

# General Studies Programme

The General Studies Programme (GSP) and the Advanced Concepts Team (ACT) focused in 2005 on formulating and conducting the preparatory activities needed to provide ESA and its Member States with the knowledge, tools and roadmaps that will allow them to meet the following challenges with confidence:

- The main challenges facing society today, namely energy, environment and security.
- The coordination and optimisation of the synergies between the short-, medium- and long-term planning of innovative and advanced R&D in the space sector, on both national and European scales.
- The advent of new concepts for future space missions and systems, stemming either from the maturation or the merging of different scientific disciplines, or from scientific areas that until now have been of only theoretical interest.

The Advanced Concepts and Studies Office has undertaken several concrete actions to provide Europeans with an adequate set of answers, solutions and plans in these domains

With the increase in worldwide population density, natural disasters, such as the earthquake-generated tsunami in the Indian Ocean in December 2004, are resulting in ever more devastating human catastrophes. The GSP therefore includes activities to explore new monitoring and warning concepts that involve a space segment, aimed at identifying the physical precursors of violent seismic events on Earth.

It is now widely accepted that the Earth's climate is undergoing a dangerous set of changes caused by human activities. By preparing new Earth-science missions, the GSP is contributing to the design and preparation of space missions to monitor these radical changes.

AIDS, tuberculosis and malaria kill over 6 million people each year, and the numbers are growing. GSP-initiated activities are currently seeking to understand how and to what extent space-based technologies can support the logistical efforts required to meet the burgeoning demand for a wide range of medicines across sub-Saharan Africa.

Guaranteeing security on aircraft, trains and other mass-transportation systems has become a major issue in our day-to-day lives. By investigating the theoretical possibilities

offered by teraHertz camera technologies for the detection and safe destruction of landmines, and for the remote detection of chemical and biological substances (a spin-off from the development of novel Earth-observation camera systems), and by sponsoring the preparatory studies needed to implement the GMES Programme together with the European Commission, the GSP is helping ESA and its Member States to shape a safer future for Europe's citizens.

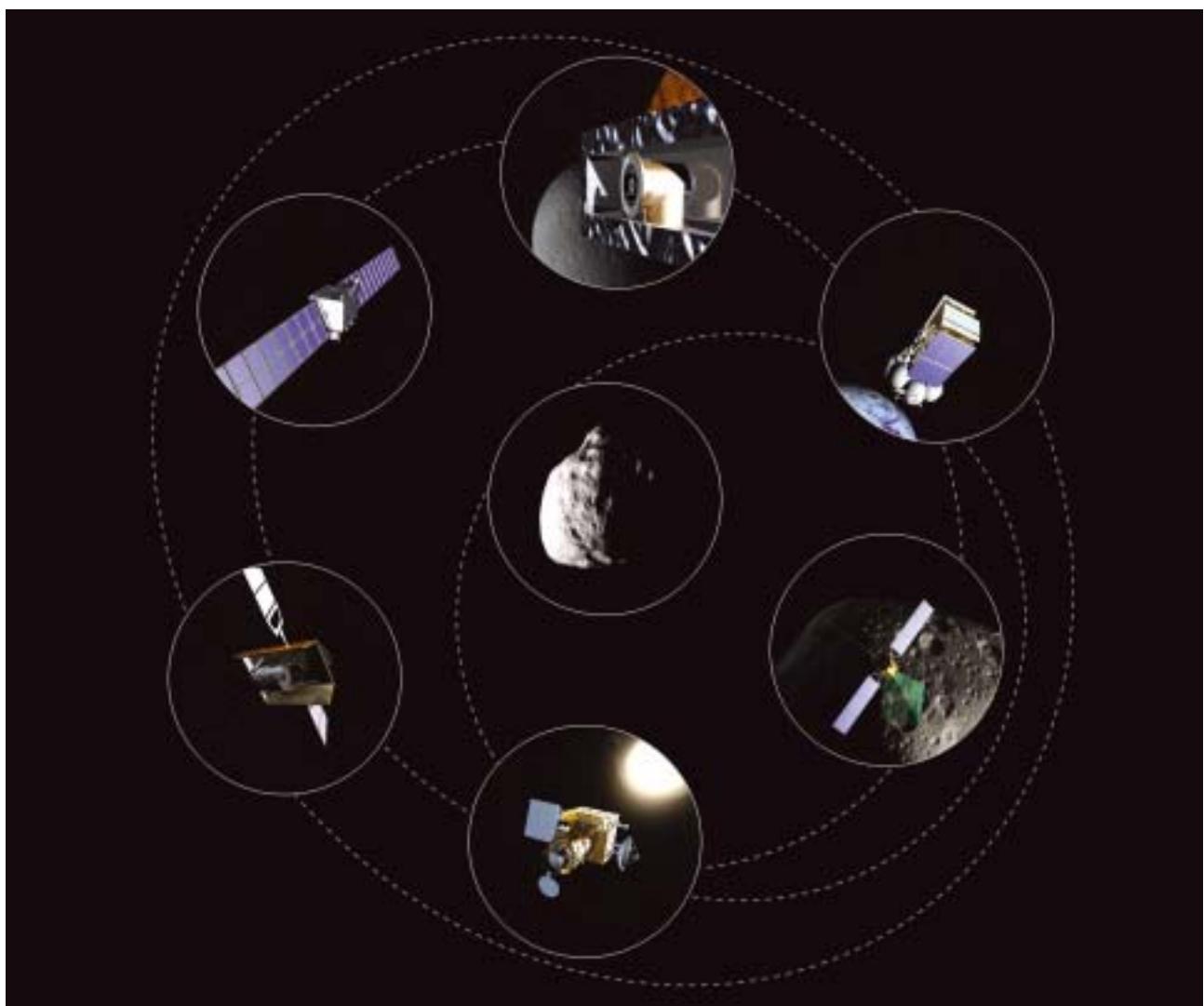
A major natural threat is posed by Near-Earth Objects (NEOs) in space, even if the risk of an impact is only significant over geological timescales. The ACT is currently implementing a pragmatic approach to exploring that risk by developing three successive responses, ranging from the short- to the long-term in application:

- The ongoing characterisation and monitoring of the orbital dynamics of NEOs by ground-based observatories.
- Investigation of the structural composition and reaction to perturbations of NEOs (by means of a small demonstrator mission).
- Definition of an operational mitigation system.

Europe must address the challenge associated with its dependence on fossil fuels. By exploring new hydrogen storage concepts, and defining a realistic roadmap for using solar-power satellites, the GSP is helping Europe to find the right balance in terms of energy sources for the future.

In defining the GSP planning for the period 2005-2006, a special effort has been made to put the activities to be undertaken into the broader perspective of the national space programmes. Some new working methodologies were introduced into the latest Call for Ideas, with the aim of stimulating the interaction between different ESA Directorates, and raising the overall quality of the study proposals vis-a-vis their eligibility for a GSP study. Pursuing the Director General's vision of 'one ESA', only proposals elaborated through the collaboration of at least three different Directorates were accepted, and a deeper internal assessment was requested from the proposing team before the procurement of a study by European industry and academia.

The activities needed for the secure implementation of the major ESA programmes and missions, such as XEUS, Darwin, GMES, the future post-Galileo positioning systems, and the



Different mission concepts to investigate and characterise Near-Earth Objects

next generation of meteorological satellites, were also defined. Common features required by these future programmes are the ability to gauge time and measure distances between spacecraft very accurately, and to perform precise formation flying. These capabilities presently require the identification or validation of new concepts derived from optical clocks and femto-laser technology, new technologies for which GSP system studies are defining the necessary requirements. A complete set of activities, with a budget of 20 MEuro, has been approved and was being implemented at a good pace by year's end.

In addition to having facilitated interaction with the GSP's external academic partners through the Ariadna programme in 2004/5, the electronic archiving of all past GSP reports is in progress with the support of the Technical Information and Documentation Centre (TIDC) at ESTEC. The GSP website ([www.esa.int/gsp](http://www.esa.int/gsp)) has also been restyled and will carry monthly updated information on new GSP results and activities, and links to other resources such as the new ACT and NEO websites. As these initiatives come to fruition, new ones will be introduced to replace them, helping Europe to stay at the forefront in space activities.