Ashwin Vasavada, MSL Deputy Project Scientist: The hope is that we can land there and basically unlock the secrets of an environment that existed there a few billion years ago on Mars that was potentially a place that life could have survived.

Narrator: Mars has beckoned to Earthbound observers for centuries, seeming to appeal to astronomers to find out the secrets of the lone bright red dot among all the bright white stars in the nighttime sky.

Those answers came sparingly, but as technology advanced on earth, astronomers were provided new tools to get better and better looks at the planet closest to Earth in terms of distance and make up.

NASA put a wheeled robot on Mars for the first time in July 1997.

About the size of a skateboard and weighing 23 pounds, the Sojourner showed Earth unprecedented views of the red planet as it rolled over the surface for three months, all within 500 meters of its base station.
Now, NASA is on the verge of launching another rover to Earth's nearest planetary neighbor, one that is nearly 1,000 times heavier than Sojourner and packing a mobile laboratory designed to look closely at what the planet is made of. The rover is called the Mars Science Laboratory or MSL. It's also known as Curiosity, and its results may answer one of the great questions of modern science.

Pamela Conrad, MSL Deputy Principal Investigator: Mars and Earth were made about the same time and yet they've had very different evolutionary pathways. We seem to be verdant and full of life and Mars is quite cryptic. So we would like to understand a bit about the past of Mars and in fact we'd like to know if Mars has ever been habitable, perhaps in some distant time, perhaps now, beneath the surface.

Narrator: When it comes to Mars, history has shown mission planners they cannot take any aspect of the launch, flight or landing for granted. NASA, the Russians and Soviets and the European Space Agency all lost missions to the red planet at one time or other.
Omar Baez, MSL Launch Director: It is tough to land on Mars.

Sometimes it's even tough to orbit Mars, so Mars is difficult. Anytime you're going that far out and you're making that transition from not only orbiting and taking pictures but add the complexity of slowing yourself down, putting a target on that planet and landing there, that's awesome.

Narrator: Launches to Mars also come with a strict time limit when the planets are aligned correctly to allow a flight.

Wanda Harding, MSL Mission Manager: For MSL, we only get an opportunity every 24 to 26 months. If you miss it, you have to wait.

Narrator: Curiosity is to begin its flight to Mars packed inside the nosecone of an Atlas V rocket. It will fly through space for nine months before beginning its work on the surface in August 2012. Like every mission to Mars, this one carries the most advanced tools available to conduct experiments on its own, millions of miles from Earth.
Vasavada: The real new thing for this rover is the ability to drill in to the rocks on Mars, collect the powder from those rocks and deliver that powder to two relatively large analytical chemistry laboratories that are located inside the rover itself. So we deliver that powder and we can uniquely determine its mineralogy, what minerals are present, as well as what chemical elements are present and this will really give the scientists the core information they need to figure out whether Mars was a habitable environment.

Harding: The MSL rover is essentially like a geologist in a self-contained laboratory and the capabilities that exist are probably the next best thing to sending a human to do the same job.

Narrator: It will also beam back remarkable views from the surface using state-of-the-art cameras, including 3-D lenses.

Baez: This is a vehicle on Mars, cruising around, drilling into rocks, chipping away at stuff to see what that planet's made out of. And even if it didn't do that, if it just cruised around Mars and took pictures, the value in that is tremendous.
Narrator: Curiosity is not headed to just anywhere on the red planet.

Scientists spent years searching for the best place to land the rover, somewhere that had the best chance to show the true past and present of Mars.

That place is called Gale Crater. A three-mile high mountain stands in the center of the crater and Curiosity will explore the sediments that have built up there in hopes that the soil will complete parts of the Martian puzzle.

Conrad: What's special about Gale is it has the thickest package of sediment that we've been able to identify on Mars, so it represents a lot of time and hopefully we'll get some idea about what has happened over time.

If Mars was ever home to vast lakes and flowing rivers, which data from other spacecraft suggest, then the rocks and minerals at Gale Crater could reveal unimagined secrets about our closest planetary neighbor.

Conrad: They suggest in a tantalizing way that perhaps they could have been deposited under water. And we associate water with the possibility, the potential
for habitability.

Narrator: It's an ambitious mission, and the robot designed to pull it off is

unlike any planetary rover devised so far.

Harding: My first thought, and I won't lie, was, "Wow!" It's a very impressive

spacecraft. The rover itself is much larger than anything we've sent up before.

It's a very, very impressive spacecraft and we're looking forward to some great

science coming out of the mission.

Vasavada: We couldn't use airbags this time because of the weight of Curiosity,

so we went back to using rockets. But the novel design is this little rocket jetpack

that flies the rover down and then lowers the rover down on a tether,

lands the rover on the ground and then that rocket jetpack flies off and we're done

with it. That leaves the rover ready to rove around on its wheels and explore Mars.

Narrator: Relying on solar cells was ruled insufficient for a mission as ambitious as

the Mars Science Laboratory. Simply put, they did not provide electricity for a
year-round mission, nor would they produce enough power for the 10 instruments on the
rover, some of which have to operate at the same time to fulfill their research goals.

The rover may cover 12 miles or more during its 23-month mission, a goal that
requires a steady amount of power.

So the Department of Energy built for NASA a nuclear-powered electrical
system instead, called a multi-mission radioisotope thermoelectric generator,
or MMRTG. It has no moving parts, but converts heat from a small core of plutonium
into about 110 watts of electricity around-the-clock and all year.

It's the same power source that enables probes to work in deep space on missions such
as Galileo's examination of Jupiter, Cassini's unprecedented look Saturn and the New
Horizons mission to Pluto and the farthest boundary of the solar system. It was also
used on the surface of Mars by the Viking landers in 1976.

NASA also takes extra precautions because of the power supply, including
working with other federal agencies to ensure its safety on Earth and during launch.
Looking at Mars through a telescope over the decades, astronomers have wondered what
secrets the planet conceals. Even looking at the surface doesn't tell the whole story,
which is why scientists have been eager to dig deeper every time they get a chance.
Baez: Those folks that actually had a hands-on role in building this thing, there's
some separation anxiety, I bet you. But now the next phase is, hey, I get to drive
this thing or I get to use the hammer drill on something,
so that aspect of it is great.
Conrad: I've been working on Mars Science Laboratory for seven years and
I'm extremely excited we're getting ready to launch.
Harding: Twenty years from now I think they'll look back on this and consider
this a true landmark mission, a great stepping stone for human exploration beyond
Earth orbit and it will certainly be one for the history books.