

ESA

POSTDOCTORAL

RESEARCH FELLOWSHIP PROGRAMME

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The purpose of this booklet is to give, without excessive detail, general information on ESA fellowships.

It does not constitute nor entail individual rights or obligations.

ESA

POSTDOCTORAL RESEARCH FELLOWSHIP PROGRAMME

I – THE PROGRAMME

Purpose

ESA's postdoctoral research fellowship program is aimed at providing young scientists and engineers, holding a doctorate or the equivalent, with the means of doing research in space science, space applications or spacecraft technology.

The fellowships, which are for one year (possibly renewable for a second year), are meant to help the applicants continue research work.

The Fellowships

The Fellowships are of two kinds:

- **EXTERNAL FELLOWSHIPS**, which allow the holders to work in universities, institutes or research laboratories on a project of their choice which is related to research activities of the Agency. The host institute chosen must normally be in Europe. A host institute in the US or in a non-ESA Member State with which the Agency has signed a cooperative agreement can be accepted provided there are particular arguments for this choice.

In addition, candidates whose project refer to a specific area of research, and appear to be of a very high standard of quality, may be awarded a commemorative external fellowship, i.e.: "*The Giuseppe Colombo Fellowship*", in memory of Professor Giuseppe Colombo who died in 1984, to support research in celestial mechanics, fundamental research or applied space sciences. "*The Luigi Napolitano Fellowship*", in memory of Professor Luigi Napolitano who died in July 1991, to support research in the field of microgravity.

- **INTERNAL FELLOWSHIPS**, for applicants who want to work on a research project inside the Agency; they are hosted at one of the ESA establishments, which accept internal fellows on the basis of their specialty and of what opportunities can be provided for work within an existing team.

Every year the Agency offers some 20 external and 30 internal fellowships. It must however be stressed that these are overall figures – i.e. they include both new fellowships and any extensions to existing ones.

General conditions for eligibility

- 1) Applicants must hold a doctorate or equivalent.
- 2) They must be working in space science or applications, spacecraft techniques, or fields closely connected to space activities.
- 3) ESA fellowships are open to nationals of its Member States, viz. Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. Application from Canada (co-operating State) will also be considered.

ESA fellowships can only very exceptionally be awarded to those from non-Member States. Given the limited number of fellowships, priority always goes to applicants from the ESA countries.

To be considered nonetheless, an application from a non-Member State must:

- 1) meet the admissibility criteria for the internal and external fellowship program;
- 2) be submitted via an ESA Member State.

The fellowship should take place in an ESA Member State.

Areas of research of interest to the Agency

The research projects of applicants for the ESA fellowship programs (internal and external) must fall in one of the categories listed in [Annex 1](#).

II – INTERNAL FELLOWSHIPS PROGRAM

Qualifications

Internal fellows will normally have a doctorate or equivalent. However, applicants who have not completed a doctorate, but have a proven research and/or publication record may also be considered. Applicants should also have an experience of research in a field connected with an activity under way in one of the Agency's establishments.

Those wishing to apply for ESA's internal fellowships will find a list of the areas of research listed in Annex 1.

Posting of fellows

Internal fellows will be posted to the Agency establishment that best matches their specialization. Generally, they join a team where they work under supervision by one or more experienced scientists or engineers; they must, however, be able to undertake work on their own.

The main ESA establishments accepting fellows are:

| | |
|--------------|---|
| ESTEC | the European Space Research & Technology Centre at Noordwijk in the Netherlands |
| ESOC | European Space Operations Centre at Darmstadt in Germany |
| ESRIN | Information Retrieval Service & Earthnet Office at Frascati in Italy |

Applications

The form provided for applying for an ESA fellowship is to be used, and **must** be accompanied by:

- four references (not relatives)
- detailed description of thesis work and relevant experience;
- a list of publications by the applicant, with the bibliographical references needed for obtaining copies of these if desired;
- a photocopy of the doctorate (or equivalent) certificate, or if appropriate of the last degree obtained;
- a detailed description of the research to be performed.

A recommendation from the National Delegation is optional in the case of applications for an internal fellowship.

COMPLETE applications should reach ESA at the following address:

EUROPEAN SPACE AGENCY
C/o Personnel Department
8 – 10, rue Mario Nikis
75738 PARIS Cedex 15

There is no closing date for applications, which may be submitted at any time during the year. Incomplete applications will not however be considered.

Selection procedure

Applications satisfying the general conditions for eligibility for an internal fellowship will be forwarded to the Establishments dealing with the area of research indicated, and will be examined by teams that can suggest a research topic related to the applicant's experience and field of interest.

Applicants likely to be able to carry through these tasks will be invited to an interview, after which the decision on awarding a fellowship will be taken.

Those chosen are informed within four weeks of the interview, and will normally start their fellowship within one to three months of the decision being taken.

Fellowship conditions and procedure

Internal fellows are considered to be a category of ESA staff members and benefit from special provisions described in the ESA Staff Regulations and Rules.

*** FINANCIAL CONDITIONS**

Internal fellows will receive a salary corresponding to a special grade determined for staff on research assignments. The attribution of grade upon recruitment will mainly depend on the appointee's qualifications and experience.

Internal fellows may be entitled to an expatriation allowance and/or to an installation allowance if conditions of entitlement are met. No removal expenses are however reimbursed.

*** TRAVEL EXPENSES**

Depending on their place of recruitment, internal fellows may be reimbursed travel expenses in economy class (when travelling by air) or in first class (when travelling by train) from there to their duty station for themselves, their spouse and dependent children.

At the end of the fellowship, travel expenses from the duty station to the place of residence are also reimbursed on the same basis, if applicable.

Fellows in post are, as a rule not authorized to travel on mission; an exception may however be made at the request of host departments if the mission is shown to be in those departments' interest as part of the work being undertaken by fellow.

*** SOCIAL SECURITY**

Internal fellows are affiliated to the ESA Social Security Scheme and are given as such a medical cover including invalidity and death benefits. A monthly deduction will be made from their salary covering the short-term and long-term risks.

*** RENEWAL OF FELLOWSHIPS**

Internal fellowships are for a period of one year, although there is a possibility of renewal for up to a further twelve months. Request for renewal, setting forth reasons, must be submitted at least three months before the fellowship is due to come to an end, by host department.

III. EXTERNAL FELLOWSHIPS PROGRAM

External fellowships are awarded to applicants wanting to undertake or continue specific research in a field directly connected with the Agency's activities (see Section I, "Areas of research of interest to the Agency"). The research is done at a university, institute or research laboratory in (or, exceptionally, outside) Europe proposed by the applicant.

Qualifications

Applicants must in principle hold a doctorate, and subject to what follows, no offer of a fellowship can be confirmed without evidence being submitted of this having been obtained.

Applicants who are selected but whose doctorate has not been awarded at the time the granting of fellowships is decided will have up to two months to provide the necessary evidence. After that period, they will be told that their application has been postponed until the following selection.

Applicants not holding a doctorate but having equivalent science qualifications and research experience can be considered.

Generally speaking, external fellows have to be able to show the ability to work on their own, and to adapt to the research activities of the host institute.

Choice of host institute

Applicants for an external fellowship will themselves choose a host institute, on the basis of their research project; but to strengthen the links that already exist in the international scientific community and to encourage exchanges through mobility, the following conditions will have to be met:

- a) the host institute must be outside the applicant's home country;
- b) and it must not be one in which the applicant has already done research, in particular in connection with his or her doctorate.

Applicants should give first priority to European institutes, if possible belonging to scientific groups already working on ESA projects. If however they can show that it would be more relevant to undertake the research in an American institute, or some other non-European country, this will be considered.

It should be noted that contacts with the intended host institute are the responsibility of the applicant.

Some instructions are given in Annex 2 to help applicants in their selection of a host institute.

Applications

The form provided for applying for an ESA fellowship should be used, and it **must** be accompanied by:

Four references (not relatives);

- A detailed research plan (of 4-5 pages) setting out the applicant's scientific/technical aims, the procedure proposed, and reasons for the choice of host institute;
- A list of publications by the applicant, with the bibliographical references needed for obtaining copies of these if desired;
- A photocopy of the doctorate (or equivalent) certificate, or if appropriate of the last degree obtained;
- A recommendation from the delegation to ESA of the applicant's home country (a list of delegations with their addresses is given in Annex 4). Applicants should send a copy of their application direct to their national delegation, which will pass it on to ESA or back to the applicant with any comments.

COMPLETE applications should reach ESA at the following address:

ESRIN
C/o Personnel Service
Via Galileo Galilei
Casella Postale 64
I-00044 Frascati
ITALY

by 31 MARCH for the JUNE selection, or
by 30 SEPTEMBER for the DECEMBER selection.

Applications received after these dates will be dealt with at the next selection. Incomplete applications will not be considered.

Selection procedure

Applications are first examined and scored by leading European scientists and engineers working in the field of research selected by the applicant. They are then submitted, together with the comments of these experts, to the ESA Selection Board. As well as taking the experts' opinions into account, the Board assesses applicants' proposals seen against their past experience, the value the suggested line of research has to offer to the Agency's (or indeed national) programs, and the suitability of the choice of host institute for the project being processed.

From these various criteria, the Board – which meets in June and December – arrives at its recommendations with a ranking that guides the decision on granting the fellowships.

The final awarding of a fellowship is subject to the host institutes accepting the applicants, and to presentation of evidence of gaining the doctorate if this was not yet held when the selection was made.

The applicants chosen are informed within two weeks of the Board's decision, and will normally start their fellowship within three months of that date.

Fellowship conditions and procedure

*** FINANCIAL CONDITIONS**

The monthly stipend represents a lump-sum grant; the present scales are shown in local currency in Annex 3.

Fellowship stipends are paid for three months at a time, and in advance.

Fellows may cumulate ESA stipends with occasional earnings from another source. However, a salary from the candidate's home organization or another research grant from a national or international body cannot be cumulated with the ESA fellowship.

Up to now stipends have not been taxed by national tax authorities. However, if such a tax authority decides that the stipend is taxable, ESA cannot refund the tax paid. This also applies if the fellow's spouse earns a salary and if tax authorities in certain countries combine the two amounts in calculating the tax payable by the fellow.

The Agency will not be responsible for the declaration of national taxes or their payment, which will remain the responsibility of the fellow.

* TRAVEL EXPENSES

Return travel expenses between the place of residence and the host laboratory or institute will be paid for the fellow, and for a spouse accompanying and actually residing with him or her during the tenure of the fellowship. No like payment will be made in respect of children.

The refund of travel expenses is limited to the cost of an economy-class air ticket for continental and intercontinental travel, and will not include excess baggage charges. If, however, the distance between the place of residence and the host institute is 500 km or less (without a sea crossing being involved), reimbursement is limited to the cost of a 1st-class rail ticket. Refund is made on presentation of supporting documents.

Fellows may choose to travel by private car, in which case they should inform the ESRIN Personnel Service of this and note that reimbursement (based on a mileage allowance) will be up to the limits described in the previous paragraph.

Apart from one journey a year for scientific purposes paid for by the Agency, any other travel during the tenure of the fellowship will not be eligible for or refunded.

It should be noted that ESA will not make any financial contribution to expenses incurred by fellows other than the stipend and the travel expenses as described above.

* VISA

It should be noted that ESA does not give assistance or contribute to the cost of obtaining any visa, which may be required.

* SOCIAL SECURITY

The Agency has a compulsory health, accident and Leif insurance scheme for all ESA fellows. If a fellow is already covered by another scheme, the contribution to the ESA scheme remains compulsory, but only complementary cover will be provided by the Agency.

ESA and the fellow each pay 50% of the cost of contributions. The scheme offers the fellow the following benefits:

- a) medical expenses are refunded up to 90%, subject to certain ceilings;

- b) payment of a capital sum equal to € 12.500,00 in the event of death, accidental or through illness, occurring during the period of the fellowship, or in the event of total and permanent incapacitation; and of a percentage of this sum in the event of partial (but at least 33.3%) permanent incapacity occurring during the period of the fellowship.

This cover is extended to the spouse and children, where these cannot be affiliated to a national social security scheme.

Fuller information on this subject is supplied to all selected applicants.

*CONTACT WITH THE AGENCY DURING THE FELLOWSHIP

Selected applicants will be allocated an ESA staff member, chosen to match their field of research, to act as “mentor” during their fellowship. This person will keep a watch on the progress of the fellowship from a scientific viewpoint, and offer help when questions arise during the work.

Besides submitting a report on their activity when the fellowship comes to an end, external fellows are expected to report, each quarter, to the Education Department and to their mentor.

* RENEWAL OF FELLOWSHIPS

External fellowships are for a period of one year, although there is a possibility of renewal for a further twelve month. Requests for renewal must be submitted to ESRIN Personnel Service at least three months before the fellowship is due to come to an end, and must be accompanied by a recommendation from the host institute.

Renewals are granted in the light of a progress report for the first year, and outlined plans for the research activities of the second year.

There is a budgetary limit on the total number of fellowships and requests for renewal will have to compete with fresh applications.

List of Annexes

Annex 1 Fields of Research Activities within ESA

Annex 2 Guidelines to Selecting a Host Institute

Annex 3 ESA Fellowships Stipends

Annex 4 National ESA Delegations

Annex 1

FIELDS OF RESEARCH ACTIVITIES WITHIN ESA

SPACE SCIENCE

ASTROPHYSICS

Infra-red and sub-mm astronomy:

- development of Fabry-Perot interferometers and observational astronomy using ground based telescopes;
- development of sub-mm super heterodyne receivers and observational astronomy using ground based telescopes.

Ultraviolet and optical astronomy:

- observational astronomy using ESA Photon Counting Detector on ground based telescopes;
- observing programs with an analysis of Hubble Space Telescope and IUE;
- development of microchannel plate/CCD cameras for UV/optical studies.

X-ray astronomy:

- analysis and interpretive study of data from the EXOSAT observatory; the development of imaging detectors (gas scintillators and CCD's) for use in future X-ray missions (e.g. XMM and SAX).

Gamma-ray astronomy

- analysis and interpretive study of COS-B data;
- the analysis of the imaging Compton Telescope data flown on the Gamma Ray Observatory (GRO).

PLANETARY AND SPACE SCIENCE

Space Plasma Physics:

- analysis and interpretation of data from GEOS, ISEE, the "Tether" satellite and INTERBALL;
- theory and modeling work in preparation for Cluster;
- development of new electric field and plasma detectors;
- laboratory studies of interactions with spacecraft and probe surfaces (particles, dust, and photons).

Planetary Science:

- cometary science: data from VEGA and GIOTTO;
- Mars magnetosphere: data from PHOBOS and experiment development for Mars 94;
- interplanetary dust: data from MUSES, and experiment development for Cassini;
- Titan atmosphere/surface: experiment developments for Cassini/Huygens.

SOLAR AND HELIOSPHERIC SCIENCE

Heliospheric Physics:

- analysis and interpretation of energetic particle data from ICE, Ulysses, GEM and other spacecraft;
- data analysis preparations for 3-D plasma and particle experiment data for the NASA WIND mission (part of the International Solar Terrestrial Science Program);
- studies of ultra heavy cosmic rays from LDEF Mission;
- development of advanced techniques for charged particle detection.

Solar Physics:

- analysis and interpretation of Atlas and Eureca-1 luminosity measurements;
- development of SOHO luminosity oscillations imager;
- development of solar corona models for SOHO;
- study of techniques for helioseismology.

EARTH OBSERVATORY AND ENVIRONMENT

EARTH RESOURCES

- advanced remote sensing
- instrumentation: passive microwave radiometry and sounding, synthetic aperture radars, scatterometers and altimeters, multispectral scanner;
- data processing methodologies: processing of image data, processing of synthetic aperture radar data and scatterometers;
- atmospheric processes and their influence on remote sensing measurements;
- advanced technology (satellite): large scale memories, optical charge coupled and acoustic wave devices for image and side-looking radar data handling;
- computer simulation of on-board processing systems.

GEODESY, GEOPHYSICS

- Earth kinematics studies (Earth rotation polar motion);
- refined studies on Earth potential;
- geodynamics, earthquake prediction research;
- position-determination and navigation systems;
- physical oceanography;
- ice dynamics;
- studies of scientific and operational aspects of satellite observation laser systems for precise position determination and for synchronization of clocks;
- satellite magnetometry.

METEREOLOGY, CLIMATOLOGY

Software:

- picture processing (wind field extraction, sea surface temperature), temperature profile inversion techniques (infrared and microwave);

Systems:

- microwave radiometry and sounding applied to meteorology;
- limb sounders, sub-mm heterodyne spectrometry Lidars;

Climatology, radiative budget of the Earth

LIFE SCIENCE AND SCIENCE UNDER MICROGRAVITY CONDITIONS

LIFE SCIENCE

- vestibular research, neurophysiology
- physiology, cardiopulmonary, musculoskeletal systems, regulatory processes
- cytology
- rhythms
- radiation biophysics
- developmental biology
- psycho-physiology
- biochemistry
- plant physiology
- microbiology
- bioengineering
- clinical medicine
- exobiology
- bioprocessing

SCIENCE UNDER MICROGRAVITY CONDITIONS

Material science:

- fluid phenomena influencing the design of microgravity experiments (convection, diffusion, viscous forces, pressure forces, transport mechanism, etc...);
- experimental/mathematical modelling (characteristic numbers, hydrostatics, fluid dynamics, thermal Marangoni flow, flow regions, etc.);
- metallurgy, composites, glasses (heat transfer, mass transfer, plane front solidification, nucleation, organization, eutectic growth, structures, liquid-solid mixtures, liquid-liquid mixtures, alloys, glasses, welding, casting, etc.);
- crystal growth (model crystals, elementary crystals, binary crystals, low temperature solutions growth, vapor growth, etc.; crucible free zone melting, lattice defects, crystal contamination, etc.);
- chemistry (chemical synthesis, corrosion processes, polymerization reactions, combustion processes, electrode reactions, free radical chemistry, catalysis, phase equilibria, etc.);
- techniques related to experimentation under microgravity (heating techniques, positioning techniques, mixing devices, measuring techniques, observation techniques, etc.).

SPACE TECHNOLOGY RESEARCH

SPACECRAFT STRUCTURES

- structure analysis methods (computer aided design, dynamics, design verification);
- advanced composites structures;
- smart structures;
- erectable structures (large areas);
- fatigue and fracture mechanics.

SPACECRAFT PROPULSION

Chemical propulsion:

- thermodynamic analyses of advanced engine cycles for storable and cryogenic bipropellant rocket engines;
- combustion instability studies;
- rocket exhaust plume analyses; plume flow-field characteristics; plume impingement effects;
- heat transfer analysis for rocket engines; regenerative cooling, film cooling;
- use of advanced materials for rocket engines (composites).

Electric propulsion:

- mission analyses for orbital manoeuvres using electric propulsion; high energy orbits, drag compensation for low orbits;
- plasma physics and Electro-optics analyses for field emission electric propulsion.

LAUNCHER PROPULSION

Rocket Propulsion:

- derivation and thermodynamic performance analysis of advanced rocket engine cycles for future launchers: influence of combustion pressure, variable mixture ratio, external expansion nozzles, advanced materials, dual fuel engines, tripropellant engines.

Air-Breathing Propulsion:

- thermodynamic analysis of advanced engine cycles for hydrogen fuelled air-breathing engines, including combined-cycle engines, for use in future reusable launchers;
- analysis of the installed propulsive performance of air-breathing engines in reusable launchers: force accounting and balance for thrust, drag, lift and vehicle weight;
- derivation of installed engine performance specific impulse and vehicle velocity losses as functions of altitude, Mach, incidence and bank angles.

Mechanisms:

- despun systems;
- solar array drive;
- space tribology;
- deployment booms and large masts;
- precision mechanisms for optical payload instruments;
- advanced momentum/energy storage actuators;
- precision pointing mechanisms.

THERMAL CONTROL

Thermal analysis and modelisation

Thermal software development

Thermal Control Technology:

- heat transport (two-phase loops, heat pipes, fluid loops);
- heat rejection (passive, heat pipe, hybrid and advanced radiators);
- cryogenic cooling (cryostats, mechanical coolers and very low temperature cooling);
- thermal protection systems for reentry and planetary entry vehicles.

ENVIRONMENTAL CONTROL & LIFE SUPPORT

ECLS analysis and modelisation
Life support software development

Life support technology (physico-chemical and biological):

- air management systems;
- water management systems;
- food management systems;
- CELSS (closed ecological life support systems).

Habitability of manned vehicles and planetary bases:

- architecture;
- hygiene;
- comfort;
- psychological issues;
- physiological issues.

RF SYSTEMS

- analog and digital communication systems design and analysis including space and ground segments;
- communication techniques (coding, modulation, access, etc.);
- TT&C techniques;
- Global navigation;
- advanced remote sensing microwave instruments (radar radiometer, etc.); design and analysis;
- microwave and digital technologies for satellite payloads (low noise receiver, power amplification, frequency generation, filters, modems, etc.);
- equipment, subsystems, systems performance evaluation in the RF systems laboratory.

ANTENNAS, ELECTROMAGNETISM, PROPAGATION

- antenna design and simulation;
- antenna calibration and measurement;
- electromagnetic compatibility;
- propagation, wave interactions.

ATTITUDE AND ORBIT CONTROL

- dynamic simulation of large flexible spacecraft;

- application of modern information/control theory to advanced attitude measurement/control systems and to robotic control;
- control organization for flexible robot manipulators;
- use of on-board processors for attitude control;
- dynamics of liquids (stability, energy, dissipation);
- use of attitude detectors and gyros for spacecraft control;
- studies of gravity gradient and solar sailing;
- expert systems for control and diagnosis;
- studies of rendez-vous and docking of spacecraft in-orbit.

ROBOTICS

- kinematics and dynamic analysis and simulation;
- control systems and algorithms computation;
- robot programming and calibration;
- diagnostics, planning and recovery;
- sensor and sensor based control system;
- joints and electro-mechanical actuators;
- wrist, end-effectors and grippers;
- electronic and electro-magnetic drives;
- collision avoidance and intelligent control;
- teleoperation and man-machine interface;
- space payload servicing and automation;
- space capture and berthing.

OPTICS

- advanced optical detectors (solid state, single point, array, matrix);
- advanced optical instrumentation for earth observations;
- optical computers;
- components for astronomy observations in the various regions of the spectrum;
- advanced optical methods for pattern recognition, data transfer, etc.;
- coherent, superheterodyne and homodyne detection.

ENERGY CONVERSION

Solar cells and arrays

- silicon solar cell efficiency improvement and testing;
- GaAs solar cell assessment, module interconnection technology;
- solar array assessment such as electro-magnetic interference and failure mode effects;
- investigation of large (multi-KW) deployable arrays;

- investigation of solar array – plasma interactions.

Assessment of solar thermodynamic generators.

Batteries:

- development of new battery couples (metal hydrogen, fuel cells, sodium sulfur, lithium, etc.);
- analysis of test results and impact on charge control.

Electronics power conditioning and control:

- optimization for missions with large variations sun distance, for multi kW power range or for wide fluctuations in power demand; AC power generation and distribution;
- high voltage converter design, incorporation of thick and thin film technology in power conditioning and control subsystems;
- investigation of EMI and EMC aspects of power distribution systems;
- investigation of ESD (electrostatic discharge);
- components for power systems and computers modeling of performances.

Thermoelectric conversion (application to radioisotope source)

Energy storage by flywheels

SPACE ENVIRONMENT

- electro-magnetic shielding at low frequencies;
- prediction of electromagnetic interference on-board spacecraft;
- control of spacecraft vibration tests;
- alternative test methods to space simulation;
- modal survey tests versus systems tests, influence on cost, reliability and schedule;
- spacecraft model philosophy, its influence on reliability, cost and schedule.

PRODUCT ASSURANCE

- cost effectiveness;
- availability and maintainability in space segment;
- reliability of mechanical systems;
- electronic, electrical and electro-mechanical components:
 - physics failure and reliability;
 - new failure analysis techniques for complex integrated circuits;
 - effects of space radiation (e.g. particles, ions, X-rays) on advanced
 - semi-conductor technologies;
 - radiation hardening of MOS technologies;

- materials:
 - materials properties in relation to the space environment;
 - new materials in relation to all technological areas;
- bio-compatibility of components in closed environmental systems;
- software product assurance:
 - tools development;
- database:
 - product assurance data collection and validation;
- experts systems for RAMS;
- sneak circuit analysis.

SYSTEMS ENGINEERING

Applications:

- long term mission studies to determine technology development needs;
- studies on definition and coherence of the future space programs;
- spacecraft and launcher system engineering concepts, optimisation;
- space systems utilization and missions studies;
- space operations in orbit servicing and support.

Tools and tool applications:

- CAD for system level applications, visualization tools;
- expert systems and A.I in system design;
- large collections of data – their handling and analysis including technical performance of systems and their costs, technology databases.

GROUND SEGMENT TECHNOLOGIES

Study, development and validation of ground based technologies for support of mission operations in the following fields:

- Ground data processing facilities for spacecraft monitoring and control, mission planning and management: expert systems, advanced man-machine interfaces, fault tolerance systems, object oriented techniques, etc.;
- Communication network concepts and protocols supporting different media and modes of operation within the environment of space to ground link.
- Spacecraft attitude and orbit determination and control: modeling, numerical methods and techniques, manoeuvre optimisation.
- Ground station monitoring and control, data acquisition and transmission processing including associated coding techniques in different RF bands.
- Space debris assessment: debris observation techniques, modelling of space debris environment, debris risk analysis.

APPLIED MATHEMATICS AND DATA PROCESSING

APPLIED MATHEMATICS

- mathematical analysis;
- numerical integration;
- estimation of theory;
- optimisation procedures;
- dynamic analysis of non rigid systems;
- orbital calculations and mission analysis;
- CFD: computational fluid dynamics;
- simulation of physical systems;
- simulation and emulation of logical (computerized) systems with embedded software;
- scientific and engineering data processing;
- software engineering;
- knowledge based systems.

ON-BOARD DATA PROCESSING AND SIGNAL PROCESSING

- VLSI design methods (analogue and digital);
- data compression (lossless and lossy);
- data storage;
- autonomous real time data systems;
- programming languages for real-time application;
- simulation of data systems;
- expert systems and artificial intelligence for fault recovery and planning;
- SAR processing;
- vision processing for robotics;
- video processing and compression.

SIMULATORS

- simulators for named systems;
- flight simulators;
- virtual reality simulation;
- simulator of human body and its motion;
- specialized computer software and hardware for high performance real-time simulators;
- Artificial Intelligence and Expert Systems, applications and standardization;
- planning and timelining software tools;
- astronaut training methods and tools.

ON-BOARD COMPUTERS

- fault tolerant computer systems;

- software validation for real-time systems using formal methods;
- design of failure tolerant highly reliable digital hardware;
- real time distributed operating systems.

ORBITAL AND ATTITUDE DYNAMICS

- orbital manoeuvres/corrections;
- orbit optimisation, optimisation of manoeuvres;
- a priori error estimation;
- tracking method, calibration;
- orbit determination and differential correction, sequential estimation;
- motion about mass centre;
- optimisation of attitude manoeuvres;
- interactions of orbit and attitude manoeuvres;
- attitude control of flexible satellites.

CELESTIAL MECHANICS

- analytical and numerical theories;
- manipulation of algebraic expressions.

INFORMATION SYSTEMS DEVELOPMENT

- object oriented database;
- multimedia archive creation and retrieval;
- documentation management system;
- knowledge base retrieval systems.

Annex 2

GUIDELINES TO SELECTING A HOST INSTITUTE

(for External Fellowships)

A host institute can be a University department or group or an institute active in the field of research in question.

It is impossible to provide a complete list of host institutes in ESA Member States and outside the Member States covering all space related activities. We therefore advise applicants to obtain information from their national space centre, or to contact an ESA office involved with the relevant research.

The ESRIN Personnel Service will also be able to assist with establishing contacts between applicants and ESA personnel who can help in providing information about host institutes.

Annex 3

ESA FELLOWSHIPS STIPENDS

(in local currency)

External Fellowships

The monthly rate of the stipend (before deduction of the contribution to the Social Security Scheme) is presently as follows:

| LOCATION | CURRENCY | AMOUNT |
|----------------|----------|-----------|
| AUSTRIA | EURO | 2,606.63 |
| BELGIUM | EURO | 2,352.56 |
| CANADA | CND | 2,715.60 |
| DENMARK | DKK | 22,824.60 |
| FINLAND | EURO | 2,797.00 |
| FRANCE | EURO | 2,675.94 |
| GERMANY | EURO | 2,573.54 |
| IRELAND | EURO | 2,611.60 |
| ITALY | EURO | 2,373.95 |
| NETHERLANDS | EURO | 2,577.29 |
| NORWAY | NOK | 25,150.80 |
| PORTUGAL | EURO | 2,071.91 |
| SPAIN | EURO | 2,214.13 |
| SWEDEN | SEK | 24199.80 |
| SWITZERLAND | CHF | 5512.20 |
| UNITED KINGDOM | GBP | 1815.60 |
| UNITED STATES | USD | 2881.20 |

Internal Fellowships

Salaries for research fellows in ESA establishments refer to a special category of ESA grades for staff on research assignments. As an indication, basic salaries presently range from:

| | |
|-------|-------------------------------|
| ESTEC | from € 2,078.04 to € 2,715.71 |
| ESOC | from € 2,075.27 to € 2,711.76 |
| ESRIN | from € 1,913.60 to € 2,501.31 |

Annex 4

NATIONAL ESA DELEGATIONS

AUSTRIA

Mr. K. PSEINER
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Direction des Programmes & des Affaires Industrielles
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GERMANY

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