



## ASSOCIATION OF SPACE EXPLORERS – EUROPE

### **ASE and ISU award the 2016 ASE-ISU scholarship and the prize for the best individual MSS project**

For the fourth time the Association of Space Explorers ASE and the International Space University ISU awarded a supporting scholarship to a young space student that financially ensures their participation to the 8-week Space Studies Program course of ISU. This year's course was held in July and August in Haifa, Israel, and the scholarship was awarded to Praskovia Milova from Russia. As Praskovia put it in her own words: "Even if I'm holding a PhD degree I was still learning a lot during the core lectures. It was a great opportunity to get a bigger picture, and I'm sure that the interdisciplinary approach is something that will help me while dealing with my daily job (and even daily life). I think the departmental activities were the best part of the program." She joined the Humanities department for the in-depth individual studies. "The highlight of the program is the people - both participants and staff. At first I was wondering what I was doing in that crowd of amazing people. But then I thought, if I was selected for the program at all, and moreover I was supported by two scholarships (ISU and ASE), maybe there was a reason for it. This thought gives me a lot of encouragement and confidence in pursuing my research work, to be more initiative, and to give back to the society as much as I can." says Praskovia. "We [also] had an Overview Effect workshop in the desert - an opportunity to experience what astronauts feel once they're in space and are able to observe the Earth from a distance."

The Association of Space Explorers is the professional organization of space flyers from all over the world who want to convey the beneficial orbital perspective that they had the privilege to experience to the current generation of people on Earth and the next generation of

space explorers. ISU and ASE closely cooperate in this endeavor, the European chapter of ASE is located at ISU in Strasbourg. The scholarship money was mostly donated by Helen Sharman from UK, who celebrated her 25<sup>th</sup> flight anniversary this year



SSP Director John Connolly hands the ASE-ISU scholarship certificate to Praskovia Milova during the SSP 2016 in Haifa

In addition and for the first time this year the best individual project thesis of the Masters of Space Studies course 2015/2016 was awarded to Carlos Entrena-Utrila for his project report on how to construct a business case out of Human Spaceflight missions to Mars. The prize money was contributed by ASE Europe member André Kuipers from the Netherlands and his education foundation.



ASE Europe Secretary Reinhold Ewald (r.) and Carlos Entrena during the MSS graduation ceremony at ISU



**Carlos Entrena-Utrila**  
**ISU MSS 2016**

### ***Development roadmap and business case for a Martian settlement***

*Abstract:* Mars has long been considered the next target for human spaceflight after the Apollo missions. NASA has made this clear in the past, with their many architecture proposals for crewed Mars missions. All these proposals, from the Space Exploration Initiative to the current Journey to Mars, highlight the priorities and constraints of a government agency: extreme risk aversion, long development times, and risk mitigation and science maximization through high mission cost. The lack of a need for revenue and an expected financial security can also be seen in the architectures, which pay little attention to financial feasibility, and focus on technical aspects. Despite all this planning, government agencies have accomplished little beyond LEO since Apollo. A fully public mission to Mars seems always further away, and little progress seems to be done in that regard by the public agencies. In recent years, a new approach to space has appeared in the form of the New Space companies. These companies enjoy some advantages over government agencies: clear strategic goals, financial stability, and higher tolerance to risk. These are created by the private source of funding, which requires a source of revenue and a business plan, and is relatively independent of public opinion, which allows the companies to take higher risks without justifying their expenses to the public. Private companies have also shown in recent years that they have the technical abilities to produce space hardware of the same quality as government agencies, with a surge of a new generation of rockets and satellites, so it would seem that they are better posed than these agencies to undertake a mission to Mars. The only piece missing is the business plan that would allow a private company to fund itself during the process.

This document is the final report of the author's individual project for the Master in Space Studies 2016 at the International Space University. The project studies the feasibility of a business case for a private Mars settlement, established before 2030 with only private funding. The intention is to show the other extreme of Mars architectures: fully private funding, and very time constrained. This would add a new point of view to the field, and hopefully lead us to the much desired human landing on our red neighbour in the near future. The report summarizes the extensive literature review on Mars human mission proposals, available technologies, and possible sources of revenue for the project. It then defines possible minimal mission architecture for a Mars settlement with a first crewed landing before 2030, identifying technical and business constraints, and creating a development roadmap. Cost estimation for the project is provided, and this is used to evaluate constraints on the performance of the different sources of income and the feasibility of the business case, based on different assumptions for the markets. It is concluded that a business case for a private Mars settlement before 2030 based only on Mars resources is not feasible, and recommendations are provided on how to improve the business case for a permanent Martian settlement.