

## Space Missions

- **ExoMars Trace Gas Orbiter (TGO) mission** • Mars Science Laboratory mission
- **MAVEN (Mars)** (18 November 2013) • Mars Reconnaissance Orbiter (MRO)
- **Atmospheric and Volatile Evolution (AVO)** • Mars Exploration Rovers (L)
- **Mars Orbiter Mission (MOM)** • 2001 Mars Odyssey

### Active Missions

- **InSight**. Mars lander (NASA) ...
- **ExoMars Trace Gas Orbiter**. Mars orbiter and lander (ESA) ...
- **MAVEN**. Mars orbiter (NASA) ...
- **Mars Orbiter Mission (MOM)** Mars orbiter (ISRO) ...
- **Curiosity (Mars Science Laboratory) (MSL)** Mars rover (NASA) ...
- **Mars Reconnaissance Orbiter**. ...
- **Mars Express and Beagle 2**. ...
- **2001 Mars Odyssey**.

### The MAVEN Mission

- **Date:** November 18
- **Mission:** Mars Atmosphere and Volatile Evolution (MAVEN)
- **Launch Vehicle:** Atlas V
- **Launch Site:** Cape Canaveral Air Force Station, Fla.
- **Launch Pad:** Space Launch Complex 41
- **Launch Time:** 1:28 p.m. EST
- A United Launch Alliance Atlas V lifted off from Space Launch Complex 41 at Cape Canaveral Air Force Station in **Florida** to send the Mars Atmosphere and Volatile Evolution, or MAVEN, spacecraft **on its way to study the Red Planet's upper atmosphere.**
- Scientists expect data gathered during the MAVEN mission to help explain **how Mars' climate has changed over time due to the loss of atmospheric gases.**

### The MAVEN mission has four primary scientific objectives: (8 Payloads)

- Determine the role that loss of **volatiles** to space from the Martian atmosphere has played through time.
- Determine the current state of the upper atmosphere, ionosphere, and interactions with the **solar wind**.
- Determine the current rates of escape of **neutral gases** and **ions** to space and the processes controlling them.
- Determine the ratios of stable **isotopes** in the Martian atmosphere.

### NASA to launch new Mars probe

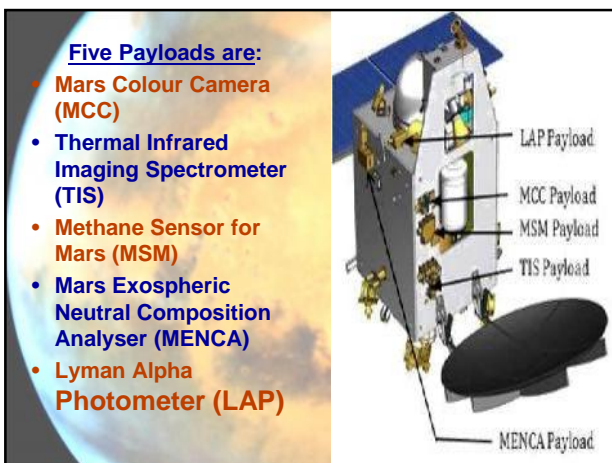
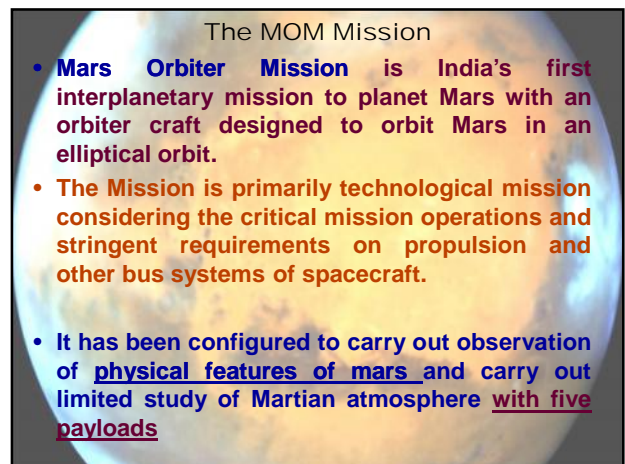
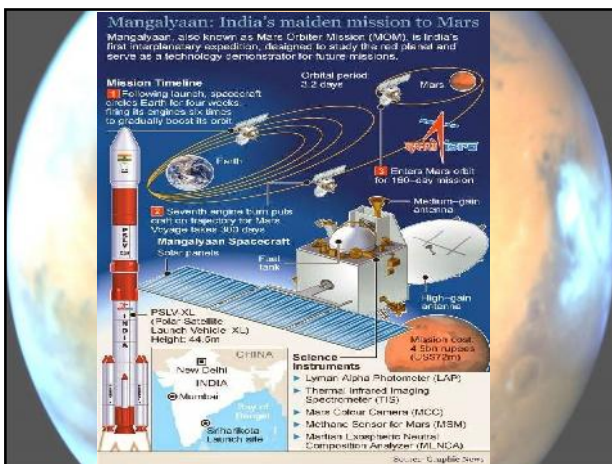
Scientists say the probe, called MAVEN, is the first to focus on the history of the Red Planet's atmosphere and whether it was able to support life.

- ▶ **Launch date:** Nov 18
- ▶ **Journey to Mars:** 10 months
- ▶ **Entry into Martian orbit:** 22 Sept, 2014
- ▶ **Total duration:** approx 2 years
- ▶ **Cost:** \$671 million

The mission will try to find out why Mars lost much of its atmosphere by exploring the upper atmosphere, ionosphere and its interactions with the sun and solar wind.

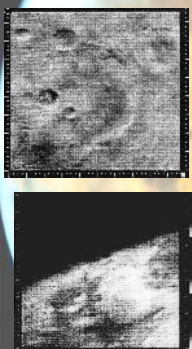
Source: NASA

Labels in diagram:  
 - 'Gull Wing' solar arrays  
 - Communications antennae  
 - Instrument suite with 8 sensors  
 - Articulated Payload Platform  
 - Length: 11.4m  
 - Mass: 903 kilos





Mariner missions  
Mars Exploration Past Missions



In July of 1965, Mariner 4, transmitted 22 close-up pictures of Mars.

All that was revealed was a surface containing many craters and naturally occurring channels but no evidence of artificial canals or flowing water.

Mariner missions  
Mars Exploration Past Missions

Mariner 6                      Launch: Feb. 24, 1969  
Mariner 7                      Launch: Mar. 27, 1969

In 1969, Mariner 6 and Mariner 7 completed the first dual mission to Mars, flying by over the equator and south polar regions.

- Analyzing the Martian atmosphere and surface with remote sensors, as well as recording and relaying hundreds of pictures.

Mariner missions  
Mars Exploration Past Missions

**Mariner 8** Launch: May 8, 1971  
**Mariner 9** Launch: May 30, 1971;  
Arrival: Nov. 13, 1971

- Mariner 8 and 9 were the third and final pair of Mars missions in NASA's Mariner series of the 1960s and early 1970s.
- Unfortunately, Mariner 8 failed during launch on May 8, 1971.
- Mariner 9 was launched successfully on May 30, 1971, and became the first artificial satellite of Mars when it arrived and went into orbit.

What is the difference between a lander and a rover?

- A **lander** is built specifically to descend toward and come to rest on a planet or moon usually transporting something to the surface.
- A **rover** is a space exploration vehicle designed to move and explore the surface of a planet or moon

Rovers, Landers & Orbiter

- A **rover** is capable of moving around under its own power after it has landed. ... As stated a rover moves around on the surface.
- A **lander** travels from orbit to the surface, and
- An **orbiter** orbits the body. The Space Shuttle was both an orbiter and a lander.
- Orbiters** fly around the planet making observations like weather and mapping, and often acting as communications relays for experiments on the surface.
- Landers** touch down and perform experiments within reach of its robotic arms, usually focusing on weather observations and soil analysis.
- Rovers** are those 6 wheeled utility vehicles that trundle slowly around on the surface, taking pictures and performing a variety of geological and chemical tests and analyses.

Viking Landers

Viking 1    Launch: Aug. 20, 1975  
                  Arrival: Jun. 19, 1976  
Viking 2    Launch: Sept. 9, 1975  
                  Arrival: Aug. 7, 1976

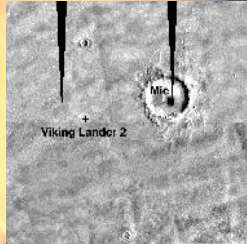
- NASA's Viking Project found a place in history when it became the first mission to land a spacecraft safely on the surface of another planet.
- Two identical spacecraft, each consisting of a lander and an orbiter, were built. Each orbiter-lander pair flew together and entered Mars orbit; the landers then separated and descended to the planet's surface.

## Viking Landers

Finally, in July and September 1976, Viking Landers 1 and 2 touched down on the surface of Mars.

The three biology experiments aboard the landers discovered unexpected and mysterious chemical activity in the Martian soil,

But provided no clear evidence for the presence of living microorganisms in the soil near the landing sites.



## Viking Landers

According to scientists, Mars is **self-sterilizing**. They believe the combination of solar ultraviolet radiation that saturates the surface, the extreme dryness of the soil and the oxidizing nature of the soil chemistry prevent the formation of living organisms in the Martian soil.

The question of life on Mars at some time in the distant past remains open.



## Mars Exploration Past Missions

Mars Observer (Mars Geoscience/Climatology Orbiter):

**Launch: Sept. 25, 1992**

- After a 17-year gap since its last mission to the red planet, the United States launched Mars Observer on September 25, 1992.
- The spacecraft was based on a commercial Earth-orbiting communications satellite that had been converted into an orbiter for Mars. The payload of science instruments was designed to study the geology, geophysics and climate of Mars.
- The mission ended with disappointment on August 22, 1993, when contact was lost with the spacecraft shortly before it was to enter orbit around Mars.



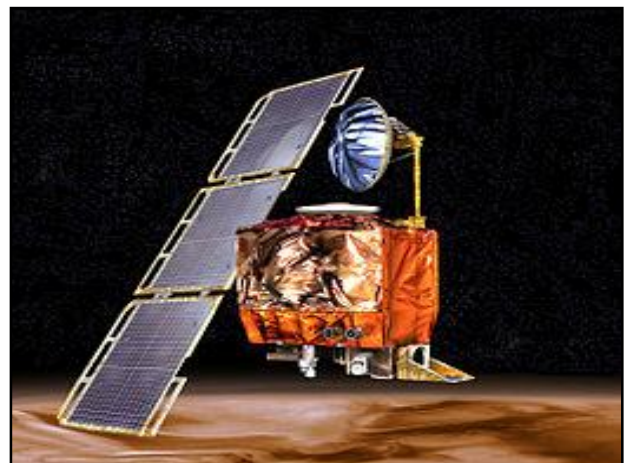
## Mars Exploration Past Missions

Mars Climate Orbiter: Launch: Dec. 11, 1998

Mars Climate Orbiter was designed to function as an interplanetary weather satellite and a communications relay for Mars Polar Lander.

The orbiter carried two science instruments: a copy of an atmospheric sounder on the Mars, and a new, lightweight color imager combining wide- and medium-angle cameras.

Mars Climate Orbiter was lost on arrival September 23, 1999. Engineers concluded that the spacecraft entered the planet's atmosphere too low and probably burned up.





Mars Exploration Past Missions

Mars Polar Lander/Deep Space 2  
 Launch: Jan. 3, 1999

Mars Polar Lander was an ambitious mission to set a spacecraft down on the frigid terrain near the edge of Mars' south polar cap and dig for water ice with a robotic arm. Piggybacking/attached on the lander were two small probes called Deep Space 2 designed to impact the Martian surface to test new technologies.

Mars Polar Lander and Deep Space 2 were lost in 1999.

Mars Exploration Past Missions

Mars Global Surveyor  
 Launch: Nov. 7, 1996  
 Arrival: Sept. 12, 1997

Mars Global Surveyor operated longer at Mars than any other spacecraft in history, and for more than four times as long as the prime mission originally planned. The spacecraft returned detailed information that has overhauled understanding about Mars.

Mars Exploration Past Missions

•**Phoenix**  
 Launch: Aug. 4, 2007  
 Arrival: May 25, 2008

The Phoenix Mars Lander successfully landed on the north polar region of Mars.

Its mission is to dig up and analyze icy soil.

The mission is the first chosen for NASA's Scout program, an initiative for smaller, lower-cost, competed spacecraft.

Named for the resilient mythological bird, Phoenix uses a lander that was intended for use by 2001's Mars Surveyor lander prior to its cancellation.

It also carries a complex suite of instruments that are improved variations of those that flew on the lost Mars Polar Lander.

The First Rover- Pathfinder

Mars Pathfinder: Launch: Dec. 4, 1996

Mars Pathfinder, consisting of a lander and the Sojourner rover, returned an unprecedented amount of data as they explored an ancient flood plain in Mars' northern hemisphere known as Ares Vallis.

The Mars Rovers: Sojourner. In 1997, NASA scientists did something pretty amazing. For the first time, they used a small wheeled robot to study the surface of Mars. This robotic explorer, called a rover, was named Sojourner.

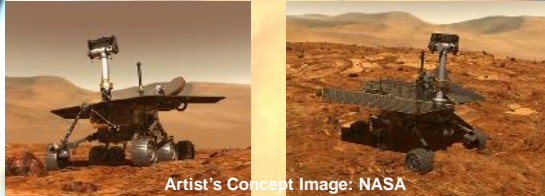
The First Rover- Pathfinder

Mars Pathfinder was the first instrumented lander and robotic Rover to study the surface of Mars.



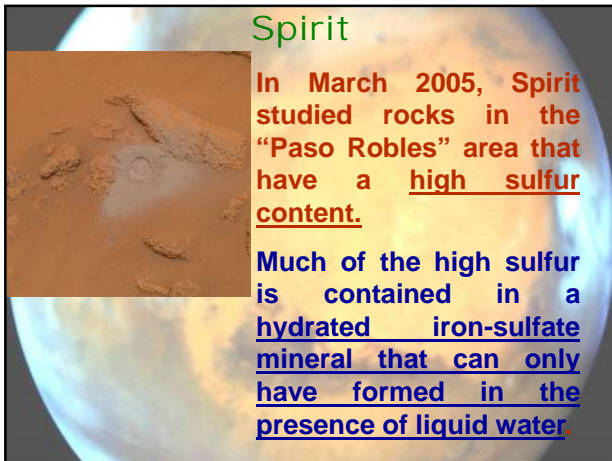
Findings from the investigations carried out by scientific instruments on both the lander and the rover suggest that Mars was at one time in its past warm and wet, with water existing in its liquid state and a thicker atmosphere.

Mars Exploration Rovers Spirit and Opportunity



Artist's Concept Image: NASA

The Mars Exploration Rovers, Spirit and Opportunity, are currently studying how past water activity on Mars has influenced the red planet's environment over time.



**Spirit**

In March 2005, Spirit studied rocks in the "Paso Robles" area that have a high sulfur content.

Much of the high sulfur is contained in a hydrated iron-sulfate mineral that can only have formed in the presence of liquid water.



**Opportunity**

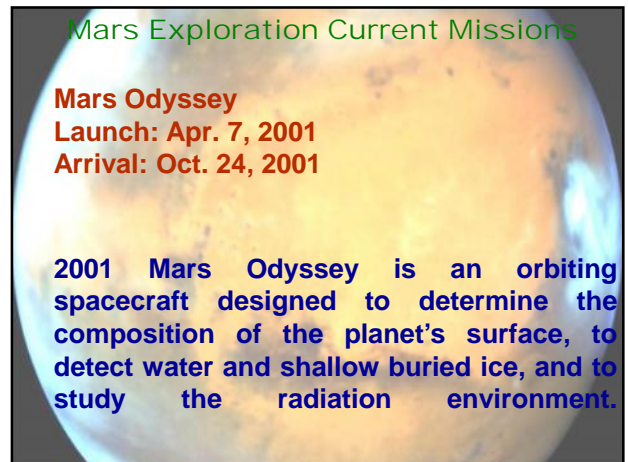
**Opportunity's spectrometer and microscopic imager found that :**

**rocks near the lower slopes of Endurance Crater were affected by water both before and after the crater formed.**



**Present Missions**

- **Exo Mars Trace Gas Orbiter (TGO) Mission**
- **MAVEN**
- **MOM**
- **Mars Science Laboratory Mission**
- **Mars Reconnaissance Orbiter (MRO)**
- **Mars Exploration Rovers (MER)**
- **2001 Mars Odyssey**



**Mars Exploration Current Missions**

**Mars Odyssey**  
 Launch: Apr. 7, 2001  
 Arrival: Oct. 24, 2001

2001 Mars Odyssey is an orbiting spacecraft designed to determine the composition of the planet's surface, to detect water and shallow buried ice, and to study the radiation environment.



**Mars Exploration Current Missions**

- **Mars Reconnaissance Orbiter**  
 Launch: Aug. 12, 2005;  
 Arrival: Mar. 10, 2006

NASA's Mars Reconnaissance Orbiter is capturing unique views of Mars with the most powerful telescopic camera ever to another planet. Its five other scientific instruments are collecting data about the Red Planet.



**Mars Exploration Current Missions**

**Mars Exploration Rovers (MER)(Spirit and Opportunity)**  
 Spirit Launch: Jun. 10, 2003; Mars Landing: Jan. 3, 2004  
 Opportunity Launch: Jul. 7, 2003; Mars Landing: Jan. 24, 2004

Two powerful Mars rovers are on the red planet. They have far greater mobility than the 1997 Mars Pathfinder rover.

Each rover carries a sophisticated set of instruments to search for evidence of liquid water that may have been present in the planet's past. The rovers are identical to each other, but are exploring different regions of Mars.



Mars Exploration Current Missions

**Mars Express**  
**Launch: Jun. 2, 2003**  
**Arrival: Dec. 2003**

NASA is participating in Mars Express, a mission planned by the European Space Agency (ESA) and the Italian Space Agency.

The mission is exploring the atmosphere and surface of Mars from polar orbit.

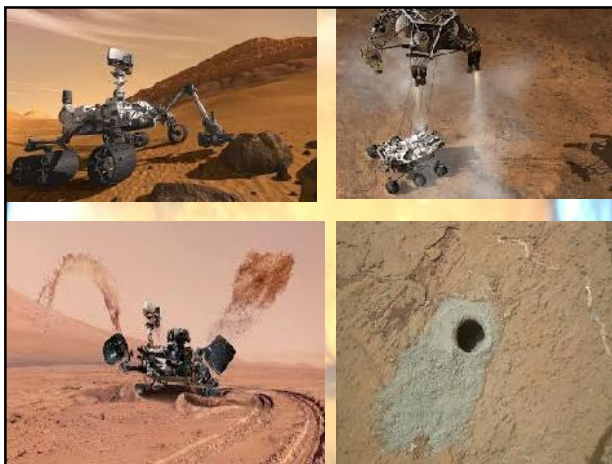
Mars Exploration Current Missions

**Mars Science Laboratory (Curiosity)**  
**Launch: Nov. 26, 2011**  
**Mars Landing: Aug. 6, 2012 (EDT)**

Building on the success of the two rover geologists that arrived at Mars in January 2004, the Mars Science Laboratory Curiosity rover, will assess whether Mars ever had an environment able to support small life forms called microbes.

In other words, its mission is to determine the planet's "habitability."

Twice as long and three times as heavy as the Mars Exploration Rovers Spirit and Opportunity, Curiosity will collect martian soil samples and rocks and analyze them for organic compounds and environmental conditions that could have supported microbial life now or in the past.



Mars Exploration Current Missions

**Mars Atmosphere and Volatile Evolution (MAVEN)**  
**Launch: Nov. 18, 2013**  
**Arrival: Sept. 21, 2014**

The Mars Atmosphere and Volatile Evolution (MAVEN) spacecraft will provide information about the Red Planet's atmosphere, climate history and potential habitability in greater detail than ever before. MAVEN - based on designs from NASA's Mars Reconnaissance Orbiter and 2001 Mars Odyssey missions - will make definitive scientific measurements of present-day atmospheric loss that will offer clues about the planet's history.

InSight

- Targeted Date: May 5, 2018 (launched)
- Mission: InSight Mars Lander
- Description: InSight (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport), the first mission to explore Mars' deep interior, is launched from Vandenberg Air Force Base in California on a United Launch Alliance Atlas V rocket. This NASA Discovery Program mission will be the first interplanetary launch from the West Coast.

Mars Exploration Future Missions

- InSight

InSight (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport) is a proposed NASA Discovery Program mission that will place a single geophysical lander on Mars to study its deep interior.

## Future Missions

- Mars CUBE One
- Exo Mars Rovers
- Mars 2020

## Mars Exploration Future Missions

- Mars 2020 Rover

The next rover NASA will send to Mars in 2020 will carry seven carefully-selected instruments to conduct unprecedented/unique science and exploration technology investigations on the Red Planet.

## Mars Exploration Future Missions

- Beyond
- NASA is developing a long-term Mars exploration program that charts a course for the next two decades.
- This visionary program will build on scientific discoveries from past missions and incorporate the lessons learned from previous mission successes and failures.

## Future Exploration of Mars



Though no concrete plans are underway for a manned Mars visit early in the next century, several studies have been launched to investigate possibilities for such visits following possible unmanned missions.

## Mars, Water and Life

- **Why Explore Mars?**
- After Earth, Mars is the planet with the most hospitable climate in the solar system.
- So hospitable that it may once have harbored primitive, bacteria-like life.
- Outflow channels and other geologic features provide ample evidence that billions of years ago liquid water flowed on the surface of Mars.
- Although liquid water may still exist deep below the surface of Mars.
- Currently the temperature is too low and the atmosphere too thin for liquid water to exist at the surface.

- **What caused the change in Mars' climate?**

- **Were the conditions necessary for life to originate ever present on Mars?**

- **Could there be bacteria in the subsurface alive today?**

- **These are the questions that lead us to explore Mars.**



- The climate of Mars has obviously cooled dramatically.
- By studying the reasons for climate change on Mars, which lacks the complications of oceans, a biosphere, and industrial contaminants, we may begin to understand the forces driving climate change on Earth.
- As we begin to explore the universe and search for planets in other solar systems, we must first ask the question 'Did life occur on another planet in our own solar system?' and 'What are the minimal conditions necessary for the formation of life?'

- What Are We Looking For?
- The planet Mars landed in the middle of immense public attention on July 4, 1997, when Mars Pathfinder touched down on a windswept, rock-laden ancient flood plain.
  - Two months later, Mars Global Surveyor went into orbit, sending back pictures of towering/huge volcanoes and gaping chasms at resolutions never before seen.
  - In December 1998 and January 1999, another orbiter and Lander were launched to Mars.

- And every 26 months over the next decade, when the alignment of Earth and Mars are suitable for launches, still more robotic spacecraft will join them at the red planet.
- These spacecraft carry varied payloads, ranging from cameras and other sensors to rovers and robotic arms.
- Some of them have their roots in different NASA programs of science or technology development. But they all have the goal of understanding Mars better, primarily by delving into its geology, climate and history.

- With the announcement in 1996 by a team of scientists that a meteorite believed to have come from Mars contained what might be the residue/remains of ancient microbes, public interest became regalvanized/excite by the possibility of past or present life there.
- The key to understanding whether life could have evolved on Mars, many scientists believe, is understanding the history of water on the planet.

- Mars Exploration: Fundamental Questions
1. What is the meteorology and climate history of Mars?
- What are, and where are, the reservoirs of water and carbon dioxide on Mars?
  - What is the process of climate change including behavior of the polar caps?
  - What does the history of climate change on Mars tell us about Earth?

2. Has there ever been life on Mars?
- What is the evidence for, and timing of, warmer, wetter past conditions?
  - Where is the evidence for past life likely to be found on Mars?
  - How do we recognize evidence of past life and sample Mars properly?

### 3. What is the geology and inventory of resources on Mars?

- What is the interior structure of Mars and is the planet active today?
- What do the global topography and geologic structure tell about the planet's evolution?
- What are the global inventory and distribution of near surface materials and volatiles?

Should Mars be the next destination for human exploration?

### Microbes Could Survive Thin Air of Mars

- **Microbes that rank among the simplest and most ancient organisms on Earth could survive the extremely thin air of Mars, a new study finds.**
- **The martian surface is presently cold and dry, but there is plenty of evidence suggesting that rivers, lakes and seas covered the Red Planet billions of years ago.**
- **Since there is life virtually wherever there is liquid water on Earth, scientists have suggested that life might have evolved on Mars when it was wet, and life could be there even now.**

### Microbes Could Survive Thin Air of Mars

- **In all the environments we find here on Earth, there is some sort of microorganism in almost all of them," said by Rebecca Mickol, an astrobiologist at the Arkansas Center for Space and Planetary Sciences at the University of Arkansas in Fayetteville, and the lead author of the study.**
- **"It's hard to believe there aren't other organisms out there on other planets or moons as well."**

### Are we the Martians?

- **The transfer of material from Mars to Earth and presumably back again has sparked some debate about the possibility of contamination early in the history of life.**
- **Some scientists argue that a meteorite from Earth could have traveled to Mars — or vice versa.**

- **Debates rage over whether or not tiny organisms would be hardy enough to survive the voyage through a freezing, airless, radiation-filled vacuum and kick off life at its new home.**

- **The idea of such seeding is not limited to interactions with Mars.**
- **Some have proposed that debris from outside the solar system could even be responsible for spawning life on Earth.**

- **But in terms of the Red Planet, it is possible that scientists might one day find life on Mars — and it could be a close relation.**

- **"If we find life on another planet, will it be truly alien or will it be related to us?"**
- **And if so, did it produce us or did we produced it?" researcher Dina Pasini, of the University of Kent, questioned in a statement. "We cannot answer these questions just now, but the questions are not as farfetched/ unbelievable as one might assume**



Could have been that Mars was habitable before Earth was. And life got its foothold on Mars and took its journey to Earth and we're all Martians



Beyond Mars: The Distant Future of Space Exploration



We finally know what happened to (most of) Mars' missing atmosphere. The answer was blowing in the solar wind. (March 30, 2017 NASA)

- About four billion years ago, Mars was warm. Water flowed in lakes and rivers under a nice thick blanket of atmosphere. But then something cataclysmic happened.
- Mars' insulating atmosphere all but disappeared. Exposed to the harsh elements of space, the red planet became the dry, frozen wasteland that it is today.
- Until now, this missing atmosphere had baffled/puzzled scientists; was it lost in space, or did the Martian crust reabsorb it?

- New data from NASA's Mars Atmosphere and Volatile Evolution (MAVEN) mission is settling the debate. Bruce Jakowski and others on the MAVEN team have calculated that most of Mars' atmosphere blew away in the solar winds.
- Scientists have known that even today Mars continues to lose some of its atmosphere to space, but these new findings are the first to put a number on how important this process has been over the course of the planet's history.
- "Our conclusion is that most of Mars' atmosphere has been lost to space, rather than getting locked up on the planet," says Jakowski. "It's a major, if not the major cause, of atmospheric loss."
- MAVEN's measurements of the noble gas argon were key to solving this mystery.



NASA plans to make oxygen from atmosphere on Mars

If successful, experiment will mark a major step towards making Mars habitable for human colonies in the future 19 August 2017

- NASA is planning to make oxygen from the atmosphere on Mars when its next robot arrives on the mysterious red planet in 2020.
- Scientists will send microbial life - possibly algae or bacteria - on the 2020 Rover mission in a bid to create air fit for human consumption.
- They aim to feed the microorganisms in Martian soil in the hope that they will pump out oxygen as a byproduct.

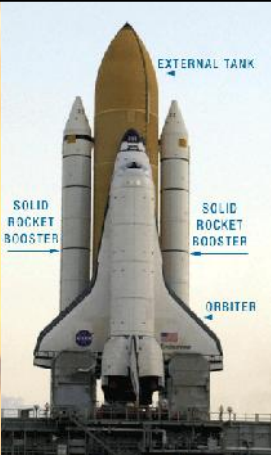
- It could then be made available for breathing or used as rocket fuel to power return flights to Earth.
- If the experiment is successful it will mark a major step towards making Mars habitable for human colonies in the future.
- Mars's atmosphere contains just 0.13% oxygen, compared with 21% on Earth.
- NASA Acting Chief Administrator Robert Lightfoot told Futurism: "Mars 2020, has an experiment where we are going to try and actually generate oxygen out of the atmosphere on Mars, clearly that's for human capability down the road."

- Space Shuttle
- **The Space Shuttle consists of three major components:**
  - **The Orbiter which houses the crew;**
  - **a large External Tank that holds fuel for the main engines; and**
  - **two Solid Rocket Boosters which provide most of the Shuttle's lift during the first two minutes of flight.**
  - **All of the components are reused except for the external fuel tank, which burns up in the atmosphere after each launch.**

The components of the Space Shuttle system:

The components of the Space Shuttle system:

- Orbiter,
- External Tank, and
- Solid Rocket Boosters.



- Underground lake found on Mars, raising possibility of life (26-07-2018)
- **Italian Space Agency has announced that a body of liquid water has been detected on Mars for the first time.**
  - **What Researchers believe to be a lake sits under the planet's south polar ice cap, and is about 20km across.**
  - **Previous research found possible signs of intermittent/flasing liquid water flowing on the Martian surface, but this is the first sign of a persistent body of water on the planet in the present day.**

- **Lake beds like those explored by Nasa's Curiosity rover show water was present on the surface of Mars in the past.**
- **However, the planet's climate has since cooled due to its thin atmosphere, leaving most of its water locked up in ice.**





**Life on Mars a possibility after discovery of first-ever liquid water lake on the surface of Mars enabling to learn more about the possibility of life on the Red Planet**

- Scientists have discovered the first-ever liquid water lake on Mars and is thought to be the largest body of liquid water ever found on the Red Planet.
- New findings from Nasa's Mars Reconnaissance Orbiter (MRO) provide the strongest evidence yet that liquid water flows intermittently on present-day Mars.
- A team of Italian researchers announced they have discovered a large saltwater lake. The body of water was found under ice near the South Pole on the Red Planet.
- The discovery has raised a possibility that life may be there on Mars in some form.

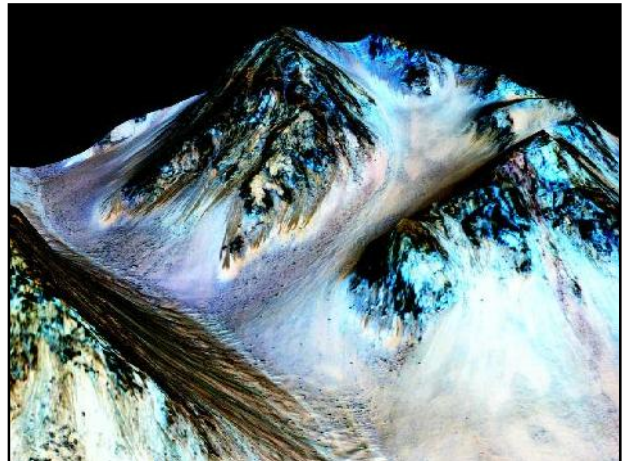
• Our quest on Mars has been to 'follow the water,' in our search for life in the universe, and now we have convincing science that validates what we've long suspected.

• This is a significant development, as it appears to confirm that water – albeit briny – is flowing today on the surface of Mars.- John Grunsfeld, astronaut and associate administrator of NASA's Science Mission Directorate in Washington, said.

• The lake under the Martian ice stretches 20 km across, said the team led by Roberto Orosei from the National Institute of Astrophysics in Bologna in a paper detailed in the prestigious journal Science.

**• PRESENCE OF LIQUID WATER ON RED PLANET**

- Nasa's Mars Reconnaissance Orbiter (MRO) captured strong evidence for seasonal flows of liquid salty water on the Martian surface.
- In the new discovery, between May 2012 and December 2015, Orosei and colleagues used MARSIS to survey a region called Planum Australe, located in the southern ice cap of Mars.
- They obtained 29 sets of radar samplings, mapping out an area exhibiting a very sharp change in its associated radar signal, about 1.5 km below the surface of the ice and extending sideways about 20 km.



• The radar profile of this area is similar to that of lakes of liquid water found beneath the Antarctic and Greenland ice sheets on Earth, suggesting that there is a sub-glacial lake at this location on Mars.

• Although the temperature is expected to be below the freezing point of pure water, Orosei noted that dissolved salts of magnesium, calcium, and sodium -- known to be present in Martian rocks -- could be dissolved in the water to form a brine.

• The researchers noted that together, with the pressure of the, this lowers the melting point, allowing the lake to remain liquid, as happens on Earth.

**• NEW POSSIBILITIES ON MARS**

• According to the journal Nature, if further studies confirm the existence of a lake, it could open new avenues for investigating Mars.

• It begins a new line of inquiry that's very exciting.- Jim Green, Nasa's chief scientist, was quoted as saying-

• Nearly 4.5 billion years ago, Mars had six and a half times as much water as it does now and a thicker atmosphere. But most of this water has disappeared into space and the reason is that Mars no longer has global magnetic fields, like Earth has.

• Dark narrow streaks called recurring slope lineae emanating are hypothesised to be formed by flow of briny liquid water on Mars

