

The perils of spacecraft exploration of Mars and Venus

Our June Science Club talk was presented by Dr Stephen Lewis who is the Deputy Head of the Department for Physical Sciences at the Open University. He began his talk by comparing Venus, Earth and Mars and how they are all rather similar in many fundamental respects, being rocky bodies of comparable size, surrounded by thin gaseous atmospheres. They have very different environments that are challenging to spacecraft exploration. Mars has proved a notoriously tricky planet on which to land a spacecraft, in fact about two thirds of all missions to Mars have failed in one way or another.



Dr Lewis is currently involved with Europe's latest mission to land the Schiaparelli probe, part of the broader ExoMars missions, on 19th October 2016. This will be the first time Europe has been involved in all aspects of landing a probe on Mars. Evidently, though the European Space Agency (ESA) have designed and built a couple of Martian probes in the past, they have never been involved with the task of actually getting them to the planet. This has usually been down to US expertise and launch vehicles. Due to national security reasons launch and flight information is not made available to ESA. As Dr Lewis pointed out

the launch vehicles are effectively Inter-continental Ballistic Missiles (ICBMs) and the US is worried that this information could be used by other countries for reasons other than landing probes on Mars. In the event Schiaparelli will be launched atop of a Russian Roscosmos rocket.

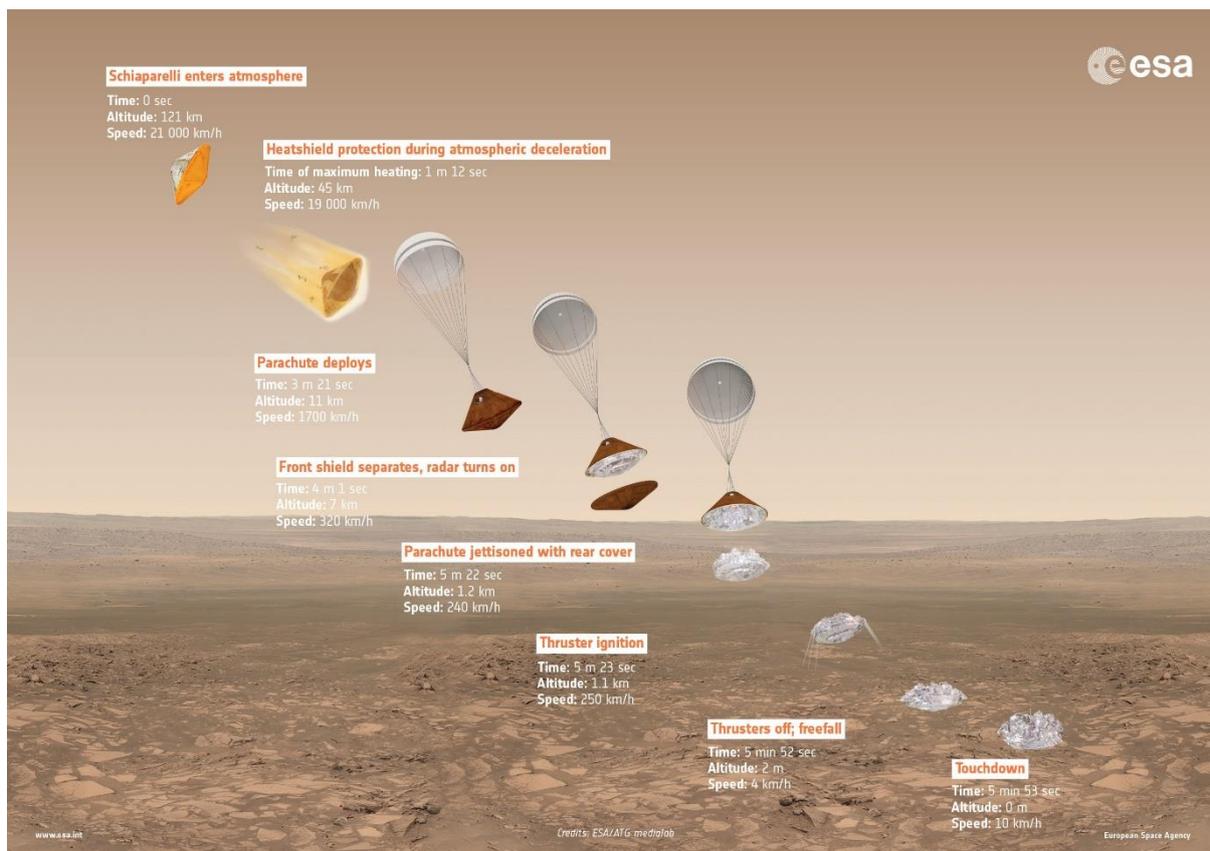
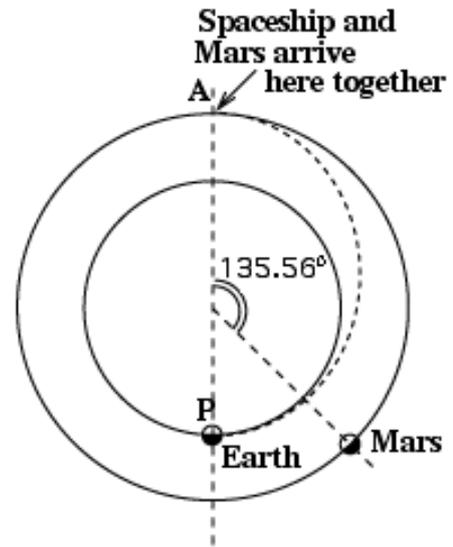


ExoMars Schiaparelli lander installed at the top of the TGO orbiter

Another interesting bit of information was that the Schiaparelli probe was to be powered by a Russian-made radioisotope power source, but due to political tensions this has not happened. The probe is in fact now being powered by a Lithium ion battery, similar to those found in your everyday laptop, and this is not expected to last for more than a day or two. Though this is a bit of a drawback, it does not, in fact, impact the main reason for the mission, which is to prove that ESA is capable of actually landing a probe on Mars without US help!

To launch a mission such as this, Earth and Mars must be in a particular alignment, as the Schiaparelli probe when launched must spiral outwards to rendezvous with a slower orbiting Mars about one year later.

One of Dr Lewis's main jobs is to try and predict the Martian weather at the time of landing as low/high pressure, dust storms and other factors will have an effect on the deceleration and angle of entry of the craft as it enters the Martian atmosphere. Schiaparelli will need to slow down from somewhere in the region of 21,000 km/h to 10 km/h in the matter of a few minutes. A heatshield made from cork is used initially to slow the probe down to single figure Mach velocities. A parachute will be deployed while the probe is still hurtling towards the surface at over Mach 1 and bring its speed down considerably and finally retro rockets are used to bring the craft's velocity to a comfortable 10 km/h just before impacting on the surface. As an added precaution the probe's base features a crumple zone similar to that in modern cars that will further protect Schiaparelli from damage.



For further information click [here](#).

Finally Dr Lewis discussed issues around landing a probe on Venus where the temperature is around 500°C and the average atmospheric surface pressure is about 90 times that of Earth's, also the atmosphere is mainly composed of Carbon Dioxide containing Sulphur dioxide with clouds composed of Sulphuric Acid. Not a very hospitable place! That is probably why most landers, mainly Russian Venera probes, which made it to the surface, only lasted a few minutes. I believe the last probe held out for almost 2 hours.

A very interesting, entertaining and informative talk which showed us just how difficult a mission to another world can be and makes us wonder about the task of putting a man/women on Mars and bringing them back safely. I think Elon Musk, founder and CEO of Tesla and Space-X, has his work and also quite a bit of money cut out for him, but as they say, "Nothing ventured nothing gained".

Marius Stuart