

Example of research paper on the landing of the mars rover curiosity

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Physics of the Landing

Curiosity rover which is the size of a small car a one tone robot landed on mars safely and it was declared as one of the most difficult and daring attempted interplanetary missions costing one point six billion dollars. The rover which is six wheeled was lowered on three nylon tethers to the surface of the Martian. The tethers were suspended from a sky crane hovering air borne with retro rockets. This is one of the most advanced planetary activity currently carried out by the engineers of physics of landing and it has took the world by surprise since many people did not believe of the success. Curiosity rover from NASA landed on the red planet three months back. There has been a large team of engineers and scientists operating on the curiosity rover on mars time. The rover has taken time for it to be launched due to various challenges. The team's starts time every day has been behind with few hours daily due to the fact that an average day in mars is longer in forty minutes from that of a day on the earth and this has ended up creating a lot of overnight shifts. The rover which is nuclear powered has sophisticated technology which is generally designed to find out if life might have been supported by mars. The curiosity of the rover is five times heavy and twice long as the spirit and opportunity rovers which landed on mars in 2004.

How fast was the Rover Launched?

In April 2004 NASA gave defined proposals for the scientific instrument the Rover and among this eight good proposals were chosen in December of the same year. During the late of 2004 the testing and designing of those

components began including the design of an engine which was monopropellant and had the ability of throttling from fifteen to one hundred percent thrust with pressure of inlet fixed propellant. By December 2008 most of the hardware and software for development of the Rover had already been completed and so the testing continued. The cost that was overrun by then added up to four hundred million dollars and due to lack of enough time for testing the launch was delayed.

However, by 2009 march, NASA ranked the general public with nine rovers which were fully developed and finished. Among those nine Curiosity won and this was announced on May 27th 2009. According to reports, the name was given by Clara Ma who was from Kansas as a sixth grader in a mass contest. Curiosity mars rover was then landed successfully on 2012 August sixth by NASA which launched it as a mission of robotic space probe by Mars Science Laboratory (MSL). The major objectives of the rover were to study geology and climate, to investigate habitability of the mars and also to collect data from mars which would otherwise have been carried by man.

How Fast Rover Travelled through the Space

Curiosity rover is said to contain a mass of eight hundred and ninety nine kilograms and can travel up to ninety metres within an hour. It is a six wheeled system of rocker-bogie which is generally powered by RTG (Radioisotope Thermoelectric Generator). The rover can communicate while on mars through UHF bands and X bands. The opportunity, spirit and a predecessor of curiosity Rover got in the mars with airbags that were saddled on it and this was as a way of cushioning as it landed on the surface

of the planet thus rolling and bouncing towards the final site of landing.

However, it is evident that curiosity rover is ten times their weight and can knock out straight through any airbag that could be built by NASA. Due to this a sky crane was built by the mission engineers. During the last twenty minutes of the rover's trip to the surface it was lowered slowly from a descent hovering vehicle on three nylon tethers which were tightly held in place by the retrorockets.

However, there are many elements of choreography landing and this was just one example. At 500 metres per second, the rover which was enclosed in a capsule entered the atmosphere Martian. Small charges then almost detonated immediately while ejecting two tungsten blocks each almost laptop size while weighing seventy five kilograms.

Rover's Acceleration on Landing

Curiosity rover entered the atmosphere of Martian at 13, 200 metres per hour. Friction first slowed the capsule that contained the rover followed by a supersonic parachute. When the rover got closer to the ground there was the release of the descent stage that was carrying curiosity and this was followed by firing of retro rockets which were situated within the rim. The rover was then dropped on huge tethers just above the Gale Crater site of landing near the equator of Martian. The major reason for this was due to prevent any damage that might have resulted from debris and sand which the retro rockets might have kicked up. The final stage then is where the descent stage breaks away and crashes at a very safe distance at a place which was detected to have a geological evidence of water before.

In order to shift once more its orientation, the rover dropped six more blocks of twenty five kilograms at ten kilometers altitude and then went ahead to deploy a supersonic parachute that so far has been termed as the largest supersonic parachute which has never been sent in another planet. This parachute helped the rover in deceleration by slowing it to eighty metres per second from four hundred metres per second in a span of less than two minutes. During the same time, the rover is exposed when the capsule drops its heat shield thus also showing its landing radar and cameras in the Martian air which is said to be very cold.

The parachute let go at 1.6 kilometers up the space and within a fraction of a second the descent plummeted vehicle went to a free fall. For the maneuver of the ambitious sky crane eight rockets roar to life which is meant to slow the vehicle to an eventual stop. Curiosity rover landing was said to be totally different from other space crafts or rovers ever landed in Mars. This however is said to have helped the rover learn some important tricks from the Opportunity and the Spirit since their wheels had holes smaller and before their release they would first clamp to the paths of landing. However by measuring the distance between the holes marks that are left in the tracks of the rover, the rover handlers realized that they could have a good view of the wheels slipping on the surface of the sandy Martian.

Major Functions of Curiosity Rover

The landing of the Curiosity rover led to an applause by the team that had all along been creating and developing the engineering concept. This is so because at last their mission has half way been accomplished. The landing of

the rover clearly shows that the mission starts for Mars Science Laboratory (MSL) since the rover is meant to act as a geologist mobile for samples gathering and analyses from the surface of the Martian. A robot is fitted in the rover with a multi-tool that is meant for scooping and drilling soil into rock. The rover is also fitted with a gun which can be used for rock zapping which are more than twenty feet away. Tiny amounts of material are then vaporized by the laser in a flash of light which can then reveal chemical data after being analyzed. Curiosity has also been fitted with a stereo camera which is very efficient in panoramic shots and also has a magnifying imager that can clearly reveal details which are even smaller than the hair of a human being.

There is an onboard laboratory that will analyze all the samples and bring out the results that are expected by the engineers and scientists of the rover. According to Bridges who worked with the rover, he claims that the science world has been given a great opportunity to move forward the worlds understanding of the evolvement of mars. The rover is expected to give the science community more chances of exploring the technological and solar system innovations. The world will be taken through geological times by the rover through its exploring mostly on large sections of landforms and exposed rocks.

Engineering Challenges

It is challenging to land a large mass on mars according to rover handlers since they claim that the atmosphere is thin for aero braking and parachutes alone for significant effectiveness. This is so especially when they remain

thick enough to develop impingement problems and creating stability when the rockets are decelerating. However in most cases airbags have been used as a way of cushioning the landing shock. According to Curiosity rover handlers they stated that the rover is very heavy for the above mentioned option. Therefore, to face the challenge they used a new descent entry of high accuracy and EDL landing system that was known as a part of spacecraft descent stage of MSL in order to set the rover on the surface of the Martian. Curiosity rover was placed to a landing ellipse within twenty by seven kilometers by the novel EDL system which was dissimilar to the landing ellipse of one hundred and fifty by twenty kilometers of the system of landing used by the rovers of mass exploration.

Teamwork and leadership is also a major challenge of the engineers when creating and developing rovers. It is evident that for the Mars missions to be successful there need to be high quality strategies in teamwork and leadership. For the design of Curiosity rover, the team work involved nearly a decade of systems design tinkering. These leadership traits and strategies have been traced all the way from Steltzner who started the career of rock n' roll for the field of physics. His former career fitted him very well at NASA as a bassist since he could practice and follow the effective leadership styles in the field of engineering. Steltzner always would advice his team to keep themselves focused and avoid freaking and fear. It is evident that two out of three missions planned to Mars fail and that is why Steltzner was named a hero for leading his team towards the impossible and thus was invited in Big Think.

Another challenge in the Engineering of the rover is lack of confidence. A lot

of people did not want to be involved with the idea since according to them it was a mission impossible. However Peter Diamandis tells us that everything regarding mars breakthrough started as a crazy idea and the industry of commercial space is a good example to that. Many people did not want to invest in the idea because they lacked confidence that it will work. However, from the point of leadership Diamandis informs the world that you need to make individuals believe that it is possible.

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