

Contributors

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Cover:

Top left: SOHO's instruments have revealed rotation speeds inside the Sun. *Top right:* a simulated exposure of 100 000 s by XMM's EPIC-PN camera. It is clear that XMM, to be launched in 1999, will detect a vast number of previously unknown X-ray sources. *Bottom left:* the ozone hole over the South Pole, as seen by the GOME instrument aboard ERS-2. *Bottom right:* MiniSTEP will test the Equivalence Principle by observing the rate of fall of test masses of different composition towards the Earth.

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This volume is dedicated to the memory of
W.R. (Bill) Burke, Editor of ESA's Reports to
the COSPAR Meetings for many years.

1. Introduction

Table 1.1. ESRO/ESA scientific spacecraft.

	<i>Launch date</i>	<i>End of operational life</i>	<i>Mission</i>
<i>Launched</i>			
ESRO-II	17 May 1968	9 May 1971	Cosmic rays, solar X-rays
ESRO-IA	3 October 1968	26 June 1970	Auroral and polar-cap phenomena, ionosphere
HEOS-1	5 December 1968	28 October 1975	Interplanetary medium, bow shock
ESRO-IB	1 October 1969	23 November 1969	As ESRO-IA
HEOS-2	31 January 1972	2 August 1974	Polar magnetosphere, interplanetary medium
TD-1	12 March 1972	4 May 1974	Astronomy (UV, X- and γ -ray)
ESRO-IV	26 November 1972	15 April 1974	Neutral atmosphere, ionosphere, auroral particles
Cos-B	9 August 1975	25 April 1982	Gamma-ray astronomy
Geos-1	20 April 1977	23 June 1978	Dynamics of the magnetosphere
ISEE-2	22 October 1977	26 September 1987	Sun/Earth relations and magnetosphere
IUE	26 January 1978	30 September 1996	Ultraviolet astronomy
Geos-2	24 July 1978	October 1985	Magnetospheric fields, waves and particles
Exosat	26 May 1983	9 April 1986	X-ray astronomy
FSLP	28 November 1983	8 December 1983	Multi-disciplinary
Giotto	2 July 1985	23 July 1992	Comet Halley and Comet Grigg Skjellerup encounters
Hipparcos	8 August 1989	15 August 1993	Astrometry
Hubble Space Telescope	24 April 1990		UV/optical/near-IR astronomy
Ulysses	6 October 1990		Heliosphere
Eureca	31 July 1992	24 June 1993	Multi-disciplinary
ISO	17 November 1995	8 April 1998	Infrared astronomy
SOHO	2 December 1995		Sun (including interior) and heliosphere
Cluster	4 June 1996		3D space plasma investigation; launch failure
Huygens/Cassini	15 October 1997		Titan probe/Saturn orbiter
<i>Planned launches</i>			
XMM	August 1999		X-ray spectroscopy
Cluster II	2000		3D space plasma investigation; Cluster replacement
Integral	2001		Gamma-ray astronomy
Rosetta	January 2003		Comet rendezvous
Planck	2006		Cosmic microwave background
FIRST	2006		Far-infrared and submillimetre astronomy

1. Introduction

ESA's reports to the COSPAR meetings previously covered the exploration of the solar system (including Sun and heliosphere), astronomy and fundamental physics. This Report to the 32nd Meeting adds Earth sciences*. Another new feature is the inclusion of pointers to the World Wide Web site of ESA's Scientific Directorate. The existence of this site and the generally facilitated access to the literature through electronic means justify the omission of the bibliographies that were earlier published as appendices to ESA's COSPAR reports. We hope that, by generally reducing the length of text and using more tables and figures, we have made the presentation of ESA's scientific satellite projects more accessible to the general reader.

ESA's 'Horizons 2000' long-term scientific programme has undergone a major revision within the reporting period. The Council Meeting at Ministerial level in Toulouse in September 1995 had approved the extension of the 'Horizon 2000 Plus' long-term programme, but it imposed a 3% annual reduction in purchasing power on the Scientific Directorate. Then, on 4 June 1996, the four Cluster spacecraft aboard the ill-fated Ariane 501 flight were destroyed. In the revised programme, the Cornerstones were maintained, but the medium-sized M-missions were replaced by smaller missions in order to regain flexibility for the programme. The new mission-types introduced are 'F' (for 'flexible'), with purely scientific goals, and 'SMART' (Small Missions for Advanced Research in Technology) missions, which can provide in-orbit proof of technologies, in particular for future Cornerstones (and may also carry, as a secondary goal, a few scientific experiments).

While this revision of the future programme was being elaborated, work continued on the completion of the final archives of two missions, the in-orbit operations of and scientific investigations with five spacecraft, and the development of several projects. It was decided to fully replace the Cluster mission with a launch date in 2000, and ESA's Huygens probe was launched in October 1997.

Since the last report to COSPAR, the following specific archiving, project and study work took place within ESA's Scientific Programme:

The final archives of IUE and Hipparcos were completed:

- the Final Archive of the International Ultraviolet Explorer (IUE), an observatory satellite that had been operating for 18 years, was completed by the end of February 1998 and is now being distributed in various versions of sophistication to national host centres;
- the Hipparcos Catalogue, which also contains the most advanced sky atlas, the Millennium Atlas, was published in 17 volumes. One volume includes all the Hipparcos-derived catalogues on CD-ROMs.

Five satellites were operated in orbit, namely:

- the Hubble Space Telescope (HST), whose payload following the February 1997 Maintenance and Repair Mission now has an extended spectral range that also covers the near-infrared;
- the Ulysses heliospheric probe, which was completing its first solar polar orbit and which will provide data on the Sun and heliosphere during the rising part of the solar activity as it orbits the Sun a second time;
- the Infrared Space Observatory (ISO), whose operational lifetime was extended well beyond the initially foreseen 18 months (to more than 28 months – the

* This reflects the current structure of ESA, where Earth sciences (as opposed to Earth observation applications) and Earth observation strategy fall under the purview of the Scientific Directorate (D/SCI). Consequently, the Earth Sciences Division has become part of Space Science Department, the traditional purveyor of ESA's report to the COSPAR Meetings. The report does not, however, cover the scientific aspects of Microgravity and other Space Station Utilisation projects carried out by the Manned Spaceflight and Microgravity Directorate (D/MSM).

- supply of superfluid helium was exhausted on 8 April 1998), allowing it to achieve full sky coverage;
- the Solar and Heliospheric Observatory (SOHO) which, having successfully completed its nominal 2-year mission, is now set for a mission extension permitting it to investigate the Sun and heliosphere by remote-sensing and in-situ measurements from an ecliptic vantage point;
 - the Huygens Titan probe, which was launched on 15 October 1997 with NASA's Cassini spacecraft and is now on its 7-year cruise towards Saturn. Huygens operations are, of course, restricted to in-orbit check-outs.

Six projects were under development:

- the X-ray Multi-Mirror (XMM) Cornerstone mission, with an Ariane-5 launch scheduled for August 1999;
- Cluster II, a full replacement for all four lost Cluster spacecraft, being prepared for launch in mid-2000;
- the International Gamma-ray Laboratory (Integral), aiming at a launch on a Russian-supplied Proton rocket in 2001;
- the Cornerstone mission Rosetta, with an Ariane-5 launch in 2003 and a rendezvous with Comet Wirtanen in 2013;
- the Planck mission, an investigation of spatial variations in the microwave background radiation (previously called Cobras/Samba);
- the Far-Infrared and Sub-mm Telescope (FIRST) Cornerstone mission.

In an effort to reduce programme costs, the last two missions might be carried on one launch vehicle or even on a common spacecraft. A decision on the actual mission profile will be taken in Spring 1998.

The studies for future Cornerstones, F-class and small missions, as well as for the first SMART mission, are presented in Section 4. The Earth Science missions in orbit, under development and under study are described in Section 5.

2. Current and Completed Missions