

## **Introduction**

At the latest Ministerial Council, held in Edinburgh in December 2001, the European Space Exploration Programme Aurora was approved, as an element of the European Space Strategy. The aim of this optional programme is to formulate first, and then implement, a European long-term plan for the robotic and human exploration of the Moon, Mars and the Asteroids, in particular those holding promise for traces of life, which can be explored by humans in the foreseeable future. Such an ambitious objective will require developing and demonstrating new technologies and innovative mission concepts. The Aurora programme aims at creating a coherent European Framework for Space Exploration. One of the specificities of the Aurora Programme Declaration is the explicit provision for co-operation with European Technical Universities. This is the recognition of the expertise and knowledge possessed by the European Academia as well as the appreciation of the motivation and the vision of students and young researchers that can facilitate the emergence of innovative concepts. Educational and outreach goals will also be pursued throughout the Programme with a constant attention towards the younger generations, through effective communication and involvement

## **Overview**

The purpose of the Student Contest is to allow graduate and undergraduate students from European Universities to propose, on a competitive basis, innovative ideas, design concepts and new enabling technologies that are relevant to Aurora programme goals and scenarios. The Student Contest is organized by ESA with the support of primary Academic Institutions in Europe and the involvement of space experts. It consists of selected student teams, one for each European University in any given category, developing innovative ideas and approaches on aspects of the Aurora programme that will be presented and judged by a panel of senior experts during a devoted event, which is scheduled to take place in September 2003. ESA will award the prizes to the best projects in each category.

Because of the multidisciplinary nature of the task, ESA encourages projects from network of Universities drawing on the excellence of each member of the Network in a given relevant discipline to produce well-integrated projects.

## **Participating in the Contest**

Interested Universities from Europe and Canada are invited to promote the contest through their students. Each University is entitled to present one and only student team with its project for each of the 5 categories listed hereafter. Ideally each University's team and project, in each category, will be the top one among those that have been produced by its students in the different Faculties and Institutes. Students should organize themselves in teams and enter the Contest, first at University level and then, if selected by their University, for the final phase. Each team will be composed by 3 to 6 junior and senior students, graduate and undergraduate. The

participation of PhD Students is allowed up to one per team. Each team will pick a name and will be supervised by one or more University professors who also act as coach. Each team will designate a “Team Leader” among the students who will also act as main contact point for the Contest.

Multidisciplinary and multinational teams are strongly encouraged as well as the participation of female students. ESA attaches great importance to a balanced gender representation.

The Student Contest Announcement will be published on the ESA web site ([www.esa.int](http://www.esa.int)), and on other suitable web sites, including the FUSE’s one (URL to be announced), with all the necessary information and background.

Each team that has been selected by its University to represent it in the Contest is invited to send in an outline of their proposal by March 9<sup>th</sup>, 2003 along with a supporting letter from the University stating that the project has been selected to represent that specific University in the Contest for that specific category. The outline will specify the team members, their University of origin, the name of the supervising professor(s) and will give a presentation of the project highlighting the elements of novelty and the technical feasibility. This outline, not exceeding 1 page, will be sent by e-mail to ESA ([students4aurora@esa.int](mailto:students4aurora@esa.int)) stating in the subject: “Outline of a project for the Aurora Student Contest” along the indication of the category for which the project is submitted.

By March 14<sup>th</sup>, 2003 ESA will notify all the teams, whose outlined projects are deemed relevant and eligible, that have been accepted to participate in the final phase of the Aurora Student Design Contest.

The full project, together with all the relevant documentation, is to be submitted by July 30<sup>th</sup>, 2003 to ESA, Aurora Student Design Contest, in electronic format (.pdf) to: [students4aurora@esa.int](mailto:students4aurora@esa.int)

The participating Teams will have to provide the following information:

- Name, nationality, date of birth and contact details and proof of studentship for each team member;
- Name, academic position and contact details of the University professor(s) supervising and coaching the team;
- A team name and a general statement of its motivation, goals and any other relevant details;
- The category for which the project is submitted;
- An executive summary of the project not exceeding 5 pages;
- The full project description along with any relevant supporting documentation and material contained in no more than 20 pages;

## **Content of the projects**

Each student team is invited to familiarize itself with the content, goals and class of missions that are featured in the Aurora Programme. ESA plans to put at the disposal

of the students a knowledge base concerning Aurora and the Student Contest that is aimed at helping students gather a better understanding of the scientific and technological challenges that are posed by such an ambitious programme.

The categories relevant to the Aurora Programme to which contest projects can be referred to are the following:

- **Flagship class missions**

These can be defined as major missions achieving an important technological and scientific goals by themselves, even without considering them in the framework of a more ambitious programme. Their objectives can be challenging and complex to achieve, such as carrying out a soft landing on a planetary surface or returning a sample from other planetary bodies back to Earth. Very often the architecture of these missions involves several elements that operate independently in different phases of the mission, such as orbiters, sub-satellites, landers, rovers, penetrators, airborne robots, planetary ascent vehicles, re-entry vehicles, etc. The challenges this type of mission involve, their transcendental contribution to the exploration goals and the fact that most of the times their main objectives can be explained in a plain and understandable way (e.g. "find life", "produce fuel from the atmosphere", "bring back a soil sample"), attract an important deal of media attention. An essential benefit is that this can facilitate the task of educating the public about the interest of planetary exploration and the need to pursue it.

- **Arrow class missions**

These are defined as cost-capped, short development time missions to demonstrate new technologies or mission approaches (e.g. in preparation of more complex Flagship class missions). They might provide needed engineering or scientific data to constraint later mission designs, enabling improving their performance and reducing unnecessary risks. Arrow type missions would also include concepts exploiting opportunities for "hitch-hiker" payloads to be carried on (already planned) European or international missions.

- **Human Missions**

Manned missions beyond Low Earth Orbit (i.e. beyond the International Space Station). The mission concepts might involve exploration of Moon, Mars and asteroids, setting up of exploration-enabling space infrastructure or preparation/training activities required for later, more ambitious missions.

- Surface Robotics

Robotic system enabling mobility or interaction of a landed or airborne spacecraft with the surrounding environment. Aspects being considered can include power generation, improved survivability, extension of lifetime and exploration capabilities, alternative locomotion systems, novel resource (e.g. energy, fuel) management approaches, alternative architectures, non-conventional materials etc. The assumed planetary environment itself could range from that of an airless body to the one of a planet having an atmosphere, from reduced gravity (w.r.t. Earth's) to microgravity conditions, or from mild to harsh thermal or radiation environment. The proposed concepts can in addition include any required supporting systems (e.g. telecommunication infrastructure, power supply, etc).

- New enabling technologies

Innovative technological concepts that would enable or facilitate robotic and human exploration of the Moon, Mars and the asteroids, extending the capabilities of the exploring system and improving its chances to fulfill the mission objectives in a shorter, cheaper and/or more successful way. Some of the key technology areas include power generation; propulsion; entry, descend and landing; communications, etc.

Even though the Contest is meant to stimulate the emergence of new ideas, concepts and approaches, students may want to get some additional insight and may want to confront themselves with the missions identified so far in the framework of the Aurora Programme and which are being currently studied by Industry. Categorized by class of missions, these are:

### **Flagship missions:**

**The Exo-Mars mission.** The mission's goal is to characterize the Martian biological environment before landings by other spacecraft or humans take place. A Mars Orbiter will deliver a descent module from Martian orbit. The descent module will deliver a rover to a specified location.

**The Mars Sample Return mission.** A composite vehicle will carry into a Mars orbit both a descent module and an Earth re-entry vehicle. The descent module will carry to the surface of Mars a landing platform equipped with a sample collecting device and an ascent vehicle.

### **Arrow missions:**

**Earth re-entry vehicle / capsule.** The envisaged mission will use a small spacecraft in a highly elliptical Earth orbit. The vehicle will be propelled towards the Earth

under conditions similar to those that would be experienced by an interplanetary return capsule.

**Mars Aerocapture demonstrator.** A small mission with the specific goal of validating technology that can slow a spacecraft and allow it to enter orbit around Mars by using friction with the planet's upper atmosphere

## Contest Prizes

The European Space Agency, together with other sponsors and partners, will be offering prizes to reward the best projects in each category.

The full detailed list of all the prizes will be announced to a later date. First prizes for each category they are likely to be those detailed below or be of comparable importance:

- a professional visit to the European Space centers, including the European Space Port (CSG) in Kourou;
- attendance to the IAF Congress in Vancouver at ESA's expenses;
- sponsorship to present the winning project to suitable conferences and symposiums.

## Important Dates

End of January, 2003	Announcement of the Aurora Student Design Contest
March 9 <sup>th</sup> , 2003	Deadline to submit outline of the design project
March 14 <sup>th</sup> , 2003	Notification to the pre-selected teams
July 30 <sup>th</sup> , 2003	Deadline to submit the final project
September 8 <sup>th</sup> - 9 <sup>th</sup> , 2003	Aurora Academia Workshop, Projects presentation and prize award