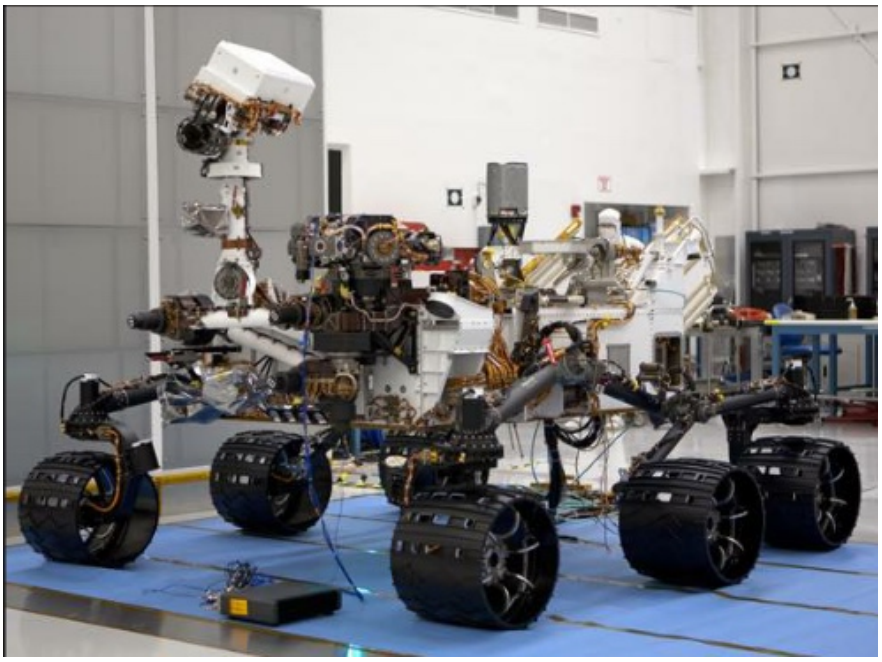
Spacecraft 3D

Mars Odyssey – 7.2 feet by 5.6 feet by 8.5 feet and 1608 pounds; Since October 2001 has been orbiting Mars studying the planet and data from landers and rovers on the surface. For the first time, the mission globally mapped the amount and distribution of many chemical elements and minerals that make up the Martian surface. Maps of hydrogen distribution led scientists to discover vast amounts of water ice in the polar regions buried just beneath the surface. Odyssey also recorded the radiation environment in low Mars orbit to determine the radiation-related risk to any future human explorers who may one day go to Mars.

Mars Reconnaissance Orbiter – At Mars; 21 feet tall with 10 feet wide dish antenna; 45 feet wide including solar panels and 4608 pounds; Launched August 12, 2005; Studying Mars in detail with a host of scientific instruments such as cameras, spectrometers, and radar used to analyze the landforms, stratigraphy, minerals and ice of Mars. It paves the way for future spacecraft by monitoring Mars' daily weather and surface conditions, studying potential landing sites, and hosting a new telecommunications system.

Curiosity – a car-sized rover launched to study Mars. Launch date Nov. 26, 2011; Does Mars have places (habitats) that could have supported small life forms called microbes? NASA's Mars Science Laboratory rover named Curiosity landed in Gale Crater and is exploring Mt. Sharp at its center. Landing on Mars is one of the most challenging efforts in robotic exploration. Its primary mission is one Mars' year, which is two Earth years.



Mars Science Laboratory Descent Stage – Carrying Curiosity to the surface of Mars; 9 feet long and 1,830 pounds (860 pounds of it are fuel); November 26, 2011; Mars Science Laboratory (MSL) represents the first use of a 'soft landing' technique called the Sky Crane maneuver. The sheer mass of MSL prevented engineers from using the familiar airbags to deliver their rover safely to the Martian surface. As rovers become more capable and carry more instruments, they become larger. So, in order to accommodate this advanced mission, engineers designed a sky-crane method that will lower the rover to the surface.

After the parachute significantly slowed the vehicle and the heatshield (that protected the rover during entry) separated, the descent state separated from the backshell. Using eight steerable engines, the descent stage slowed the nested rover down even further to eliminate the effects of any horizontal winds. When the vehicle slowed to nearly zero velocity, the rover was released from the descent stage. A bridle and 'umbilical cord' lowered the rover to the ground. During the lowering, the rover's front mobility system was deployed so that it was essentially ready to rove upon landing. When the on-board computer sensed that touchdown was successful, it cut the bridle. The descent stage then pitched away from the rover and powered away at full throttle to a crash-landing far from the Mars Science Laboratory.

Mars Exploration Rovers – Spirit and Opportunity roving Mars; 5.1 feet high, 7.6 feet wide and 5.5 feet long weighing 383 pounds. Spirit was launched Jun 10, 2003 and Opportunity was launched July 8, 2003. Designed as roving field geologists. Spirit and Opportunity landed three weeks apart in January 2004 and were designed to last 92 Earth days (90 Martian days).

Spirit explored Gusev crated for more than 6 earth years. In that time Spirit's instruments found rocks containing minerals that can only form in the presence of water and deposits of nearly pure silica that could have come from the interaction of water and volcanic activity in a hot-springs like environment.

As of December 2016, Opportunity continues to explore a region of Mars called Meridiani Planum. Sent there to investigate an orbital signature of a mineral called Hematite, Opportunity almost immediately found evidence of rocks laid down in the presence of liquid water. After a nearly 3 year trek to a large crater called 'Endeavor' Opportunity found evidence for clay minerals formed in a more neutral pH environment that might have been conducive to life.

MAVEN (Mars Atmospheric and Volatile EvolutionN) – solving Mars' climate mystery; 37.5 feet with solar panels deployed and 5410 pounds; Launched Nov. 19th, 2013; first mission devoted to understanding the Martian upper atmosphere. Goal is to determine the role that loss of atmospheric gas to space played in changing the Martian climate through time. Where did the atmosphere and water go?

NASA 3D viewer

Crawler-transporter – A pair of behemoth machines called crawler-transporters have carried the load of taking rockets and spacecraft to the launch pad for more than 40 years at NASA's Kennedy Space Center in Florida. Each the size of a baseball infield and powered by locomotive and large electrical-power generator engines, the crower-transporters stand ready to keep up the work for the next generation of launch vehicle projects to lift astronauts into space. One crawler-transporter is being modified to accommodate the heavier weight of te SLS vehicle and the Mobile Launcher tower. See the size of the school bus on top for scale.

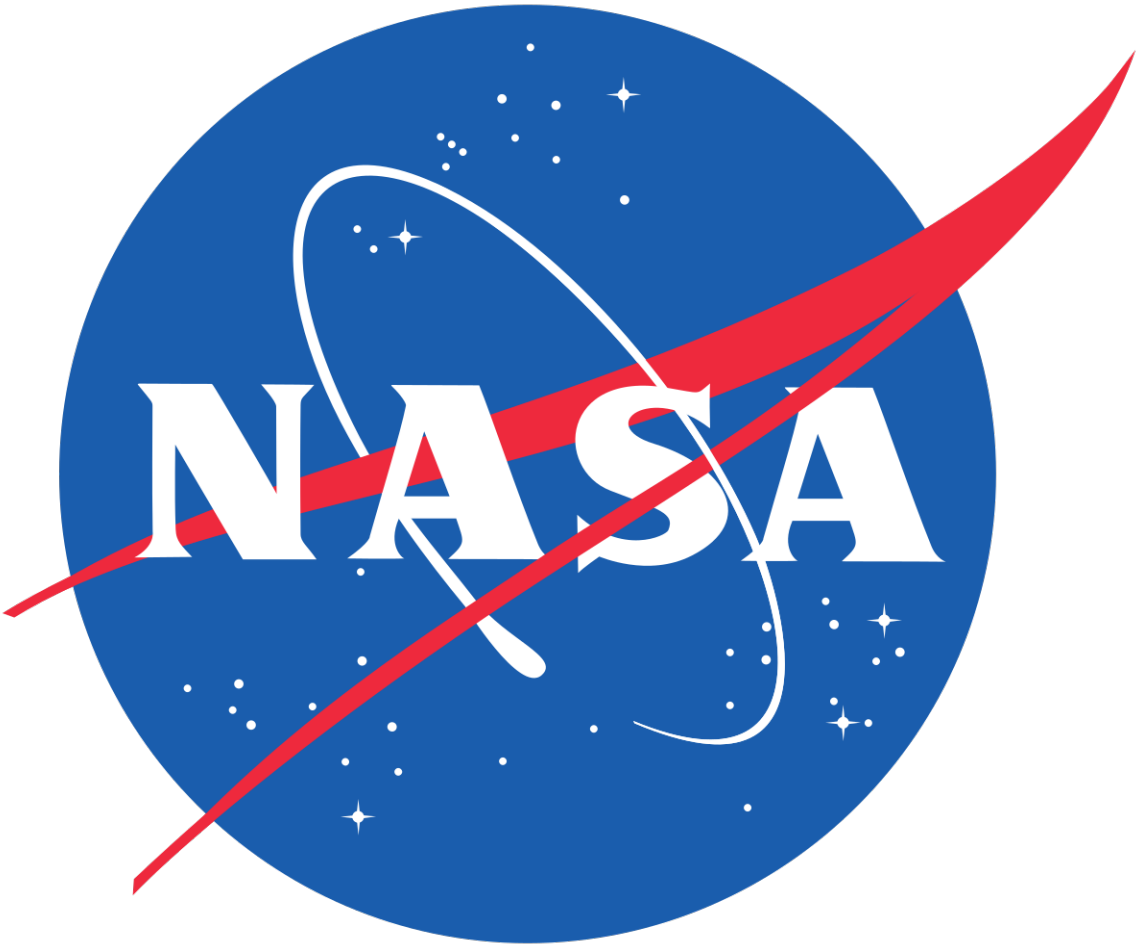
Tower (MLP) – Modification of a new Mobile Launcher (ML) is under way at Kennedy Space Center in Florida for NASA's Space Launch System (SLS). The ML is designed to support the assembly, testing, check out and servicing of the rocket, as well as transfer it to the pad and provide the platform from which it will launch.

Space launch system – NASA's Space Launch System is an advanced heavy-lift launch vehicle that will provide an entirely new capability for science and human exploration beyond earth's orbit. The SLS will give the nation a safe, affordable and sustainable means of reaching beyond our current limits and open new doors of discovery from unique vantage points of space.

Orion spacecraft – Named after the largest constellation in the night sky and drawing from more than 50 years of space flight research and development, the Orion spacecraft is designed to meet the evolving needs of our Nation's deep space exploration program for decades to come. It will be the safest, most advanced spacecraft ever built, and it will be flexible and capable enough to take us to a variety of destinations.

Launch the rocket – America's new heavy-lift rocket will be the largest vehicle ever built and more powerful than the Saturn V rocket that carried Apollo astronauts to the moon. The 70-metric ton (77 ton) configuration will lift more than 154,000 pounds and will provide 10 percent more thrust than the Saturn V rocket. The first SLS mission – Exploration Mission 1 – scheduled for 2017 will launch an unscrewed Orion spacecraft to demonstrate the integrated system performance of the SLS rocket and spacecraft prior to a crewed flight.

Many different jobs that go into making these types of machines and missions work from scientist, physics, engineer, astronaut and many more.


NASA

About InSight's Launch

InSight is scheduled to launch under pre-dawn skies from Vandenberg Air Force Base on the central coast of California in May 2018.

The mission's launch period is May 5 through June 8, 2018, with daily launch windows that last two hours per day. Launch opportunities are set five minutes apart during each date's launch window. The first opportunity begins at approximately 4:00 a.m. Pacific Standard Time on May 5.

InSight will launch from Launch Complex 3 and ride atop an Atlas V-401 rocket provided by United Launch Alliance, Centennial Colorado, a joint venture of Boeing Co. and Lockheed Martin Corp.

The Atlas V is one of the biggest rockets available for interplanetary flight. This is the same type of rocket that launched the Mars Reconnaissance Orbiter in 2005.

The launch is only the beginning; the trip to Mars takes about six months. The journey is about 301 million miles (485 million kilometers).

No matter at what particular time and date InSight launches during its launch windows, its date with Mars is set for Nov. 26, 2018.

Orion

Orion ("o-**rie**-un") is a new NASA spacecraft for astronauts. The spacecraft will play an important part in NASA's journey to Mars. Orion will carry astronauts farther into the solar system than ever before.

What Will Orion Do?

Orion will carry astronauts into **deep space** and then return them home to Earth. Orion will be able to travel to an asteroid or even Mars.

NASA is developing a huge rocket called the Space Launch System, or SLS. This rocket is a heavy-lift launch vehicle. Orion will launch on top of this rocket. The heavy-lift launch vehicle will carry Orion beyond low Earth orbit, where the International Space Station orbits, and far past the moon.

Orion has three main parts. The upper section is the launch abort system, or LAS; the crew module is the middle part; and the service module is the lower portion of the spacecraft. Astronauts will sit in the middle section, the crew module. This will be their living quarters. If an emergency occurs during launch or the climb to orbit, the LAS would activate in milliseconds. It would propel the crew module away from the rocket to safety. The LAS looks like a tower on top of the crew module. Beneath the crew module is the service module. It holds the power and propulsion systems. Solar array panels on the service module will absorb sunlight to create electricity. This power will allow the spacecraft to remain in orbit for months at a time.

How Was Orion Designed?

NASA uses new technology and lessons learned from other missions to build new spacecraft. The Orion spacecraft is similar to NASA's Apollo capsule. Apollo was the

space program that carried astronauts to the moon in the 1960s and 1970s.The shape of Orion looks like the Apollo capsule, but the new vehicle is bigger. Instead of the three-person Apollo crew, Orion will carry up to six astronauts.

Orion is made of three main sections. From the left: (1) The service module, from the European Space Agency, fuels and propels the spacecraft. (2) The crew module is the habitat for up to six astronauts. (3) The Launch Abort System jettisons away after Orion reaches orbit.
Credits: NASA
When returning from deep space, a spacecraft re-enters Earth's atmosphere at a very high speed with high temperatures. A new heat shield will keep the astronauts safe as the crew module returns home. Orion will land in the ocean when it returns with its crew. NASA used lessons learned from Apollo and space shuttle parachutes to design the new Orion parachutes. The updated parachutes will help Orion land safely in water as the vehicle returns from deep space. Orion will use modern technology in many other areas, such as computers, electronics, life-support systems and **propulsion** systems.

Why Doesn't NASA Use the Space Shuttle?
The space shuttle was an amazing spacecraft that served NASA for 30 years. From 1981-2011, the space shuttle flew 135 missions. The shuttle carried satellites to orbit; transported parts, cargo and crew to build the International Space Station; and helped NASA learn about living and working in space.

However, the space shuttle was not designed to travel beyond low Earth orbit. And it could not stay in space for much more than two weeks at a time. When a spacecraft returns from a deep space mission, it will return at high speeds. The space shuttle was not built to resist the high temperatures of a high-speed return.

Orion's First Flight
Before a spacecraft can fly on a mission, NASA must test it to make sure that it will do the job well and work safely. So Orion had its first flight test on Dec. 5, 2014 -- without a crew. Launched from Florida on a rocket called a Delta IV (4) Heavy, the test vehicle flew two orbits around Earth. The flight lasted 4.5 hours. Orion reached an altitude of

3,600 miles above Earth (15 times higher than the International Space Station). The test vehicle hit speeds of 20,000 mph and temperatures approaching 4,000 degrees Fahrenheit as it entered Earth's atmosphere. The test vehicle splashed down in the Pacific Ocean near California.

This first flight tested many parts of Orion. NASA tested Orion's computers, **systems**, and **sensors**. The launch abort system and the fairings, which covered the service module, fell away from the spacecraft as planned. The spacecraft passed through high levels of harmful **radiation**. But shielding protected Orion, so the radiation did not have a negative effect on the spacecraft systems. When Orion re-entered Earth's atmosphere, it traveled at 20,000 mph. The fast-moving spacecraft pushed away and heated the air particles that surrounded it. The temperature around the spacecraft reached 4,000 degrees Fahrenheit. The heat shield withstood the temperatures that were almost twice as hot as molten lava. And NASA tested large parachutes that successfully slowed Orion down when it returned to Earth at high speeds.

On December 5, 2014, the Orion spacecraft launched into space and splashed down in the Pacific Ocean. The Navy ship in the background picked the capsule up after its safe landing.
Credits: NASA

What's Next for Orion?
The flight test of the Orion spacecraft was an important step in NASA's journey to Mars. When the new SLS rocket is finished, NASA will test Orion with it. No crew will ride on this flight either. This mission is called Exploration Mission-1 and will last about 25 days. Orion will make a large orbit around the moon. The spacecraft will go farther into space than people have traveled before. After Orion is tested on this mission, it will soon be time for the spacecraft to transport humans. Exploration Mission-2 will travel the same path as Exploration Mission-1, but this time with a crew! Then, in the 2020s, Orion will carry astronauts to an asteroid. In the 2030s, NASA’s goal is for Orion to carry the first human explorers to Mars, the Red Planet!