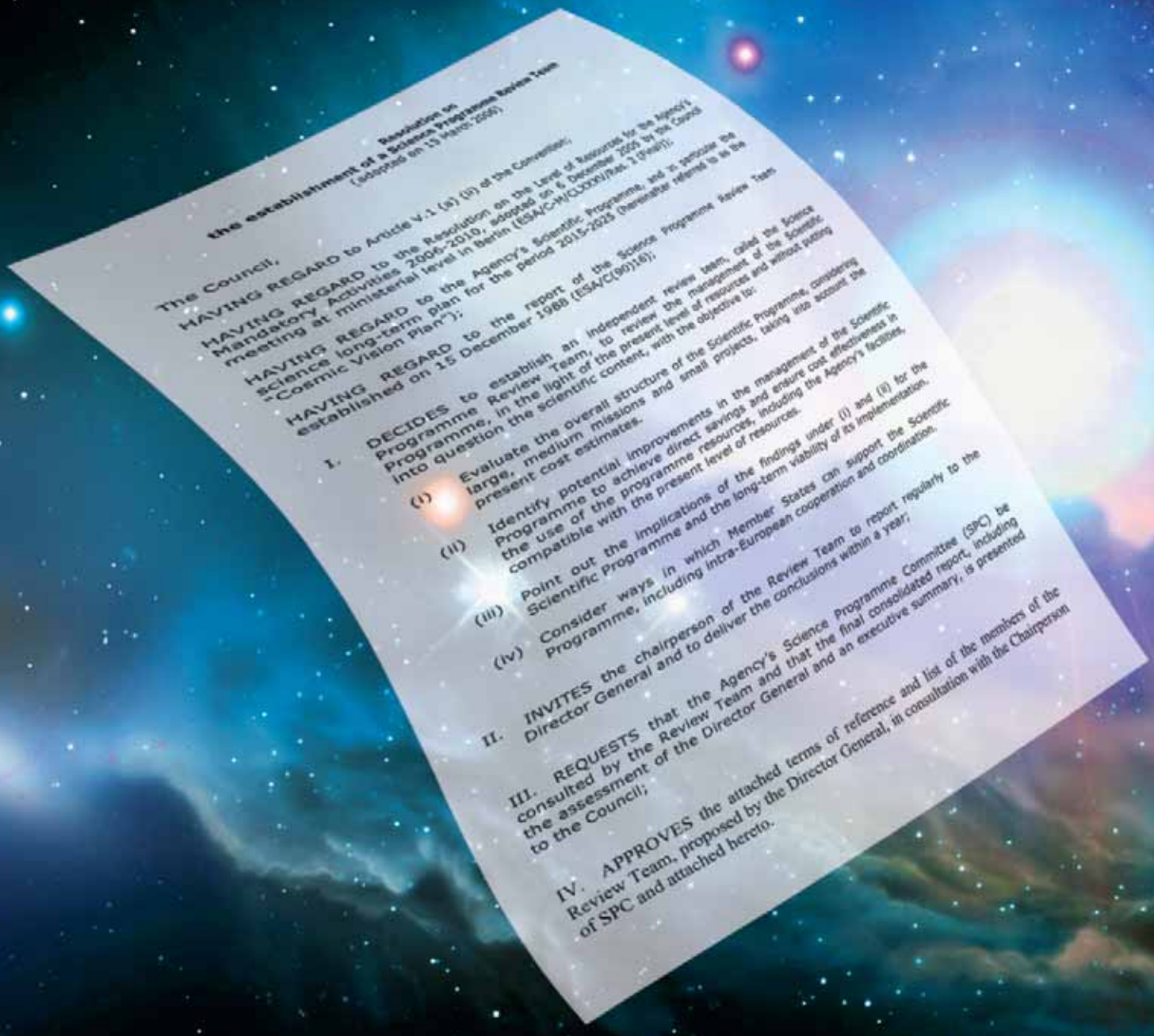
Reviewing the Future

The 2006 External Review of the Science Programme



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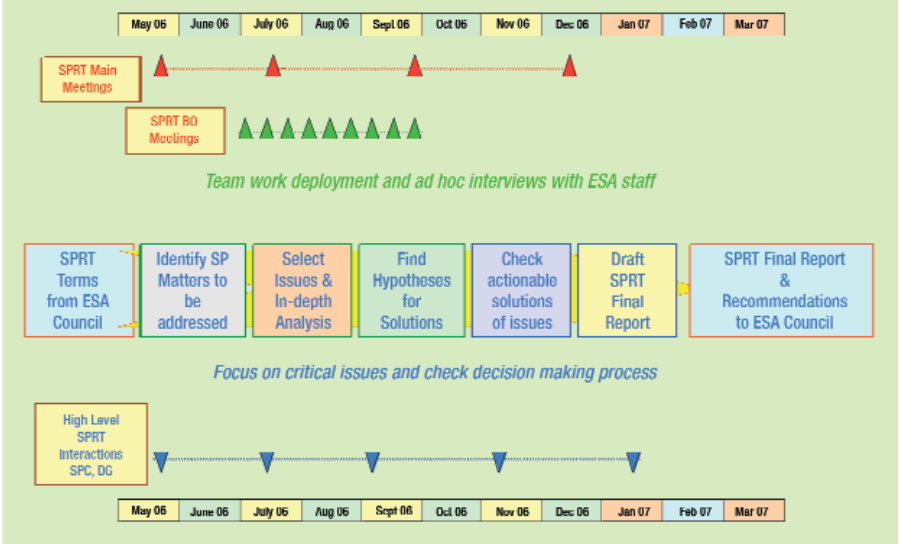
ESA's hugely successful Science Programme is facing flat budgets for the foreseeable future. The resources will be insufficient to satisfy all of the science community's wishes for new missions. As a result, the Science Programme Review Team (SPRT) was established to recommend ways for the Programme to meet its obligations to current and approved missions and to support new projects to the greatest extent possible.

Introduction

As has been stated many times, the Science Programme is the 'backbone' of ESA. 'The Case for a Strong ESA Scientific Programme' (ESA/(C2005)157), presented to the Ministerial Council of December 2005, puts this point in context: "*The Science Programme of ESA is a successful programme. Over the last twenty years, its missions have gained leadership or co-leadership in most space science research areas such as cometary science (Giotto, 1985; Rosetta, 2004), astrometry (Hipparcos, 1989), Infra-Red astronomy (ISO, 1995), X-Ray astronomy (Newton, 1999), magnetospheric physics (Cluster, 2000; Double Star, 2003 and 2004, in cooperation with China), Gamma-Ray astronomy (Integral, 2002, in cooperation with Russia) and planetary science (Mars Express, 2003; SMART-1, 2003). In joint missions with NASA, the leadership extends to Ultra-Violet Astronomy (IUE, 1978), Interplanetary and interstellar medium (Ulysses, 1990), Optical Astronomy (HST, 1990), Solar physics (Ulysses, 1990; SOHO, 1995).*"

The Cosmic Vision report is available at: http://www.esa.int/esapub/br/br247/br247.pdf



The working process of the Science Programme Review Team

The paper continues, "*In addition to providing first class science and consuming only 12% of the total ESA budget, the Science Programme, nonetheless, employs about 25% of the ESA technical workforce, thereby keeping a pool of highly skilled technical labour at the Agency and its Member States' disposal. It pays more than 25% of the recharges, which maintain the Agency's core administrative and strategic capacity. With its 16 spacecraft presently in operation, the Science Programme gives work to a network of ground segments [and] provides about 80% of the operations workload for ESOC and close to 100% for ESAC, developing thereby a node for data exploitation and archiving for all European space astronomers. With its frequent missions, the Science Programme is also a sustaining customer of the spacecraft and launcher industries because its budget of one MEuro per day, albeit modest, is at present stable. The Programme has, up to now, used more Ariane-5 launchers than any other agency customer.*"

From this, it would seem that the Programme is in good shape, and, indeed, in most respects, it is certainly functioning in a highly efficient and effective way. However, it is a victim of its own great success in that, at present, it has the highest number ever of missions underway, more under development and a huge expectation, on the part of the European scientific community, of its delivering new missions, under the Cosmic Vision plan (ESA BR-247). Unfortunately, the budget is planned to be 'flat' into the future, and the resources at the Programme's disposal (financial and other) are, therefore, largely insufficient to be able to satisfy all of these demands.

The Science Programme Review Team

Towards the end of 2005, recognising the necessity to take action quickly to avoid further deterioration in the Programme's capability to satisfy the demands of the scientific community, the Chair of the Scientific Programme Committee (SPC) decided to call for an external review. Accordingly, the SPC proposed to Council that a Science Programme Review Team (SPRT) be set up. Its members would be recognised high-level experts from Industry and Science, with a mandate, later contained in a Council Resolution passed at the March 2006 Council, to conduct a detailed review of the Science Programme and to recommend ways by which the Programme could meet its obligations to current/planned missions as well as the legitimate desires of the community for new missions, to the maximum extent possible.

This is not the first such review. There was one in 1977 and another in 1988 when, at the request of Council, a comprehensive review of the management and the activities of the Programme was similarly carried out, by a group of high-level external experts.

The first review, led by Dr Harry Atkinson, turned in an 8-page report with 23 recommendations. The second, headed by Prof Klaus Pinkau, delivered a 237-page report, with 16 recommendations. The latest review, led by Dr Reinder van Duinen, recently presented its report (ESA/C(2007)13) of 366 pages, including 40+ recommendations and six formal observations. It contains more than 200 pages of references, compared to Pinkau's 120 and Atkinson's zero.

The 2006/2007 SPRT

Dr van Duinen and the rest of the team were appointed soon after the Council meeting of March 2006 and the setting-up process started immediately. The systems, process and organisational structures, the protocols for handling the Team's future interactions with the Executive and Advisory Structure, as well as the logistics needed to get things moving, had to be put in place very

The Team at work, with Dr van Duinen emphasising a point

quickly. During April, the Chairman and the Executive Secretary worked closely together to organise the first meeting of the Team, which was held at ESTEC on 18/19 May 2006.

Science Programme Self-Evaluation

At the request of the SPRT Chairman and with the full support of the Prof David Southwood, Director of the Scientific Programme, a self-evaluation was carried out by the Scientific Programme during March and April 2006. Senior staff of the Director's office worked with the SPRT Chairman to prepare a list of questions to be answered and topics to be addressed. A Directorate team then spent a number of hectic weeks producing detailed inputs, which were reviewed by the Director and senior managers, responding to the identified issues. The self-evaluation process was acknowledged by all involved to have been comprehensive and informative and to have delivered a response that was of value, not only for the SPRT, but also the Directorate. It was also seen as an excellent exercise in internal collaboration and sharing information across functions and gaining an understanding and appreciation of the work of colleagues from other parts of the Directorate. The final evaluation report, which is one of the Reference documents reproduced as an Annexe to the SPRT Report, was presented to the SPRT Chairman and Team at its first meeting and was heavily drawn upon in the initial stages of the SPRT's work.

The SPRT 'Problem-Statement'

Based, in part, upon a detailed review of the Self-Evaluation Report, the SPRT developed a problem-statement, to guide its future work: "*What opportunities exist for ESA to enable the scientific community to make significant advances in science through improvement of programme management, costs control, and better mission decision making processes?*"

Developing the problem-statement further led to the identification of a number of key points that would be focused upon during the SPRT's work. These key issues were initially identified as:

1: instrument development, risks and funding;
2: the decision-making process;
3: overhead charges and facilities;
4: advanced technology development;
5: 'overheating' of the Science Programme;
6: contingency management, risk- and budget-control;
7: mission mix and timescales;
8: operations and data centres.

The Science Programme Review Team

Dr Reinder van Duinen (Chairman)
Former President of the European Science Foundation (ESF) and former Vice-Chairman of Fokker; The Netherlands

Mr Alvaro Azcarraga
Former Managing Director of Aerospace, SENER; Spain

Mr Jean-Jacques Dechezelles
Former Director, Science Meteorology and Environment, Alcatel; France

Prof Therese Encrenaz
Director of Research at the Centre National de Recherche Scientifique, Laboratoire d'Etudes Spatiales et d'Instrumentation, Observatoire de Meudon, Paris; France

Prof Kerstin Fredga
Former Director General of the Swedish National Space Board (SNSB); Sweden

Mr Kurt J. Gluitz
Former Vice President and Managing Director Science and Earth Observation Division of DASA/Dornier Satelliten Systeme GmbH; Germany

Prof Michael Grewing
Former Director of the Institut de Radio Astronomie MilimOtrique (IRAM); Germany

Prof Luciano Maiani
Department of Physics, University of Rome 'La Sapienza' and former Director General of CERN; Italy

Prof Sir Martin Sweeting
Group Chief Executive of Surrey Satellite Technology Ltd (SSTL); United Kingdom

The reaction to the Report by the SPC and the Director General confirmed the validity of the majority of the recommendations, albeit with some reservations as to the applicability or indications of a requirement for a different approach on some issues. Overall, the Report was acknowledged as delivering a new and different perspective, a solid assessment and appropriate, actionable receommendations.

To address these issues, the Chairman created a number of 'breakout groups', essentially working groups consisting of subsets of the full Team, each concentrating on one or more of the eight issues. The structure of each subgroups ensured an equal number of members with backgrounds in Science and in Industry.

It is not hard to imagine the challenges involved in supporting eight simultaneous subgroups, composed of highly motiva-

A Real Team Effort

As well as bringing a huge range of individual experience and knowledge to the task, it was notable that, at a very early stage, the team members formed into a well-working and collaborative unit. Their approach, as could be expected, was both thorough and methodical but, equally, the general atmosphere was surprisingly and pleasantly informal. The Chairman certainly facilitated this, as he was strongly focused on ensuring the maximum participation and inclusiveness in the process, and he devoted considerable attention to achieving consensus in the team.

The SPRT meetings and off-site activities generated a large amount of administrative work. Support in handling this was provided by many colleagues in the Science Directorate and elsewhere. In particular, Asa Ericson and Valerie Lecuraud helped enormously with these often very complicated administrative arrangements. In addition, the responsiveness of other colleagues throughout ESA to requests, frequently at short notice, for them to be available to the SPRT, was excellent. This made a very positive impression of their professionalism and commitment on the members of the team.

ted, task-oriented and demanding top-level experts, in terms of organising meetings, arranging the (right) contacts when needed, providing background documentation, giving guidance and advice, ensuring the sharing of relevant information, keeping records and drafting reports. The sheer volume of documentation analysed (and produced) by the Team required the setting up of a dedicated document and reference library, allowing all Team Members to view any documents whenever needed.

The Team's Work

Since the deadline given to the Team to complete its mandate was the March 2007 Council and given that work could not begin before May 2006, the Team worked almost continuously for the next 8 months. During that period, four plenary meetings were held, three presentations were made to the SPC, two meetings were held with the Director General, a number of meetings

ESA's Rosetta comet mission passed close to Mars on 24 February 2007. (ESA © 2007 MPS for OSIRIS Team MPS/UPD/LAM/IAA/RSSD/INTA/UPM/DASP/IDA)

took place with the Director of Science, and about 50 members of the Executive were interviewed. Numerous other meetings and interviews also took place with non-ESA experts, each meeting being led by individual members of the Team. For each, a summary had to be prepared, to ensure that the whole Team had access to the information gathered by the breakout groups.

Following a request from Council, the Chair of the SPC participated in all of the plenary meetings, although there were one or two closed sessions when only the Team was involved. The Executive was kept informed, when necessary and within the limits of maintaining the confidentiality of the SPRT activity, via the Chairman and/or the Executive Secretary. This led to the very positive situation whereby adaptations were made, both by the Executive and the SPC, to current procedures or practices, taking account of developments during the work of the SPRT. Examples of this include an adaptation of the documentation related to the Call for Proposals, the realigning of SPC agendas to separate decision points from information items, the issuing of a new strategy paper by the Executive, and other similar changes.

The Report and its Recommendations

By the end of August 2006, things were beginning to take shape on the direction in which the Team's recommendations were likely to go. The plenary meeting at the end of September, a huge amount of email traffic between then and the end of November and an intense pre-drafting session by the Chairman and Executive Secretary resulted in a 'preliminary content' paper – a draft structure for the Report and Recommendations. During early December, the thousands of pieces of the jigsaw puzzle, generated by all of the Members, had to be put together and developed into a cohesive and clear text, which was circulated in draft form to the Team. The last meeting, held at ESTEC in mid-December, put the finishing touches to the structure of the Report (if not yet the final content), and the drafting of the final Report could begin. The target was to have this issued to the Team before Christmas – and we made it, on 22 December, the last (official) working-day of the year! As expected, the Team Members were not idle during the Christmas holiday. All carefully read the entire text and made their comments – mostly editorial, but, nonetheless, crucial nuances and clarifications that added much to the first draft.

Having succeeded in pulling together all of the Team's comments, the final version of the Report was issued to the Director General, all SPC delegations and the Director of the Scientific Programme, early in January 2007.

Assessment of the Report

On the initiative of the SPC Chair, the Report's content and recommendations were 'dissected' by four working-groups composed of members of the SPC, during a 2-day meeting dedicated entirely to the Report, at ESTEC in the second week of January.

The recommendations contained in the Report were, by and large, well understood and the plenary meeting focused on addressing the issues where there were differing views as to how to find a solution to some of the problems

Areas Covered by the SPRT Report and Recommendations

(Given the Programme-specific nature of the recommendations and their relevance principally to the Science Programme and its Advisory Structure, the full recommendations are not reproduced here. Only the major topics and some examples are provided for illustration.)

Chapter 4. IMPLEMENTING COSMIC VISION
- The Call for new mission proposals
- Mission mix and international collaboration
- Payload development
- Block decisions

Examples: the SPRT Report called for the removal of EUR 200 million from the Programme, before issuing any new Call for Proposals. It also suggested the reopening of an option to have small missions (about EUR 75 million). The previous practice of making 'block decisions', which freezes the Programme for a period into the future, was considered no longer feasible or desirable by the SPRT.

Chapter 5. DECISION-MAKING AND MANAGING THE SCIENCE PROGRAMME
- Cost increases
- Technology readiness
- Core technology programme
- Cooperation
- Peer reviews
- Timing of mission selection and adoption by SPC
- Contingency in the Science Programme
- Extra demands on the Programme
- Operations and support costs
- Overhead charges
- Financial contributions to payload developments by scientific institutes
- Extensions of mission operations

Examples: decisions should only be taken when there is solid information available on the readiness of critical technology, as assessed by independent peer-groups. The projected Cost-at-Completion is exceeded, decisive actions need to be taken. Costs that are not directly associated with spacecraft procurement have to be reduced. The level of contingency margins at Programme and Project level have to be carefully determined and managed. The scientific return from mission extensions has to be carefully weighed against the potential cost of opportunities to the rest of the Programme.

Chapter 6. INDUSTRY
- Follow-up of payload instrument development and assessment of risks
- Procurement practice and development methodology
- Costs, contingencies and contractual terms
- Coupled missions and related potential cost savings

Examples: within the limits imposed by the ethics of competition, Industry experts should assist ESA experts and others in conducting a comprehensive assessment of mission-critical technologies, prior to the adoption of a mission.

Chapter 7. GENERAL
Examples: the SPC should become more fully involved in those decisions it is making but without micro-managing. A review of the effectiveness of the division of roles between the Executive and the SPC would be useful. *Ad hoc* SPC working groups, seconded by outside experts, could help in the preparation of difficult decisions.

identified by the SPRT. In parallel, the Chairman of the SPRT met with the Director General and the Chair of the SPC, in separate meetings, to discuss the Report in finer detail.

The outcome of the SPC Working Group review was presented at the February meeting of the SPC, in conjunction with a formal presentation and discussion of the Report, in the presence of the SPRT Chairman. The final stages of completing the SPRT mandate was achieved by the submission of the Report to the March 2007 Council, accompanied by the comments of the Director General and the observations of the SPC.

Conclusions

Both the SPC and the Executive have warmly commended the work of the SPRT and have stated that the work by Dr van Duinen and his Team was conducted very competently and comprehensively and to have resulted in a very good Report and set of recommendations.

The van Duinen Report should, therefore, mark a significant point in the history of the Science Programme. As well as indicating areas for improvement, it will help to highlight and recognise its successes, achievements and opportunities, so as to put it on an even better footing for the future. It may be useful to note that, whereas previous SPRT reports were produced assuming good growth potential in the future, this one was done from the perspective of a constrained budget.

As the Director General has remarked, the potential effects of the van Duinen Report's recommendations are not limited to the Science Directorate, since many comments and recommendations deal with facilities and services provided by other ESA Directorates to the Science Programme. Equally, therefore, the process and the main issues that have been highlighted are relevant right across the Agency. In effect, the outcome of the deliberations at the March Council can have consequences for activities/facilities that are not under the direct control of the Programme. A crucial aspect of dealing with the van Duinen Report is that both the Executive and ESA Delegate bodies are monitoring and evaluating the implementation of the recommendations. Within the Science Directorate, a member of the management team has been given specific responsibility for monitoring the implementation of the SPRT recommendations, but there is no doubt that this task requires the attention of all in the Directorate to ensure an effective response.