

# Technology

## THEMES



EARTH OBSERVATION

SCIENCE / ROBOTIC  
EXPLORATION PREPARATION

HUMAN SPACEFLIGHT /  
MANNED EXPLORATION  
PREPARATION

SPACE TRANSPORTATION /  
RE-ENTRY TECHNOLOGY

TELECOMMUNICATION /  
NAVIGATION

GENERIC TECHNOLOGIES  
AND TECHNIQUES

### TRP 2004-2006 and GSTP-4

Preparation of the TRP (Basic Technology Research Programme) and the GSTP (General Support Technology Programme) is one of the most exciting exercises within ESA as it spans all of the technical disciplines and targets application horizons 5 to 10 years ahead. It also endeavours to serve all of the Directorates, with programmes at various stages of definition and development. A carefully thought out approach is therefore essential to satisfy all of these constraints.

#### Setting the Approach

In November 2002, the Directorate representatives had unanimously approved the approach proposed by the Technology R&D Division for defining the scheme to be followed. The high-level driver was that the scheme should reflect ESA's objectives and applications, and provide visibility and efficiency in terms of co-ordination, definition, and implementation throughout the programme life cycle. As each ESA Programme Directorate mirrors a space application, it was decided that the TRP and GSTP should be structured according to six 'Themes' (see above illustration). This simple but effective framework would allow the necessary focus and the customer-oriented process needed to give both the TRP and GSTP their appropriate enabling and supporting roles in

ESA's programmes and missions. Such an approach would also pave the way for consolidation, consistency and coherency at programme level.

#### Programmes in the Making

The individual R&D activities, proposed and endorsed through a selection process, form the building blocks of the TRP and GSTP work plans, and are the basis for the procurement, contracting, and contract execution process. With the Themes in place, the objective in preparing TRP 2004-2006 and GSTP-4 was therefore to gather proposals and ideas that would form the basis for selection.

Proposals were solicited via a Call for Proposals led by the Technology R&D Division, with the participation of the relevant Programme and Support Directorates. Each Theme was supported by two dedicated inter-Directorate teams: an Advisory Panel of senior managers, who assessed how the different horizons might be configured around 2010-2015, and a Working Group of technology specialists, who gathered, evaluated and recommended activity proposals. The highest-level board, the Focal Point Forum, constituted the top-level representation of Directorates for technology matters. It was responsible for final decisions regarding the overall consistency and compliance of the proposed work plans with

The Technology Programme  
Theme Guidelines:  
translating a vision into  
technology activities



SMART-1's novel ion-engine propulsion system

the TRP and GSTP programmatic objectives, and with the Agency's plans for future missions and programmes. Programme Guidelines described the principles of the ESA Technology Master Plan, the details of the specific TRP/GSTP preparation process (including the financial bases), and the criteria used in evaluating activity proposals. Specific guidelines were also issued reflecting the vision, targeting model, and focus of the efforts for each Theme.

Although the Call for Proposals was not issued externally, dialogue with industry was an important element in the process, with between 45% and 80% of the proposals received for each of the Themes benefiting from industry interaction.

### Launching the Programmes

A preliminary TRP plan was presented to ESA's Industrial Policy Committee (IPC) in November, just one year after the start of the preparation process. The latter was run with full transparency and provided a unique opportunity to strengthen inter-Directorate communication and cooperation on technology. The impact on the preliminary plan of 'Agenda 2007', the ESA strategic document

released in mid-October, was being assessed at the end of the year, and recommendations will be made for the way forward.

Pending the final consolidation of the overall three-year work plans, a TRP plan for 2004 will be issued in order to initiate key items and ensure continuity in technology development, which is a concern shared by all of the players, especially industry.

## Other Highlights

### SMART-1

Launched during the night of 27/28 September, SMART-1 is the first of a new series of ESA missions designed to demonstrate innovative and key technologies. Not only is it Europe's first scientific spacecraft to orbit the Moon, but its technology demonstrations will pave the way for future deep-space science missions. Its innovative solar electric propulsion system was successfully fired for the first time on 30 September. SMART-1, which has benefitted from substantial TRP participation, will also demonstrate a wide range of other new technologies used in both the spacecraft and its payload.

### Subscriptions to GSTP

The attractiveness of GSTP was further demonstrated in 2003 with Member-State contributions to Phase-3 of the Programme increasing from 192.3 to 224.5 MEuro (at 2000 economic conditions). A preliminary selection of activities for Phase-4 will be produced by mid-2004.

## Technology Harmonisation and Strategy

### European Space Technology Requirements Document (Dossier 0)

Dossier 0 is the starting point and a key element of the space-technology strategy developed by the Agency, providing a complete overview at European level of:

- all the envisaged missions and their related top-level technology requirements ('user pull')

- the technology requirements related to 'technology push'.

In particular, it is a unique European instrument for the generation of all European space-technology R&D plans. As of 2003, the Dossier 0 is composed of an introductory document and an electronic database, the Dossier 0 Web Application (DOWA). DOWA, accessible over the Internet (<http://dossier0.esa.int>), has been developed as the single repository, to further improve data accessibility and to be used as the tool for future yearly updates.

### Innovation Triangle Initiative



The ESA Innovation Triangle Initiative (ITI) is designed to combine the creativity, knowhow and experience of academia, space customers, and industry for innovation in any technical domain applicable to space. The ability to rapidly introduce absolutely novel products, technologies or services is a recognised key strategic element for maintaining industrial competitiveness. Through ITI, therefore, ESA provides early financial support, networking, and technical support with the objective of creating a dynamic environment in which new ideas can be easily validated, developed, and used by the space industry. The Innovation Triangle concept is based on the premise that rapid and successful introduction of breakthrough innovations in industry requires the collaboration of three different entities: an inventor, a developer and a customer. This premise was validated during the ITI Pilot Phase in 2003, and the launch of the ITI Operational Phase is planned for March 2004.

### European Space-Technology Harmonisation

This initiative, begun in 2000, is designed to achieve better coordinated space-technology R&D activities in Europe, with 'filling the gaps' and 'reducing unwanted overlaps' as major



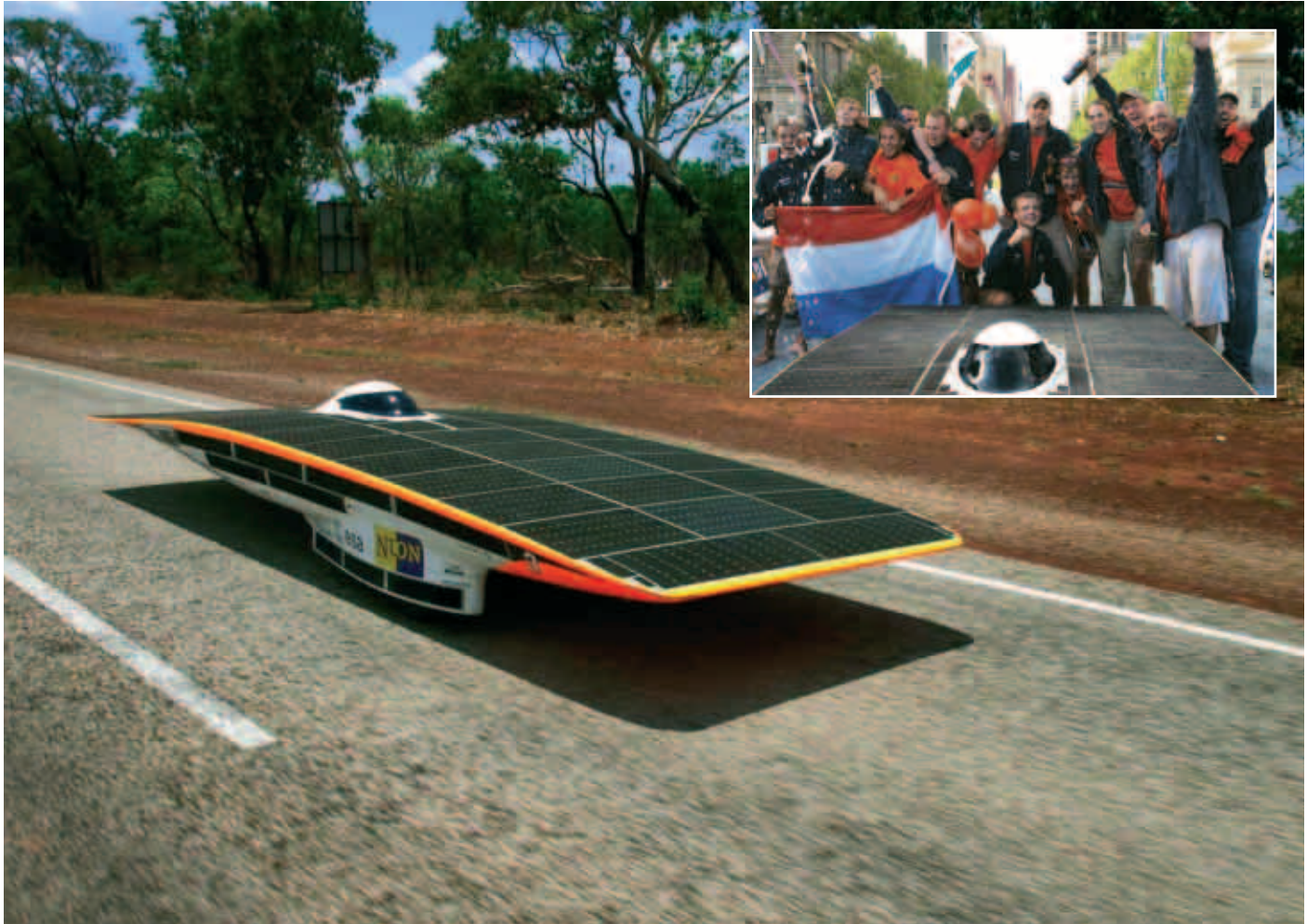
objectives. The harmonisation process takes into account the various European developments, capabilities and budgets to enhance the complementary roles of the different stakeholders in meeting common objectives, addressing a range of situations in terms of technology maturity, industrial competitiveness, funding needs, and political interests.

After pilot cases in 2000 and 2001, 25 technologies had been harmonised by the end of 2003, with the involvement of the Agency's Delegations, the European Commission, Eurospace, and about 100 European space companies. The progress of these harmonisation activities was presented at the 2003 Industry Space Days at ESTEC in November. In anticipation of the new challenges that lie ahead, a review of the evolution of harmonisation activities was initiated in the context of the 'Agenda 2007' objectives, to reinforce continuity between ESA's technology and industrial procurement policies.

### European Space-Technology Master Plan (ESTMP)

The ESTMP, mandated by the 2001 Ministerial Council, has the technology programmes of ESA, the EC and their Member States as its foundation. It covers the European technology authorities and programmes,





The Nuna-II solar car speeding across the Australian outback, heading for its second victory in the World Solar Challenge, and (inset) the winning team

the strategies and funding approaches, and provides a comprehensive database of current technological activities in Europe (>1600 entries), as well as analysing their degree of compliance with the requirements laid down in Dossier 0. Issue 2 of the ESTMP, introduced at the Le Bourget Air Show in June by Mrs Claudie Haïgnéré, French Minister for Research and New Technologies, attracted high-level attention from all European players.

### Cooperation with the EC on Space Technology

Beyond the ongoing fruitful collaboration with the European Commission on space technology, in 2003 the ESA/EC Joint Task Force's Technology Working Group focussed its efforts on participation in the consultation process on a European Space Policy (Green Paper) and on the drafting of the resulting EC White Paper. ESA's Dossier 0, Harmonisation, and ESTMP initiatives

were repeatedly referred to as promising tools for shaping the future of space technology in Europe in the context of EU sectorial policies and the accession of new EU Member States.

### Technology Transfer Programme (TTP)

The ESA Technology Transfer Programme fosters space to non-space technology transfers and the creation of spin-offs and start-up companies. In the thirteen years of its existence, the TTP, through its network of technology brokers throughout Europe, has effected more than 200 transfers, including 15 in 2003. They represent a cumulative turnover in the space and non-space sectors of over 530 MEuro. More than 30 new companies/start-ups/spin-offs have been created, resulting in some 2500 jobs, and the

revenues for Member States generated by successful technology transfers have exceeded the associated expenses by a factor of 15-20 times.

The year saw a number of new initiatives aimed at specific sectors, including the setting up of a Health Care Network to bring the results of medical research conducted in space to products aimed at the consumer and fitness market. The ESA Council also approved additional funding to foster the creation of new technology-based growth businesses exploiting space-developed technologies and services.

### European Space Incubator

A European Space Incubator (ESI) was established at ESTEC by the TTP in 2003 as a facility and service to give small start-up companies the opportunity and means to develop technologies and products based on space-developed expertise in a secure environment and with limited risk. By year end, two companies were in residence at the ESI, with a further seven accepted and ready to install themselves. The ESI is an integral component of ESINET, a network of some 34 incubators throughout Europe with a strong space connection and supported by both ESA and the European Commission.

An essential step in furthering the objectives of the ESINET initiative, and enabling small and innovative firms to break into the market and commercialise their products, is the establishment of a funding mechanism for the benefit of all ESA Member States. This 'ESINET Fund' is intended as a source of equity financing to enable capital investment in the new start-ups. ESA's contribution of 5MEuro will hopefully attract other public and private investors to take the Fund beyond its critical mass ( $\geq$  50MEuro) and achieve its primary objectives of new-business and job creation over the next ten years.

### Some Recent Success Stories

In October the Dutch solar car Nuna-II, incorporating several European space technologies, won the bi-annual World Solar



XP patient Alex Webb checking out a prototype of the new protective suit that exploits space technologies

Challenge – a 3010 km race across Australia for cars powered purely by the Sun's energy – for the second successive time, breaking the four World records it had established in 2001. The space technologies aboard the car, which was made from carbon fibre, Kevlar, and aramide, included the highly efficient, three-layer, triple-junction gallium-arsenide solar cells used on the SMART-1 spacecraft, and maximum-power-point trackers to optimise their output by monitoring the available battery power. In addition, 46 lithium-ion fuel cells were used to supply 5 kW of electrical energy and keep the car's weight as low as possible.

A new protective suit derived from ESA space technology promises to let 300 children across Europe who have been diagnosed with the genetic disorder Xeroderma Pigmentosum (XP) – extreme sensitivity to the Sun's ultraviolet (UV) rays – to lead a more normal life and play safely outdoors. No one currently produces anti-UV clothes for XP patients, so the TTP became involved in an effort to assist these children. Special protective undergarments were designed using fabrics with a special UV-proof coating employed on spacecraft. A special cooling system was also designed to be hidden below normal clothing in warm weather, along with special headgear with a polycarbonate visor. The prototype suits are now being tested with a view to starting production in 2004, with the hope that finance can be found to provide one for every XP-afflicted child in Europe.