Theansuwan and Triratanasirichai, 2011; Al Smadi, 2011; Tourab *et al*., 2011; Raptis *et al*., 2011; Momani *et al*., 2011; Ismail *et al*., 2011; Anizan *et al*., 2011; Tsolakis and Raptis, 2011; Abdullah *et al*., 2011; Kechiche *et al*., 2011; Ho *et al*., 2011; Rajbhandari *et al*., 2011; Aleksic and Lovric, 2011; Kaewnai and Wongwises, 2011; Idarwazeh, 2011; Ebrahim *et al*., 2012; Abdelkrim *et al*., 2012; Mohan *et al*., 2012; Abam *et al*., 2012; Hassan *et al*., 2012; Jalil and Sampe, 2013; Jaoude and El-Tawil, 2013; Ali and Shumaker, 2013; Zhao, 2013; El-Labban *et al*., 2013; Djalel *et al*., 2013; Nahas and Kozaitis, 2014).

Materials and Methods

InSight probe landed at 11:52:59 PT (2:52:59 ET ET) on November 26, 2018, near the equator of Mars, on the west side of the flat plains area called scientists Elysium Planitia.

Elysium Area Planning was selected not for its surface features, but for safety reasons of the mission, the area believed to be safe by NASA scientists. The main purpose of InSight is to study the interior of the planet, not the surface as Curiosity has already done. Thus, in selecting a landing site, what was on the surface was of greater importance in this mission than in previous rover missions focused on geology.

The plan is right for a large flat surface, a geometric plane or flatness, or a plain if we can say that. Elysium is an ancient name from the ancient Greek name designated for a paradise of life after death, which in English is generally called "in the Elysian fields".

The landing site is located west of Elysium Planitia, centered about 4.5 degrees north latitude and

135.9 degrees east longitude. It is just 373 miles (600 kilometers) away from Curiosity's predecessor landing at Crater Gale.

The landing ellipse had a length of about 130 kilometers, generally to the west and east and a width of 27 kilometers, covering the area where the ship had a 99% landing chance when moving toward the center of the ellipse. So the area was practically selected not only as a good starting point for internal investigations, but also for clear reasons for the safe landing of the InSight probe on the Martian surface.

InSight has 360 panoramic images in all directions on this landing site, another important consideration for choosing this martian field as the landing area. Scientists have waited for a flat surface without hills nearby and some great stones in sight. It was based on high-resolution images taken from the orbit as part of a detailed analysis of site selection.

Several workshops took place in 2013, 2014 and 2015 to evaluate 22 candidate landing ellipse, of which only four finalists remained. All 22 sites are located in Elysium, which is one of three Mars areas that meet two of InSight's needs.

One requirement was that the landing place should be located near the equator. This ensures that the solar panel of the soil can provide adequate power at any time of the year and the soil can remain warm: Between 5 degrees north latitude and 3 degrees north latitude.

The altitude of the site must be small enough to have a sufficient atmosphere above the place for a safe landing, as the spacecraft is based on the deceleration atmosphere during the descent.

HiRISE on NASA's Mars Reconnaissance Orbiter plays an important role in assessing Mars landing sites. HiRISE took over 150 images of InSight landing sites, covering almost all of the site's final site.

The scientific success of InSight and the safe landing depended on landing in a relatively flat area. It also depends on landing in an area where stones are few in number. A too steep slope could prevent the access of the robotic arm to a large work area. A steep gradient in the wrong direction could jeopardize the power of solar networks. A large stone at the landing site could block an opening of a solar series.

The site evaluation also took into account the underground structure. For mission success, the InSight Heat Flow probe must be able to penetrate the ground into the lander's workspace. The probe was designed to bury soil (not rock) at a depth of 10 to 16 feet (three to five meters). NASA's Mars Odyssey thermal imaging system (THEMIS) has provided essential evidence that the chosen landing site is suitable for afforestation. THEMIS remarks can show how quickly the earth cools at night or gets warm in the sunlight. The solid rock changes the temperature slower than the softer ground.

Results

NASA launched an InSight space-based spacecraft that was anchored in a Martian region on a six-and-a-half-hour trip worth 480 million kilometers with a two-year internal analysis mission and the press international "Red Planet". InSight is actually a mission of the NASA Discovery program, specially designed in NASA's workshops, which involves placing an autonomous module on the surface of Mars with the obvious role of studying the interior of this planet. Especially the inner part that has not been shown to us until now, but only to a small extent in just a few more or less random locations.

The JPL mission team near Los Angeles announced that the success of the assault was confirmed by the signals transmitted to Earth by one of the two microsatellite missions and remained in the orbit of Mars.

Members of the mission control team have constantly applauded after receiving the successful landing confirmation. In the next few hours, the team starts the hard work as well as the hours the mission was designed because all this team of specialists will check the operation of all instruments on board and the mission accomplishment step by step. Once the probe successfully placed on Mars it will have a lot of work and the whole team that designed and prepared it will assist you permanently. It can be said in other words that serious work is just beginning for NASA, for all those wonderful people who are concentrating on the planet and for humanity so that we can fulfill our humanitarian mission to conquer cosmic space in the immediate millennium following.

Using the sophisticated geophysical arsenal, InSight will explore the interior of the Red Planet in search of life, matter, including living matter traces. The InSight module will evaluate the "vital signs of the planet" and then decide if the planet's core is solid or liquid and why Mars does not have a surface of mobile tectonic plates, just like Terra.

"Our robot science explorers, like InSight, pave the way for the ambitious mission to send people to the red planet," said Geoff Yoder, associate director of the NASA Science Division in Washington.

Unlike the autonomous routers that revolutionized remote red-eye exploration, the InSight module is stationary. InSight will dig a deep pit and try to find out if there is a heat current in the Mars basement to determine if this planet has a warm core like the Earth. The InSight module is also equipped with a seismometer to detect the smallest Martian earthquakes.

If Mars is tectonic, InSight will definitely detect it. Scientists know the earthquake - earthquakes cause seismic earthquakes traveling through the basement of the planet, the propagation mode and the speed of motion being influenced by the different layers of rock and sediment that these waves traverse.

For the moment, we do not know what Mars's interior looks like. Several missions in the past have led to seismometers on the planet's surface, but the results have been postponed. For example, in the case of the Viking probe, the seismometer from the first well did not open and the second recorded only the motions printed on the probe installed by the Martian wind, so we could not talk about the planet's tectonic movement once it was recorded and the vibrations produced by the wind. This time preparing for reading the Martian tectonic waves if they exist is much better done by NASA scientists. The concept is clear and there is no way to deliver.

This machine now on Mars is the first Autonomous Curiosity rover, which has reached its destination in 2012 and is currently the only active robot on the planet's shell. Better said it was because Curiosity has recently been out of power and cannot be refilled and used anymore. But he has done his full duty, even much more than he initially asked. Only the United States succeeded in successfully introducing robotic devices on Mars. The former USSR has only succeeded in collapsing several Landing Modules on the "Red Planet", as well as Europeans in general, which must be said and courageous at the moment since missions of this kind are ultimately vital to mankind is the moment when the millennium of its expansion into the universe must begin. In other words, we cannot play with this, given the importance of entrepreneurship, its purpose, our expectations of all but above all the huge costs introduced.

Discussion

For the mission of this Martian probe, in which NASA has invested enormously, there is hope as it will succeed in its mission, all the more as it started with the right, placing the probe exactly in the desired area.

Fig. 2: The Atlas V rocket was the ship who has carried out the InSight module (May 4, 2018)

The photos taken and transmitted immediately after weaning were in considerable quantity. Samples already collected and studied have also been successfully launched immediately by depreciation. We are looking for and waiting for other important investigations that the probe must successfully exploit in the future. The Atlas V rocket was the ship who has carried out the InSight module (Fig. 2).

Conclusion

Launch of InSight launches also launched a separate NASA technology experiment: Two spacecraft called Mars Cube One or Marco. These office-sized CubeSats flew on the road to Mars behind InSight.

Their purpose was to test new miniaturized communication equipment. Upon arriving on Mars, twin markers successfully transferred InSight data when they entered the Martian atmosphere and landed. This was the first test of CubeSat miniaturized technology on another planet, which researchers' hopes can offer new capabilities to future missions.

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Compared to other terrestrial planets, Mars is neither too big nor too small. This means tracking training and providing information about planets on the ground. It is a perfect laboratory to study the formation and evolution of rocky planets. Scientists know that Mars has a low geological activity. But a Lander like InSight can reveal how active Mars is.

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Ethics

Author declare that are not ethical issues that may arise after the publication of this manuscript. This article is original and contains unpublished material.

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Figures Sources

Fig. 1: Source: https://mars.nasa.gov/insight/timeline/landing/summary/

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