

**SINGULAR SCIENTIFIC AND
TECHNOLOGICAL INFRASTRUCTURES
(ICTS)**

Background

Singular Scientific and Technological Infrastructures (ICTS) are a most relevant factor for advancing in the experimental scientific progress and technical development of a country. These facilities are also a source of dynamism for the economy due to the strong involvement of private companies during their construction and development phases. During the exploitation phase they have also implications in the economic dynamics of their environments. Spain has traditionally had a deficit in this kind of infrastructures.

The **Ingenio 2010** strategic programme, presented in 2005, has identified a set of long-term goals that, regarding the Singular Scientific and Technological Infrastructures, can be summarised as follows:

1. To increase the availability of this kind of infrastructures for Spanish science and technology, considering both the construction of new facilities within the national territory as well as the participation in other facilities of international character.
2. To maintain and improve the technological and scientific capacity of existing infrastructures, consolidating and enhancing their competitiveness.
3. To facilitate the access to these facilities of all interested groups, either national or international, for carrying out research projects or for training in the use of the specific technologies of the facility.

For pursuing these goals, a strategic 15-years-horizon plan called 'Spanish Map of Singular Scientific and Technological Infrastructures' has been designed and is being developed in order to achieve the following objectives:

1. To contribute to territorial balance and cohesion by choosing the optimal location for the new infrastructures according to their goals and the industrial, technological and scientific environment. This will facilitate indeed the development in the selected region. This general policy will be developed for every new initiative with the financial and political support of the Autonomous Communities (Regional Governments), which will contribute with complementary resources to those provided by the Spanish Government.
2. To foster the internationalisation of the Spanish facilities, and the Spanish participation in new European initiatives.
3. To facilitate the creation of a wide network of companies with high technological knowledge, well positioned to compete in the international market, in particular when tendering for work packages for developing hi-tech projects.
4. To promote the socio-economic progress in the geographical area around the facility, often acting as real drives for regional development.

Current situation

Spain has 22 ICTS recognised as such by the CICYT (Inter-Ministry Commission for Science and Technology), the sole body entitled to award the ICTS label. The largest

part were constructed during the 80 and 90s, often without any previous planning. They have been the result of valuable initiatives and are playing an outstanding service to the technological and scientific community since then.

The National R&D Plan (2004-2007) is financing the maintenance, modernization, eventual enhancement and use of the existing ICTS through successive calls, with budgets of 5 M€ (2005), 7 M€ (2006) and 5 M€ (2007)

The list of the 22 ICTS is the following:

1. ***Solar Platform of Almería***
2. ***Astronomical Centre of Calar Alto***
3. ***Radiotelescope of IRAM in Pico Veleta***
4. ***Scientific Reservoir of Doñana***
5. ***Teide Observatory***
6. ***Roque de los Muchachos Observatory***
7. ***Astronomical Center of Yebes***
8. ***Communications and Computing Centre of Catalunya (CESCA)***
9. ***Nuclear Magnetic Resonance Laboratory of the Barcelona's Scientific Park***
10. ***Clean Room of the Microelectronics National Centre***
11. ***Barcelona Supercomputing Centre-National Supercomputing Centre***
12. ***Center for Coastal Resources Research (CIEM)***
13. ***Thermonuclear Fusion device TJ-II of CIEMAT***
14. ***Safe Biological Installation of CISA (INIA)***
15. ***Singular Infrastructures for civil engineering in CEDEX***
16. ***Red-IRIS Network of advanced telematic services***
17. ***Technological Centre of the Opto-electronic Systems Institute in the Polytechnic University of Madrid***
18. ***El Pardo Model Basin (CEHIPAR)***
19. ***Oceanographic Research Vessel Cornide de Saavedra***
20. ***Oceanographic Research Vessel Hespérides***
21. ***Spanish Antarctic Stations Juan Carlos I and Gabriel de Castilla***
22. ***Canfranc Underground Laboratory***

One of them has recently been re-structured:

(11) **National Supercomputing Centre - Barcelona Supercomputing Centre.** In April 2005 a collaboration agreement among the Ministry of Science and Education, the Generalitat de Catalunya (Regional Government) and the Polytechnic University of Catalunya was signed for the creation and exploitation of this centre. Its main objective is the research in Computing Sciences and e-Science, specifically in Life and Earth Sciences.

The Centre started operation equipped with the MareNostrum SuperComputer by IBM, with a processing capacity of 42 Tflop/s, the highest in Europe. In October 2006 the Marenostrum 2 device is added, a new supercomputer with a processing capacity of 62,63 Tflop/s, the highest in Europe and the fifth in the world. Out of this centre, the creation of a distributed supercomputing network which will cover the

calculus necessities of the different Spanish research groups is in the development phase. This network is taking off with 4 nodes in Andalucía, Aragón, Canarias and Madrid, all of them made up from components from the first Marenostrum supercomputer.

Another 4 infrastructures can be added to the existing-ICTS list, these are facilities in a prominent development phase though not yet identified as ICTS by CICYT. They are the following:

1) ALBA Synchrotron

Alba synchrotron is a electron accelerator that will allow to generate X-Ray beams of high brilliance and concentration, used to learn more about the solid matter structure in different fields: pharmacy, new materials, etc.

Its construction is financed 50% each by the Ministry of Science and Education and the *Generalitat de Catalunya*. It is placed in *Cerdanyola del Vallés* (Barcelona) and its start-up phase is scheduled by year 2010.

2) Oceanographic Vessel SARMIENTO DE GAMBOA

The oceanographic Vessel Sarmiento de Gamboa will be a multipurpose ship. Its construction is financed by the Ministry of Science and Education, CSIC and Xunta de Galicia. Vigo harbour will be its operating headquarters and 2008 is scheduled as its first year of operation.

3) Large Telescope of CANARIAS

The Large Telescope of Canarias will be the first European telescope built-up using the segmented mirrors technique, what allows reaching a high performance. The University of Florida, the National Autonomous University of México, the Canary Islands Government and the Ministry of Science and Education participate in its construction. Its operation is scheduled to start by the end of year 2007.

4) CENIEH

This facility is set-up as a consortium, co-financed 50% each by the Ministry of Science and Education and Junta de Castilla y León, aiming at the construction, equipment and exploitation of the Research National Centre of Human Evolution (CENIEH). This center is located in Burgos.

Finally, the following project can be also considered:

5) Neutron Spallation Source

The European Union, through the European Strategy Forum on Research Infrastructures (ESFRI) has identified the European Spallation Source (ESS) as a priority infrastructure for the European science and technology. Besides, the advanced state in the design and the scientific case of this facility makes viable the quick start of negotiations in order to launch the project in a very short time. The budget involved for its construction, operation and maintenance leads to the need of pan-european collaboration, which will be implemented by means of financial contributions from the interested countries.

A collaboration agreement between the Ministry of Science and Technology and the Basque Country Government has recently been signed, which enables the preparation of a Spanish candidature for hosting this emblematic project in Bilbao.

These **5 Research Infrastructures** (Synchrotron, Sarmiento de Gamboa Vessel, Large Telescope of Canarias, Spallation Source and CENIEH), which have been the result of bilateral cooperation agreements between the State General Administration and the corresponding Autonomous Communities', are incorporated to the Map of existing facilities.

A **third group of ICTS**, which has also been incorporated to the existing-facilities list under proposal from the Autonomous Communities, are those which, even if they fulfil the ICTS requirements, they have not been yet approved and recognised as ICTS by the Permanent Commission of CICYT.

The ICTS Map proposal

The list of ICTSs in the strategic National Map is shown below. The right column shows the existing Infrastructures, the center-left column those proposed and approved to be built in the coming 15-20 years. Both columns make up the ICTS Map.

Singular Scientific And Technological Installations included in the Map

Autonomous Community	Proposals for new ICTS	Existing ICTS or being constructed
ANDALUCÍA	<ul style="list-style-type: none"> • Services and Data Centre for Social Sciences. • Renewable Energies Facility 	<ul style="list-style-type: none"> • Solar Platform in Almería • Astronomical Centre in Calar Alto • Radiotelescope of IRAM in Pico Veleta • Scientific Reservoir of Doñana • Supercomputer Node • National Accelerators Centre
ARAGÓN	<ul style="list-style-type: none"> • Advanced Microscopy Laboratory 	<ul style="list-style-type: none"> • Canfranc Underground Laboratory • Supercomputer Node.
ASTURIAS	<ul style="list-style-type: none"> • Coastal Observatory System 	
BALEARES	<ul style="list-style-type: none"> • Coastal Technological Platform 	
CANARIAS	<ul style="list-style-type: none"> • Oceanic Observatory Platform 	<ul style="list-style-type: none"> • Teide Observatory • Roque de los Muchachos Observatory • Large Telescope of Canarias • Supercomputer Node
CANTABRIA	<ul style="list-style-type: none"> • Large Tank for Maritime Engineering 	<ul style="list-style-type: none"> • Supercomputer Node.
CASTILLA LA MANCHA	<ul style="list-style-type: none"> • Hydrogen Technology and Fuel Cells Facility 	<ul style="list-style-type: none"> • Astronomical Centre of Yebes
CASTILLA Y LEÓN	<ul style="list-style-type: none"> • Ultraintense Pulsed Lasers Facility 	<ul style="list-style-type: none"> • CENIEH
CATALUÑA	<ul style="list-style-type: none"> • Proteomic Structural Biology installation, linked to the ALBA Synchrotron • "Mouse-clinic" Platform 	<ul style="list-style-type: none"> • Communications and Computing Centre of Catalunya (CESCA) • Laboratory of Nuclear Magnetic Resonance

		<ul style="list-style-type: none"> • Clean Room of the National Centre of Microelectronics • National Supercomputing Centre (Marenostrum2) • Center for Coastal Resources Research (CIEM) • ALBA Synchrotron • International Centre for Numerical Methods in Engineering
EXTREMADURA	<ul style="list-style-type: none"> • Grid Facility 	
GALICIA	<ul style="list-style-type: none"> • Oceanographic Unit • Finis Terrae Supercomputer 	<ul style="list-style-type: none"> • Oceanographic Research Vessel Cornide de Saavedra • Sarmiento de Gamboa Vessel
LA RIOJA		
MADRID	<ul style="list-style-type: none"> • Singular Installation for Fusion Technology • Medical Image Treatment Facility 	<ul style="list-style-type: none"> • Thermonuclear Fusion device TJ-II • Safe Biological Installation of CISA • Singular Infrastructures for civil engineering • Red-IRIS Network • Technological Centre of the Opto-electronic Systems Institute • El Pardo Model Basin • Supercomputer Node • Advanced Microscopy Facility
MURCIA	<ul style="list-style-type: none"> • Acuiculture and Oceanographic Facility • Research Platform for Hydro Resources 	<ul style="list-style-type: none"> • Oceanographic Research Vessel Hespérides
PAÍS VASCO	<ul style="list-style-type: none"> • European Spallation Source • Molecular Image Facility 	
NAVARRA	<ul style="list-style-type: none"> • Medical Image Facility and Diagnose • Biofuels Installation 	<ul style="list-style-type: none"> • CENER
VALENCIA	<ul style="list-style-type: none"> • Medical Physics Centre. • Motor tests facility for the aeronautic, maritime and automotive industry. 	<ul style="list-style-type: none"> • Supercomputer Node.
		<ul style="list-style-type: none"> • Antarctic Stations Juan Carlos I and Gabriel de Castilla

Spanish participation in international research infrastructures

Spain participates in the following international and European Infrastructures:

1. ***Atacama Large Millimeter Array (ALMA)***
2. ***European Organization of Nuclear Research (CERN)***
3. ***European Synchrotron Radiation Facility (ESRF)***
4. ***Institut Max von Laue-Paul Langevin (ILL)***
5. ***European Molecular Biology Laboratory (EMBL)***
6. ***Neutrons Source ISIS***
7. ***Beamline BM16 in ESRF***
8. ***Beamline BM25-SpLine in ESRF***
9. ***Instruments D1B y D15 in ILL***
10. ***Spain also participates in the European Spatial Agency (ESA), being the Ministry of Industry the financing body.***

Besides these, further recent progress in the Spanish participation in international organisations and new research infrastructures must be highlighted:

- ***Spanish Adhesion to the European Southern Observatory(ESO)***

ESO is the most important European entity for astronomical observations from earth. Spain belongs to the most relevant European and multilateral organizations in this field of Science and Technology except ESO. The reasons for this have several origins, though mostly the difficulties for paying the special quota of entry which amounts a proportional part of the investments already made by the organization.

A significant part of such special contribution will be provided in kind. A large part of it, through a scientific program to be developed at the Large Telescope of Canarias (GTC).

The adhesion to ESO, in force since February 2007, allows the participation in the design phase of the next large project of ESO, the Giant Telescope ELT (Extremely Large Telescope, ELT) as well as in the following phases of construction and scientific exploitation of the facility. Even more, Spain is considering the possibility for bidding to host this large facility nearby the Roque de los Muchachos Observatory, in La Palma island.

- ***X Free Electron Laser (X-FEL) and Facility for Antiproton and Ion Research (FAIR)***

Through the signature of a Memorandum of Understanding (MoU) the Ministry of Education and Science has participated in the preparation phase of these projects, and Spanish research groups and companies have been financed for contributing to the development of both projects in several topics of high technological content.

- ***ITER Project***

ITER is an effort of international cooperation to construct and operate an experimental fusion device. ITER intends to demonstrate the feasibility of energy production from fusion processes. Furthermore, it aims at obtaining the technological knowledge necessary to design, construct and operate the future fusion power plants.

The ITER project is a unique effective international collaborative model in science and technology. The partners of this outstanding project are the European Union, Japan, Russia Federation, United States, South Korea, China and India. These regions represent more than half the World population. The project will be built in Cadarache, France, and the European Agency in charge of managing the European technological contribution to this project will be located in Spain (Barcelona).