



## EUROCORES Programme

# Smart Structural Systems Technologies (S3T)

***The theoretical and experimental bases for the integration of sensor and system developments into mechanical, civil and other structural engineering systems in order to facilitate extensive monitoring and structural management***

## *Call for Outline Proposals*

### **What is a EUROCORES?**

The EUROCORES (ESF Collaborative Research) Scheme is an innovative ESF instrument to stimulate collaboration between researchers based in Europe to maintain European research at an international competitive level. The principle behind the EUROCORES Scheme is to provide a framework for national research funding organisations to fund collaborative research, in and across all scientific areas. Participating funding agencies (national research councils and academies and other funding organisations) jointly define a research programme, specify the type of proposals to be requested and agree on the peer review procedure to be followed. The ESF provides support for the networking of funded scientists while the funding of the research stays with national research funding organisations. Further background information on EUROCORES Scheme may be found on the ESF web site (<http://www.esf.org/eurocores>).

### **Research funding opportunities in the field of S3T**

Following agreement with funding bodies from *Austria, Belgium, the Czech Republic, Finland, France, Hungary, Ireland, Italy, the Netherlands, Poland, Portugal, Slovakia, Spain, Turkey, and the United Kingdom*, the European Science Foundation is launching a first Call for Outline Proposals for collaborative research projects (CRPs) to be undertaken within the EUROCORES programme S3T. The programme will run for up to five years and includes national research funding and a European networking component. Information on the programme is also available on the ESF website <http://www.esf.org/s3t>.

***Proposals are sought for collaborative research projects.***

### **Context for a Programme in S3T**

Major incidents due to failures in engineering infrastructure, modern transportation or other spheres of human activity are becoming less acceptable; zero-risk protection of citizens is now a long-term aspiration of governments. Whether it is civil infrastructure, industrial plant, or a fleet of trains or aircraft, operators and engineers are under pressure to make every possible effort to assure public safety, including the procurement of new technology, whilst at the same time being under pressure to achieve substantial increases of operational efficiency and cost

reduction. There is consequently less focus on the design of new structures and more on the long-term goal of extending indefinitely, through minimum intervention, the safe and economical operational lifetime of individual structural components and entire systems. This task is comparable with medical research working to extend the life of human beings; in both cases the steps are condition assessment, health monitoring and control.

### **S3T – A Smart Structure Approach**

A “smart structure” is a system that has the ability to learn about its environment (i.e. its static & dynamic condition including the presence of defects), process the information in real time and reduce uncertainty, and generate and execute control actions in a safe and reliable manner to accomplish the desired objectives (i.e. maintenance of structural integrity and continued safe & efficient operation). The EUROCORES S3T programme seeks to lay down theoretical and experimental bases for the integration of state-of-the-art sensors into systems to monitor and control major structures. Extensive monitoring, structural management and more generally the development of smart structures and systems are the technologies focussed upon. A truly multi-disciplinary approach is required, since monitoring techniques and instrumentation, which have originated within the disciplines of physics and electronics, must be combined with mechanical and civil engineering knowledge to ensure a realistic appreciation of the

engineering environment in which a smart structural system must function. “Mechatronics”, which combines mechanics, electronics and information technology, is one example of a multi-disciplinary approach. The field of sensors has recently made important advances with the development of new sensing devices, based on MEMS, ultrasonic and piezocomposite arrays, fibre Bragg gratings (FBG) and other sensing and/or nano-technologies. Capabilities are scattered widely throughout Europe’s research base and need to be brought together, arguing for a truly European approach. A further challenge is to identify those developments in entirely different sectors which might be relevant to smart systems and to translate the technology across the sector boundaries.

### **Priorities and Areas of research**

The following are important priorities in this strategy:-

- Formulation of end user requirements, including a better understanding of goals and bottlenecks and how they impinge on technology. The identification of innovative case studies in collaboration with industry.
- Assessment of existing sensor and evaluation technologies and investigation into new sensors and methods, including remote sensing, sensor fusion and network methodologies.
- Improvement of the level of structural smartness, e.g. on-line damage detection, and integration into structural control feedback; more advanced assessment methodologies for increasingly complex multidisciplinary hardware systems.
- Exploitation of advances in digital electronics, communications and the Internet to enable autonomy and/or tele-monitoring. Improving system reliability.
- Development of modelling for problems arising in health monitoring & control.
- Strategies for multidisciplinary technology transfer including professional training.

To meet these priorities and have a wide impact across Europe requires a large research effort.

**Proposals are sought for one or more areas of research, examples of which are listed below, that are consistent with the above priorities.** The list is intended to illustrate main themes within a coherent multidisciplinary approach, but is not intended to be exclusive – novel approaches not listed would be welcome. Research proposals should be aimed at non-military structures and must be transnational in implementation. Although there are some differences between different sectors, such as aerospace, mechanical and civil structures, their needs are listed together to stress the desire for a generic approach:-

### **1. Modelling of structures and machines**

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- Modelling of structures and machines as dynamic systems
- In-service degradation of structural materials and damage assessment
- Sensors and actuators as integrated structural elements
- Modern techniques of shape and feedback control

### **2. Sensors & Actuators**

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- Capability to detect, locate and quantify damage and degradation directly
- Sensing effects; improved transduction and actuation; design and evaluation
- Optimisation of emerging technologies for structural application
- Dense & sparse transducer arrays for locating damage and control
- Global, non-contact and remote sensors for structural health monitoring
- Accuracy, reproducibility, reliability & durability
- Cost, fitness for purpose, size reduction, attachment and accessibility
- Intelligence
- Energy requirement strategies and power supplies

### **3. Systems**

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- Wireless and networked sensor systems
- Power supplies
- Fault tolerant & reconfigurable sensor systems & networks

- System design tools & strategies, including integrated platforms for sensors
- Networking strategies for a wireless and potentially hostile environment
- Connectivity & communication, remote monitoring, diagnostics
- Advanced modelling of complete monitoring & control systems
- Hierarchical processing and communication schemes
- Data management and storage

#### **4. Analysis & Decision-making**

- Signal processing and analysis software for condition monitoring & control
- Data reduction and management, sensitivity analyses
- Data acquisition strategies including hierarchical processing and the utilisation of advances in telecommunications
- Inverse modelling for data interpretation
- Interpretive software for integrated systems to enable decision-making and to guide consequential actions
- Structural performance evaluation and damage assessment
- Linkage into management systems to define maintenance & control procedures
- Decision procedures for accident situations, alarm procedures

## **Programme structure and management**

The programme will run for three to five years with research funding starting in late 2005.

The programme will be overseen by a *Management Committee* formed by one representative from each participating national funding agency and a representative from the ESF.

An independent international *Review Panel* formed of leading scientists in the field, with a mandate from the funding agencies, will undertake and oversee the peer review assessment of proposals to the Programme.

Outline proposals will be screened by the Review Panel, with successful applicants being invited to submit full proposals.

Full proposals will be internationally peer-reviewed. Referees will be selected by the ESF, principally using a pool of international scientists whose names are provided by the participating national funding agencies. Based on the results of refereeing, the Review Panel will recommend and prioritise the best applications for funding by the national funding agencies of the selected applicants. The membership of the Review Panel and the names of referees used will be published after the selection process is complete.

Funding of the proposals recommended by the Review Panel will depend on the total amount of money made available in each country by the national funding agencies supporting the Programme. The use of funds in a project will be subject to the rules of each national funding agency supporting that project as well as to the national laws of those countries.

Once launched, the Programme will support successful projects and applicants by networking them to facilitate cross-project communication, exchange of information and presentation and discussion of results. To this aim, scientific workshops, conferences, publications and similar activities will be organised on a regular basis, coordinated by a *Programme Coordinator* appointed by ESF who will be advised by a *Programme Science Committee* formed of representatives from the projects. Web facilities will be made available and/or supported.

# Guidelines for proposals

Proposals from individual scientists and research groups from the countries participating in the programme will be accepted, subject to the eligibility rules of their national funding agency participating in the EUROCORES S3T. Priority will be given to applications from individual scientists/groups planning to undertake cross-disciplinary research together with scientists in other European countries participating in the EUROCORES S3T. **Proposals must, as a minimum, involve 2 eligible groups or individuals from 2 countries (ie 1 each) participating in the programme.** Proposals involving larger collaborations will be welcome.

The involvement of *Associated Scientists* or *Associated Groups* not eligible to apply to these agencies for funding, and from industry, is acceptable where their added value to a proposal is justified in the scientific case. Their participation must be fully self-supporting and will not be financially supported by the Programme.

As well as relevance to the S3T programme and overall scientific quality/excellence of the proposal, the following criteria will also be taken into consideration:

- Originality/Novelty
- Feasibility and Methodology
- Level of transnational collaboration (especially European scientific added-value) particularly between the participating groups
- Level of multi-disciplinarity
- Suitability of the proponents (eg expertise and track record)
- Budget/value for money

Applications should normally be for three years although applications for shorter or longer time periods may be considered. Taking into account the selection and approval processes, requested project start dates should be on or after July 2005.

It will be assumed that arrangements for the handling of ipr (Intellectual Property Rights) will be in place within projects, following the applicable national legislation and national funding agency rules. Applicants are strongly urged to have such arrangements in place, covering all research groups (including any *associated groups*) before the start of any project. It is expected that the results of the projects supported by this EUROCORES programme will be placed in the public domain and published in accordance with normal academic practice.

The application procedure will take place in two steps:

- the first for outline proposals;
- the second for invited full proposals.

## Outline proposals

As a first step, outline proposals are invited by the close of **2 November 2004**. A short proposal, with a scientific rationale of up to 1500 words and details of the collaboration, must be completed following the application guidelines for Outline Proposals. All intended partners (e.g. national, international, industry, university) should be clearly indicated. Any equipment necessary should be specified and an estimate of the total project costs should be included. An Outline Proposal should normally be made by the potential *Project Leader* (see below) of a successful full application. Outline Proposals may include a one-page curriculum vitae of the partners, including a list of their five most important publications.

The programme Review Panel will screen the outline proposals. The Panel may give recommendations concerning the further development of a proposal such as suggesting joining forces with teams in other countries. It may also reject proposals that are considered either not to fit within the scope of the programme or to be non-viable. Successful applicants will be notified by January 2005 and invited to submit full proposals.

**For detailed information, eligibility for funding or restrictions of the participating funding agencies, please contact the contact person listed on page 6.**

**Outline proposals should be sent by email (in one attachment only) in pdf or rtf format by close to 2 November 2004 to:**

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Tel: +33 3 88 76 71 27  
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## **Application Forms**

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There is no application form for outline proposals. Applicants should follow the proposal structure indicated in the Outline Proposal Application Guidelines.

## **A second Call for Proposals**

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A second call may be established with the agreement of the funding agencies.

## **Full proposals**

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As a second step, full proposals will be invited. The deadline for full proposals will be announced, but will be on or about **1 March 2005**. Full proposals must include a well-argued scientific case, a list of participants, a detailed budget and other supporting information. To integrate multi-national applications, a single, common scientific case must be submitted; however, the amount requested from each national funding agency has to be clearly and separately specified.

*Detailed instructions on requirements and how to complete the application forms will be made available.*

The *Principal Investigator* (leader) of each eligible group in the project seeking funds will be required to provide information which will form the basis for any subsequent award from the relevant funding agency. It is expected that the *Project Leader* will be the *Principal Investigator* of their group.

The *Project Leader* will act as the principal contact for the proposal, and for the duration any subsequent project. The *Project Leader* will be responsible for representing the project, for its participation in programme activities, and for any reporting requirements placed on the project as a whole as part of the programme. *Principal Investigators* will be responsible for dealing with the requirements attached to the contributions of their own funding agencies.

Funds requested within the EUROCORES S3T should be for the additional costs of participating in the project and can include items like salary for temporary scientific and technical staff, equipment, travel and networking costs within the project, fellowships, etc according to the rules of the participating national funding agencies. Major items of expenditure will require justification in the proposal. ESF will provide support for inter-project networking and other cross-programme activities.

Full instructions and application forms will be available on the web site (<http://www.esf.org/s3t>) after the full proposal stage has started.

# Participating agency contacts

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## Italy

(please note that all Italian proponents must contact the CNR to check conditions of eligibility before submitting their proposals)

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