

## Space Story Three:

### The Phoenix Mission

#### Eric Choi and His Friends from the Phoenix Mission

*Founded in 1987, the International Space University (ISU) is an educational institution headquartered in Strasbourg, France that offers a number of space-related academic programs, including an annual Space Studies Program (SSP) that is held in a different location around the world every year. The author was a student at SSP 1999 and a teaching associate at SSP 2003, and he was a systems engineer who worked on the Canadian meteorology instruments on the Phoenix Mars Lander.*

*This article was originally written for the ISU textbook The Farthest Shore and appears in that publication in a significantly modified form. With the exception of some minor changes to clarify content for the benefit of non-ISU readers, the article that follows represents the original version as it was intended by the author.*

\*

In the summer of 2003, I was the teaching associate for the Space Systems Engineering Department at the Space Studies Program (SSP) in Strasbourg, France. There was a celebration at the Holiday Inn next to the ISU Central Campus building for the birthday of Professor Mikhail Marov on July 27<sup>th</sup>. One of the well-wishers was George Tahu (SSP 1994, USA) from NASA Headquarters. At the time, NASA was considering four proposed missions for its new Mars Scout program. I was a team member of the Phoenix mission proposal, so I asked George if a decision had been made. George smiled, and said neutrally that all four finalists were still under consideration.

About a week later, I got an email from George. “Be careful what you wish for,” it said. The Phoenix mission had been selected to go to Mars.

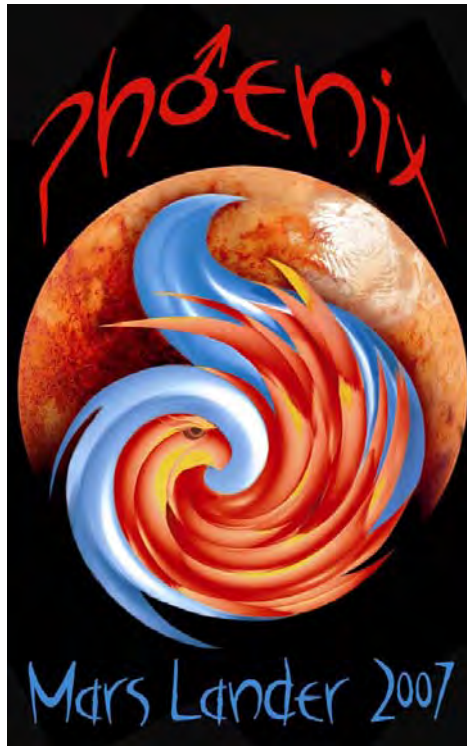
In the mythology of many cultures, the phoenix is a fabulous bird that was consumed in fire and later reborn from its ashes. It was an appropriate name for the mission because Phoenix would reuse the 2001 Mars Surveyor Lander that had been grounded following the loss of the Mars Polar Lander in 1999.



The Phoenix Mars Lander. (Courtesy of NASA/JPL)

The reborn Phoenix would carry an impressive suite of scientific instruments to the unexplored northern polar regions of Mars: a robotic arm, a stereo camera, a mass spectrometer, a wet chemistry laboratory, optical and atomic force microscopes, a conductivity probe, and a meteorology station. Led by the United States, the Phoenix mission included instrument and science team contributions from Canada, Finland, Denmark, Switzerland, Germany and the United Kingdom.

Just four years after the go-ahead, the Phoenix spacecraft was atop a Delta II rocket that would send it to Mars. At Cape Canaveral to watch the launch was Isabelle Tremblay (SSP 1998, Canada) of the Canadian Space Agency (CSA). As the CSA's lead systems engineer for Phoenix, Isabelle played a crucial role in the development of the meteorology station. But in an example of ISU's interdisciplinary spirit, Isabelle is also an accomplished artist who created the official logo of the Phoenix mission.



Isabelle Tremblay (SSP 1998, Canada) and the Phoenix mission logo.  
(Courtesy of CSA/NASA/University of Arizona)

“Creating a logo was a perfect opportunity to express and share how I felt about the mission,” says Isabelle. Her unique design juxtaposed the scientific search for water on Mars with the mythology of the Phoenix bird. In the background was an image of Mars highlighting the northern polar regions where Phoenix would land. “Focusing on the science allowed me to create something more artistic and abstract,” Isabelle explains.

At 09:26 UTC on August 4<sup>th</sup>, 2007, the Delta II rocket carrying Phoenix soared into the heavens on a column of fire. The rising Sun was just nearing the horizon, and its emerging light illuminated the rocket's exhaust plume against the still dark sky. As Isabelle and the other

spectators watched, the winds began to twist the plume into a shape resembling wings and a long tail, looking very much like the majestic bird in her logo. It was a wonderful omen – the Phoenix had risen.



Post-launch exhaust plume, resembling the mythical phoenix.  
(Courtesy of Sébastien Gauthier/CSA)

After a nine month, 679-million kilometer voyage, Phoenix arrived at Mars and began the perilous entry, descent and landing (EDL) phase of the mission. Monitoring the landing from his console at the NASA Jet Propulsion Laboratory (JPL) was Rob Grover (SSP 1997, USA). Rob knew the spacecraft well. His first job after graduating from the University of Washington was working on the mothballed 2001 Mars Surveyor Lander that would be reborn as Phoenix. He then worked as an attitude control engineer on the Mars Odyssey orbiter, and later as an EDL systems engineer for the Spirit and Opportunity rovers. For the Phoenix mission, he was one of the EDL leads.



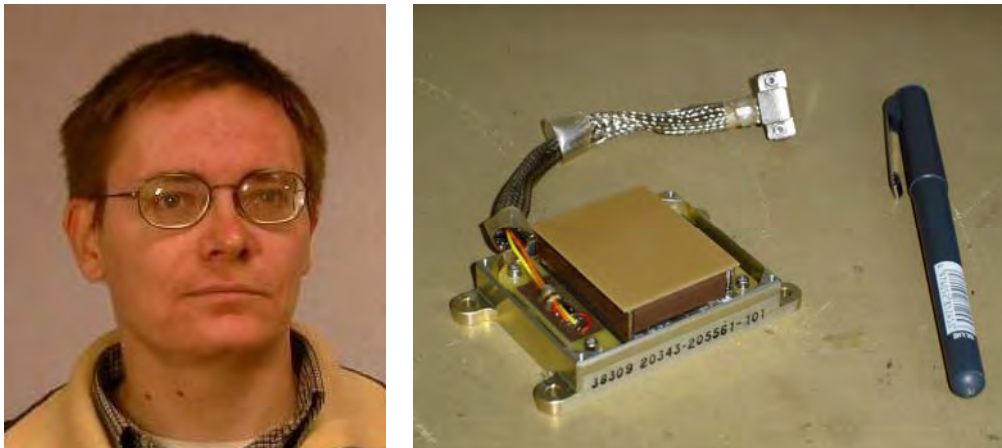
Rob Grover (SSP 1997, USA) with an engineering model of a Mars Exploration Rover.  
(Courtesy of NASA/JPL)

Over five years of work by hundreds of engineers and scientists from seven nations came to fruition when Rob and the operations team at JPL received confirmation of a successful landing at 23:53 UTC on May 25<sup>th</sup>, 2008. Phoenix had arrived at the unexplored northern plains of Vastitas Borealis.

“Having rehearsed and gone over it for years, it was terrific that everything could go so perfectly,” says Rob. “At the moment of touchdown there was a lot of joy and excitement, but some caution as well. You always think of the little things that could still go wrong, but when we got confirmation that everything was fully deployed and operational it was truly an exciting moment.”

The first pictures from Phoenix were received later that evening. “It was spectacular,” says Rob. “It was at that point that the mission became a very real thing. In the engineering world, a lot of the mission exists as numbers and models and such. But once the first pictures came down there was the excitement of seeing a new place on Mars and discovering what it looks like. At that point, it became real that you have a spacecraft sitting on another planet.”

Following the successful landing, control of the Phoenix mission was transferred to the Science Operations Centre (SOC) at the University of Arizona. In the SOC, the international science teams prepared and uplinked commands to their instruments aboard Phoenix, and then received and analyzed the downlinked data.



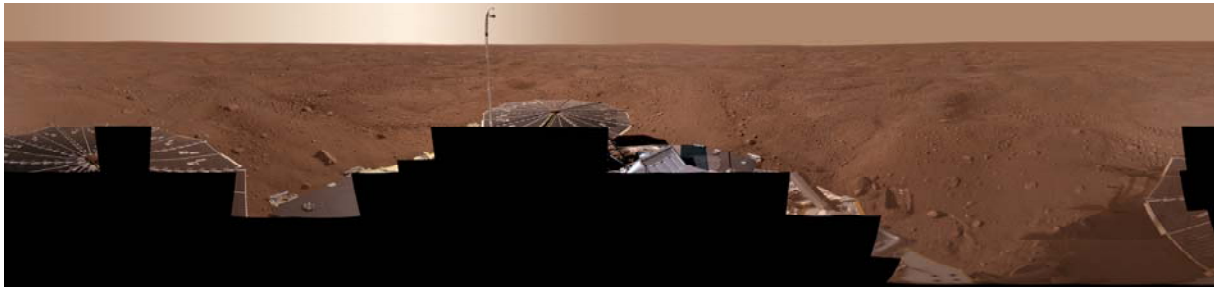
Jouni Polkko (SSP 1991, Finland) and the Phoenix atmospheric pressure sensor.  
(Courtesy of the Finnish Meteorological Institute)

Jouni Polkko (SSP 1991, Finland) of the Finnish Meteorological Institute (FMI) was one of the scientists at the SOC. FMI provided the pressure sensor element of the Phoenix meteorological station, which Jouni had been working on since 2004. The Phoenix pressure sensor was actually the fourth that FMI had built for Mars missions. Three earlier units were lost due to the failures of the Mars 96, Mars Polar Lander and Beagle 2 missions. In January 2005, an FMI sensor recorded the pressure profile of Titan’s atmosphere during the descent of the European Space Agency’s Huygens probe. Three years later, FMI would enjoy success again with Phoenix on Mars.

“The first scientific data arrived in the afternoon of May 26th,” recalls Jouni. “Our instrument worked perfectly, measuring a pressure on Mars at the landing site of 8.55 hPA. In the following days, the first dust devils were observed by the pressure instrument.”

Isabelle Tremblay was at the SOC as well, providing engineering support for the operation of the meteorology station. She remembers the experience with great fondness. “The community and team spirit were so strong, to see people from all over the world working together for common goals. You wish the world would be more like that in other areas.”

Originally designed for a surface mission of 90 Martian sols (92 Earth days), Phoenix far exceeded its planned lifetime, returning data for months before succumbing to the onset of Martian winter in late 2008. Its legacy is the wealth of scientific data returned, and the path it has blazed for further robotic and eventual human missions to Mars. For all the ISU alums that were privileged to be involved, it was the journey of a lifetime.



Panorama of the Phoenix landing site at Vastitas Borealis, Mars.  
(Courtesy of NASA/JPL)

### **Acknowledgement**

The author gratefully acknowledges the assistance of Dr. Leslie K. Tamppari, Phoenix project scientist at the NASA Jet Propulsion Laboratory, in the preparation of this article.