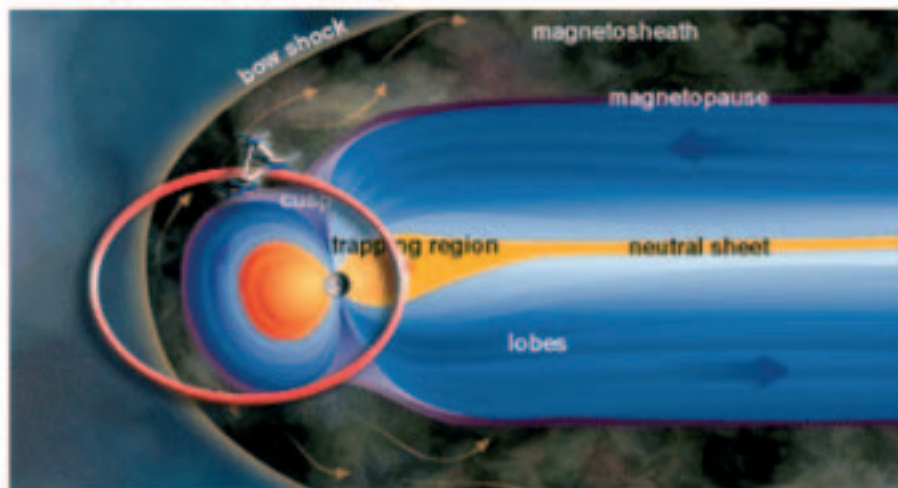




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- ▶ Rosetta Status Report
- ▶ SMART-1 Status Report
- ▶ Mars Express Status Report
- ▶ Double Star Status Report
- ▶ INTEGRAL Status Report
- ▶ Cluster Status Report
- ▶ XMM-Newton Status Report
- ▶ Cassini-Huygens Status Report
- ▶ SOHO Status Report
- ▶ Hubble Status Report
- ▶ Ulysses Status Report
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- ▶ INTEGRAL spectroscopy of the accreting millisecond pulsar XTE J1807-294 in outburst
- ▶ Tentative detection of warm intervening gas towards PKS 0548-322 with XMM-Newton
- ▶ The Magnetic Structure of Filament Barbs
- ▶ Transition Region Downflows in the Impulsive Phase of Solar Flares
- ▶ Discovery of an aurora on Mars
- ▶ Possible Cryovolcano on Titan
- ▶ Simulations of the formation, evolution and clustering of galaxies and quasars
- ▶ A fresh start for Europe's space agency
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# Information Services to the Scientific Community on the Web

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**F**or the past several years, the ESA Science Directorate has run a number of websites serving the wider scientific community. Much of the information, from the moment a scientific mission is conceived to the moment it ceases operations, needs to be processed and made available to a wide range of audiences. These audiences range from Member State delegates, at decision-making level, to the scientists working on various aspects of the mission, to the engineers who actually build the spacecraft, to operations and to the curious public, both informed and uninformed, all of whom are interested in following developments at ESA.

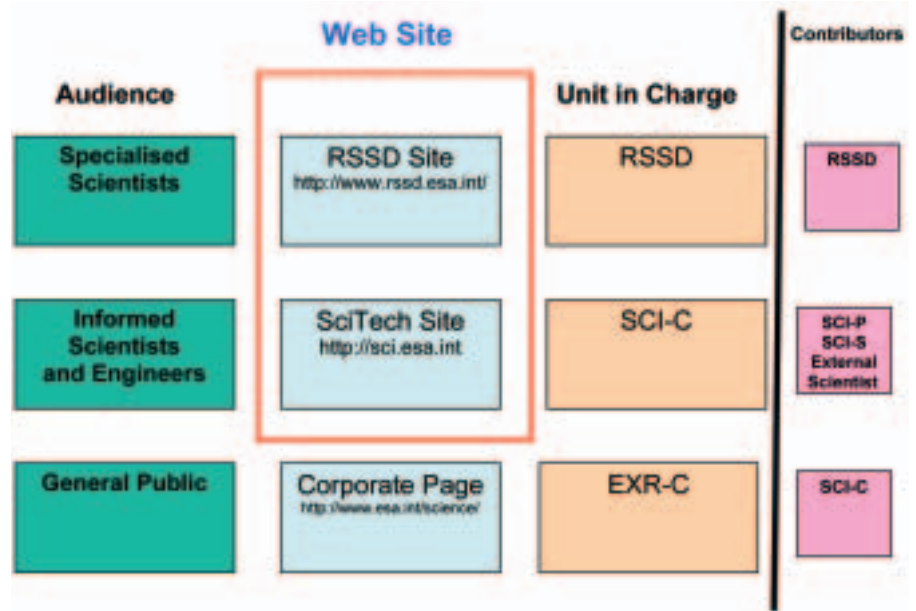
*This article sheds some light on what lies behind the scenes and attempts to explain the individual steps taken to ensure that the information put into the public domain is both correct and up-to-date.*

### The Science Web

There are basically three tiers to the Science Web services: the Research Website, which caters for the needs and requirements of every scientific project run by ESA; the Science and Technology Website, which provides in-depth information about each spacecraft and status reports on the operational satellites; and the area devoted to the general public, which is integrated into the ESA Portal. This the first two websites, which are a part of the services that the Science Programme provides directly to the scientific community.

### The Research Science Portal

The teams who provide the payloads for the ESA science missions interface with their Project Scientists in the Research and Scientific Support Department (RSSD). Since these days most of the payload teams, and the user communities, are very



The three web services offered by the ESA Science Directorate are targeted at three different audiences. The specialised communities involved in a particular mission would access the RSSD site. The informed scientists and engineers interested in following developments in all areas of science would access the Sci-Tech website. The general public interested in event-driven news, such as a launch or a major mission milestone, would access the ESA Corporate Webpage

The screenshot shows the ESA Gaia website interface. At the top, there is a navigation bar with categories like 'Astronomy', 'Planetary Exploration', 'Solar Terrestrial Science', 'Fundamental Physics', 'Science Operations', and 'Research'. The main content area is titled 'News from Gaia' and features three news items:

- 2005-07-01 Industrial ITT Documentation Released:** The Gaia Project Team in ESA-ESTEC has released the complete package of documentation representing the industrial 'Invitation to Tender' for Phases B2/C/D (detailed design, development, launch and commissioning of the Gaia satellite), including the detailed 'Statement of Work' and the 'Mission Requirements Document'.
- 2005-06-27 Establishment of a Data Analysis Coordination Committee:** The first meeting of the Data Analysis Coordination Committee (DACC) was held at ESTEC on 15 and 16 June. The DACC was formally set up by the GST at its 15th meeting in April 2005 and is charged with defining and putting into place the Gaia Data Analysis Consortium (GDAC).
- 2005-06-24 Postdoc positions at ZARM - University of Bremen:** Two postdoc research positions, each for a period of two years, are offered by the Center of Applied Space Technology and Microgravity (ZARM) at the University of Bremen.

The right sidebar contains several sections: 'The Three Disciplinary Teams with Gaia', 'Proceedings of the Gaia Synopses', 'Picture of the Week', 'Celestial ground station', 'Gaia People', 'Poster List', 'Spotlight on...', 'Science gold from the STS', and 'Gaia opportunities for research'.

large, RSSD provides facilities to help coordinate these activities within the RSSD Science Portal.

The Research Science Portal is not a 'typical' website in that it is not 'outward-facing', nor is it a purely local intranet. It is a hybrid, a 'wide-area intranet' or 'e-community', i.e. an HTTP-based framework to facilitate communication within and between the various science teams and mission groups inside ESA and in the wider community. Based on web technology, and making use of the www paradigm, the portal also provides a structured environment for communication, data dissemination, and application delivery. In addition to the centrally located RSSD Portal, the operational and post-operational data archives located at ESAC in Villafranca (E) also fall within the remit of RSSD Web Services and, in line with the policy of centralising the resources, the RSSD Portal provides an interface to these sites.

In addition to supporting the mission communities, the RSSD Portal serves as

the interface to the many administrative functions associated with the Science Directorate, providing access to the research Publications Management System, the Electronic Preprint Delivery Service, the RSSD Document Management System, LDAP Directory Services and Mailing List generators, the Journal Library Catalogue, Technical Mail Services and infrastructure/software support to RSSD staff and contractors. Capturing the complete record of a project's scientific publications throughout all of its phases has never before been attempted and offers a challenge for the service – this task normally being restricted to the exploitation phase once in orbit.

### The Science and Technology Portal

SciTech took over from the original Science Website, which was originally conceived purely as a communication tool, in June 2003. The main objective is to combine a wide range of information gathered from all parts of the Directorate

and to present this via one consistent portal. The site attempts to generate a consistent web structure and hierarchy for each mission. The site navigation is built up from technical descriptions of the spacecraft and instruments, 3D models, orbital simulations, science and services such as technical publications, an event calendar and conferences. In addition, news, images and the latest status reports from operational satellites are provided.

The SciTech website can be considered as a general scientific journal, one that can be read by the educated public, scientists and engineers wishing to be kept up-to-date on all of the scientific missions ESA is flying. Technological aspects of instruments and experiments are regularly updated and combine all engineering and scientific issues at a single reference point on the web.

### Phases of a Science Programme

There are several phases through which a scientific mission passes, before it is built and flown, and the SciTech site structure is



built around these phases. The most relevant ones, from the web-services point of view, are:

*Assessment Phase*

The Science Mission Team, composed of scientific and technical staff from the Directorate, set down their ideas and concepts during this phase. A model payload is drawn up. The feasibility of the mission is first investigated, culminating in the submission of a Study Report to the ESA Science Programme Committee (SPC).

These Study Reports are made available through the SciTech website to the broader community and the first designs for each spacecraft are published. As we progress into the definition phase, the number of articles and reports increases. Some of these directly involve academic institutions and industry, which provide input via their respective ESA interfaces.

*Definition Phase*

After assessment has been successfully completed and approved, a set of study projects are initiated to establish the cost and schedule of the mission in greater detail. During this 'Definition Phase', the spacecraft really begins to take shape and detailed descriptions of all its parts and payloads are assembled. The SPC is kept up to date regarding the status of each study, and finally estimates of the total cost and schedule are presented to it. Now we are ready to actually start building the spacecraft.

*Implementation*

At this point, a project team and a science team are put together. A Project Manager and Project Scientist are nominated to follow up each and every technical aspect of the mission during its implementation and construction. This phase ends at the

moment ESA receives the spacecraft from the industrial consortium and accepts it as being ready for launch.

The project teams are now ready to build the spacecraft, and all of its specifications have been laid down. This enables the SciTech website to provide instrument-description pages, as well as detailing the final scientific objectives. Reports come in on a regular basis, as each milestone is reached during the building phase. These can range, for instance, from the delivery of the Herschel mirror, which is ready to be integrated, all the way to the systems tests carried out on Venus Express. This is usually also one of the longest and busiest periods for the project's technical and scientific teams.

During the pre-operational phases of a mission, the RSSD Portal serves as a focal point for the mission's numerous team members, who may be spread geographically throughout the world (e.g. Gaia and Planck both have several hundred contributors spread across four continents). In addition to the communication aspect, the RSSD Portal also provides a unified interface to the many applications that are being implemented for use during both the developmental and operational phases of the missions (e.g. Planck-IDIS, Gaia Parameter Database, document sharing, calendars, etc). These generic tools help the Project Scientist to better coordinate the payload providers' activities and obviate the need for each payload team to maintain redundant information sets.

*Launch*

The launch phase begins with the placing of the spacecraft into orbit and culminates at the end of the commissioning period. It is the period during which acceptance tests are carried out on all instruments and all operational units, and all necessary checks prior to the spacecraft beginning its operations are made.

The SciTech Website has now covered a number of launch campaigns and time-critical mission events, such as the recent descent and landing of the Huygens probe. The concept of a regular mission status report was first fully applied for the SMART-1 mission, with the full support of

both the project and scientific teams. In the first months, status reports were received and published on a weekly basis. At the time of writing, 39 reports have been produced since launch, providing a comprehensive archive on the evolution of the mission from launch, through the coast phase, lunar capture and now into lunar science operations. Over time, the frequency of reporting has been reduced from weekly to monthly, to reflect the changing operational status of the spacecraft.

Input for the reports can come from a variety of sources: the Project Scientist, the Project Manager, or ESOC. The editorial team combines these various inputs to produce an acceptable online report, ensuring consistent style and content.

The same approach is being applied for the Rosetta mission, launched on 2 March 2004 and now ready to be handed over from the project team to the science team. At the time of writing, there are 43 status reports on line.

#### *Operations*

As a mission evolves, there is a change in the reporting of results on SciTech. Since all of the data sources have some proprietary period, the reporting of results can depend on information being released through Principal Investigators (PIs). Over time, however, more and more data enters the public domain and the number of results appearing in external publications with various degrees of specialisation, such as Nature or New Scientist, also increases. The website serves as a link to those results appearing in a wide variety of publications.

Science payloads fall into two basic categories – the facility type, used mostly for observatory missions, which are common in the astrophysics domain, and the PI-experiment type, which are dominant in solar-heliospheric and planetary missions. At present, most astrophysics missions are operated by the Science Operations Centre located at ESAC (E). Wherever possible, the community support also becomes the responsibility of the ESAC teams, inheriting the knowledge built up prior to

launch and available in the RSSD Science Portal. ESAC is also responsible for user support during operations and the development of the final data archives.

The solar-heliospheric and planetary communities have traditionally been more independent, but the increased complexity of payloads and today's geographical spread have necessitated, in the case of programmes such as Rosetta, BepiColombo and Huygens, a similar support approach by RSSD. Furthermore, the ongoing development of the Cluster Active Archive and the SOHO Archive is bringing the solar-system missions more in line with the paradigm traditional in the astrophysics community. In the future, interplanetary missions are also foreseen to be operated from ESAC.

The need for strong information security in the pre-operational period is a key design parameter, and the portal was designed to support the requirement for tight, mission-based (even team-based), multi-level, information security. It therefore provides a configurable, flexible, authentication system incorporating single-password access to all registered applications.

#### *Post Operations*

The RSSD Web presence continues into the operational and post-operational phases, hosting the data archives and data-delivery systems for all operational science missions. These systems provide web-based access for the wider scientific community to both the raw and interpreted mission data. Most of these systems are (or will soon be) physically located at ESAC, but for the purposes of consolidation, the RSSD portal hosts interfaces to each of these archives. The Planetary Archive (which combines the data from all planetary missions, and currently covers Rosetta and Mars Express) is tightly linked to the RSSD Portal, which hosts a copy of the Planetary Science Archive access application and support pages. The Portal also provides direct links to the XMM-Newton, Integral and ISO data archives.

#### **Other Services**

In addition, SciTech is a vital point of

information for other aspects of the Directorate. The Cosmic Vision plan is updated regularly, giving a glimpse behind the scenes on the evolution of the programme and the foreseen schedule of launches. The Director's Desk offers a view into issues concerning the advisory body of the programme. Services specifically set up for the various Working Groups, the Space Science Advisory Committee (SSAC) and the Science Programme Committee (SPC) can be found there, together with a full list of the members of each committee.

The Agency's PRODEX Programme provides funding for the industrial development of scientific instruments or experiments proposed by institutes or universities in the Participating States and selected by ESA for one of its programmes in the various fields of space research. Each contributing country is represented in the PRODEX section of the website, with details about the annual funding and the research activities being undertaken. This service allows the whole PRODEX community to view the areas of current research and identify potential areas for future collaboration.

The Payloads and Advanced Concepts web section reports on ongoing technological feasibility studies. These crucial studies define the future missions and pave the way towards a better understanding of where the technological limitations are, prior to carrying out a mission. The Advanced Concepts group can be considered visionary in that it defines the framework for building a mission. In addition, the group is tasked to develop instrument technologies and run the laboratories for the Directorate.

Another recent addition has been the Science Educational Support web section. This particular service is targeted at teachers and educators wishing to make use of material that is otherwise hard to find on other sites. It is an integral part of the website in that much of the information found there is gathered from other sources that have been specifically targeting the scientific community. We do not distinguish between a schoolteacher and scientific or engineering staff, since all of

these professions possess a common understanding of the underlying science in the domains of astrophysics, solar-system sciences and fundamental physics.

The Science Educational Support web pages offer, for instance, exemplar material that fits most European curricula. This material can be used for lectures, lessons, hands-on activities, role-playing, homework content, examinations, etc. In addition, there is also supporting and illustrative material for teacher tools used in the classroom. Material already available on the SciTech site has simply been repackaged to make it more accessible and comprehensible to teachers, whilst


partnerships have been established with other stakeholders who redistribute the content through various other channels. The advantage of this approach is that it ensures that students at all levels come into contact with ESA's science missions and their results, and gain a better understanding of how space technology works.

### Finally.....

The vast amount of information that we are currently accumulating will lead to a better understanding of space science and its benefits at all professional levels. The exchange of information among professionals and keeping abreast of

ongoing activities yields an increase in the quality of work on the task at hand. Our approach and conviction is to continue to be a major reference point on the Internet for all aspects of ESA's Science Directorate missions and to continue to serve the professional world at all levels.

### Acknowledgements

We would like to thank the Staff of the Science Directorate for their dedication and commitment to keeping the content of the Directorate's web pages up-to-date, and their continued motivation and active support in recognising this tool as a crucial means of informing and educating the public. 

The SciTech Website can be found at: <http://sci.esa.int/>  
 The RSSD Website can be found at: <http://www.rssd.esa.int/>  
 The General Public Science Webpage can be found at: <http://www.esa.int/science>

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