



Greg Smith – editor

**Volume 24, No. 8
December 2018**

**Program: Club Christmas Party
Pot Luck**

**Meeting: December 12th
6pm River View Condominiums
4th floor Recreation Room**

2 New and 2 Reused

The month of December is a very busy month in the exploration of the solar system. We have a rocket that sticks it landing for the 3rd time, two probes make their destinations, and a third that will miss December by one day [depending on your time zone. 9:33 pm PST is still Dec 31].

The NASA Mars lander, InSight, made a very successful landing at a perfect spot on a very flat plain with few rocks. It will soon begin to deploy its seismometer for detecting Marsquakes and sending the data so scientists can learn what the structure of Mars interior looks like. It also has the ability to deploy a thin probe into the surface of Mars to a depth of 50ft and take the temperature of the planet. It will also be measuring the atmosphere for its components.

It looks like InSight is giving Mars a medical checkup. Measuring its heartbeat, taking its temperature and checking on how it is breathing.

Then we have NASA's Probe OSIRIS-Rex that just saddled up next to the asteroid Bennu. This probe will be taking pictures, analyzing the spectra of the asteroid for its chemical composition and eventually land and gather soil samples (the

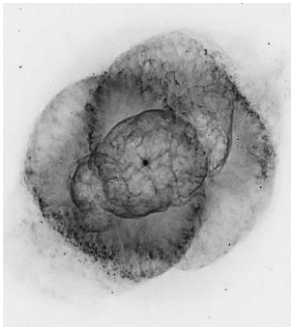
largest amount of material since Apollo's moon rocks), then return it to Earth for very detailed examinations.

The third probe is the New Horizons (of Pluto fame) that will be flying by a Kuiper Belt object called 2014 MU69 and nicknamed Ultima Thule, which is about 4.1 billion miles (6.6 billion kilometers) away from Earth. This will be the first time an Earth probe will examine an object this far away. It will be taking pictures of Ultima Thule with the same cameras it used at Pluto but will be flying by at a closer distance and get even better detail in these pictures. No one knows what to expect, but what ever is found will be all new stuff.

Not just NASA is doing new things. Space X just launched 64 small satellites at one time on a re-used rocket. In fact, it was its third launch and landing. This time the landing was on a drone ship in the Pacific Ocean. The video of it landing shows that it hit the bulls' eye of the drone ship.

We are truly experiencing a lot of great things in the exploration of space.

**Every Day is a Star Filled Day
Every Night is a Starry Night**



Touchdown on Mars! NASA's InSight Lands to Peer Inside the Red Planet

By Mike Wall, Space.com Senior Writer

NASA's InSight lander touched down safely on the Martian surface today (Nov. 26), pulling off the first successful Red Planet landing since the Curiosity rover's arrival in August 2012 — on the seventh anniversary of Curiosity's launch, no less.

Signals confirming InSight's touchdown came down to Earth at 2:53 p.m. EST (1953 GMT), eliciting whoops of joy and relief from mission team members and NASA officials here at the agency's Jet Propulsion Laboratory (JPL), which manages the InSight mission. A few minutes later, the team received confirmation from the lander's radio that it's functioning after the landing.

NASA's InSight Mars lander captured its first image just moments after touching down on the Red Planet on Nov. 26, 2018.

But the tension hasn't completely dissipated and won't for a while yet: Mission team members won't know whether InSight successfully deployed its solar panels until 8:35 p.m. EST (0135 GMT on Nov. 27) at the earliest. Without those arrays extended, the lander cannot survive, let alone probe the Red Planet's interior like never before — the main goal of the \$850 million InSight mission. [They did deploy and are generating record amount of power.]

The agonizing delay is unavoidable; NASA's Mars Odyssey orbiter won't be in position to relay the deployment confirmation to mission control until more than 5 hours after touchdown, agency officials said.

If the arrays do unfurl as planned, InSight will join a relatively select club. Less than 40 percent of all Mars missions over the decades have successfully arrived at their destination, be that an orbital path around the planet or its dusty red surface.

A long road to Mars

InSight launched on May 5 from Vandenberg Air Force Base in California, in the first-ever liftoff of an interplanetary mission from the U.S. West Coast. (Florida's Space Coast is the traditional jumping-off point for such far-flung voyagers.)

InSight shared its Atlas V rocket ride with two briefcase-size cubesats called MarCO-A and MarCO-B, which have been making their own way to Mars over the past 6.5 months. The MarCO duo (whose name is short for "Mars Cube One") have been embarked on an \$18 million demonstration mission, which seeks to show that tiny spacecraft can explore deep space.

MarCO-A and MarCO-B also played a key role in today's excitement, relaying data from InSight to mission control here at JPL during the lander's harrowing entry, descent and landing (EDL) sequence.

And harrowing it was. InSight hit the thin Martian atmosphere at about 12,300 mph (19,800 km/h), nailing its entry angle of exactly 12 degrees. If the lander had come in any steeper than that, it would have burned up; any shallower, and it would have skipped off the atmosphere like a flat stone across a pond.

As the lander streaked through the Martian skies, its heat shield endured temperatures around 2,700 degrees Fahrenheit (1,500 degrees Celsius) — hot enough to melt steel. Atmospheric drag slowed InSight down tremendously, to about 1.7 times the speed of sound, at which point the lander deployed its supersonic parachute.

InSight soon fired up its small onboard thrusters to decelerate further, finally touching down on a flat equatorial plain called Elysium Planitia at around 5 mph (8 km/h). (These numbers are based on pre-landing modeling work by the InSight EDL team; the actual figures may end up being slightly different.)

All of this happened in just 6.5 minutes — InSight's total travel time in the Martian air, from atmospheric entry to touchdown. The lander's EDL sequence was a bit shorter than Curiosity's famous "7 minutes of terror" experience, which featured a rocket-powered sky crane that lowered the heavy, car-size rover onto the Martian surface on cables. (InSight's EDL mirrors that of NASA's Phoenix lander, which touched down near the Red Planet's north pole in May 2008. InSight's body is also based heavily on that of Phoenix; both landers were built for NASA by aerospace company Lockheed Martin.)

MarCO-A and MarCO-B didn't follow InSight onto the surface. The bantam probes flew right on by Mars, their work done and their place in history as the first interplanetary cubesats cemented.

"We believe that this is a really interesting technology overall, and we've really shown something unique in deep space that will allow us to further future missions in a compact and efficient way," MarCo-A mission manager Cody Colley of JPL said here yesterday (Nov. 25) during a pre-landing news conference.

Their work is probably done, I should say: It's possible that MarCO-A and MarCO-B could observe an asteroid or other celestial body if their paths bring them close enough, and if funding for an extended mission is granted, John Baker, NASA's program office manager for the MarCO mission, told Space.com.

Probing the Martian interior

As exciting as the landing was, it was just the prelude to the main event — InSight's science work on the Red Planet.

Over the next two Earth years, the lander will probe Mars' interior structure and composition in unprecedented detail. InSight will use two main science instruments to do this: a heat probe that will hammer itself up to 16 feet (5 meters) beneath the Martian surface, and a suite of three incredibly precise seismometers, which will be on the lookout for "mars quakes," meteorite strikes and other jolts.

"Incredibly precise" doesn't do these seismometers justice, actually.

"They can see vibrations with an amplitude of about the size of an atom — maybe a fraction of an atom," InSight principal investigator Bruce Banerdt, also of JPL, said during yesterday's news conference.

The seismometer suite is therefore encased in a vacuum chamber, to minimize disturbances that could muck up the data. In late 2015, the mission team detected a leak in this chamber. The leak was fixed, but not in time for InSight to launch in March 2016, as originally planned. Launch windows for Mars missions roll around just once every 26 months, so the lander had to wait until this past May to get off the ground.

The science team will also track InSight's position in space using the 789-lb. (358 kilograms)

lander's communications gear. This information will allow scientists to measure the slight wobble of Mars' axis of rotation, which in turn will help them better understand the planet's core, NASA officials have said.

Together, all of this data will give scientists an unprecedented look at the Red Planet's interior.

"That is the goal of the InSight mission — to actually map out the inside of Mars in three dimensions, so that we understand the inside of Mars as well as we have come to understand the surface of Mars," Banerdt said.

And scientists can use Mars as a sort of laboratory to understand how rocky planets in general form, he added. That's because the Red Planet's insides have been more or less frozen in place since shortly after Mars formed about 4.5 billion years ago. We can't look to Earth as a time capsule in this way because our planet's insides have been roiled continuously over the eons by plate tectonics, mantle convection and other processes.

InSight (whose name is short for "Interior Exploration using Seismic Investigations, Geodesy and Heat Transport") features an unusual degree of international cooperation. The burrowing heat probe was provided by the German Aerospace Center, and France's national space agency CNES led the consortium that developed the seismometer suite.

"A slow-motion mission"

Don't expect InSight to dazzle you with pretty pictures. The mission isn't interested in cool surface features, which explains why it landed on Elysium Planitia; the plain is smooth and flat with a paucity of boulders, boosting the odds of a safe landing (and of the burrowing heat probe being able to get deep down into the Martian dirt). And InSight is a lander, not a rover, so any photos that it takes over the course of its mission will depict the same terrain.

It'll also take a while for the spacecraft to get up and running on Mars. InSight will use its robotic arm to place the heat probe, the seismometer suite and a weather shield (which will surround the seismometers) on the ground.

No other Mars mission has done such an instrument deployment — science gear tends to be fixed to the bodies or arms of Red Planet spacecraft — and the InSight team wants to make sure they get it right. So, once they get a look at InSight's Martian surroundings, they'll practice the deployment over and over using a testbed lander here at JPL.

Actual deployment probably won't happen until two or three months from now, Banerdt said. And it'll take another month or so to calibrate the instruments for use on the Red Planet.

So, it'll be at least six months before the InSight team even "gets a glimmer of what we're looking for," Banerdt said. And it'll likely take the full two-year mission lifetime, or close to it, to get a really detailed look at the Martian interior.

"Once we get to the surface, InSight is a slow-motion mission," Banerdt said.

Minutes of the November Meeting

Ted Gruber, Vice President, called the meeting to order. He had the guests introduce themselves.

Ted introduced our guest speak, Howard Knytych, from Rose City Astronomers. He teaches astronomy at Concordia. His talk was entitled Living In the Middle of the Universe. The scale of the universe stretches from the smallest, Planck 1×10^{-35} to the Cosmic 9×10^{26} m. You can find more information at <http://htwins.net/scale2/>.

Ted thanked Howard for tonight's talk. He also thanked Chuck Ring for the announcement about tonight's meeting in The Daily News.

After a 10 minute intercession for refreshments, we discussed our annual Christmas Party. It will take place on Wednesday, December 12th at 6 pm. It will be a potluck dinner at River's Edge. Thank you Peg Miller for reserving this spot. We will also have an astronomy related White Elephant gift exchange.

Ted Gruber gave the Sky Report. In the evening sky we still have Saturn as it makes it final appearance in the evening sky until next summer. Mars is not considerable dimmer than it was during its summer peak. It is visible in the southern sky at twilight until setting in the west-southwest around 11 pm. The morning sky consists of Venus, Mercury, and Jupiter. Venus rises in the southeaster sky around 4 am and remains until fading into the morning light. Mercury returns to the morning sky at the end of November. It reaches its peak about 10 degrees above the horizon around 45 minutes before sunrise in mid-December. Jupiter returns to the morning sky in early December. It rises before Mercury through December 21st and after Mercury starting December 22nd. Mercury passes 0.9 degrees north of Jupiter the morning of December 21st. The Leonids are active through November 30, peaking the night of the 17-18. The Geminids are active from December 4-17th, peaking the night of December 13-14. The Messier of the Month is M-56. It is a magnitude 8.3 globular cluster in the constellation Lyra. it is about 32,900 light years away and 84 light years across. It contains about 80,000 stars. It is one of the more challenging Messier objects to observe with binoculars because of its relatively dim magnitude and the fact that it does not have a bright central core. Small telescopes show the cluster as a fuzzy patch of light, while an 8 inch or larger scope will resolve individual stars.

Roy Gawlick gave an update on the Solstice Walk that is scheduled for **December 21st** from 7-9 pm. Starting at the Sun and walking to Pluto is the simple version. Another idea is to get different groups at each planet. We would get the Sun. Each table (planet) would be a "destination". Possibly have a kids "passport" that kids can get a stamp at each planet. Roy has submitted the permit to the city. We need help with set-up on day of event. Park restrooms should be open for use during the event. Our table needs lanterns, lights, etc. We are still working out the insurance.

A motion was made to let the Board, because of time constraints, approve up to \$250 to get insurance, for all club evens including Solstice Walk.

Meeting adjourned.

☞ **December 2018 Meeting** ☞

DATE: Wednesday, December 12, 2018

TIME 6:00 pm

PLACE: River View Condominiums
1548 River Road, Longview
4th Floor Recreation Rm

PROGRAM: Clubs Christmas Pot Luck

SNACKS: All who come.

DRINKS: Bring your own to share

Friends of Galileo Club Officers

PRESIDENT	Greg Smith
VICE-PRESIDENT/ PROGRAM CHAIR	Ted Gruber
SECRETARY	Becky Kent
TREASURER	Steve Powell
WEBSITE	Roy Gawlick
NEWSLETTER ED.	Greg Smith
ALCOR	Tom Meek

Next Month's Newsletter Deadline

The deadline for items in next month's newsletter is:

Wednesday: seven days before next meeting.

Please feel free to send in your thoughts and experiences about your astronomical adventure.

Submit your material by E-mail to:

grlyth@msn.com