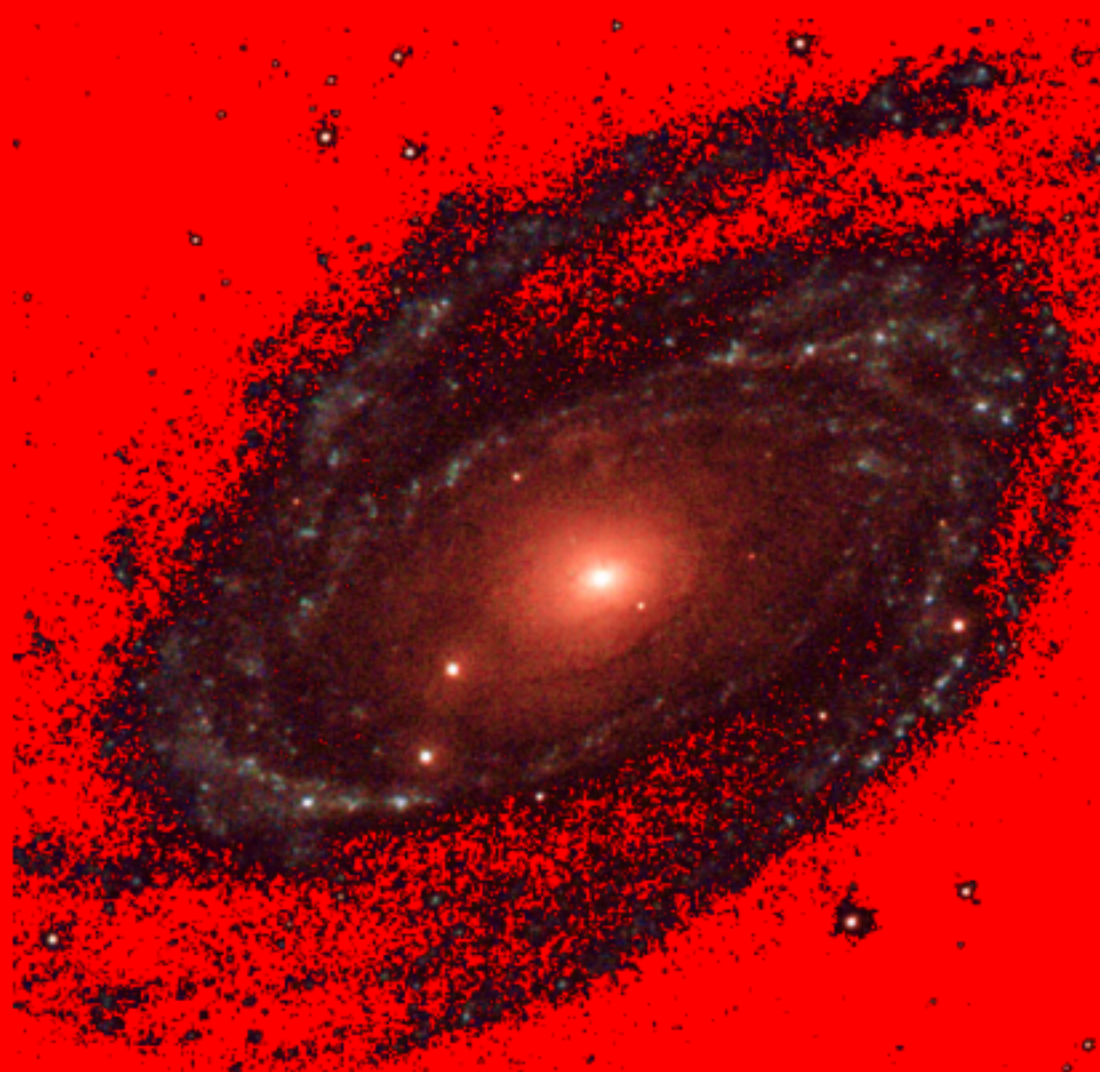




European Space Science Committee

SIX YEAR REPORT 1997-2002



June 2003

Six-Year Report (1997-2002)

The European Space Science Committee (ESSC) is an expert committee of the European Science Foundation (ESF). Established in 1975, it covers space physical science, life and physical sciences in space, and Earth observation. It considers space research activities in Europe, with particular emphasis on the definition and organisation, collaboration and exploitation, and assessment of such research endeavours. The Committee investigates and presents the view of the scientific community in Europe and provides an independent voice on European space science policy. It is the ESF's expert body on space research.

It aims to promote space science related activities, to facilitate the definition and the organisation of space research programmes in Europe, and to encourage the coordination of space research in concertation with ESA, the European Commission, European scientific associations, national space agencies and scientific organisations of European or other countries concerned with space-related research.

The ESSC is one of the main spokesperson on European issues concerning space research and related activities. It is a place for reflections and proposals made independently from agencies and governments.

Financial support for the work of the ESSC, ESSC panels and work groups, has been provided since 1997 by the following organisations:

- European Space Agency
- Fonds zur Förderung der Wissenschaftlichen Forschung in Österreich (Austria)
- Fonds voor Wetenschappelijk Onderzoek – NFWO (Belgium)
- Fonds National de la Recherche Scientifique – FNRS (Belgium)
- Forskningsrådene, then Forskningsstyrelse (Denmark)
- Suomen Akatemia (Finland)
- Centre National de la Recherche Scientifique – CNRS (France)
- Centre National d'Etudes Spatiales – CNES (France)
- Arbeitsgemeinschaft der Grossforschungseinrichtungen – AGF (Germany)
- Helmholtz-Gemeinschaft Deutscher Forschungszentren – HGF (Germany)
- Agenzia Spaziale Italiana – ASI (Italy)
- Nederlandse Organisatie voor Wetenschappelijk Onderzoek – NWO (Netherlands)
- Consejo Superior de Investigaciones Científicas – CSIC (Spain)
- Oficina de Ciencia y Tecnología – OCYT (Spain)
- Naturvetenskapliga forskningsrådet, then Vetenskapsrådet (Sweden)
- Nationalfonds zur Förderung der Wissenschaftlichen Forschung (Switzerland).
- Science and Engineering Council – SERC (United Kingdom)
- Particle Physics and Astronomy Research Council – PPARC (United Kingdom)
- Natural Environment Research Council – NERC (United Kingdom)

The ESSC comprises three permanent discipline-oriented panels : the Space Physical Science Panel (ESPSP), the Earth Observation Panel (EEOP) and the Life and Physical Sciences in Space Panel (ELIPSP). Lists of the members of the Committee since 1997, as well as the current committee membership, are reproduced hereafter.

ESSC Membership List

(1997-2002)

François Becker, ENSPS, Strasbourg, Chairman until 12/1997
John Leonard Culhane, MSSL-UCL, Chilton, Chairman, 01/1998 to 09/2002
Gerhard Haerendel, IUB, Bremen, Chairman from 10/2002

Werner Alpers, Universität Hamburg, Hamburg, 05/1996 to 04/1999
Georges Balmino, GRGS, Toulouse, 01/2002 to 09/2002 (early resignation)
Daniel Beysens, CEA, Pessac, from 04/2000
Johan Bleeker, SRON, Utrecht, 01/1998 to 12/2001
Maurizio Candidi, IFSI, Frascati, 01/1995 to 12/1997
Peter Cargill, Blackett Laboratory, London, from 01/2002
Anny Cazenave, LEGOS, Toulouse, 01/1998 to 12/2000
Marie-Lise Chanin, SPARC, Verrières-le-Buisson, 01/1998 to 12/2001
Augusto Cogoli, ETH Technopark, Zürich, from 05/1999
Mike A. Cruise, Univ. of Birmingham, Birmingham, 01/1995 to 12/1998
Pietro E. di Prampero, SFU, Udine, 01/2001 to 05/2002 (early resignation)
Klaus Dose, Institut für Biochemie, Mainz, 01/1995 to 04/1997
Pascale Ehrenfreund, Leiden Observatory, Leiden, from 01/2002
Jean-Jacques Favier, CENG, Grenoble, 09/1995 to 12/1999
Jean-Louis Fellous, IFREMER, Issy-les-Moulineaux, from 01/2002
Hasse Fredriksson, KTH, Stockholm, 11/1999 to 12/2002
Alvaro Giménez, INTA, Torrejón de Ardoz, 01/1995 to 12/1999
Robert J. Gurney, University of Reading, Reading, 01/1995 to 12/1999
Eberhard Grün, MPI für Kernphysik, Heidelberg, from 01/2002
Gerhard Haerendel, MPI für extraterrestrische Physik, Garching, 01/1995 to 12/1998
Gerhard Haerendel, ex officio as COSPAR President, 01/1999 to 09/2002
Gerda Horneck, DLR, Köln, 01/1998 to 12/2002
Norbert Kiehne, DLR, Köln, 01/1995 to 12/1997
Hannu Koskinen, University of Helsinki, Helsinki, from 02/2000
Jean-Claude Legros, MRC, ULB, Bruxelles, 09/1995 to 12/1999
Dag Linnarsson, Karolinska Institutet, Stockholm, 01/1995 to 12/1998
Wolfgang Lucht, PIK, Potsdam, from 01/2001
Niels Lund, DSRI, Copenhagen, from 05/1999
Nazzareno Mandolesi, I.T.E.S.R.E., Bologna, 01/1995 to 12/1998
Philippe Masson, Université Paris Sud, Orsay, 05/1996 to 12/2000
Gérard Mégie, IPSL, Paris, 01/1995 to 12/1997
Jean-Loup Puget, IAS, Orsay, from 01/2002
Ian S. Robinson, SOC, Southampton, from 02/2000
Rafael Rodrigo, IAA, Granada, 11/1999 to 12/2002
Paul C. Simon, IASB, Bruxelles, 11/1999 to 12/2002
Hans Sünkel, Graz TU, Graz, 05/1996 to 12/1999
Fred W. Taylor, Clarendon Laboratory, Oxford, 01/1995 to 12/1997
Gianni Tofani, OAA, Firenze, 11/1999 to 12/2002
Martin J.L. Turner, University of Leicester, Leicester, from 05/1999
Gilbert Védrenne, CESR, Toulouse, 01/1995 to 12/1998
Stefano Vitale, Università di Trento, Povo, Trento, from 05/1999
John C. Zarnecki, The Open University, Milton Keynes, 01/1998 to 12/2001
Andrzej Zdziarski, CAC, Warszawa, 05/1996 to 12/1999

Jean-Claude Worms, Illkirch

ESSC Scientific Assistant, 01/1994 to 12/1997
ESSC Executive Scientific Secretary, from 01/1998

Michele Fratta, Strasbourg

ESF Scientific Secretary, 06/1995 to 12/1997

Hans U. Karow, Strasbourg

ESF Scientific Secretary, 01/1998 to 06/1999

Svenje Mehlert, Strasbourg

ESF Scientific Secretary, from 07/1999

ESSC Current Membership List

(1 May 2003)

Gerhard Haerendel, International University Bremen, Germany, Chairman

Earth Observation Panel (EEOP)

Jean-Louis Fellous, IFREMER, Issy-les-Moulineaux, France, *Interim Chair*

Bruno Carli, IFAC-CNR, Firenze, Italy

Christine King, BRGM, Orléans, France

Wolfgang Lucht, PIK, Potsdam, Germany

Ian S. Robinson, School of Ocean & Earth Science, Southampton, United Kingdom

Kai-Uwe Schrogl, DLR, Köln, Germany

Space Physical Science Panel (ESPSP)

Jean-Loup Puget, IAS, Orsay, *Chair*

Peter Cargill, Blackett Laboratory, Imperial College, London, United Kingdom

Angioletta Coradini, CNR-IFSI, Roma, Italy

Eberhard Grün, MPI Kernphysik, Heidelberg, Germany

Gerhard Haerendel, International University, Bremen, Germany

Hannu Koskinen, Dpt. of Physics, University of Helsinki, Finland

Niels Lund, DSRI, Copenhagen, Denmark

Martin Turner, University of Leicester, United Kingdom

Stefano Vitale, LBT, Trento, Italy

Life & Physical Sciences in Space Panel (ELIPSP)

Daniel Beysens, CEA-ESEME, Pessac, *Interim Chair*

Bernard Billia, MATOP, Marseille, France

Augusto Cogoli, ETH, Zürich, Switzerland

Pascale Ehrenfreund, Leiden Observatory, Leiden, The Netherlands

Monica Grady, Natural History Museum, London, United Kingdom

Peter Norsk, Flyvemedicinsk Klinik, Copenhagen, Denmark

Jean-Claude Worms, Illkirch, ESSC Executive Scientific Secretary

Svenje Mehlert, Strasbourg, ESF Scientific Secretary

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From the Chair

In May 1999, the ESF General Assembly approved the new terms of reference of the European Space Science Committee, following an extensive discussion on the increased role of the Committee and its growing recognition at the European and international level. These terms of reference were built upon the recommendations of the ESSC Review Panel, chaired by Professor André Lebeau, which met in 1996 and produced its final report in September of that year. Important tasks were undertaken since that last review of our Committee. The description of these tasks, as well as the imminent next review, necessitated the production of a major (1997-2002) activity report. We are thus happy to be able to introduce this document, and report on a very busy period, which has led the ESSC to become the natural partner to which scientific institutions and space agencies now turn for independent scientific advice on European space research policy. This position was achieved through the work and dedication of many individuals, whom we would like to gratefully thank; these achievements are also to be put to their credit.

The structure of the ESSC-ESF reflects the variety of space-related disciplines in Europe and the world, but also the way that these disciplines are frequently categorised in space agencies. The Committee members thus belong to one of three panels, following a scheme established since 1994. "Classical" space science (astrophysics, space physics and planetary exploration), Earth sciences, life and physical sciences in space, constitute the backbone of the ESSC. Presently, the Space Physical Sciences Panel (ESPSP) is chaired by Prof. Jean-Loup Puget (IAS, Orsay), the Earth Observation Panel (EEOP) by Dr. Jean-Louis Fellous (IFREMER, Issy-les-Moulineaux), and the Life and Physical Sciences in Space Panel (ELIPSP) by Dr. Daniel Beysens (CEA, Pessac). The current membership level is 21, coming from 8 European countries, and the COSPAR President (currently Prof. Roger M. Bonnet) is represented ex officio in the Committee.

Several major changes however occurred during the period covered by this report. Firstly, following the evolution of the European space arena, and the growing involvement of actors such as the European Commission in space-related research, the ESSC-ESF was called upon to extend its advisory role to other bodies, while ESA had traditionally been its natural "customer". The apex of this evolving role was reached during the past three years, with the ESSC-ESF being granted an observer status in the Joint Space Strategy Advisory Group (JSSAG), jointly managed by ESA and the European Commission. The involvement of ESSC in the discussion on issues such as the European Strategy for Space or the GMES concept are token of that recognition. Secondly, and in parallel with this role at the European institutional level, the Committee was granted an observer status at the ESA Council of Ministers, which met twice during this period, first in May 1999 and, more recently, November 2001. This position in Europe comes, it is important to stress, as a result of the specific nature of the ESSC-ESF, namely the fact that its members are not representatives of national institutions, but are appointed ad personam, thus ensuring a full independence of the Committee's advice and recommendations vis-à-vis national priorities. The ESSC members are not isolated however, and are strongly required to maintain close relationships with their national institutions. In addition, at a structural level, the former "microgravity" panel decided to evolve into a life and physical sciences in space panel, thereby demonstrating that microgravity itself is but a useful tool for scientists to conduct specific research programmes in space.

As already addressed, the ESSC differs from the other ESF Committees insofar as it is not concerned with establishing and managing scientific programmes, but solely with acting as spokesperson of the scientific community concerned with space-related issues, and as such,

with providing European space-related bodies and decision makers with recommendations established from the viewpoint of this community. In order to play this role efficiently in the changing space arena within Europe and in the world, the ESSC has established numerous links with the main scientific bodies concerned with space oriented research in Europe, the USA, Japan and, in a more recent and preliminary way, China.

The ESSC also maintains close relationships with the European Space Agency, the European Commission and the European Parliament, the United Nations Office for Outer Space Affairs, as well as national space agencies. Close relationships exist with the US Space Studies Board with a regular exchange of representatives to plenary meetings. Similar contacts are developing with the Japanese Science Council's Space Research Committee. Contacts are also maintained with international organisations such as COSPAR, EUMETSAT, IGBP, EUROGOOS, etc. The ESSC participates ex-officio in the scientific advisory committees of ESA (SSAC, ESAC, LPSAC) and, as mentioned already, is an observer in the EC-ESA JSSAG. Although 2003 is not covered by this report, the last months have seen an increase in that respect, with the strong involvement of ESSC in the consultation process on Europe's "Green Paper for Space", at the request of ESA and the European Commission.

As a result of this broad spectrum of involvement the reputation of ESSC has grown in the space community, as demonstrated by the more and more frequent appeals to its expertise and representativeness. Several examples of these solicitations can be mentioned briefly: joint study with the SSB on US-Europe collaboration in space science (1998); joint workshop on US-European-Japanese cooperation in space science (1999); report for ESA's science Directorate on the future of international collaboration in space science (2000); assessment for ESA's Manned Space Flight & Microgravity Directorate on its future research plan (2001); input to Framework Programme 6 of the European Union (2000); recommendations on GMES, on the European Strategy for Space and to the ESA Council of Ministers (1999-2001); study on the demography of European space science (2002-2003).

The rationale for space is changing, increasingly focussing on user needs in various areas, e.g., telecommunication, navigation systems, environmental monitoring. These needs have to be accommodated by various means, among which is the existence of a space infrastructure. In parallel the need for a clear European space policy, with the corresponding means to enforce it is now obvious to all, although its early advocates were for a long time just voices in the wind. These times are past however as the various actors involved seem determined to set the wheel spinning. A remaining and serious concern however lies with the support which is offered to science in general, and space science specifically. Major decisions concerning European space programmes have been made by ESA Ministers at the end of 2001. Sadly, the gap rather seems to be growing between objectives defined by European policy-makers, and the corresponding means. Although the decline of the buying power of the science programme seems to have stopped, inflation is still not fully compensated, and the annual funding basis is much lower than previously agreed. Similarly, other science components of ESA's programmes have seen major cuts to their requested budget. This trend must be stopped, or the balance and coherence achieved by Europe in space science, leading to world-wide excellence and recognition, will disintegrate. A "knowledge-based continent" must be fully committed to invest much more in Research and Development. This is not the case yet and this situation must be reversed, particularly for space science. Those are the wishes we formulate for Europe.

Gerhard HAERENDEL
Chairman ESSC-ESF
(10/2002 – 12/2005)

Len CULHANE
Chairman ESSC-ESF
(01/1998 – 09/2002)

The European Space Science Committee

1.1 The ESSC policy and its terms of reference

The European Space Science Committee (ESSC) has been established in 1975 under the auspices of ESF and as a successor to the provisional Space Science Board for Europe. It is a place for reflections and proposals made independently from governments and agencies.

In its past form, the ESSC had a structure in which Members were selected according to geopolitical representation, after adequate consultation with the ESF Member States. This structure, although suitable for ESF Programme Committees, turned out to be inappropriate for such an advisory body which should guarantee to provide scientific opinions and recommendations independently from the agencies or the national research institutions. This led the Committee members to propose, and the ESF General Assembly to approve in 1991, a new structure by which the ESSC would have a smaller number of members suggested by the Committee and the Member Organisations and institutions funding the ESSC, and appointed by the ESF Executive Board, according solely to their scientific expertise in the fields covered by the Committee.

In the years that followed, this policy has proved valid. New terms of reference, formalising this operational mode, were drafted by the ESSC and ESF, to serve as a Charter for the ESSC. These new terms of reference, reproduced below, express the responsibilities of the Committee and serve as a guideline to meet the challenges faced by the space science community in Europe for the years to come, as asked by the ESSC Review Panel in 1997. These Terms of Reference were formally approved by the Board of ESF in March 1999.

ESSC Terms of Reference

The Charter of the ESSC is defined below in accordance with the views of the Committee and the recommendations of the 1996 ESF Review Panel for the ESSC as approved by the 1996 ESF Assembly. Beyond the Charter, the Statutes of the ESF shall apply where relevant.

1. ESSC Mission and Status

The mission of the ESSC is to provide an independent scientific input on the forming and implementation of European space science policy.

The ESSC, as an Expert Committee of the ESF, is an integral part of the ESF. It acts as the scientific expert committee for the ESF on space research related issues.

2. ESSC Terms of Reference

The ESSC, in coherence with the ESF, will:

- monitor, review, and produce independent advice on space science and related research and technology,
- promote space science-related activities,
- facilitate the definition and the organisation of space research programmes in Europe,
- encourage the coordination of space research and related technology and applications,
- provide a discussion forum on space research, technology and applications, and increase public awareness of these fields at the European and international level.

In the pursuit of these tasks, the ESSC seeks interaction with the major bodies and supranational entities at the European level, in particular with the European Space Agency (ESA) and with appropriate institutions of the European Union. The ESSC also seeks interaction with bodies outside the European Union.

The Committee may set up a detailed set of objectives to be realised during its term.

3. ESSC Committee Membership and Chairmanship; ESF-ESSC Liaison

Committee Members are drawn from reputed experts active in all fields of space research on the basis of scientific expertise and recognition within the community, so as to ensure the authority and credibility of the Committee. The Members are appointed ad personam by the ESF for a three-year term after appropriate consultation with the ESSC and with national research councils and academies in European countries (in particular ESF Member Organisations and institutions subscribing to ESSC). Committee Members are required to maintain links with their national ESF Member Organisation(s) involved in space science and in space technology applications for science and research.

The committee membership should not normally exceed 15 persons. A credible coverage of disciplines and geographical balance of its membership needs to be ensured. The ESF Standing Committees of ESF related to space science and technologies may appoint Liaison Members to ESSC, as may the decision-making bodies in ESF.

The Chairman of the ESSC is appointed by the ESF, after appropriate consultation and search action.

The ESF Scientific Secretary primarily concerned with space matters shall act as the Liaison Officer of the ESF and shall normally attend the Committee's meetings to assist in its deliberations.

4. Subscribing Member Institutions of ESSC

The Subscribing Member Institutions of the ESSC – financing the budget of the Committee – should be involved in space science and technology research, in the operation of related facilities, and/or in space technology applications for science and research.

Subscribing Member Institutions generally belong to the Member Organisations of the ESF. Beyond these, a national or supra-national institute or agency can become a Subscribing Member Institution of ESSC if its statutes are consistent with those of the ESSC and the ESF. New Subscribing Member Institutions are accepted by the ESF, after consultation with the ESSC and the existing institutions.

The term of Subscribing Member Institutions shall continue as long as the association of the Committee with the ESF is effective. An institution may withdraw from ESSC at the end of the ESF financial year following that in which notice of withdrawal is given to ESF.

5. ESSC Modus Operandi

The Committee generally holds two plenary meetings per year at which all business items are considered. The committee meetings are convened by the ESSC Chairman.

The Committee establishes structures and procedures as necessary to meet its mission. The Committee works through three disciplinary panels: (i) Space Physical Science, (ii) Earth Observation and (iii) Life and Physical Sciences in Space. The Panel Heads are appointed by the Committee; they may assist the ESSC Chairman in his tasks. The Committee may set up additional panels and ad hoc groups to carry out particular tasks, involving also external members of the community.

The Committee may appoint an Executive Secretary/Scientific Assistant who assists the ESSC Chairman and the Committee in its work.

The Committee, if it is deemed necessary, may draw up a set of regulations for its modus operandi, in line with the Charter.

6. ESSC Finance

The budget of the ESSC is contributed à-la-carte by the Subscribing Member Institutions. Contributions from other bodies - such as the European Commission or the European Parliament – may also be sought.

The budget of the ESSC (income and outflow) is managed by the ESF. Financial commitments for the Committee's operation and work, including those for scientific and secretarial assistance, are made through the ESF.

The Committee sets up an annual Work and Budget Plan within the envelope of its inflow budget. The Committee may appoint one of its Members as Treasurer who shall oversee its budget in consultation with the ESF.

7. Reporting and Advising of ESSC

The Committee reports to the appropriate ESF decision-making bodies and relevant scientific Standing Committees.

In making recommendations to external bodies, the ESSC acts responsibly and independently within the framework and procedures of the ESF. The Committee will ensure that the ESF Standing Committees and ESF Board are appropriately consulted before the publication of such advice. ESSC views expressed in such reports may not necessarily represent the opinions of the ESSC sponsor organisations, and would not bind the sponsors in any way.

8. Review of ESSC's Mandate

The ESF will review the work and mandate of the ESSC, and decide upon a continuation request, no later than five years after the start of the current mandate.

The Committee will periodically review its activities and will decide on whether to request the ESF for a new mandate.

This Charter was set into force by the ESF Executive Council on 28 May 1999.

1.2 Organisation of the ESSC and external relations

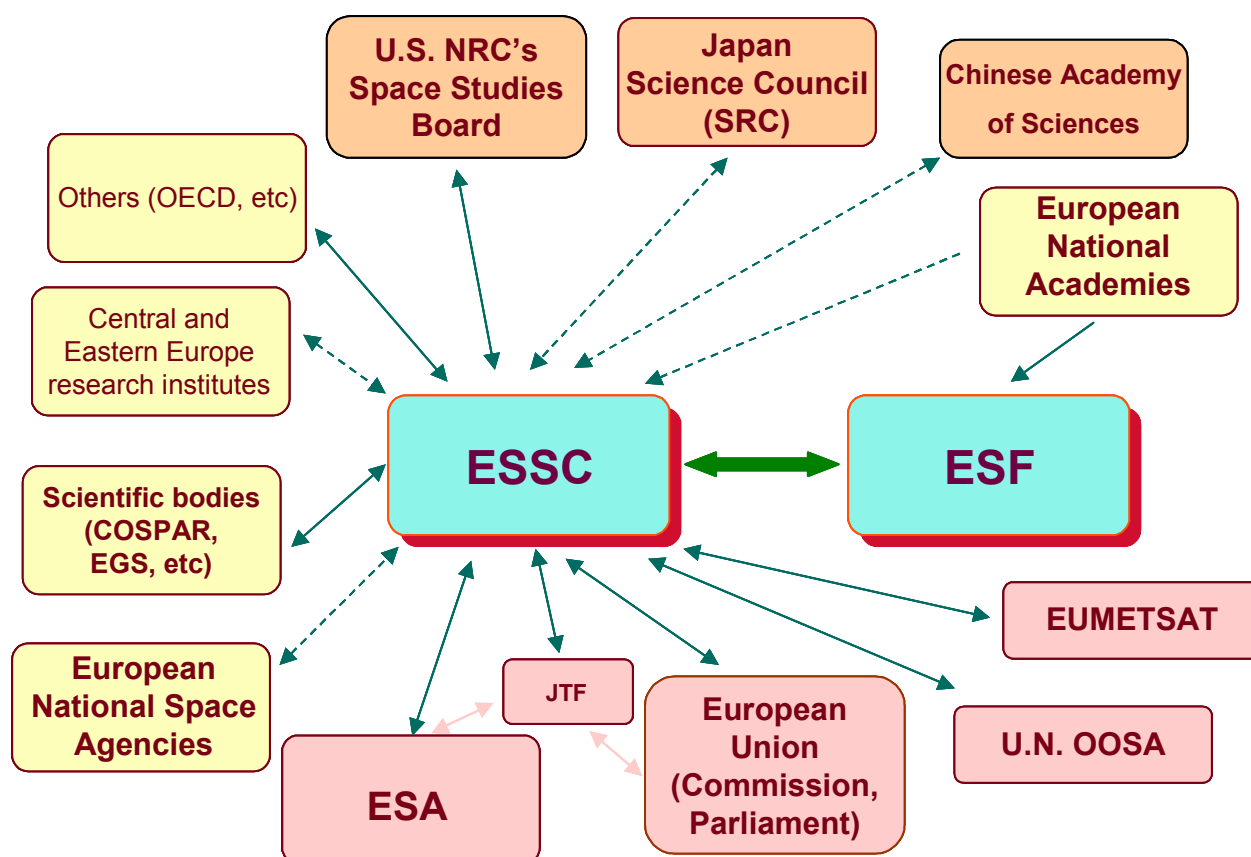
The Committee's structure comprises three panels as depicted in the following diagram, showing the panel composition as of 1 May 2003. Although not a scientific discipline in itself, "space policy and space law" was added very recently, as this type of expertise is now needed to fully comprehend the place of science within the complexified arena of space.

EARTH OBSERVATION <i>Chair : J.-L. Fellous</i>	SPACE Astronomy	PHYSICAL Solar System <i>Chair : J.-L. Puget</i>	SCIENCE Fundamental Physics	LIFE & PHYSICAL SCIENCES IN SPACE <i>Chair : D. Beysens</i>
Atmos. Physics J.-L. Fellous (FR) Atmos. Chemistry B. Carli (IT) Biosphere & Land W. Lucht (DE) Solid Earth C. King (FR) Oceanography I. Robinson (UK)	X, γ , Cosmic N. Lund (DK) M.J.L. Turner (UK) UV + Optical - I.R. + Sub-mm J.L. Puget (FR)	Earth environment & Space Physics H. Koskinen (SF) G. Haerendel (DE) Solar Physics P. Cargill (UK) Planets and Moon A. Coradini (IT) Small Bodies E. Grün (DE)	Fundamental Physics S. Vitale (IT)	Biology A. Cogoli (CH) Human Physiology P. Norsk (DK) Exobiology P. Ehrenfreund (NL) M. Grady (UK) Material Sciences B. Billia (FR) Fluid Sciences D. Beysens (FR)
5	9			6
Space Policy / Law K.-U. Schrogli (DE)				
NEW AREAS (1)				

Ad hoc working groups are created as appropriate to address specific issues, or to steer studies commissioned by external organisations such as ESA. Such working groups established between 1997 and 2002 are listed below.

Workshop on US-European-Japanese cooperation	January 1998 – May 1999	L. Culhane, P. Masson, A. Nishida, G. Skolnikoff, M.J.L. Turner, P. Whitney, J.C. Worms
Future of international collaboration in space science	June 1999 – April 2000	J. Bleeker, L. Culhane, A. Giménez, G. Haerendel, P. Masson, M.J.L. Turner, S. Vitale, J.C. Worms, J.C. Zarnecki
ESA's future life & physical sciences in space programme	March – November 2000	N. Amrhein, P. Clancy, L. Culhane, M. Heppener, G. Horneck, S. Mehlert, P. Omling, R.P.H. Thompson, J.C. Worms
Global Monitoring for Environment and Security	May 2000 – March 2001	S. Mehlert, P.C. Simon, I.S. Robinson, J.C. Worms
Near-Earth objects	January - May 2001	H. Atkinson, M. Bailey, A. Carusi, M. Coradini, L. Culhane, S. Mehlert, C. Koeberl, R. West, J.C. Worms + S. Michalowski, H. Haubold (ext. experts)
ESA Planetary Exploration initiative (Aurora)	April – May 2001	L. Culhane, G. Haerendel, M.J.L. Turner, S. Vitale
Space weather	April – May 2001	J. Bleeker, L. Culhane, G. Haerendel, J.C. Worms
Demography of space science	August 2002 – February 2003	I. Butterworth, L. Culhane, P. Ehrenfreund, J. Farrow, L.M. Mas-Hesse, S. Mehlert, J.-L. Puget, S. Vitale, N. Walter, J.-C. Worms, J. Zarnecki

The ESSC has established regular links with national European and international organisations concerned with space research as shown in the following figure.



1.3 Strategy and actions

The general policy along which the ESSC-ESF organises its actions is based upon the recommendations of the review conducted in 1996. Most of these recommendations have in fact been incorporated in the ESSC Terms of Reference (see § 1.1). Some of the most important areas in which the ESSC successfully implemented the recommendations of the review panel are detailed in the following table :

Recommendation of the Review Panel	Action
Revised Terms of Reference should state clearly that the ESSC is an integral part of ESF	Implemented in the new Terms of Reference (§ 1)
Improve membership renewal process in order to avoid self-replication	Extensive consultation of all relevant European scientific bodies is carried out prior to membership renewal Scientific excellence remains the main criterion, with fair geographical balance
Strengthen relationships with ESA committees and Council (observer in SPC, preparation of Ministerial Council)	ESSC participates ex officio in all ESA's scientific advisory committees and has members in SPC ESSC was invited as observer at the past two Ministerial Councils
Need to have formal contacts and closer links with the European Parliament	Formal contacts were established with EP's related intergroup « Ciel et Espace Européen », and with other MEPs

Need to have formal contacts and closer links with EUMETSAT	Presence of EUMETSAT at several ESSC meetings ; regular contacts are implemented
Need to have formal contacts and closer links with the Japanese scientific community	Formal contacts established through the Space Research Committee of the Japan Science Council ; a US-JPN-EUR workshop was held in Tokyo in May 1999, leading to the publication of a major report on cooperation

In order to finalise the guidelines upon which to base this general policy, an Action Plan was established in 1999-2000. All the objectives set at that time have been achieved today.

1.3.1 General policy

In order to fulfill the main tasks and responsibilities described in its Charter, the Committee undertook during this six-year period several actions in the frame of its general policy, described hereafter.

- a) Identification of key issues in European space research and production of corresponding recommendations and reports. Among them were:
- better coherence between ESA's and national programmes
 - role of EU in space and the place of space science in EU's research programmes
 - identification and visibility of a general European policy for space research
 - secure scientific programmes of ESA, taking into account the necessity to turn Earth observation and life and physical sciences in space into mandatory programmes
 - means to support data archiving and distribution policy issues in Europe
 - international collaboration
 - support for young scientists

Most of these issues have been, and continue to be, addressed; the resulting reports are presented in chapters 3 and 4. The status of other ongoing issues is presented in chapter 5.

- b) Reinforcement of the Committee's tools in order to be able to deal with these issues, e.g. by bringing in additional expertise in developing areas; this has started.
- c) Creation or improvement of links with scientific and decision making bodies within and outside Europe. Development of contacts with national space organisations, scientific institutions and academies.
- ESA: the ESSC is represented ex officio in SSAC, ESAC, LPSAC, EPAC, SSUP. ESA Directors are invited to, and attend, ESSC meetings
 - EU: the ESSC-ESF is now an observer in JSSAG meetings, and regularly invited to GMES-related events
 - relationships with the US Space Studies Board, COSPAR, EUMETSAT, EUROGOOS, etc

1.3.2 Actions

In order to achieve this policy, the ESSC develops several types of actions which are described in detail in further chapters.

- a) *Regular plenary meetings.* These occur twice a year with the following general policy.
- at least one meeting per year is held outside of ESF Headquarters to give the committee members the opportunity to get information on the space programmes and policies of European countries, and a chance to meet with national decision makers.

- they are also the occasion to meet with space scientists in Europe and be briefed on the activities in their research centres and laboratories.
 - the discussions in these meetings lead to the elaboration of the policy of the Committee, and the drafting and approval of position papers and recommendations.
 - the different meetings which took place since 1997 are presented in § 2.1.
- b) *Working Groups and Panel meetings.* The Committee creates *ad hoc* working groups to address specific subjects of interest (§ 2.4). These working groups regularly report to the panels (§ 2.3) and the Committee and usually produce reports which are discussed by the Committee and possibly published as position papers and/or recommendations, after approval by the ESF.
- c) *Actions implemented by the Chairs and Committee members* in specific meetings. The representation of the ESSC in several bodies and institutions lead its representatives to present the activities of the Committee, to intervene on subjects at hand and generally to contribute to the outreach of the ESSC. These actions conducted within and outside Europe are described in § 3.

As the responsibilities of the Committee grew, so did its work load. A large number of mid- and long- term ongoing actions testify to this increase and are presented in § 5.

1.4 Budget

The budget of the ESSC is contributed à-la-carte by the Subscribing Member Institutions (national research councils and space agencies in Europe). Contributions from other bodies (such as the European Commission) may also be sought. The budget of the ESSC (income and outflow) is managed by the ESF. Financial commitments for the Committee's operation and work, including those for scientific and secretarial assistance, are made through ESF.

The increasing volume of activities during the past two years has recently led the ESSC to produce a three-year financial plan and to request increased support from its funding institutions, as of 2002. Answers received so far have lent support to this request. This increase of activities has also led the Committee to make a more intensive and better use of the money provided by the contributing countries. The balance sheet for 2002 and draft 2003 budget are reproduced below (preliminary figures); amounts are in euros. The names of the organisations contributing to the activity of ESSC are given on page 1 of this report.

1.4.1 Contributions requested in 2003

Austria	4,000
Belgium (FWO)	2,400
Belgium (FNRS)	2,000
Denmark	4,800
Finland	5,000
France	19,000
Germany	15,000
Italy	15,000
Netherlands	9,500
Spain (CSIC)	2,400
Spain (OCYT)	2,400
Sweden	5,200
Switzerland	4,800
United Kingdom (PPARC)	14,000
United Kingdom (NERC)	3,811
European Space Agency	20,000
TOTAL	129,311

1.4.2 Balance sheet in 2002 (provisional)

Item	Designation	Expenditures
1.1	Salary costs (Executive Scient. Secr.)	66,110
1.2	Salary costs (Project Assistant ¹)	16,000
2	Committee meetings	30,327
3	Workshops, travel needs, studies	28,043
5	Publication and publicity	-
8	Management of ESSC office in Illkirch	3,588
9	ESF administrative costs	7,876
10	Bank charges and miscellaneous	206
	Unallocated funds ²	18,279
	TOTAL	170,429

¹ The study carried out in 2002 "Demography of European Space Science" commissioned by ESA, necessitated to hire a Project Assistant for a few months, the cost of whom was covered by a specific additional contribution from ESA.

² A sum of 8,000 euro was provisioned to support a workshop to be decided in 2003.

At the time of preparation of this report, some expenses earmarked for 2002 (e.g. demography study) had not yet been passed, and thus they appear as "unallocated funds". The final expense sheet will include all expenses relevant to the 2002 budget.

1.4.3 Budget for 2003 (provisional)

Item	Designation	Expenditures
	Available funds	
	Left-over from 2002	18,279
	Expected non-payments 2002	-3,000
	Expected contributions	129,311
	Total inflow	144,590
1.1	Salary costs (Executive Scient. Secr.)	66,774
1.2	Exceptional labor costs	10,668
2	Committee meetings	31,000
3.1	Specalised workshop	10,000
3.2	Other travel needs	15,000
5	Publication and publicity	1,500
8	Management of ESSC office in Illkirch	3,332
9	ESF administrative costs	6,316
	Total outflow	144,590

The current 2003 budget is based on the funding requests made in the 2002 Financial Plan to ESSC funding institutions. It appears that a few of these institutions may meet with difficulties and, as a consequence, maintain or reduce these amounts. As can be seen from the draft budget, some of these projected non-payments have already been taken into account, as a precautionary measure.

Should further reductions be imposed, the present draft budget would become insufficient to follow up the activity increase, and cuts in various areas would have to be implemented (travel needs, specialised workshop, etc). In particular, the management of the ESSC office in Illkirch, which has already been reduced in a very drastic way in the past years (8400 € in 1997; 3300 € in 2003), would have to be further streamlined to meet these budget constraints. Part of this serious problem lies with the fact that the rationalisation in the use of the funds which started in 1993, led to a substantial decrease in the left-over money accumulated in the previous years. Basically all money allocated to the committee is now fully used. However, while this sound practice was continued since that period, the contributions were left essentially unchanged, or with very small increases. The present situation is thus a very stringent budget, not adapted anymore to the objectives and activity of ESSC-ESF.

Activity of the Committee, panels and working groups

2.1 Plenary meetings

The ESSC held 11 plenary meetings since January 1997. Excerpts from the discussions held during these meetings, as well as salient elements which guided the action of the committee during these years, are reproduced below.

Stockholm, Sweden, May 1997

The 14th plenary meeting was held at the famed Karolinska Institutet. The Swedish Natural Science Research Council (NFR--*Natursvetenskapliga forskningsrådet*) had recently accepted to contribute financially to the activities of the ESSC. The activities of the Swedish National Space Board were presented by L. Nordh, and those of the Environmental Physiology Laboratory of the Karolinska Institutet by D. Linnarsson, ESSC member. The ESA programmes were presented to the attendants by G. Cavallo (space science), C.J. Readings (Earth observation), R.C. Colette (applications) and P. Clancy (microgravity research). Contacts with the EC had recently been developed and R. Winter, Director of the Space Applications Institute at the JRC in Ispra, presented the activities of his institute. The international session was fruitful, with a presentation by M.S. Allen, Director of the US Space Studies Board, who detailed the SSB and NASA activities and programmes, and briefed the participants (jointly with F. Becker) about the status of the joint ESSC-SSB study on international collaboration in space science.

The recommendations from the recently published review committee report were emphasised, stressing the importance of retaining *ad hominem* members. The recruitment process should however be improved, by e.g. consulting with Academies & Scientific Societies and ask for suggestions of candidates. H.U. Karow indicated that the ESF Search Committee chaired by Prof. W. Kröll had finished its consultations and will be in a position to report its proposals concerning the next ESSC Chair to ESF soon. Another recommendation of the review panel dealt with increasing relationships with Japan and Russia. This action was initiated by P. Masson and suitable correspondents in Japan have already been identified at Agency and government level, as well as with the scientific community. With regard to Russia, no progress could be achieved.

An article on the definition of a European space policy was published [26] and circulated to the members. The review by an *ad hoc* group of the ISLA proposal [1], requested by ESF was sent to ESF. Recommendations concerning the new structure of ESA were approved and sent to the Agency [3]. Finally, it was envisaged to publish the joint ESSC-SSB study at the beginning of 1998. Actions encompassed drafting a letter to ESF concerning the EC' 5th Framework Programme, preparing a membership renewal plan for the period 1998-2000, and organise an ESSC-SSB-ESA-NASA consultation. The 1991-1995 report was acknowledged [2].

Brussels, Belgium, November 1997

This meeting was marked by the change of chairmanship. Prof. J.L. Culhane replaced F. Becker, who had served since January 1994. Participants heard various presentations on space activities in Belgium, and particularly a keynote address from Mr. Truffin, Head of the Cabinet of the Belgian Minister for Science Policy. Exchanges with Mr. Truffin and Mrs. Limbourg (SSTC, Belgian Delegate in ESA) were very fruitful, and Mr. Truffin indicated that ESSC was one of the few bodies in Europe with a global view in the field. The scientific activities of the Microgravity Research Centre were presented by J.-C. Legros, ESSC member.

Three documents were produced since the previous meeting. (1) a letter of recommendation to the ESA DG concerning the necessity of additional flight opportunities during the period 1998-2002 which was proposed during our last meeting, was drafted and sent to J.M. Luton, with copies to the concerned Directors and the ESSC Members; (2) in order to update its recommendations concerning Framework Programme V following the publication of documents by the EC, the Committee had published a new set of recommendations on this topic in July 1997 [4], which were sent to the Commissioner on R&D, Directors of concerned Directorates of the EC, and Members of the Committee on R, T.D. and Energy of the European Parliament; (3) following the discussion in Stockholm concerning the stalled METOP & EOPP programme, letters were sent to this respect to the concerned European Ministers (DE, ES, FR, IT).

Presentations from guest speakers included ESF (H. Karow) and ESF-PESC (J. Fenstad), ESA's space science (R. Bonnet), Earth observation (D.J. Southwood & C.J. Readings), manned space flight and microgravity (G. Seibert), European Commission (M. Paillon). In the area of international collaboration, the ESSC initiated discussions to hold a consultation meeting between ESSC, SSB, NASA and ESA, concerning problems of international cooperation in space science. A first date was fixed at the time of the Cassini launch, but the delay caused the meeting to be cancelled. It was foreseen to use the opportunity of a joint ESA-NASA meeting in early 1998 to schedule this event. L. Culhane intended to set up an appointment with A. Nishida, Director of ISAS, on the occasion of a visit in Japan.

Financial contributions were asked of Spain and Italy. Among issues recommended by the review panel, one concerned the need to establish contacts with the European Parliament, and efforts were undertaken in that direction. Concerning recommendations of EC, ESA, and ESA Ministers, comments on the EC Earth observation Action Plan were sent to DG12. The first letter to the Director General of ESA, requesting to be represented in ESA's Ministerial Councils was sent out in December. Finally, the joint ESSC-SSB study final draft was sent to ESF for formal approval by the Board.

Paris, France, April 1998

The 16th plenary meeting was held in ESA Headquarters at the invitation of the Director of ESA's Scientific Programmes. The Committee Members heard presentations from the ESA Director General A. Rodotà, from Executives of the ESA Directorates of Scientific Programmes (G. Cavallo, D.J. Southwood) and Microgravity & Manned Space Flight (G. Seibert), from the Director of the R&TD action on Environment in EC-DGXII (C. Paternmann), and from American colleagues of the Space Studies Board and of NASA Office of Space Science (J. Alexander, C.R. Canizares, M.S. Allen). Mr. Antonio Rodotà, made an introductory address to the meeting, stressing that the real essence of the Agency was space science and its goal, to export the science programme approach to other fields (e.g. Earth Observation). He indicated that there is a need in Europe for a forum where to discuss the multi-faceted aspects of space (i.e. science, industry, etc). In his views, emphasis should be placed on employment in the next century, and space is certainly a main field of potentialities to this respect. Support from the ESA Executive concerning the ESSC-ESF request for being represented in the Council of ESA was demonstrated. The proposal will be presented to the Council of ESA. Furthermore, the ex officio participation of the Committee in all three ESA scientific advisory committees (ESAC, MAC, SSAC) has been secured.

The ESSC panels (Earth Observation, Microgravity and Space Science) met during the first afternoon session to prepare draft recommendations for the upcoming ESA Ministerial Council in June. This was the principal item on the agenda. These recommendations focussed on the world-leading role of Europe in science, and particularly in space science, with an emphasis on the crucial role of ESA to this respect. A final draft was then approved at the end of April by the ESSC and sent to the ESF for discussion and endorsement by the

ESF Executive Council. With the ESF's agreement, Dr. Jean-Claude Worms, formerly Scientific Assistant, was nominated ESSC's *Executive Scientific Secretary*.

Five new members were appointed by the Committee for a three-year term as of 05/98, after confirmation of their nomination by the Executive Council of ESF. The Committee membership level was then 19. A draft of the new Terms of Reference was approved; a final synthetic text was produced and circulated to the interested parties in the following weeks. Finally, contacts were established with individuals from the European Parliament's Intergroup "Ciel et Espace Européen" (A. Pompidou, C. Desama).

Strasbourg, France, November 1998

The 17th plenary meeting of the ESSC was held in ESF Headquarters, at the invitation of the ESF Secretary General, E. Banda. The Committee Members heard presentations from Executives of the ESA Directorates of Scientific Programmes and Microgravity & Manned Space Flight (D. Southwood, P. Clancy), from the new Chair of the Committee of International Space Programmes of the Space Studies Board (E.B. Skolnikoff), from the International Relations Office in EUMETSAT (P. Counet), from the United Nations Office for Outer Space Affairs (S. Camacho), from the Director of INSU-CNRS (J.-F. Minster) and from the CNES Delegate for Scientific Programs (R. Bonneville). Spain (CSIC & OCYT) and Italy (ASI) announced their intention to fund the ESSC as of 1999.

E. Banda made an introductory address to the meeting. It was his first appearance at an ESSC meeting, as he took his position in May 1998. He stressed the good relationships between ESF and ESSC, and the ESF will to help the ESSC where possible. He underlined the progress made by ESSC, e.g. in being instrumental in obtaining an observer status for ESF-ESSC at the next ESA Ministerial Council (May-June 1999), or in publishing jointly with the US SSB a very important report on US-European collaboration in space science.

The panels met during the afternoon session to prepare draft recommendations for the upcoming ESA Ministerial Council in May-June. These recommendations focussed on the world-leading role of Europe in space science, with an emphasis on the crucial role of ESA to this respect. Recommendations concerning the optional programmes encompassed support to ground-based research and flight opportunities in the pre-ISS phase (microgravity research & life sciences), and the need for small, focussed and timely missions in the Earth Explorer class, as well as the means to ensuring compliance with environmental international agreements on greenhouse gas emissions (Earth observation). In addition, specific recommendations pertaining to the role of the European Union in space and the respective roles of the different actors involved in carrying out European space policies, were drafted, to be circulated to European Ministers, EU and EP executives, etc. These recommendations encompassed essentially topics related to Earth observation and microgravity research. It was decided that the COSPAR President will sit ex officio in ESSC.

The attendants heard a presentation from the new CISP Chair, Professor Gene Skolnikoff, and discussed various issues with him and Program Officer, Ms. Pam Whitney. The ESSC-SSB study report on US-Europe cooperation in space science was published in June [7], jointly by ESF and the US NRC, and officially presented to the space agencies and to the press. In line with certain recommendations of this report, the ESSC proposed that ESSC and SSB together suggested to ESA & NASA to take a step forward towards reducing the existing redundancies, e.g. in international cometary missions. Concerning Japan, contacts were initiated between ESSC/SSB and the Space Research Committee of the Japanese Science Council, in order to explore the possibility of regular relationships between these bodies. A first meeting was held in July 98, during the COSPAR General Assembly held in Nagoya, Japan. Joint discussions between the SRC, the SSB and the ESSC led to the proposal to organise an international workshop on international cooperation in space science.

Ispira, Italy, March 1999

The 18th meeting took place on 22-23 March 1999 in Ispira, Italy, at the Joint Research Centre of the European Commission, at the invitation of the JRC Director General, H.J. Allgeier, who introduced the meeting. The Committee Members heard presentations from Executives of the Joint Research Centre, from the Space Coordinating Group of the EC and from the DG XII. Executives from the ESA Directorates of Scientific Programmes and Microgravity & Manned Space Flight (G. Cavallo, D. Southwood, P. Clancy) gave presentations on the ESA scientific programmes. This meeting represented the first formal establishment of regular relationships between the EC and ESSC, although many encounters had taken place in the past.

H. Allgeier presented the activities of the JRC and, as Chairman of SAG and of the Space Coordination Group (SCG), discussed the coordinating activities in aeronautics and space in the EC. SCG was an interservice group of the EC aimed at coordinating activities related to space, developing and establishing a consistent approach in space for the benefit of EU Member States, ESA, « third » countries (Russia, USA, Japan,...) and industry. It grouped some 60 officials from DGI, IA, III, VI, VII, VIII, XI, XII, XIII, XIV, XVI, JRC and three cabinets of Commissioners Bangemann, Cresson, Kinnock. The role of the JRC was to focus its research programme on the European Union's policy agenda ; it is the science and technology reference centre of the EU and it is, rather than a trans-national entity such as ESA, a supra-national body. After this restructuring process, the EC also started to take an interest in space & aeronautics issues, partially as a result of repeated requests from the European Parliament. This also came as a recognition that the situation in Europe was evolving in this area ; however, the concern of the EC in aeronautics & space does not go as far as challenging the traditional role of ESA. The Fifth Framework Programme included a key action « aeronautics », dealing essentially with navigation & telecommunications (see the issue of the GNSS), as well as Earth observation. Although its issue date had been postponed, a 4th « communication on space » was published a few months after that meeting. An informal meeting (Baveno, May 1998) grouped the EC, Europe's national space agencies and related organisations, to examine the implications various European policies have for space activities. A follow-on initiative was then organized in May 1999 in Baveno, to which the ESSC was invited.

G. Cavallo, D. Southwood and P. Clancy presented the ESA scientific programmes in space science, earth sciences, and microgravity research and life sciences. The focus of these presentations was on the preparation of the next ESA Ministerial Council, to meet in Brussels on 11-12 May 1999, and to which the ESSC was later invited with an observer status. The financial situation of the science programme being uncertain, the ESA Science Director was asking the Ministers to resume the inflation updating, and to transfer the funds resulting from economies on the general budget to the science budget. In earth sciences, the envelope programme had been established.

The new Terms of Reference [40] were adopted by the ESF Board on 25/03/1999. Four new members were nominated and awaited their official appointment by ESF in May 1999. The attendants also discussed the preparation of the joint SRC-ESSC-SSB workshop on international cooperation in space science, to be held in Tokyo, Japan, on 19-21 May 1999.

Granada, Spain, November 1999

The 19th plenary meeting of the ESSC took place on 23-24 November 1999 in Granada, Spain, Instituto de Astrofísica de Andalucía, at the invitation of the ESSC Spanish member and of the IAA Director, R. Rodrigo, who presented the organization of space research in Spain, on behalf of PNIE (Spanish National Space Plan) ; J. Lopez-Moreno then described the scientific activities in IAA. The Committee Members heard presentations from the Space

Coordinating Group of the EC (J. Hamelin). Executives from the ESA Directorates of Scientific Programmes and Microgravity & Manned Space Flight (G. Cavallo, D. Southwood, M. Heppener) gave presentations on the ESA scientific programmes and H. Olthoff (ESA D/SCI) briefed the participants on the status of the PRODEX programme. M. Heppener indicated that the ESSC should play an active role in reviewing microgravity programmes, including exobiology issues.

The international aspect of the discussion was fueled by presentations on the US Space Studies Board (J. Hughes), and also on the Japanese NASDA (Y. Fujimori) and ISAS (A. Nishida) programmes. A. Nishida (DG ISAS) also detailed the space-related decision-making structure in Japan, as well as the existing scientific advisory structure. The issue of an international hearing on collaboration in space science was discussed ; the SSB would send delegates and the SRC wished to attend as observer.

The EC had issued in June 1999 a communication on space, entitled : « Towards a Coherent European Approach for Space » -SEC(1999)789- emphasizing the need for synergy with ESA. The EU Space Advisory Group (SAG) was now co-chaired by ESA. This approach was found to be very much in line with the ESSC past and current recommendations. The upcoming EU Council of Research Ministers had a space-related item on its agenda, in preparation of which ESSC briefed the ESF Secretary General [17,18]. The EC was aiming at the creation of a high-level group on (i) environmental monitoring ; (ii) science. The EC was thus actively engaged in defining with ESA a strategy for space in Europe ; a joint document to this regard should be ready by the end of 2000.

It was recalled that the new Terms of Reference were adopted by the ESF Board on 25 March 1999. Seven members left the Committee after the meeting ; the term of one member was extended for one year. Eight new members have been or will be nominated and await their official appointment by ESF in November 1999 and at the first ESF Board meeting in February 2000. After this process was completed, the membership level was 19. The space physical science panel concentrated on the preparation of the international hearing and the structure of the matrix which will be used to assess the science roadmaps of the space agencies (NASA, ESA). The Earth observation panel decided to launch an activity on climate monitoring for global security in Europe, paving the way for what would become a major involvement of ESSC and ESF in the coming years, i.e. GMES. The microgravity panel addressed issues linked to access to the ISS, and discussed its involvement in the preparation of the joint ESA-ESF workshop on exobiology (October 2000, ESTEC).

Paris, France, April 2000

The 20th meeting of the ESSC took place on 18-19 April 2000 in Paris, France, ESA Headquarters, at the invitation of the ESA Director of Science. The Committee Members heard presentations from the ESA Director of Science (R.M. Bonnet), the Associate Director of Strategy (J.-J. Dordain), from the Executive (G. Naja, C.J. Readings, M. Heppener), from the Space Coordinating Group of the EC (P. van Nes) and from EUMETSAT (D. Williams). Contacts at the informal level had been established with EUMETSAT and this marked formally the inception of these contacts.

ESA was expecting improvement concerning the collaboration with NASA from the recommendations of the ESSC-ESF study and from the evolving role of the Inter-Agency Consultative Group (IACG). The ESA Directorate responsible for research in microgravity is in the process of implementing a bottom-up approach in their science and applications planning process. The ESSC-ESF was asked to assess that plan when it is ready. Six main fields (highest level objectives) have been identified and should form the backbone of the plan, based on existing proposals selected in response to AOs. The term « microgravity », which is more a tool than a research area, was to be progressively replaced by, e.g., « Life and

Physical Sciences and Applications ». Coordination with D/SCI on exobiology and other issues were now taking place, in line with ESSC recommendations.

The European Commission issued 4 communications on space since 1988, and the Council passed two resolutions. The European Union policies on space encompassed the areas of Research, Transport, Telecommunications and Environment. The EC was actively engaged in defining with ESA a strategy for space in Europe ; a joint document to this regard would be ready by the end of 2000. This joint strategy was needed, as the rationale for space was evolving, encompassing user needs in various areas (e.g., navigation systems, telecommunications). The plan presented in Paris was the outcome of a consultation process between ESA, EU, European Council, WEU and members states. The basic principle was that there would be no organisational changes but members states should enable ESA to act as a technical agency to manage EU programmes and funds. The ESSC-ESF was asked to provide a contribution to this discussion, for instance, on issues such as public understanding of science, climate monitoring issues, etc.

D. Williams presented the activities and mandate of EUMETSAT. The separation of various space-related items in the EC (e.g., agriculture, environment, research) posed boundary problems that needed to be overcome. An issue which was extensively discussed is that of data assimilation (oceans, atmosphere, etc), and of the European structure to manage it.

The space physical science panel concentrated on the preparation of the international hearing (Nice, France, 27-28 April) to assess the science roadmaps of ESA and NASA. The Earth observation panel continued the discussion initiated in Granada concerning an activity to be launched as soon as possible on climate monitoring for global security in Europe (GMES). The microgravity panel addressed issues linked, in particular, to its involvement in (i) the preparation of the joint ESA-ESF workshop on exobiology (October 2000, ESTEC), (ii) the assessment of ESA's D/MSM roadmap. The Committee membership level was 18. Seven members would leave the Committee in one year. The next round of search for new members (ESSC suggestion in May 2001, consultation with Member organisations, ESF appointment in November 2001) started in June 2000.

Utrecht, The Netherlands, November 2000

The 21st plenary meeting of the ESSC took place on 21-22 November 2000 in Utrecht, The Netherlands, in SRON Headquarters, at the invitation of the SRON Director General, Prof. Johan Bleeker. The Committee Members heard presentations from the ESA Director of Science (R.M. Bonnet), the ESA Director of Manned Space Flight and Microgravity (J. Feustel-Büechl), from the ESA Executive (C.J. Readings, M. Heppener), from the Space Coordinating Group of the EC (P. van Nes) and from the ESF Marine Board Chairman (J. Marks) ; a special Near-Earth Objects (NEOs) session was held with presentations from the Chair of the UK Task Force on NEOs (H. Atkinson), from the the Chair of the ESF « Impact » Steering Committee (C. Koeberl) and from ESO (R. West).

J. Feustel-Büechl explained the new bottom-up approach of ESA's Research Plan Proposal for a Future Life and Physical Sciences Programme. ESSC-ESF had accepted to assess that plan and ESA appreciated this involvement. This period marked the start of the construction phase for the ISS, which programme had been initiated in the 70's! R. Bonnet explained that technological development had become the key issue ; nowadays satellite reliability was not a problem anymore, but payload reliability was! European institutions should become involved in the funding of payloads and of the ISS utilization, the latter through the Large Research Infrastructure scheme.

P. van Nes, Head of the EC Space Coordination Group, presented the recent communication to the Council of the European Union on a European Space Strategy. This document was prepared in the frame of joint ESA-EC discussions and resulted in its approval

by the EU Council (resolution of the Council of EU Research Ministers). The Research Council was followed by a meeting of the ESA Ministerial Council which adopted a Resolution of the same tenor. To follow-up this activity a joint task force was put in place in the following weeks, and would report to the next ESA Ministerial Council meeting. The ESSC-ESF was asked to provide a contribution to this Task Force.

H. Atkinson presented the report published by the UK Task Force on NEOs. Nine recommendations of this report dealt with scientific aspects and five with organisational aspects. A significant result of this study was that NEOs of 100-300 m size must be surveyed. A big threat could indeed come from asteroids of that size impacting an ocean, thereby creating devastating tsunamis. C. Koeberl explained the role of the ESF IMPACT Steering Group and presented the work done up to now. The IMPACT programme is the outcome of a network funded by ESF from 1993 to 1995. IMPACT aims at understanding the effects of NEO impact on the development and evolution of the Earth system. R. West represented Catherine Cesarsky (Director General of ESO) who unfortunately could not attend. He presented the role and activities of ESO and indicates that ESO was ready to discuss the NEO issue and participate in a joint European NEO programme.

J. Marks presented the ESF Marine Boards activities which focus on defining a marine science plan for Europe. There is already within ESA an important body of experiments to cover this field. The key issue is to be able to define what key variables are needed in the long-term. Then ESSC panels concentrated on the preparation of the recommendations to be sent to the joint EC-ESA Task Force, and on the next ESA Ministerial Conference to be held in November 2001. These recommendations would be finalised and approved at the next ESSC plenary meeting in April 2001. In addition to this the Earth observation panel discussed the organisation of the workshop on global environment and security (GMES), to be held in Brussels on 26-27 March 2001. Furthermore the formerly « microgravity » panel changed its name to « European Life and Physical Science Panel », with the acronym: ELIPSP. Five members would leave the Committee at the end of 2001. The next round of search for new members started in June 2001.

Firenze, Italy, April 2001

The 22nd plenary meeting of the ESSC took place on 2-3 April 2001 in Firenze, Italy, in the *Convitto della Calza*, at the invitation of Prof. Gianni Tofani, member of the committee. The introductory session was dedicated to Italian space research and presented by G. Palumbo, representing G. Bignami, ASI Director of Science. The Committee Members heard presentations from the ESA Director of Science Designate (D.J. Southwood), from the ESA Head of the Earth observation Future Programmes Department (A. Ginati), from the President of COSPAR (G. Haerendel) and from the U.S. Space Studies Board (G. Skolnikoff, J. Alexander, P. Whitney). A special Space Weather session was held with an overview of the topic made by the Chair of ESA's Space Weather Working Team (R. Gendrin) and with the presence of P. Gille, representing F. Lefeuve (Director of LPCE-CNRS), engaged in preparatory studies on this issue.

D.J. Southwood will become Director of Science on 1 May 2001, replacing R.M. Bonnet. He described the legacy of the Agency's mandatory science programme and explained that the main concern was the financial erosion of the level of resources for the science programme, based on the lack of inflation compensation. The apparent high-level will in Europe to change the situation of research (European Research Area, Lisbon 2000 declaration) lacked practical support: the investment was decreasing while the European GDP was growing. In line with P. Busquin's ERA concept, D. Southwood advocated to have more science through ESA, rather than more science in ESA. A. Ginati, representing C. Mastracci, ESA Director of Applications Programmes, presented the status of ESA's programmes in Earth observation. The main elements of these programmes in view of the

upcoming Ministerial Council were (i) the 2nd « slice » of the Envelope Programme and, (ii) the Earth Watch component. All of ESA's EO programmes were currently under the responsibility of the Directorate for Applications, but a Director of Earth and Environment Monitoring from Space would be appointed in the following months. There was an ESA proposal to implement GMES as an Earth Watch element. These various topics were also being discussed at the Commission's level, and the EC had submitted its 6th Framework Programme proposal recently. Most items became riper for discussion later this year and it was decided to hold the next ESSC plenary meeting in Brussels to have the input and feedback from EC Executives. Discussions were taking place to involve ESSC in the work of the Joint Strategy for Space Advisory Group.

J. Alexander presented an overview of the SSB current membership, structure and tasks, and G. Skolnikoff discussed the present situation in the USA with regard to space and space research. ITAR (export rules) was an issue of concern in the academic world. Fundamental research was normally exempt of ITAR rules. In the space area however, fundamental research was intrinsically linked to technology and thus, subject to ITAR through exchange of technology, foreign post-doctorate students, etc. Unfortunately science has little influence on the agenda of difficult policy issues such as global change / Kyoto protocol.

G. Haerendel presented a history of COSPAR creation and achievements. P. Simon presented the outcome of the GMES workshop held in Brussels on 26-27 March at the initiative of ESSC, and with the financial support of ESF's LESC and PESC. Over 40 people attended this high-level event, providing insight to the issue of global monitoring. Recommendations stemming from this workshop were being drafted and would be published by ESSC-ESF and included in the ESSC-ESF input to the EU Research Council and ESA Ministerial Council in June and November 2001. R. Gendrin presented an overview of the situation in Europe with regard to space weather (SW). The joint EC-ESA strategy for space mentions SW as a significant issue; the aim of the ongoing discussions was to provide end-users in the affected sectors with tailored products to avoid or reduce SW hazards through design or operation, thus laying the foundations for a Space Weather Service. L. Culhane reported on the outcome of the 1st meeting of the ESSC-ESF ad hoc group on NEOs, held in Strasbourg on 23 March. Participants to this first meeting included H. Atkinson, C Koeberl, A. Carusi, M. Coradini, L. Culhane, S. Mehlert and J.-C. Worms. A second meeting was then held in Strasbourg on 9 May, and produced recommendations which formed the basis of a European strawman programme on NEOs [24]. This 2nd meeting was enlarged to other participants from IAU, ESO and UN OOSA.

Panels concentrated on the preparation of the recommendations for the upcoming EU Research Council (June 2001) and ESA Ministerial Council (November 2001). These recommendations were finalised in the following weeks and presented for approval at the May 2001 ESF Board meeting. The Committee membership level was 18. Five members were to leave the Committee at the end of 2001; a replacement should be rapidly identified for the field of solid Earth. The next round of search for new members started in June 2001.

Brussels, Belgium, February 2002

The 23rd plenary meeting of the ESSC took place on 21-22 February 2002 in Brussels, Belgium, in the *Palais des Académies*, at the invitation of Prof. Paul Simon, member of the committee, and Chair of the ESSC's Earth observation panel. Three guest sessions were featured throughout the meeting: European Commission, European Space Agency and US Space Studies Board. The Committee Members heard presentations from the ESA Director of Science (D.J. Southwood), from the ESA Head of the Earth Observation Applications Department (S. Briggs, D/EOP), from the ESA Head of ISS Utilisation and Microgravity Promotion Division (M. Heppener, D/MSM), and from the U.S. Space Studies Board (G. Skolnikoff, J. Alexander), the ESSC sister committee in the USA. Status reports were

provided on issues of Space Weather, Near-Earth Objects and exobiology; the latter was introduced by a presentation of European activities in this domain made by A. Brack.

L. Tytgat, Head of the Space Coordination Unit in EC's Directorate General for Research (DG/RES), presented the conceptual approach followed by the Commission in terms of the EU's involvement in space and space research. There was no current official competence of the EC and EU towards space, even though the 6th Framework Programme now included a specific action on aeronautics and space. A lot of progress was achieved in the past two years however, with a communication which was drafted jointly with ESA ("Europe and Space: Turning to a New Chapter"). The second positive step was taken with the inception of the Joint Task Force and of the corresponding delegate-body, the Joint Space Strategy Advisory Group. The role of defense and security using space was referred to for the first time, for peace-keeping purposes. As a result there would be for the first time a real political debate in Europe concerning space, with the organisation in 2002 or 2003 of a joint ministerial council; to this respect, the role of ESSC would be to prepare recommendations to this joint council. L. Tytgat insisted that ESSC-ESF should play a strong role in this process, through its participation in JSSAG, and at the level of the science-oriented working groups advising the Joint Task Force. Meetings of these working groups took place in March 2002 in Brussels, and the ESSC was auditioned. Furthermore, the ESF, through ESSC in particular, would be invited to participate in the work of the GMES Steering Group and Forum; the first meeting of this Steering Group should take place in Madrid in June 2002.

J. Alexander (SSB Director) presented an overview of the SSB current membership, structure and tasks, and described the current status of NASA's programmes and budget. G. Skolnikoff (former Chair, CISP-SSB) discussed the present situation in the USA with regard to space and space research and, in particular, concerning the ITAR rules (export rules for items often used in spacecraft payloads, exchange of information, etc). SSB had to suppress its Committee on International Programmes (CISP) which G. Skolnikoff was chairing, although this did not change the interest of the SSB in dealing with international cooperation. The ongoing trilateral discussions with the Chinese Academy of Sciences continue to raise an interest, should a change in the political situation occur.

M. Heppener, representing J. Feustel-Büechl, presented the ESA scientific programmes in life and physical sciences in space, and addressed the worrying situation of the International Space Station, after the report of the "Young" panel (cap on annual funding for the ISS, and a foreseen level of 2.5 crew/year in terms of maintenance potential). The ELIPS programme, reviewed successfully by ESF, was subscribed at roughly 50% of the Executive request, to a level of 171.40 Meuro, with a population of 1200 scientists involved in related programmes, and 125 non-space industries. D.J. Southwood described the difficult situation of the Agency's science programme after the decisions taken by European Ministers in Edinburgh in November 2001. This implied a complete re-assessment of the Horizon 2000 plan, which had started already. ESA's advisory structure (AWG, SSWG, FPAG, SSAC) presented a new plan to SPC in May. S. Briggs, representing J. Achache, the new Director of Earth observation at ESA, and C. Mastracci, Director of Applications Programmes, presented the status of ESA's programmes in Earth observation. ENVISAT was to be launched on 1 March. Various issues have been studied with data from EO platforms, such as the disappearance of fishing industry on the coast of Peru because of El Niño (ERS-2), land subsidence (differential interferometry – ERS), interaction between forest fires and ocean circulation. S. Briggs also addressed the subject of GMES, and of the significance of the word "security" contained in the acronym, in ESA's terms, namely oriented towards peace-keeping purposes. The ESA GMES Service Element (part of the Earth Watch programme) was approved in Edinburgh at the level of 83 Meuro (100% of the Executive's proposal).

S. Mehlert briefed the participants on the status of ESF Standing Committees and on-going initiatives. P. Egerton (Executive Scientific Secretary, European Polar Board) and L. Panaye (European Marine Boards) briefed the ESSC members on issues on common interest, i.e. exobiology, GMES, Near-Earth Objects, and presented the activities of their committees. A status report on ESSC involvement in space weather-related events was presented by L. Culhane, pointing to the fact that specific related recommendations were incorporated in ESSC's report to the ESA Ministerial Conference in November 2001. J.C. Worms reported that, following the work of the ESSC-led ad hoc group on NEOs which met twice in 2001, and subsequent recommendations to ESA Ministers, ESSC was included in the list of organisations participating to the work of the United Nations Action Team # 14 on NEOs. A. Brack presented the European activities in astro-exobiology, and informed the participants about the creation of the EANA (European Astro-exobiology Network Association). Panels discussed various issues linked to the outcome of the ESA Ministerial Council (November 2001) and the preparation of the recommendations for the upcoming Joint Ministerial Council (end 2002 ?). The next ESA Ministerial Council could take place in the fall of 2004. The Committee membership level was then 21. Eleven members should leave the ESSC at the end of 2002. The next round of search for new members should thus start in June 2002.

Köln, Germany, September 2002

The 24th plenary meeting of the ESSC took place on 9-11 September 2002 in Köln, Germany, in the *Deutsches Zentrum für Luft- und Raumfahrt (DLR)*, at the invitation of Dr. Gerda Horneck, member of the committee, and Chair of its life and physical sciences in space panel. The introductory session was dedicated to German space research and presented by A. Bachem (DLR Executive Board), E. Auf der Heide (Managing Director of HGF), V. Liebig (DLR), and R. Gerzer (Director Institute for Aerospace Medicine). Two guest sessions were featured throughout the meeting: European Space Agency, and ESF Life and Environment Standing Committee (LESC). The Committee Members heard presentations from the ESA Directorate of Science (G. Cavallo and H. Olthof), from the ESA Directorate of Earth Observation (J. Aschbacher), from the ESA Directorate of Human Space Flight and Research (M. Heppener), from the ESA Directorate of Strategy (F. Ongaro) concerning the AURORA programme, and from the ESF LESC (D. Altiner). Status reports were provided on issues of demography of space science in Europe, funding of European space science, future of ESSC, and future workshops (life in extreme environments, GMES, Mars exploration, etc).

M. Heppener's presentation covered the difficult situation of the ISS in the context the ReMaP report, with a probable reduction of ISS crew to 2, at least until 2004 (N.B. this took place before the Columbia disaster, and timelines are now completely uncertain to this regard). Europe was ready to comply with its international obligations (Columbus ready to launch in 2004). A proposal was being discussed at the level of ESA's related programme board (PB-HSR) to request to ESSC-ESF to organise a second users consultation workshop in 2003 or 2004, which should perhaps also include industrial aspects. This would follow the "Bischenberg" workshop where ESF and ESSC evaluated the ELIPS research plan. Two other issues needed to be discussed with ESSC and ESF (which were also discussed during the audition of the ESSC at the meeting of the JTF working group on science): (i) the assessment of required resources in Europe (possibility of an ESSC-ESF study on funding of space science) and, (ii) the issue of standardisation of European peer-review system. The baseline for that request was that in the USA, NRC's reviews are valid everywhere. In Europe, conversely, programmes could be accepted at ESA's level, and rejected at the national level (or vice-versa). Ideally an harmonised system should be implemented in Europe. ESF could perhaps act as a "certifier" of various peer-review systems to this end.

G. Cavallo described the new COSMIC VISION 2020 scenario of ESA's science programme, following the re-assessment conducted after the ministerial decisions in Edinburgh. This

issue of payload provision was becoming a central and critical one, with much faster development times now needed. It was expected of the scientific community, and of the Agency's programmes and Executive, that the services that stem from the applications (themselves stemming from the science and technological demonstrations) should be better identified. The goal of a study on funding by ESSC-ESF could perhaps be to try and identify better what these services are. H. Olthof then described the issue of coordination between ESA's and national programmes. There were a number of missions developed by ESA Member States, e.g. OERSTED (DK), COROT (FR), DIVA (DE), AGILE (IT) and ODIN (SE). The limited implementation means of such national programmes led to a number of requests for support by ESA. In order to avoid ad hoc responses a set of clear rules were needed to govern this potential ESA involvement. J.-C. Worms remarked that an informal request had been made this year by ESA D/HSR to ESSC and ESF to study such a possible harmonised scheme. No answer had been made yet, but it was clear that a solution to this problem would be of great benefit in advance of the 2004-05 Ministerial Council.

F. Ongaro described the recently initiated AURORA programme, which was approved in Edinburgh, and was presented as the next "large" programme, after the ISS. It deals, from the European perspective, with the early steps in preparation of human exploration of the solar system (emphasis on Mars). With the means available in Europe it will attempt to stimulate creative thinking. The current activities were aiming at linking the exploration infrastructure and related technological development to a given mission scenario. The goal was to propose AURORA as an envelope programme (5 year, with a 3-year preparatory period), including a long-term plan until 2030. The advisory body for this programme is called EPAC, to which ESSC participates ex officio.

S. Mehlert briefed the participants on the status of ESF Standing Committees and on-going ESF initiatives. D. Altiner, LESC member, presented the activities of this Standing Committee. He recalled that expert groups cover specialised themes/areas, but have a wider policy-wise coverage at the European level. The interaction between these groups and other ESF scientific activities should be widened, e.g. in the area of environmental protection, through ESSC's coverage of EO from space, but also meteorite research and NEOs, etc. Specialised workshops could be organised (e.g. life in extreme environments), as well as policy workshops. An involvement in the Forward Looks activity should be envisaged, where appropriate (e.g. Forward Look on Global Change). Interactions with LESC are obvious with EEOP (GMES), ELIPSP (polar regions), and through general recommendations. Concerning the European Research Council, D. Altiner replied that the debate had started within ESF, taking recommendations from its Standing and Expert Committees into account. The task was given to ESF by the EU to lead this debate.

A status report on the ESSC on-going study on demography of European space science was presented by N. Walter, Project Assistant. The rationale for the study (commissioned to ESSC by D/SCI) was detailed, as well as the means put together to carry it out. Concerning data gathering, two questionnaires (one at the individual level, the other at the institutional level) had been prepared and would be put on-line in the following weeks. The questionnaires would remain on-line at least until December. ESA asked for an essentially factual study, so no recommendations were needed, at least at that stage. It was expected that the final report could be presented to ESA in early 2003. J.C. Worms then reported that ESA D/SCI had asked ESSC to consider submitting a proposal to study the existing avenues of funding (of European space science) and extract possible incoherencies and redundancies between European and national programmes. After discussion with ESSC and ESF he had presented the embryo of such a proposal at the meeting of the Joint Task Force Working Group on Science, where ESSC was invited. The EC counterpart in this working group was also interested by such a study but had stated that EC could not currently envisage to fund such an exercise. At that meeting, the representative of ESA D/HSR had demonstrated a

large interest as well. Initial questions from ESA to which ESSC-ESF was invited to reply were: Does the ESF-ESSC believe that a study on the volume of investment in basic science, in relation to the effort in basic science, and commensurate with the European ambition, would be useful? If yes, could ESSC-ESF take care of it? How long would it take and what would be its cost? At the working group meeting, and after discussing the issue with ESF Executives, J.C. Worms provided the following preliminary answers. The subject was appropriate and timely, given the current lack of commitment to basic space science by decision-makers. It would have to be a high-level, high visibility exercise, in order to be able to attract the attention of decision-makers. It could only be an ESF study, i.e. it required Executive Board approval, full-transparency and clear mandate, to be done properly. A proposal would be submitted to ESA in the following months. Concerning future workshops, some small funds had been allocated under the new finance plan to initiate small-scale "exploratory" workshops or events. Various ideas had been put forth and discussed within ESSC, and also with other ESF expert groups such as EPB (polar science) and EMB (marine science). For the following year, the members agreed that it would be useful to try and launch an event linked to exo/astrobiology in Europe (or life in extreme environments). EPB in particular was very much interested by such a topic. It was stressed that ESSC members could also make use of existing ESF instruments, such as the Exploratory Workshop scheme.

J.C. Worms then reminded the members of a few key dates in the history of the Committee. In 1994 a reshaping of the ESSC resulted in a "new" committee, dealing with all areas of space science (including Earth sciences, as well as life and physical sciences in space). This took place following the realisation that space science had evolved to incorporate these new areas of research. Today, space-related topics had extended beyond space science, and the European arena involved non-space scientists, and also included areas of enormous potential importance at political and industrial level, namely telecommunications, navigation, GMES, space weather, etc, with a substantial application content. Furthermore in this new environment, the ESSC was being asked for advice, not only from ESA, but also from other emerging actors (such as the European Commission), and in particular to consider and review space-related aspects linked to the "European Research Area" concept. An immediate concern related to the implementation of the ERA was for instance the new action "Aeronautics and Space" contained in FP6. Thus ESSC needed to evolve to adapt to this new situation by gathering the additional required expertise, e.g. in climate monitoring, social and political sciences, space law, civilian security, or even industry. He thus suggested that the committee should consider incorporating a few new members in some of these areas. This suggestion was welcomed by the members, and panels would consider identifying such candidates. To have this take place in an efficient and professional way, ESSC would also need to become a fully "integral part of ESF" (cf ESSC Terms of Reference), i.e. to re-locate its office and staff within the cradle of the ESF Headquarters, where it would be able to benefit from the ESF administrative support and from the daily interactions with other Scientific Secretaries and staff. J.-C. Worms indicated that he had an appointment with the ESF Secretary General in June 2002 to discuss this suggestion with him. E. Banda's reaction was very positive, and agreed in principle to have the ESSC office located in ESF. Practical issues made it impossible at this time, but solutions would be investigated on short notice, and it was expected that the office could be moved during 2003.

Finally the panels addressed various issues (data report produced at the Brussels meeting [25,44], and sent to ESF and the EC; better coordination of astrobiology activities in ESA; future workshop proposals), and made several suggestions for membership renewal in 2003. Concerning the study on funding, the panels thought that budgetary figures would be easy to retrieve from space agencies, but not so from contributing institutions. A first, rough proposal should be sent to participating bodies, and then a study group should be set up.

2.2 Chair and Executive Scientific Secretary

In addition to these plenary meetings, contacts with various institutions, agencies or individuals are maintained through participation to various events of the Chairperson, the Executive Scientific Secretary and, when mentioned, other ESSC members.

A summary list of these events since January 1997 is presented below. Nominal participations to ESA's science advisory committees are not cited here, as the number of these meetings reaches a dozen a year. For the same reasons, participation to meetings of ESF Standing Committees, or meetings with ESF Executives, are also not specified.

- 3rd Executive workshop on the study on international collaboration in space science, Paris, 23-25 January 1997
- 121st SSB meeting, Washington, DC, USA, 3-5 March 1997
- Meeting with the Commission on Research, Technological Development and Energy of the European parliament, Brussels, 27 May 1997 (J.C. Legros)
- Tentative ESSC-SSB-ESA-NASA consultation meeting on international cooperation on space science missions, Kennedy Space Centre, October 1997 (CANCELLED)
- 123rd SSB meeting, Irvine, CA, USA, 19-21 November 1997 (with J.L. Culhane)
- Meetings with MEPs (A. Pompidou, C. Desama), Intergroup "Ciel et Espace Européen", Strasbourg, 11 March 1998
- Meeting between J.L. Culhane and A. Nishida, Tokyo, April 1998
- European Parliament Colloquium on "Aeronautics & Space Industrial Policy", Brussels, 5 May 1998
- 32nd COSPAR general assembly, meeting with A. Nishida (ISA, SRC), L. Lanzerotti, E. Skolnikoff (SSB), etc, Nagoya, 16 July 1998
- EUROSCIENCE 1st General Assembly, Strasbourg, 10-11 October 1998
- Meeting of the European Parliament Intergroup "Ciel et Espace Européen", ESSC Audition, 21 October 1998
- 126th SSB meeting, Irvine, CA, 2-4 November 1998
- 2nd European Symposium on the utilisation of the ISS, ESTEC, Noordwijk, 16-18 November 1998
- European Union Launch Conference of the 5th Framework Programme, Essen, 25-26 February 1999
- 127th SSB meeting, Washington, DC, 9 March 1999
- Meeting of the European Parliament Intergroup "Ciel et Espace Européen", 15 April 1999
- ESA Ministerial Council, Brussels, 10-12 May 1999
- 4th SAI Annual Users' Seminar, Baveno, 18-19 May 1999 (M.-L. Chanin)
- International workshop on US-European-Japanese cooperation in space science, Tokyo, 19-21 May 1999
- UNISPACE III Conference, United Nations, Vienna, 21-22 July 1999
- ESA Capodimonte workshop, Napoli, 20-23 September 1999
- Inaugural Meeting of the European Exobiology Steering Group, BNSC, London, 25-26 October 1999
- 129th SSB meeting, Stennis, MS, 8-10 November 1999
- Meeting of the ad hoc group for the preparation of the International Hearing on Collaboration in Space Science, ESA, Paris, 21 December 1999
- 130th SSB meeting, Washington, DC, 6-8 March 2000
- ESSC-ESF & ESA brainstorming session on microgravity research, ESF, Strasbourg, 13 March 2000
- ESSC International Hearing on collaboration in space science, EGS 25th General Assembly, Nice, 27-28 April 2000

- Meeting of ESA's microgravity programme board, ESSC report on the assessment of ESA's future research plan in life and physical sciences in space, 8 May 2000
- Consultation meeting on NEOs organised by ESA, Paris, 11 May 2000 (J.C. Zarnecki)
- 1st meeting of the ESSC-ESF planning group on the assessment of ESA's future research plan in life and physical sciences in space, Noordwijk, 5 July 2000
- 33rd COSPAR general assembly, meeting with Executives from the US SSB and the Chinese Academy of Sciences, Warsaw, 20 July 2000
- EC Conference on Research Infrastructures, Strasbourg, 18-20 September 2000
- 20th meeting of the Inter-Agency Consultative Group, ESSC presentation, La Jolla, CA, 27-28 September 2000
- Colloque Espace "Surveillance et Protection de l'Environnement", Lille, 16-17 Octobre 2000 (P.C. Simon)
- European Exo/Astrobiology Workshop, CNES, Paris, 18-19 October 2000
- 132nd SSB meeting, Irvine, CA, 13-15 November 2000
- ESF Workshop on the assessment of ESA's future research plan in life and physical sciences in space, Le Bischenberg, 28-30 November 2000
- GMES workshop "The Users' Perspective", Stockholm, 21-22 March 2001 (P.C. Simon)
- 1st meeting of the ESSC ad hoc group on Near-Earth Objects, ESF, Strasbourg, 23 March 2001
- ESSC-ESF workshop on GMES, Brussels, 26-27 March 2001
- 2nd GMES consultation meeting, Baveno, 3 May 2001 (with I.S. Robinson)
- Meeting of ESA's microgravity programme board, ESSC final report on the assessment of ESA's future research plan in life and physical sciences in space, 7 May 2001
- 2nd meeting of the ESSC ad hoc group on Near-Earth Objects, ESSC-ESF, Illkirch, 9 May 2001
- 1st EC-ESA Joint Space Strategy Advisory Group meeting, ESA, Paris, 16 May 2001 (with P.C. Simon)
- 1st European workshop on exo/astrobiology, ESRIN, Frascati, 21-23 May 2001
- ISS Forum 2001, Berlin, 5-7 June 2001
- 134th SSB meeting, ARC, Ames, CA, 13-15 June 2001
- ESA's Space Weather Working Team, ESSC presentation, Darmstadt, 5-6 July 2001
- National Space Science Missions in the European Context, ESA workshop, Stockholm, 5-6 September 2001
- 2nd EC-ESA Joint Space Strategy Advisory Group meeting, EC, Brussels, 13 September 2001
- "Météorologie de l'Espace", French space weather meeting, Paris, 12 October 2001
- GMES Conference (Belgian EU Presidency), Brussels, 14-15 October 2001
- Sustainability Geoscope workshop, Berlin, 25-26 October 2001
- ESA Ministerial Council, Edinburgh, 14-15 November 2001
- ESSC-ESA-EC informal meeting on European space strategy (J.L. Culhane, G. Cavallo, W. Wittke, L. Tytgat, J.C. Worms), ESA, Paris, 13 February 2002
- 3rd EC-ESA Joint Space Strategy Advisory Group meeting, ESA, Paris, 8 March 2002 (P.C. Simon)
- Conférence "Aeronautics & Space. New Instruments in Framework Programme 6", Brussels, 14 March 2002
- EC-ESA Joint Task Force working group on science, ESSC audition, Brussels, 21 March 2002
- ESA-ESSC 1st meeting on demography of space science, Paris, 3 May 2002
- 4th EC-ESA Joint Space Strategy Advisory Group meeting, EC, Brussels, 6 June 2002
- 137th SSB meeting, GSFC, Greenbelt, MD, 25-27 June 2002
- 1st Steering Group meeting on Demography of European Space Science, DLR, Köln, 11 September 2002

- 1st Interim Report Meeting to ESA, study on Demography of European Space Science, ESA, Paris, 20 September 2002

In addition, meetings are organised on an occasional basis with representatives from national space agencies, or other space-related organisms, as appropriate.

Recently, the Director General of ESA has asked the Chair of ESSC to sit ex officio in a newly created body, the Exploration Programme Advisory Committee (EPAC). EPAC advises ESA on the new AURORA programme decided by the Ministers in Edinburgh. The science base of AURORA is important, although this programme also encompasses technology.

2.3 Panels

2.3.1 The European Earth Observation Panel (EEOP)

The EEOP was formed in February 1992 by the ESSC with the specific objective of providing general independent assessments and recommendations of all facets of the European Earth Observation programmes. Successive Chairs of the EEOP since its inception were K. Hasselmann (Germany), R. Gurney (United Kingdom) and Paul Simon (Belgium); the current Chair of EEOP is Jean-Louis Fellous (France).

As its first task after its creation, the EEOP produced a major report titled "A Strategy for Earth Observation from Space", published by ESF in September 1992. It was hoped that the space agencies in Europe would be able to incorporate its basic tenets in their planning. Among many topics, the Panel strongly recommended the fact that the science part of ESA's Earth Observation Programme should become mandatory. Although this is still not the case, ESA's Earth Observation Envelope Programme, decided by ESA Ministers meeting in Brussels in May 1999, incorporates some long-term planning and funding elements, which is clearly a step in the right direction. At the last plenary meeting (February 2003), a new member was appointed, with an expertise in space policy and space law. This member participates to the discussions held in EEOP.

Several members of the EEOP were also members of ESA's former Earth Observation Advisory Committee when the latter was still active, and these members now participate to the newly formed ESAC (ESA's Earth Sciences Advisory Committee). The ESSC Chair, or his representative, usually the EEOP Chair, participates ex-officio to ESAC.

2.3.2 The European Space Physical Science Panel (ESPSP)

The ESPSP met for the first time on 19 September 1994 in Paris and provides specific advice concerning the "classical" space science elements of ESA's and Europe's programmes, i.e. astronomy & astrophysics, planetary exploration, space & solar physics, fundamental physics. Successive Chairs of ESPSP were H. Schnopper (Denmark), J. Bleeker (Netherlands), J.L. Puget (France).

The ESPSP has been very active in the past few years in the assessment of, and recommendations on, the future of ESA's space science programme, but also in dealing with studies on international cooperation in space science. In particular, members of that panel were directly involved in the preparation and organisation of the international hearing on cooperation in space science (Nice, 2000).

Since the last several years, the Chair of ESPSP, or a representative, is invited to participate ex officio in the meetings of the Committee on Planetary Exploration (COMPLEX), a committee of the US Space Studies Board.

2.3.3 The Life & Physical Sciences in Space Panel (ELIPSP)

The ELIPSP (formerly, EMP) met for the first time on 19 September 1994 in Paris and has produced recommendations that were included in the ESSC position papers concerning the

International Space Station, and recommending in particular that microgravity research should also become a mandatory programme within ESA. Chairs of ELIPSP were D. Mesland (Netherlands), J.-C. Legros (Belgium), G. Horneck (Germany); the current Interim Chair is Daniel Beysens (France) until the end of 2003.

An important aspect of what has been learned in the past years in that field of research is that a large fraction of the microgravity science programme can be done on the ground, but that no money is ever provided for that type of activities in Europe. Microgravity experiments in space can only be a small part of an overall attack on a particular scientific problem, and should always be imbedded in larger programmes of theoretical and ground-based laboratory research. Hence, the panel has recommended the initiation and funding of a European ground-based microgravity research programme, in addition to the continuation of ESA's ELIPS programme.

The ELIPSP was involved in 2000 in a major report commissioned by ESA and concerning the future of ESA's research plan in life and physical sciences in space [12]. Since the last 2 years, the Chair of ELIPSP, or a representative, is invited to participate ex officio in the meetings of the Committee on the Origins and Evolution of Life (COEL), a committee of the US Space Studies Board.

2.4 Working Groups

Apart from plenary meetings and general strategic reflexions on space research policies in Europe and the world, the activity of the Committee is rythmed by ad hoc studies or workshops on various subjects. Usually, these activities are carried out with the help of a dedicated working (or steering) group. The composition of these groups which activities are described hereafter are to be found in § 1.2.

2.4.1 Workshop on US-European-Japanese cooperation

Following the publication in June 1998 of the joint ESSC-SSB study « US-European Collaboration in Space Science », contacts were initiated with Japanese officials in July 1998 on the occasion of the COSPAR Assembly which took place in Nagoya, Japan. Our Japanese colleagues wished to establish a regular relationship with our committees ; this was achieved by discussion with the Space Research Committee (SRC) of the Japanese Science Council (JSC), chaired at the time by Professor Atsuhiko Nishida, also Director General of ISAS. Since January 2000 the SRC is chaired by Professor Takeo Kosugi. A first activity was the organisation of an international workshop on space cooperation in Tokyo on 19-21 May 1999. This trilateral workshop was hosted by the SRC and included representatives of the Committee on International Space Programs (CISP) of the SSB-NRC and the ESSC-ESF. In the course of this workshop participants examined past Japanese-US-European collaborative missions in space science (Geotail ; Yohkoh/Solar-A ; Asca/Astro-D), but also discussed ongoing or upcoming missions such as Halca, Nozomi, Lunar-A, Selene, Solar-B, Astro-E, Muses-C, Astro-F.

Apart from the historical survey of missions achieved thereby, the outcome of this exercise was a set of "lessons learned", to help improve future cooperations between Europe, Japan and the USA. A report was published from this workshop [29].

2.4.2 Future of international collaboration in space science

This ad hoc group met three times during its mandate. Meanwhile, the ESA Director of Science decided to commission and fund a study to ESSC on "Establishing Themes for Space Science Research at a Global Level". To get maximum credibility and impact, this study was to be conducted jointly with the SSB and, if possible, with the SRC. However, for various reasons, the SSB participation had to be kept informal. The ad hoc group defined the structure of the matrix which was used as a filter to apply impartially to the scientific

roadmaps of the agencies (NASA & ESA) and see what emerged in terms of issues. This was done by inviting broad-minded speakers at an international hearing (scheduled during the EGS General Assembly held in Nice on 27-28 April 2000) and having them present views in their field on the basis of this matrix. The outcome was injected back into the agencies in terms of what should and what should not be pursued in collaboration. The hearing benefited from the informal advice and active participation from SSB colleagues, and an observer from the SRC.

The result of this activity was a report [10] which was circulated to NASA and ESA. In addition, a related article [35] was published in the journal Space Policy. This report was acknowledged by both agencies and the ESSC Chair was invited to attend the September 2000 meeting of the IACG. The Terms of Reference of the IACG were subsequently modified, taking some of the report's recommendations into account.

2.4.3 Assessment of ESA's life & physical sciences in space programme

At the beginning of 2000 the ESA Directorate for Manned Space Flight and Microgravity (D/MSM) and the Microgravity Programme Board (PB-MG) were in the process of defining a "Roadmap for the future programme in life and physical sciences and applications", to prepare the grounds for the ESA Programme Proposal to be approved at the 2001 Ministerial Council in these areas. In the area of basic scientific research, Europe's policy in space is decided at national level by the various National Research Councils. Almost all the national organisations responsible for the support of scientific research are associated to the ESF. ESF was thus judged by ESA to be an ideal partner for strategic discussions on basic research objectives. Therefore, ESA decided to submit its full research plan ("ELIPS") to the ESF with the aim of receiving a formal judgement on its contents.

To prepare this evaluation, a group was formed and met twice (March and July 2000). It was decided to organise a workshop where top-level scientists, both from the space and non-space communities, would be invited to share their views on ESA's research plan. The structure of this workshop would be such that ESF endorsement of the final report would be dealt with adequately. It meant that ESF standing committee representatives would need to report to their parent body and seek approval. This workshop took place in November 2000, and a set of recommendations was produced [12], which was then discussed and approved by the ESF standing committees PESC, LESC and EMRC. ESA accepted most of these recommendations in the final version of its research plan, and even asked the ESF to produce a reaction to this plan, to ensure that the ESF's recommendations had properly been taken into account. Furthermore ESA requested that ESF should look at the way this plan would evolve and be implemented in the next few years. Initial discussions to engage into such an exercise have started in May 2003.

2.4.4 Global Monitoring for Environment and Security

The need for long-term climate monitoring is widely assessed and a European independent capability in this domain has been deemed essential by all actors involved. The appropriate technical capability has been established in Europe (industry, ESA) but the situation is not clear as to which institution should manage this task. Although the necessary parameters to be measured would not come solely from space-based observations, the ESSC-ESF considered at the end of 1999 that it could serve as a link between various relevant bodies to facilitate the implementation of this activity and deal with it in a concerted way. Existing co-ordinating initiatives, such as the "Baveno group" on Global Monitoring for Environment and Security (GMES), or the ESA-EU discussions for the elaboration of a joint European space strategy, were evidently important elements to this regard. Indeed, the importance of GMES for the European Space strategy was officially recognised by the European Research Council and the ESA Council meetings at ministerial level, on November

16, 2000. Furthermore the European Commission and ESA were invited to provide a common framework for this initiative and formulate concrete implementation proposals by the end of the first semester of 2001.

To reach this goal the ESSC-ESF set up an ad hoc group to organise a European gathering on this issue. In the process, close contact with the ESF was maintained regarding their Forward Look initiative on "global change". The concept matured during the year 2000, and the workshop finally took place in March 2001, gathering some 40 participants from the scientific community, ESA, the European Commission, EUMETSAT, ECMWF, WMO, national meteorological offices, national representatives, and industry. It followed the space symposium on "Monitoring and Protection of the Environment", organised by the French Ministry of Research in Lille in October 2000, and the GMES workshop on "Defining the role of EO in the environmental policy making development and implementation processes" organised, both, by the Swedish Environmental Protection Agency and the Swedish National Space Board, in Stockholm, in March 2001. The final recommendations from the ESSC-ESF workshop [31] were approved by ESF and imbedded in the ESSC-ESF report to the ESA Ministers [14], meeting in Edinburgh in November 2001.

As with issue of exobiology, ESSC suggested at the ESF level that this issue be followed by other ESF interested bodies, such as EPB or EMB. Following this, an internal ESF group was set up to monitor the development of GMES-related initiatives in Europe, and participate as appropriate to GMES-related events, such as the GMES Forum or the GMES Steering Committee. In line with this ESSC suggestion, the ESF was officially invited for the first time to the GMES Steering Committee in April 2003.

2.4.5 Near-Earth objects

The task force set up in 2000 in the UK to study potentially hazardous near-Earth objects (NEOs) wished to have the views of ESF and ESSC regarding the potential threat of NEOs and to know of areas of the Foundation's activities which were relevant to this subject (e.g., the ESF "IMPACT" programme). The final report of this task force contained 14 recommendations to address the NEO issue; 2 of these recommendations (nos. 8 & 11) specifically referred to the role of ESSC-ESF. A session on NEOs was therefore scheduled during the ESSC 21st plenary meeting held in Utrecht in November 2000, with the presence of Harry Atkinson (Chair U.K. Task Force), Christian Koeberl (Chair ESF IMPACT programme) and Richard West (Head, ESO P.R. and Education). A small group was then initiated, and approached ESA, ESO, the United Nations, IAU, the Spaceguard Foundation, OECD, etc, to get feedback on their attitude with regard to this issue. Ways were sought to identify the relevant components of the programmes of the European Union which would apply to this topic in order to link the topic to existing issues in the EC-ESA draft strategy for space, rather than creating new ones. The aim was to initiate a strawman programme for Europe.

After meeting twice on 23 March and 9 May 2001, the ad hoc group produced a set of recommendations which were also imbedded in the ESSC-ESF report to the 2001 ESA Ministers meeting. Furthermore these recommendations were presented to the June 2001 meeting of EIROFORUM [24,33]. The result of this activity is that ESSC and ESF are now identified as one of the European actors dealing with this important topic: the ESSC-ESF was invited to participate to the OECD workshop on NEOs in January 2003, and was also added to the list of organisations participating to the UN Action Team n° 14 on NEOs.

2.4.6 ESA Planetary Exploration initiative (Aurora)

The AURORA programme is intended to provide ESA and the European space community with a comprehensive and consistent approach of solar system planetary exploration. The programme, as prepared, was then proposed to the Edinburgh Ministerial Conference. The objective of the AURORA programme was to formulate first and then implement, a European

long-term plan for the robotic and human exploration of the solar system bodies holding promise for traces of life. Prior to this conference the ESSC had noted the proposed contents of this programme, and particularly the ample response from the scientific community regarding the corresponding call for ideas, signifying the energy and creativity of a very active European space science community. The Committee recognised that manned flight to objects within the solar system was an upcoming theme full of scientific implications. While this was a potentially exciting new field of scientific endeavour, it needed to be carefully tuned with the science programme proper, specifically regarding the upcoming planetary missions and related landers, including Rosetta, Mars Express and BepiColombo. Thus at the time, the ESSC emphasised that a higher level of coordination between initiatives having potential scientific implications, such as this one, and ESA's Science Programme, was mandatory in terms of programme strategy. Moreover a clear cut management structure of AURORA on the side of the ESA Executive was clearly required to safeguard a proper dialogue between the Directorates involved, in order to preclude any conceptual misunderstandings on content and respective roles. These reflexions were presented to the ESA Ministers, along with the other ESSC recommendations.

After the approval of this programme in November 2001, the ESA Executive proceeded to set up the infrastructure needed to initiate this activity. At the delegate level, a specific Programme Board was set up, and a new advisory committee was established, the Exploration Programme Advisory Committee (EPAC). The Director General of ESA asked the ESSC Chair to participate in EPAC with an observer status. In line with our recommendations, coordination with other Directorate's activities is tentatively maintained through the participation in EPAC of the Chairs of the other ESA's science advisory bodies.

2.4.7 Space weather

The situation of this topic has evolved a lot in Europe in the past 2 or 3 years. The joint EC-ESA draft strategy for space mentions space weather as a significant issue. Two groups (industry/science consortia) were tasked with laying the grounds of a European space weather programme, and ESA has established a Space Weather Working Team (SWWT) to examine the contents of such a programme. In order to stay informed on this important subject, the ESSC organised a specific session on space weather during its plenary meeting in Florence in April 2001. R. Gendrin, the Chairman of ESA's SWWT, presented an overview of the situation in Europe. Reports were being prepared by the 2 different consortia involved in this study phase; the aim was to provide end-users in the affected sectors with tailored products to avoid or reduce space weather hazards through design or operation, thus laying the foundations for a Space Weather Service. Establishment of such a service is not a scientific subject by itself: its relevance to science is the increasing concern over space weather effects, which makes it difficult to incorporate in ESA's science directorate. Some important features still lack detailed scientific understanding. ESA is proposing to execute a Pilot Project and other activities. A strong and coherent support is needed from ESA and the EC, through Framework Programme 6 and through the joint ESA/EC Task Force. The various actors involved felt at the time that the situation was not ripe enough yet to present a full-fledged programme to the ESA ministerial conference; however a firm decision to progress with a minimal amount of study money, was needed. The assessment and support of ESSC was requested. As with issue of GMES or exobiology, ESSC suggested at the ESF level that this issue be followed by other ESF interested bodies, such as EPB or EMB.

A small informal group was thus set up to keep informed about the subject and advise the Committee on possible actions, when appropriate. The Chair and Executive Scientific Secretary attended two meetings of SWWT. In addition, in order to attract the attention of the European Commission on this topic with a high application potential, the ESSC briefed the ESF Secretary General, who in turn, wrote to the Commission's Director General for

Research on 12 September 2001 [43]. This activity is still ongoing, with little progress to show on the side of the EC. The prevailing view in the EC concerning space weather seems to be that this area is best tackled by ESA.

2.4.8 Demography of European Space Science

In the course of 2002, ESA's Directorate of the Science Programme (D/SCI) invited the ESSC-ESF to carry out a study on "Space science demography in Europe: status, perspectives, proposals". This invitation was originated by a letter to D/SCI from R. Bonnet, at the time CNES Deputy Director General for Science, outlining his concerns regarding the situation of the space science community in France. Since then, the initiative had been supported by ESA's Science Programme Committee delegations. That letter raised the worrying French situation and, more specifically, the ageing and retirement of a whole generation of scientists that was actively involved in the first 40 years of space research. CNES addressed the fact that the expertise and know-how this generation had developed, in particular in terms of instrument design and development, seemed not to have been transferred to the new generation of young scientists. With the full support of ESA's delegations, an official proposal was made in April 2002 by the ESA Director of Science to ESSC-ESF. A first consultation meeting took place on 3 May, 2002 in ESA Paris to discuss the details of the study.

A steering group was then established to establish the guidelines and working procedures to conduct such a demanding exercise. To gather the very important amount of required data, process it, extract the relevant statistical information, etc, a Project Assistant was hired during four months. A database of European space institutions and related expertise was constructed in the course of this study, which is now heavily used by various actors. The statistical data gathered through direct inquiries, on-line questionnaires, etc, was then studied by the steering group, which produced a unique, factual report [16], thus providing a snapshot view of the space science community in Europe, and its foreseen evolution in terms of age distribution, transfer of competences and skills, etc. The final presentation to ESA's Science Programme Committee took place in February 2003.

2.5 Relationships with ESF Standing and Expert Committees

Being an Expert Committee of ESF, the ESSC has natural relationships with the ESF governing bodies and Committees. Nevertheless, the ESSC departs from the other ESF Committees insofar as it deals with all the scientific disciplines concerned with space or space tools, and as it is not concerned with establishing and managing scientific programmes, but rather with acting as a spokesperson of the scientific community concerned with space related issues. Consequently, the ESSC has particular relationships with ESF bodies and defines its own policy, although it maintains close contacts with, and reports to, the standing committees LESC and PESC. The fact that space research encompasses areas as diverse as, for instance, human physiology in space, has led the ESSC to also initiate contacts with EMRC.

The ESSC benefits from the support of ESF from several points of view. Scientifically, the Committee is supported by an ESF Scientific Secretary who acts as liaison Officer with all the ESF bodies and reports to them on the ESSC activities concerning ESF. Furthermore LESC has appointed a liaison member who attends ESSC plenary meetings. Such a cooperation scheme is also being discussed at the level of PESC.

The ESSC covers, from the space point of view, disciplines which fall under the scope of the activities of LESC (environmental sciences, atmospheric sciences, oceanography, glaciology, ecology,...), of PESC (astronomy, astrophysics, material and fluid sciences, technology and engineering,...), or of EMRC (human physiology in space). For that reason, the ESSC has developed contacts with these three ESF Standing Committees. The ESSC

Chair or Executive Scientific Secretary has presented the activities and members of ESSC to these committees on several occasions, and the LESC and PESC Chairs were also invited to meetings of the Space Committee. Co-ordinated actions should be reinforced while still maintaining the specificity of each of these bodies. Concerning other ESF expert bodies such as EMB (marine science) and EPB (polar science), multiple avenues of joint endeavours are currently being discussed and investigated, such as exobiology (life in extreme environments), GMES, space weather, etc. These are detailed in § 5.

From an organisational point of view, the ESSC is representing the ESF in several decisional bodies at the European level, i.e. in the EC-ESA Joint Space Strategy Advisory Group (JSSAG) and in the scientific advisory committees of ESA. Indeed the ESSC is the ESF's interface with ESA. Furthermore, most of the ESSC recommendations have been endorsed by ESF, thereby reinforcing their impact on decision makers. This was the case in particular in 2001 for the assessment of ESA's ELIPS research plan in life & physical sciences in space, which was achieved by a workshop to which representatives of ESSC, LESC, PESC and EMRC participated. Another recent case of this synergy between ESSC and other ESF Standing Committees and Expert Groups is provided by the workshop on GMES in March 2001, to which LESC, PESC, EMB and EPB attended, with even financial support from LESC and PESC. Due to these particular relationships, the ESSC Chair and Executive Scientific Secretary regularly meet with the Secretary General of ESF. The activities of the ESSC are presented at the meetings of the ESF Board, Governing Council and General Assembly as Progress Reports of the Committee [5,6,8,11,13,15].

Finally, from an administrative point of view, the budget of the ESSC is managed under ESF's financial rules, but has a particular status as funds can be supplied even by non-ESF Member Organisations, and earmarked specifically for space activities. In 2003, funding from non-ESF Member Organisations should reach 42% of the total contributions.

2.6 Reviewing activity

When requested, the ESSC can be involved in reviews of ongoing or future programmes, scientific proposals and projects, etc. These requests can originate from national space agencies, ESA, or ESF itself. In some instances, the request is made to nominate candidates for review panels established by, e.g. the ESF.

This was the case in the past few years with the ISLA proposal for which ESF requested the ESSC to carry out a review [1], the evaluation at ESA's request of the ELIPS research plan [12], the request to nominate a review panel member in ESF's review of ESA's microgravity facility APCF, or the participation to ESF's assessment of EVN-JIVE.

European and international relationships and actions

3.1 General strategy

The primary function of the ESSC is to represent the position of the scientific community in relation to European needs and priorities in space science and technology. We aim to focus our efforts on this fundamental mission, i.e. providing an independent voice on European space science policy.

Establishing such a policy was the traditional purview of the European Space Agency ; however, such a task now proves an increasingly difficult one because of the complexity of the space arena in Europe. New actors (European Union / Commission / Parliament, EUMETSAT, industry, etc) have appeared on this scene during the last twenty years and their involvement constitutes a recent and important additional component to existing European space research programmes (ESA's and national programmes). The development of scientific, technical and industrial activities in this area, and the willingness of the European institutions (including the European Parliament) to play an active role in the definition of a global European space policy, has increased to the point of challenging the traditional division of responsibilities for space in Europe. The discussions held during the past 3 years between ESA and the European Commission which should culminate at the end of 2003 with the publication of a "White Paper on European Space Policy", is a first step in that direction. This situation clearly implies the definition of a long-term strategy in Europe for space research which, ideally, should aim at reducing duplication and maximising the return on investment.

We believe that the ESSC-ESF can – and should – act as a catalyst to facilitate the necessary discussions between all involved parties and ensure that the strategies which will be defined duly take scientific research into account. This main goal finds multiple applications in various areas of the Committee's expertise, which are detailed hereafter.

In the next sections, the focus will be put on the aspects of these recommendations which are of special interest to either of these actors.

3.2 European Space Agency

Europe has a world-leading role in science. Since the start of the space-age in 1957, European institutions have adapted and evolved to include the use of space-based techniques as an essential component of this broadly based position of scientific leadership. The role of ESA is crucial to maintaining this leadership. To prepare the meetings of the Council of Ministers of ESA Member States which met in May 1999 and November 2001, the ESSC drafted an assessment of the role of ESA in the three areas of the Committee's expertise. These recommendations were approved by the Board of ESF and sent to the Ministers [18,14]. The ESSC-ESF has been granted an observer status during the Ministerial Conferences since May 1999.

ESA is one of the European bodies with which the ESSC has had strong and efficient relationships since the establishment of the Committee in 1975. The terms of reference of the ESSC make provision for facilitating the definition of space research programmes in Europe, and to encourage the coordination of space research in concertation with ESA, the EC and other countries concerned with space-related research. An agreement with ESA was first outlined in 1976 and later amended in 1986 and tasks the Committee with advising and consulting with ESA, and in particular to issue recommendations on the level, organisation and support of European space science in general, and of particular projects.

This role has been preserved throughout the years and the evolution of space science in Europe. ESA has fulfilled its part by regularly and fully briefing the Committee on current issues pertaining to space, space science and the status of the Agency, by regularly delegating high-level representatives at the ESSC meetings, and also by lending its facilities for meetings of the Committee on several occasions. Conversely, the ESSC participates ex officio in all of ESA's science advisory committees, such as SSAC (space science), ESAC (Earth science), LPSAC (life & physical sciences). In addition, the Chair of ESSC was also asked to attend with an observer status the meetings of the recently created EPAC (planetary exploration), the advisory body to ESA's AURORA programme, decided by the Ministers in November 2001.

Concerning the past few years and the evolution of Europe's position on the science programmes of the Agency, the ESSC has produced several position papers and recommendations dealing with the Agency's programmes that strongly supported the necessity of maintaining a high-level scientific programme in the different fields covered by ESA, namely space science, Earth observation and life & physical sciences in space. The Committee thus strongly recommended the establishment of a mandatory – or at least a multi-year programme – for scientific research in Earth observation, and in life & physical sciences in space. In addition, and as depicted in the other chapters of this report, ESA has commissioned 3 studies to ESSC in the past 3 years on various topics.

Several aspects need consideration and appropriate action of the ESSC in the near term :

In the area of « classical » space science, we must orient our efforts towards the safeguarding of the ESA mandatory science programme by strongly advocating a stop to the decline in purchasing power by compensating for the inflation. This was last stressed again in Edinburgh in November 2001, with little success however.

In Earth sciences, it is essential to maintain a European capability in Earth observation-related areas. Skill and competence in Earth observation are especially important for ensuring compliance with environmental legislation and in particular for securing the implementation of international agreements such as that made at Kyoto on greenhouse gas emissions. To this regard, it has been recognised by the EEOP-ESSC that a gap seems to appear for earth Watch missions beyond 2005, which must be filled. Data issues, and the important budgets necessary to archive and exploit these data, are also issues of concern. As with space science, the Ministers meeting in Edinburgh have however decreased the funding of the Earth Observation Envelope Programme. Furthermore the ESSC has played a leadership role within ESF concerning the emerging field of GMES (see, e.g. § 2.4.4), in which ESA is also actively engaged.

In life & physical sciences in space, the development of a medium and long-term programme requires the definition of a reliable flight strategy for scientific experiments. However balanced progress is at present difficult to achieve due partly to the very low level of ESA Member States support for the provision of experiments within this ESA optional programme. An appropriate level of national funding for flight experiments is needed at an early enough stage to allow for the preparation of accepted experiments in a reliable and cost-effective manner. European support to the ISS, possibly through the EC's Framework Programme various instruments, is thus strongly advocated.

3.3 European Union

During the last few years, new actors have appeared on the European space scene. First, the European Union, by means of the EC's Directorate on Research, but also Environment, Transport, etc, provides an additional component to the existing European space research programmes with a focus on Earth Observation, telecommunications and navigation systems. The last two areas are outside the remit of this committee; however Earth

Observation, and related topics such as GMES, are clearly areas where the ESSC should play an active role. Second, the establishment of EUMETSAT constitutes a new and important factor for the operational uses of Earth observation.

This emerging change is well illustrated by the process led during the first few months of the period covered by this report, by the Space Advisory Group of the Commission, to implement a European policy for Earth Observation from space. The ESSC has consequently developed substantially its relationships with the European Union, first through this Space Advisory Group. The Chairman and Executive Scientific Secretary also met on regular occasions with EC and EUMETSAT officials to exchange ideas. The main interaction with the EU at that time dealt with the drafting of the ESSC recommendations for the Sixth Framework Programme. The ESSC participated actively to this process at the invitation of DGXII (now DG Research). The ESSC contribution especially addressed the fact that, besides the fundamental necessity to improve our general knowledge, no major technological development can occur without a strong and continuous effort in fundamental scientific research. Although the main line of the proposed policy of the EU was aiming at developing a market for space applications, and having this market drive the development of Earth observation, the ESSC insisted on the necessity to maintain a strong reference to space research in the rationale for this policy along two directions, first by improving our knowledge on planet Earth and second, by improving our know-how in applying the Earth sciences data to respond to the users' needs. Most of these recommendations which had been developed and approved through several ESSC meetings and reports were indeed imbedded in the final Framework Programme document of the EC.

The present will by the EU to acquire an important position in defining a policy for Europe in space leads to the necessity of redefining the respective roles of the European actors. To address this necessity, the ESSC formulated recommendations on the Joint Strategy for Space as early as 1999. In summary, the ESSC had recommended that:

- a global strategy and synergistic approach be implemented, that takes into account a defined role for each partner (ESA, EC, EUMETSAT, national space agencies)
- ESA 's scientific "roadmaps" serve as elements to underpin a European Space Strategy
- the EC should fund an operational GMES programme
- the ISS should be recognised and funded as a Large Research Infrastructure

A few years later, the ESSC interactions with the European Commission have developed and strengthened considerably. Several sets of recommendations concerning the future space policy were published by the Committee. In 1999, the Director General of ESA commissioned an independent study on the future of Europe's space policy. The report from this study, dubbed "The 3 Wisemen Report", made a number of recommendations, leading towards a unified approach being debated by the concerned actors.

An EC-ESA Joint Task Force (JTF) was therefore set up, to develop the concept of a space strategy for Europe, supported by various working groups (including one on science) and by a delegate body (Joint Space Strategy Advisory Group – JSSAG) to which the ESF, along with EUMETSAT, was invited to attend as an observer. The ESSC attended four JSSAG meetings so far, and executives from the space policy unit of the European Commission regularly attend ESSC plenary meetings and brief the attendants on EC-ESA joint space efforts. The first progress report of this JTF was published in November 2001. An EC Communication to the European Parliament "Towards a European Space Policy", published in December 2001 recognised the role of ESSC-ESF, indicating that "synergies should be assessed" with the ESSC-ESF. Following this recognition, an ESSC-ESF presentation was done at the March 2002 meeting of the JTF working group on science. At that meeting, the possibility of commissioning to the ESSC a study on the avenues for funding of space science in Europe, was discussed and explored. This study could start in the fall of 2003.

To develop this European strategy for space further, the European Commission, together with ESA, have prepared a "Green Paper on Space". This paper looks into Europe's assets and weaknesses in this sector. As a basis for a broad consultation, the report tackles key issues such as the EU's independent access to space, scientific excellence in this field, the industrial and technological base, relevant markets, human resources, the legal and institutional framework, international co-operation, and environmental and security aspects. The corresponding consultation will help shape an EU response to competitiveness and security challenges related to space, to be detailed in a forthcoming White Paper.

The process of consultation on this "Green Paper" has officially started on 6 March 2003, during a conference held in Brussels, and to which the ESSC-ESF was invited. This consultation process is structured as a series of workshops, which will take the debate to the Member States, and to actors in the space domain. ESSC and ESF were invited to the various related events to present their contribution. This ongoing consultation period will stop at the end of May 2003 and a final meeting will take place in Paris on 23-24 June. A set of recommendations will be examined by the ESF Executive Board in June 2003.

3.4 Space Studies Board

ESSC has collaborated successfully for over fifteen years now with the Space Studies Board of the US National Academy of Sciences. There have been regular exchanges of ESSC representatives at meetings of the Board and, conversely, of SSB observers at our meetings.

In 1995, the relationships initiated these past few years had an opportunity to grow even stronger with the launch of a joint study aimed at studying the past of US-Europe cooperation in space science and extracting the important lessons learned from these ventures in order to try and improve US-Europe collaboration. Following the resolution proposed during the 9th meeting in Paris, this item was discussed with the SSB during their Board meeting in Washington on 8-9 June 1995 and it was agreed to start this work by drafting an outline of this study and then by defining a list of candidate missions to be addressed. Both parties were conscious of the importance of involving Russia and Japan in this project, but it was decided as a first step to consider only US-Europe cooperation. Involvement of Russia and Japan should obviously be envisaged but at a future stage of the study. The final report from this study was published in 1998 as a joint ESF-NRC report [7], after a series of workshops in Europe and in the USA. This work examined the history of past joint activity in classical space science, Earth observation and research in microgravity; it also stressed the importance of continued future joint activities. Excerpts from that report were also published in Space Policy [28].

While these studies have initially involved the USA and Europe, and later Japan, the importance of scientific collaboration among the world's spacefaring nations has been strikingly emphasised as a result. At the request of ESA a more focussed study was undertaken by the ESSC in 2000. It sought to (i) broaden the base of international collaboration, (ii) identify fruitful areas for such collaboration, e.g., large astronomical missions and solar system studies involving multiple spacecraft and (iii) propose a coordinating body involving the major world space agencies which could address collaboration on large missions and coordination of the more focussed smaller scale activities in space, through the harmonisation of their programmes. This study has benefited greatly from the participation of individuals nominated by the SSB and by the presence of an observer from the Japanese Space Research Committee.

Preparatory meetings and discussions culminated in April 2000 during the EGS General Assembly held in Nice, France, where an international hearing was held. Speakers in the four main areas covered by NASA's and ESA's "roadmaps" (Astronomy, Fundamental Physics, Planetary Exploration, Heliosphere and Sun) presented the situation of their disciplines,

offered assessments of the agencies' roadmaps and proposed findings and improved ways of cooperation. Indeed, all interested parties concurred on the fact that the current system was having an increasingly damaging effect upon cooperation, and thus needed to evolve for the better.

It was made absolutely clear though that the current role of space agencies in laying out foundations for future space science programmes was not questioned. Agencies and their respective scientific advisory bodies must continue to construct scientific roadmaps, and to select and prioritise missions. Following the definition of these strategic roadmaps by the agencies however, a rational and systematic approach to the harmonisation of these plans should be undertaken on a regular basis. In order to achieve this a new operational implementation scheme was required. The findings of this study thus served as a basis for proposing a new operational structure for inter-agency cooperation. In order to adapt the presently existing structures of discussion/coordination between space agencies the ESSC proposed the establishment of an "Inter-Agency Scientific Collaboration Working Group", which would include responsible agency executives from ESA, NASA, Japan, Russia, etc. The aim of this working group would be, on a regular basis, to provide a global forum for (i) discussing collaboration on large missions such as space observatories, planetary exploration missions, or data exploitation; (ii) enabling coordination of more focussed science missions.

A meeting of the existing Inter-Agency Consultation Group took place shortly after the publication of this report [10], and the ESSC Chairman was invited to attend that meeting. The current member agencies, ESA, ISAS, NASA and the RASA, agreed the new terms of reference which represent a valuable step towards enabling the discussion and planning of future international space science activities. While each agency retains complete control of its own programme, the terms of reference allow the establishment of inter-agency Task Groups and Working Groups under the auspices of the IACG. An article appeared in the journal *Space Policy* reviewing the situation [35].

Further issues of common interest are currently being considered. Such was the case in 1999, with a joint Europe-USA-Japan workshop which is described in § 3.5.

3.5 Japan and China

Establishing contacts with the Japanese scientific community was one of the recommendations of the ESSC review panel in 1996. Following the publication in June 1998 of the joint ESSC-SSB study "US-European Collaboration in Space Science", such contacts were initiated with Japanese officials in July 1998 on the occasion of the COSPAR Assembly which took place in Nagoya, Japan. Our Japanese colleagues also wished to establish a regular relationship with their European and US counterparts. This was achieved by discussion with the Space Research Committee (SRC) of the Japanese Science Council (JSC), chaired at the time by Professor Atsuhiko Nishida, also Director General of ISAS. A first activity was the organisation of an international workshop in Tokyo on 19-21 May 1999. In the course of this workshop participants examined past Japanese-US-European collaborative missions in space science (GEOTAIL ; YOHKOH/Solar-A ; ASCA/Astro-D), but also discussed ongoing or upcoming missions such as Halca, Nozomi, Lunar-A, Selene, Solar-B, Astro-E, Muses-C, Astro-F. The report from this workshop [29] was published in 1999, as a joint ESF-NRC-SRC document.

These contacts were not limited to this exercise. A. Nishida attended the ESSC plenary meeting of November 1999 in Granada, presented the activities in ISAS, and detailed the advisory process and decision procedure for space science in the Japanese system, as well as the mission approval sequence and the differences between the ISAS and NASDA structures. He explained the role of the Japan Science Council (JSC) and of the Space Research Committee. One outcome of that meeting was to involve A. Nishida as an observer

in the April 2000 international hearing on cooperation. Since January 2000 the SRC is chaired by Professor Takeo Kosugi, with whom we have had a few contacts. At that same meeting, a representative from NASDA, the other Japanese space agency in charge of Earth observation and microgravity research, was present. Y. Fujimori presented the programmes of NASDA with an emphasis on the future utilisation of the International Space Station which represents a fourth of the NASDA programmes.

Finally, these relationships were at the basis of the very first contacts between ESSC, SSB, and Chinese scientists during the COSPAR General Assembly in Warsaw in July 2000. Following the successful joint activities with Japan, SSB and ESSC decided to investigate possible avenues of collaboration with the Chinese scientific community. ESSC, SSB, and several members of the Chinese Academy of Sciences (CAS) participated to that Warsaw meeting. The role and functions of CAS, NRC, ESF, SSB and ESSC were introduced and explained by the participants, as well as the organisation of space research in the USA, China and Europe. After this initial contact it was envisaged to hold a workshop in the future, or participate in a symposium, to identify areas of possible future cooperations. A possibility could have been offered by the COSPAR Colloquium on Solar-Terrestrial Magnetic Activity and Space Environment, which was held in Beijing, China, in September 2001. However, the international tensions between USA and China rendered this scenario impossible, and these plans had to be deferred. Since then, further contacts were established in 2002 between the ESSC Secretariat and J. Wu, Head of a committee which remit appears close to the ESSC or the SSB. When the situation becomes riper, it is envisaged to organise an international workshop with all interested parties, to explore issues of cooperation between them.

3.6 United Nations and OECD

The United Nations have an office dedicated to space: the Office for Outer Space Affairs (OOSA), with a corresponding delegate body, the Committee for the Peaceful Uses of Outer Space (COPUOS). An OOSA representative, who recently became its Director, participated to the ESSC 17th plenary meeting in Strasbourg in November 1998. Following this, the ESSC was invited to attend the UNISPACE III Conference with an observer status. The Chairman and Executive Scientific Secretary attended this conference, held in Vienna in July 1999, where the ESSC presented a written contribution to the plenary session [19]. Excellent relationships between the ESSC and OOSA are established since that period.

Following the recommendation n° 11 in the 1999 report of the UK Task Force on Potentially Hazardous Near Earth Objects (i.e. asteroids and comets), the ESSC had established an ad-hoc group to consider the question in both a European and broader international context with special reference to the possible role of European Agencies.

Following the work of this ad hoc group, recommendations were published and embedded in the document sent to ESA Ministers in November 2001. At the core of these recommendations was the fact that the ad hoc group fully endorsed the conclusions of the UK Task Force, believing that the threat posed to humanity by NEO impacts was real, and comparable in magnitude with other risks of low probability but high consequence which Governments take very seriously (e.g. earthquakes and volcanic activity). The immediate need was to identify in full the population of NEOs with scale sizes that are potentially hazardous. Europe, in a fully international context, should play a major role in dealing with this issue in a scientifically sound and cost-effective way. In addition, the ESSC ad hoc group identified the European Southern Observatory (ESO) as having a very significant potential role in the use of ground-based telescopes for discovery, accurate orbit determination, and physical characterisation of NEOs. ESA was recognised as having an equally very significant potential role, not achievable from the ground, both in the discovery and follow-up observations using dedicated space-based telescopes with wide spectroscopic capability and

in-situ observations through encounter missions. Finally, the group noted that the broad multi-disciplinary nature of the NEO problem would require the expertise of a range of physical and social sciences in addition to those supplied by the astronomy and space disciplines. Thus, ESF could play a most valuable enabling role in the deployment of such a range of expertise.

As a result of this activity, which included representatives from the United Nations, and also from OECD, the ESSC was added to the list of organisations contributing to the work of the United Nations Action Team n°14 on NEOs. In addition, these recommendations were also presented at the first meeting of EIROFORUM [24], and are part of the background informative material of the UN Action Team.

The OECD has also geared up its activity on NEOs and organised a related workshop in January 2003, to which the ESF/ESSC was invited. Few, if at all, official representatives of their governments participated, but several crisis managers in different countries were present. A draft report from this workshop was made available, and will be presented to the OECD Global Forum in July 2003 and, then, possibly made available to the public.

3.7 Scientific bodies and institutions

Space science-related activities are by nature international : most of the research programmes and projects are undertaken by international teams and most of the technical developments, instruments and tools are international. All these activities are also interdisciplinary and rely on scientific fields such as physics, astrophysics, geophysics, biology, etc. Thus there must be a close link to the research patterns in these disciplines. Space scientists therefore have many formal and informal contacts.

In Europe, large international organisations such as the European Physical Society (EPS), the European Geophysical Society (EGS), the European Astronomical Society (EAS), the European Association of Remote-Sensing Laboratories (EARSeL), the European Center for Medium-Range Weather Forecasting (ECMWF), the European Low-Gravity Association (ELGRA), etc, have been developing. The scope of other scientific bodies such as COSPAR is not limited to Europe and encompass USA, Japan, etc.

The Committee relies on close and regular interactions with these bodies and has therefore established contacts with several of them (EGS, ELGRA, EARSeL, ECMWF). Relationships with COSPAR are set on an even closer footing as the President of this organism is an ex officio member of the ESSC.

In addition, the Committee sometimes takes advantage of specialised European forum such as the ones organised by EURISY.

3.8 Central and Eastern Europe

It has been one important aspect of the policy of the Committee in the past few years to attempt to develop further interactions with Eastern and Central European countries dealing with space research (Russia, Poland, Hungary, Rumania, Czech Republic, etc) or aiming to develop such a program. This aspect was initiated following a report of an ad hoc group chaired by W. Riedler in 1994. To draft that report, W. Riedler and the members of this work group had visited several countries including Poland, the Czech Republic, Hungaria, Ukraine and Finland. In addition, Polish and Hungarian delegates attended the September 1994 Paris meeting of the Committee. Representatives from several Central and European countries have attended a few ESSC meetings in the past years, and a meeting of the Committee was even held in Budapest in 1992. Central and Eastern European scientists most strongly welcomed the invitations to attend ESSC meetings. One of the more recent results of this activity led to the nomination of a Polish scientist in the ESSC, during a period covered by this activity report (1997-1999).

A specific item of interest to the committee was ESA's PRODEX programme which was found to present a potential interest in all of the visited countries, specifically when concerning the inclusion of small- or micro-satellites in the PRODEX programme. It was noted however that the big concern was the lack of funds -not only for any substantial international cooperation, but also for financing even smaller national programmes or projects. It was felt throughout this survey that this very basic problem could not be solved by PRODEX. On the other hand, PRODEX was considered as serving as one of the first steps for approaching ESA when the financial situation improves. ESA executives in charge of the PRODEX programme regularly brief the committee members on the evolution of this programme and on its achievements.

Although the ESSC is kept fully informed of the ongoing work by the concerned scientists, it is only fair to note that the inclusion of scientists from central and eastern Europe has not progressed as far as the committee would have hoped, or as the ESSC review had recommended. Part of the problem resides in the fact that funds are often scarce in these countries, and the – minimal – support which is needed for participation in the ESSC is often not met. In the case of Poland the participation of a scientist occurred without any funding from this country to the ESSC.

Concerning Russia, the Committee has had in the past several occasions to meet with representatives from the Russian Academy of Sciences, the Space Research Institute (IKI), the Russian Space Agency (RKA-RSA) or scientific and technological institutions. Academician A.A. Galeev (then Director General of IKI) participated to the sixth meeting of the Committee held in Strasbourg, France, on 4-5 March 1993 and gave then a high level presentation of the space and Earth observation research conducted in Russia. More recently, Academician V.F. Utkin, Director General of TSNIIMASH (Central Research Institute for Machine Building), presented during the September 1995 Chilton meeting the activities in his Institute, and provided details about the Science and Technology Advisory Council which was created by RKA and the Russian Academy of Sciences. In January 2003, on the occasion of a EU-Russia workshop, contacts were established between the Executive Secretariat and Academician N. Anfimov (Rosaviakosmos), and several other high-level individuals in Russian space research, a prelude to further fruitful interactions.

The Secretariat has also established a first contact with Bulgarian colleagues. Bulgaria has recently become one of ESF's Member Organisations.

No formal mechanism of interaction with the Committee has been established yet, but the ESSC will certainly try and enhance its efforts in this direction in the near future. It is true though that such a regular collaboration is difficult to implement given the recurrent uncertainty concerning space research programmes and funding, e.g. in Russia.

3.9 National Agencies in Europe

Multilateral cooperation obviously constitutes a very important contribution to the total European Space Research Programme. To get a clear picture of the whole European contribution to world-wide space research, it is then essential to survey these national space programmes and to meet therefore with the national space agencies. The Core Group and Chair have met on various occasions with representatives from ASI (Italy), CNES (France), INTA (Spain), BNSC (United Kingdom), DLR (Germany), and other agencies in Europe. Although the means at the disposal of the ESSC do not allow regular interactions with national space agencies, such contacts allow the members of the Committee to be adequately briefed on the situation of space research in these countries, and thus develop an adapted argument towards the reduction of redundancies and incoherences between national programmes, and the programmes of ESA.

These briefings usually take place on the occasion of ESSC plenary meetings in the various European countries, during which the representatives from these agencies present their activities.

Publications and outreach

4.1 Publications

Reports

The Committee has published nine main position papers in the 1997-2002 period, in addition to its regular reporting to the ESF Assembly or review reports (covered in § 2.6). This makes it a very active committee within ESF.

The first one was an activity report covering the period 1991-1995 [2], and which served as the basic document for the review of ESSC in 1996.

A second position paper followed a year after and commented upon the re-organisation of the ESA structure, among other items grouping Earth observation and space science [3]. This gave another opportunity for the Committee to stress again the need for mandatory programmes in Earth observation and microgravity research.

The third position paper consisted of the recommendations of the ESSC on the EU's Fifth Framework Programme [4]. This marked the beginning of fruitful relationships with the EC.

In 1998, as mentioned before the NRC and ESF published their study on US-European collaboration in space science [7]. This report covered in substantial detail and at the level of missions, a fruitful period of cooperation with the USA, and served as a stepping stone for subsequent exercises between the ESSC, the SSB and, later, the SRC. Two years later, and under the commission of the ESA Directorate of Science, the ESSC report on the future of international collaboration in space science was published [10], this time as an ESF report alone, but with considerable help from our US and Japanese colleagues.

Meanwhile, in 1999, ESF published a Policy Briefing containing the ESSC's view on the future space policy for Europe [9]. This publication contained most of the recommendations which had been submitted the same year to the Ministers of ESA Member States, who met in Brussels in May 1999 [18].

In 2000, the ESA Directorate for Manned Space Flight and Microgravity commissioned to the ESSC an evaluation of its future research programme in life and physical sciences in space. The report from this study was published at the end of the year [12] and ESA used all of its recommendations to update its plan.

In 2001, the ESSC was also preparing the ESA Ministerial Conference of Edinburgh (November 2001), and ESF published on these grounds a report for the Ministers [14]. That report covered ESA's scientific programmes, but it also addressed the future European space strategy, and dealt with other activities, such as GMES, exobiology, space weather, or NEOs.

Finally in 2002, under commissioning by the ESA Director of Science, a major exercise concerning the demography of European space science was conducted, and a report published at the beginning of 2003 [16].

Statements

Many different statements were issued by the Committee in the course of these six years. Usually these documents were then expanded and constituted the cores of the reports or position papers described above. This was for instance the case for the various recommendations to the European Union ([17],[18],[20],[22],[23]). In other cases, such as the recent statement on the use of "space" data [25], the statements were self-sufficient,

and sent to specific bodies or institutions. That specific statement on data archiving and exploitation was a follow-up of the work done by the ESSC panel on data archiving in 1993.

Another example is the statement to the UNISPACE III Conference in July 1999 [19].

Articles and proceedings

The Committee was asked on several occasions to prepare articles for several journals or proceedings of conferences. In other cases, the ESSC felt that a particular subject of concern mandated such a publication. Furthermore, members of the ESSC were interviewed on several occasions by the specialised press.

Examples of such articles appeared in the journal *Space Policy* in 1996, 1998 and 2001, and dealt with international cooperation in space science ([28],[35]), or the future European space policy [26]. Other articles appeared in ESF publications ([27],[30],[32],[33]). In addition, the specialised press, essentially *Space News*, interviewed the acting Chair and Executive Scientific Secretary before and after the Edinburgh Ministerial Conference, and several of these interviews were published ([36],[37],[38]), thus shedding light on the position and representativeness of the committee.

Miscellaneous

The principles upon which ESSC acts are described in its "Charter and Terms of Reference" [40]. To guide the action of the Committee, an Action Plan [39] was published in 1999. Since 2001 the Committee publishes a leaflet describing the role, membership and main activities of the ESSC-ESF. Two editions have already been published [42]. This leaflet serves as outreach material to quickly introduce the ESSC to the outside world. As with all of ESSC's publications, this document can be downloaded from the Internet.

4.2 The ESSC internet site

The 11th meeting of the ESSC held in Chilton tasked the Scientific Assistant with developing an ESSC information service on-line through the World-Wide Web. The ESSC site has since then been hosted by the ESF web site, which went through several evolutions since its creation. Although imbedded in a hierarchical way within the ESF service, direct external access to an ESSC home page is of course possible. The URL of the ESSC site is <http://www.esf.org/essc>. This site is referenced by many other space-related web services throughout the world, among which are ESA, European Commission, national space agencies in Europe, SSB, COSPAR, *Space News*.

Apart from structural information (membership list, funding bodies, structure), the site features all of the ESSC publications which can be downloaded as PDF files. Restricted areas allow members to access draft documents and provide feedback, or register on-line and retrieve agenda packages for meetings. Specific sections of the site are also used to provide ad hoc group members or international partners with the necessary information and background documents.

Ongoing and future actions

5.1 The European Space Policy

Although Europe now appears to be on the verge of establishing a space policy for the continent, space research as such is not presently identified as an element of the programme, but rather diluted throughout its various actions. The apparent exception of the action n°4 "Aeronautics and Space" in the Sixth Framework Programme does not address fundamental space research, classical space science, nor life and physical sciences in space. This situation is not appropriate at a time when major changes are emerging. Europe is recognising the importance of space and has obtained outstanding results in space research highly thought of in the international community as well as outstanding achievements in space industry and applications.

Looking at the alleged objectives of the European Union in the broader context of technology and applied research, for which science is the main driving force, it appears clearly that our present competencies and capabilities cannot be maintained with the current level of R&D in Europe. In this sense, the ESSC considers that, in order for Europe to stop lagging behind, a substantial effort of investment in R&D is required. This effort is underlined by both, the need for making the space-related funding avenues more coherent, and the need to recognise that funding for R&D in Europe should be substantially increased, if Europe is to truly become the "most dynamic knowledge-based society in the world", as the political leaders of Europe declared in Lisbon in 2000. Hence, redundancies between national and European programmes should be reduced, while maintaining the necessary capabilities at the national level.

Overall the ESSC-ESF believes that there has to be a synergistic approach taken by the European Commission and other involved European institutions, to ensure that coordination and existing interfaces are improved, rather than one in which they would seek to completely redefine institutional responsibilities in space. The development of a strategy for an efficient action of Europe in the space field must start from the identifications of the objectives and of the resources. Space scientists are regularly challenged about the high implementation costs of their disciplines. This situation is caused by the high cost of access to, and operation from, space, and also by the increasingly complex background in which science evolves. The will of scientists and space agencies alike was therefore strengthened to engage and reinforce collaborative programmes, to minimise duplication and maximise the return on public investment. Coordination between European and national programmes could become the norm with a strong ESA programme, while it is presently often the exception. Political will and investment means are required to sustain these upstream efforts. The ESSC recommendations on the "Green Paper on European Space Policy" will be published and circulated among decisions-makers and political leaders in Europe.

Thus the ESSC will continue to play a strong role during this consultation and definition process. Furthermore, and at the request of ESA, a proposal concerning a study on European funding for space research is currently being drafted and will be submitted to ESA and the EC in the coming weeks.

5.2 GMES

The discussion on GMES started in 2000. ESSC-ESF's role has been recognised, as shown by the invitation to ESF to attend the GMES Steering Committee on 11/12 March 2003. Within ESF, ESSC initiated a coordinated approach among various entities (Marine Board, Polar Board, social sciences and life sciences & environment standing committees, Cabinet of

the Secretary General, Large Research Infrastructures Unit, etc), and an ESF "view" on GMES is emerging. After a hesitant start, this activity indeed seems to lift itself above mere declarations, and a vision of GMES is slowly taking shape. The GMES Service Element of ESA's programme was approved at a level of 83 M€ in Edinburgh, and the recently initiated related AO reaches 15 M€. In Framework Programme 6, 100 M€ are foreseen in addition to this ESA component, with 45 M€ for its first call for opportunities, spread through the Global Change, Information Society, and Aeronautics & Space Actions. In the previous framework programme, 78 studies were related to GMES. One can be reasonably optimistic therefore, although the level of coordination between the interested parties, and the harmonisation in the Steering Committee, should certainly be improved.

ESF needs to keep up-to-date with this activity, involving not only the skill and expertise of its space expert group, but also the competences from other bodies of ESF.

5.3 Future prospects and specialised workshops

5.3.1 Exo/Astrobiology

Life in extreme environments (or Limits of life) is one of the topics to be explored and supported by ESSC, but also by EMB, EPB, and LESC. A meeting between LESC and these expert groups took place in May 2003 and explored avenues of coopeartion, among which such a workshop would find a place. The aim is not to fund existing science workshops on this topic, but rather to initiate a small-scale (typically with a maximum of 50 people), policy-oriented workshop to look at strategy and funding issues. Contacts will be re-initiated with other key European exo/astrobiology individuals and networks, who solicited the support of ESSC a few months ago. Presently, this concept indeed seems to be the ripest one proposed. Such a workshop could take place back-to-back to another science event on the subject.

5.3.2 Funding of European space science

ESA's Science, Earth observation, and Life & Physical Sciences in Space Directorates have suggested to ESSC in 2002 to consider submitting a proposal to study the existing avenues of funding (of European space science) and extract possible incoherences and redundancies between European and national programmes. After discussion with ESSC members, such a proposal was made at the meeting of the Joint Task Force Working Group on Science, where ESSC was invited. The EC counterpart in this WG was also interested by such a study but stated that EC could not currently envisage to fund such an exercise, although they would be very interested by its outcome. At this meeting, the various ESA representatives demonstrated a large interest as well.

The subject now appears riper, and discussions with the EC seem to show that ways to fund such an exercise could be investigated by the EC (e.g. through support of related workshops). The rationale behind this proposal encompasses topics such as: (a) ensure that space research continues to be engaged in by European scientists; (b) an appropriate level of resources continues to be made available to European research institutions; (c) assess the multiplicity of funding sources for space research in Europe; (d) study the issue of payload funding; (e) explore redundancies and incoherences. ESSC, possibly with the help of ESF, should address all these issues and offer recommendations.

In order to have an impact, the results of such a study would have to be made available before the next ESA Ministerial Council (end 2004 or early 2005). Three phases are currently foreseen; these are: (1) consultation and data retrieval; (2) assessment of coherence; (3) determination of a strategic view (and optimal funding level?). Not necessarily all of these three phases would receive the assent of the commissioning bodies. It is clear for instance that the undertaking of Phase 3 could present some difficulty.

5.3.3 Planetary exploration and RTGs

Solar system exploration is another of these concepts which the committee members discussed recently. The aim is to initiate a critical discussion on this issue at a global scale, i.e. including colleagues/institutions from outside Europe. Since funds could probably not be made available on a short timescale, it was proposed as a start to include a dedicated session on this subject during the next plenary meeting of the ESSC (Strasbourg, November 2003), where several key individuals will be invited, including colleagues from the US Space Studies Board, and perhaps Japan. The central theme should be our present scientific state of knowledge concerning Mars. Two related science lectures are foreseen.

Along the same line of thought, the use of RTGs for solar system exploration is a mandatory issue to be tackled, if Europe wants to extend its mission packages to the outer solar system (Jupiter and beyond). At present though, ESA cannot on its own incorporate such nuclear devices in payloads. This decision is then a strategic one that must be tackled by Member States (the AURORA programme, through EPAC, is also addressing this aspect, through cooperation with Russia). ESSC members were invited to comment on this proposal in the coming months; the aim would be to propose a workshop in about 2 years.

Conclusion

During this six-year period, the European Space Science Committee was reorganised in order to cover in a more appropriate manner the whole of the space related scientific research, namely research in space, from space and on space, including emerging areas such as GMES, and to fulfill more efficiently the various tasks and responsibilities defined in its new Terms of Reference. This enabled the ESSC to create the necessary links with the principal actors and decision makers in the European space arena, to provide them with position papers and recommendations, and to prepare articles in journals presenting the policy of the Committee. These papers and recommendations dealt with the main issues raised by the important changes which were occurring in the space domain during this period. This enabled the ESSC to formulate the viewpoint of the space science community on most of the decisions which were taken in the space domain during these years.

As a consequence, the ESSC has reinforced its position as one of the main spokesperson of the European space science community. As an ESF Expert Committee, it contributed to the expertise and scope of ESF in the field of space science.

From a quantitative point of view, the Committee met 11 times during these 6 years and held these meetings in 7 different countries. It organised 8 working groups on specific issues and published 25 reports, position papers and statements, 9 articles in journals, 2 workshop proceedings, action plan, financial plan, and leaflets. Its Chairman, Executive Scientific Secretary, or members, were interviewed on several occasions by the specialised press. In addition to hosting SSB representatives during European meetings of the Committee, the ESSC participated to six meetings in the US with the Space Studies Board, which reinforced our relationships and allowed our two bodies to finalise one joint study on US-Europe cooperation in space science, and a further study, where the help of our US and Japanese colleagues were much appreciated.

Qualitatively, the Committee has reached a level where it is expected to contribute regularly to the bodies in charge of defining policies for space and space research at the European level. The token of this recognition is assessed, first by the observer status of ESSC-ESF in the ESA Ministerial Councils since 1999, and second, by the observer status in the EC-ESA Joint Space Strategy Advisory Group since 2000. The challenge for the years ahead is to be able to ensure that science is maintained as a central part of the European Space Policy being currently defined. The ESSC is certainly willing to continue to play its part in advising and counseling European bodies, by providing them with the viewpoint of the scientific community on these issues.

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3. *Recommendations on ESA's New Structure*, European Space Science Committee, REP(97)1, ESF, Strasbourg, January 1997.
4. *Recommendations for the Fifth Framework Programme of the European Union*, European Space Science Committee, REP(97)5, ESF, Strasbourg, June 1997.
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18. *Statement and Recommendations by the ESF's European Space Science Committee to the ESA Council of Ministers*, ESF, Strasbourg, May 1999.

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23. *Preparation of the June 2001 EU Research Council*, ESSC Contribution to the ESF Statement, REP(01)4, ESF, Strasbourg, June 2001.
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