



2018 - 2021

STRATEGIC PLAN
Instituto de Astrofísica de Canarias



Executive Summary

Fecha de preparación del Plan Estratégico: Marzo 2017

EXECUTIVE SUMMARY

The IAC is a largest astrophysics research centre in Spain. The principal objectives of its new Strategic Plan are to seek excellence in science and **strengthen and consolidate the IAC's position as a centre of reference for astrophysical research.**

For the period 2018-2021 the main efforts will be devoted to achieving:

1. **RESEARCH EXCELLENCE AND TECHNOLOGICAL POTENTIAL**, The Strategic Plan involves exploration and discovery using major world facilities (like GTC, VLTs and space observatories), developing further physical insight, advanced modelling, innovation in technologies/techniques for ground/space observatories, and generation of new knowledge in key areas of astrophysics with impact in fundamental physics.

The IAC scientific program will address problems on: very high energy phenomena in the Big Bang and around black holes, the genesis of cosmic and gamma-rays, formation and evolution of galaxies, the life cycles of stars, physics under strong gravity fields, the physics of magnetic fields in the Sun, and the detection and characterization of Earth-like planets in nearby stars. The IAC will use and will develop a large variety of cutting edge ground/space facilities and attract new excellent young/senior researchers to develop advances and breakthroughs in physical modelling, computer simulation and technology.

To accomplish this, IAC will continue developing advanced telescopes and instrumentation for major ground-based observatories (e.g. CTA, GTC, EST, VLT, E-ELT, WHT, GREGOR) and space observatories (e.g. Euclid, Plato). In the next four years, technological activities will focus on high spectral resolution (HIRES, HARPS3, NIRPS, HORS), high spatial resolution (e.g. GTC/O/LGS, AOLI, EST, AO), optical and infrared 3D spectroscopy (e.g. HARMONI, WEAVE, FRIDA, MIRADAS) and microwave instrumentation (e.g. QUIJOTE).

2. **INTERNATIONAL DIMENSION**, promoting a sustainable framework of international collaborations with the top-class research centres worldwide. International collaboration is in fact one of the defining characteristics and strengths of the IAC. The interaction with world-leading institutions and scientists stimulates top-quality research, both in collaboration with our partners, as well as from the activity originated and led by our researchers. The main evidence of the level of present international collaboration comes from the fact that the vast majority of research articles produced by the IAC, around 95%, are published with international co-authors. Moreover, the IAC is part of many international consortiums for the development of advanced astronomical instrumentation.
3. **ADVANCED TRAINING AND SOCIAL COMMITMENT**. Based on a long-term partnership with University of La Laguna for graduate students, a very intense training program is proposed which would lead to at least 50 new PhDs being defended over the next four years. IAC aims to hire 25-30 post-docs and 10

engineers every year (typically with contracts of 2 or 3 years) and will continue the annual organisation of the “Canary Islands Winter School of Astrophysics”. Moreover, the IAC will foster its *SOCIAL COMMITMENT* by (1) enabling the best scientific and technological value for its research infrastructures and facilities; (2) promoting dissemination of science and public awareness; and (3) exploiting its technological capabilities in terms of socio-economic development; and (4) coordinating a series of activities addressed to provide high-level training through vocational internships of students in communication, accounting, project management and technical training, among others.

In addition, IAC aims to develop its active technology transfer program in close collaboration with industry to develop payloads for small satellites and applications in biomedicine.

The IAC faces outstanding opportunities: research infrastructures that will be installed in the *Observatorios de Canarias*, space missions which could imply significant enhancement of our research activities; instrumentation projects for current and future telescopes, etc. Taking advantage of these opportunities requires strong and timely political and economic support, increased flexibility in public procedures, a significant increase of our capacity to recruit the best specialists from anywhere, and a higher number of scientific leaders - among other key aspects.

As regards the evolution of the IAC’s Human resources, in 2017 the IAC staff numbers about 380 people (including ULL & CSIC staff based at the IAC). Around 50% of the positions are dedicated to research (permanent researchers, post-docs and PhD students) around 80 positions are high level engineers (permanent and temporary), and the rest provide technical and administrative support. A proposal is made for the next four years to incorporate 13 new permanent positions for research and to significantly increase the number of permanent (16) and temporary (30) engineering contracts to accomplish the development of new large telescopes (CTA, EST) and new technology programs (IACTEC). In addition, 13 new administrative and technician positions are also planned. So, the IAC staff would reach a total number of 450 by 2021.

A budgetary plan is proposed to recover by fiscal year of 2018 the level of stable funding the IAC had before the international financial crisis, and consolidate by year 2021 a minimum budget contribution by the Public Administration, referred hereafter, as internal funding, of 20 M€ p.a. .

External funding obtained via competitive calls currently obtains about 7 M€ p.a. for the IAC’s Research and Technology Programmes. Additional external funding will be actively pursued beyond 2017. The participation of the IAC in several large-scale projects, which we designate as Large Institutional Projects (CTA, EST, LT2, TMT, IACTEC), is expected to generate an additional external funding in the order of 15 M€/year.

To successfully accomplish the present Strategic Plan, there will be a synergistic collaboration between the IAC Divisions (Research, Technology and Graduate Studies) with the General Administration, which is responsible for the financial, economic, administrative, operational and budgetary management.

TABLE OF CONTENTS

i. Executive Summary

1. INSTITUTO DE ASTROFÍSICA DE CANARIAS

1.1. Vision, mission and values

1.2. SWOT analysis

2. THE 2018-2021 STRATEGIC PLAN

2.1. Strategic Goals

2.2. The Strategic Plan

2.3. List of Actions

1. INSTITUTO DE ASTROFÍSICA DE CANARIAS

1.1. Mission, vision and objectives

The Instituto de Astrofísica de Canarias (IAC) is a public research Consortium formed by the General Administration of the Spanish State (represented by the Ministry of Economy and Competitiveness), the Canary Islands Regional Government, the University of La Laguna and the Spanish National Research Council (CSIC).

<p>Mission</p> <p>To perform excellent research and technological developments in astrophysics, securing the appropriate training of graduate students, young researchers and engineers, promoting outreach and technology transfer in many different areas and fostering a fruitful and stable environment of international collaboration.</p>	<p>Vision</p> <p>International leadership in Astrophysics and Space Sciences, by delivering excellent scientific and technological outcomes, strengthening the “astronomical reserve” of the Observatorios de Canarias (OCC), and promoting the transfer of knowledge between scientific communities and society.</p>
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Objectives:

The IAC's main objectives, according to its statutes, are:

- a) to conduct and promote astrophysical research as well as to develop and transfer technology;
- b) to disseminate astronomical knowledge, collaborating in university teaching in the area of astronomy and training researchers and engineers in scientific and technical fields related to Astrophysics;
- c) to manage the centres, observatories and astronomical facilities already existing, as well as those to be built or assigned, and other related facilities,
- d) to promote relations with the national and international scientific communities

The IAC is governed by a Board (Consejo Rector) that is Chaired by the Minister of the Economy, Industry and Competitiveness and made up by the national and regional bodies which constitute the IAC.

The Director of the IAC reports to the Board, and is assisted by a Management Committee formed by the Vice Director, the IAC's Administration Manager and the Heads of the Research, Graduate Studies and Technology Divisions.

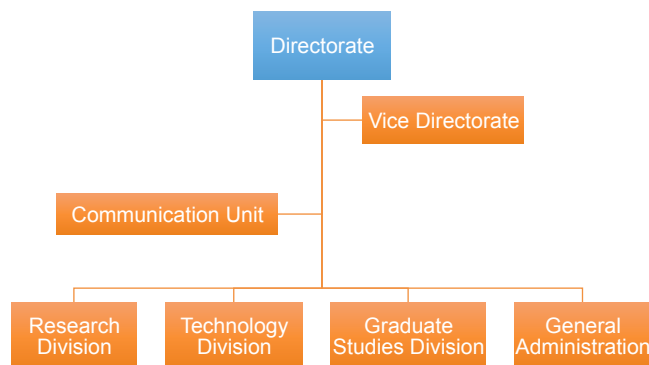


Figure 1

1.2. SWOT Analysis

The IAC faces outstanding opportunities but also threats. How the national policies on RTD activities will be implemented in the coming years by the corresponding public departments, and specially the management and levels of financial contributions to support these policies, will be of paramount importance to recover the level of activity within the IAC that existed at the beginning of the current crisis.

The following diagram shows in detail the strengths, weaknesses, opportunities and threats that have been identified in the IAC for the period covered by this Strategic Plan.

Strengths
<ul style="list-style-type: none">• Internationally competitive research and technology programme, spanning important areas of astrophysics.• Recognition as ‘Severo Ochoa Centre of Excellence’ by Spanish Government.• Two observatories exploiting the extraordinary astronomical quality of the heights of the Canary Islands, protected by law.• Sustainable funding model, with core contributions from the national and regional governments, and significant grant income.• Strong implantation in the Canary Islands, we are a reference for regional society.• Recognition and significant presence in external funding programmes.• Access to leading facilities, including ESO, ESA, GTC, WHT and other telescopes in Canary Islands.• Strong international agreements and collaborations.• Appropriate critical mass of research staff to keep leadership.• Strong links with the University of La Laguna for advanced training of PhD students.
Opportunities
<ul style="list-style-type: none">• Attract new large international infrastructures: EST, CTA, LT2, TMT,...• Full scientific exploitation of the GTC.• Development of advanced instrumentation for coming projects.• Astrophysics as a priority under the RIS3. Access to Canarian funds.• IACTEC as a hub element connecting with the private sector. Access to Cabildo de Tenerife funds.• Synergies between ground-based and satellite observations.• Attract external grant income for job creation and investment in RTD.• Use of local supercomputers and high-speed internet links to attract RTD partners that require heavy computer and data flow use.• Attract new international partners for infrastructures or collaborations.• Attract highly qualified researchers to develop a professional career at the IAC.• Become a key stakeholder in the development of Astrotourism in the Canaries as one of the new Canaries' booming tourism industry sectors.

Weaknesses

- Current economic situation affecting RTD activities worldwide and in Spain.
- Low EC funding, if compared with international entities of similar profile.
- Limited flexibility of financial management.
- Difficulties in multi-year planning.
- Very complex and lengthy administrative procedures, affecting areas as diverse as purchasing, building permits, formalization of agreements and collaborations and human resources.
- Lack of flexibility in permanent staff appointments.
- Limited possibility for negotiation of employment contract conditions.
- Lack of internationally leading and widely recognised scientists among staff.
- Located far away from main research centres in Europe, and from EC.
- Lack of high-tech industry and private RTD in the region.
- Lack of strategy to secure external funding at EU level and with private sponsorship.
- Regulatory complications for the signing of national and international agreements.

Threats

- Funding bellow sustainability levels.
- Loss of prominence as 1st-class centre attracting advanced instruments.
- Inability to manage funds in relation to the corresponding commitments.
- Failure to attract some of the best international facilities.
- Lack of competitiveness in attracting external, and in particular European, grant funding.
- Failure to attract top-level staff and students due to rigid and internationally uncompetitive employment conditions.
- The aging of IAC workforce and lack of long-term stability of Technical and support staff.
- Insufficient national financial support to actively participate in the construction and operation of major research infrastructures and their planned instruments.

2. THE 2018-2021 STRATEGIC PLAN

2.1. Major Goals

The following major objectives are proposed for the period 2018 – 2021. These objectives need to be suitably coordinated and implemented by means of appropriate strategies and actions, as detailed in the following sections.

Strategic Objectives 2018 - 2021

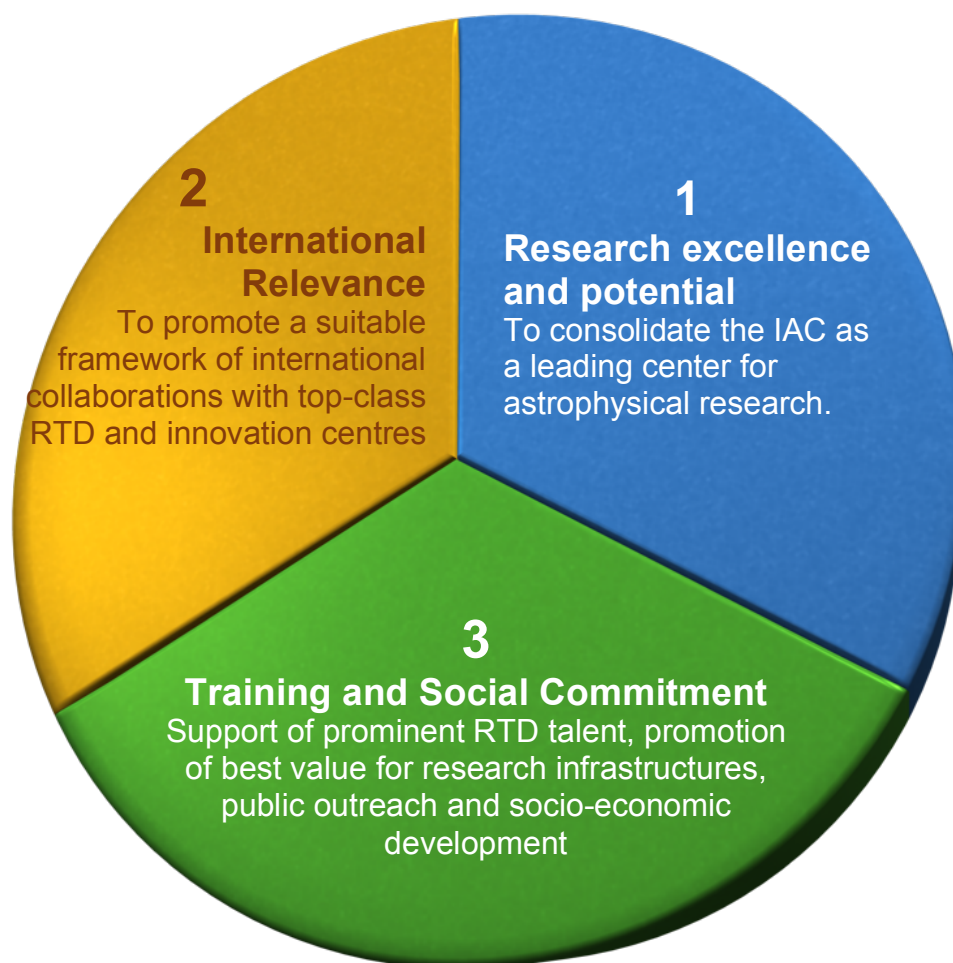


Figure 3.1

Scientific and technological excellence is the overarching theme of our strategic plan. IAC aims to have a significant impact in Astrophysics and Space Science during the next decades by means of the following baselines: Conducting excellent RTD; building visionary strategic partnerships at international level; consolidating our Observatories as the European flagship for ground-based observations; training highly qualified people (researchers, engineers and technicians), agents of progress at the global level, who are capable of transferring their knowledge to society; strengthening IAC's commitment to reinforce social perception of science and its potential to generate socio-economic added value and last but not least, acting responsibly and ethically.

2.2. Strategies

The IAC will focus on eight complementary strategic directions in order to maximize the impact of its actions and the pursuit of its major goals for the period 2018-2021:

Strategy A: A highly focused research programme capable of promoting talent and leadership

- To achieve major advances in astrophysics, reinforcing the potential of current staff and developing the infrastructure to create new leaders in astronomical research fields, early identification of potentially outstanding researchers and providing them with the necessary environment and tools to compete on the international scene.

Strategy B: The best value for major infrastructures and equipment.

- To attract and maintain future and current world-class telescopes and equipment at the *Observatorios de Canarias*, increasing the quality and quantity of the access provided. To maintain and improve laboratories and workshops infrastructure to support instrument maintenance and development. Develop a strong body of support astronomers able to provide interdisciplinary inter-project support to IAC research groups from software to hardware. Particular focus will be given to develop the potential to handle and carry out research with the large databases of present and future astronomical surveys.

Strategy C: Fostering international research collaboration.

- ● To improve the centre's international scientific leadership, strengthening collaboration with top research centres, universities and the coordination of international networks of excellence. Develop a set of measures that further increase the IAC's appeal as a host institution to recipients of major national and international grants and awards.

Strategy D: Technology developments for astrophysics.

- ● ● To increase leadership in advanced technologies of wide interest for astrophysics: cryogenics, high-spectral and high-spatial resolution, microwave polarimetry and interferometry, 3D spectroscopy, satellite payloads and general capacities.

Strategy E: Training through RTD.

- ● To continue developing the current Master in Astrophysics and Doctorate Programme, as well as training of engineers, supporting PhD students and summer programmes & schools at international level.

Strategy F: Public Outreach.

- ● To obtain recognition of the IAC as an international reference in the field of communication and dissemination of astronomy for a non-specialized audience.

Strategy G: Advanced technology as a motor of socio-economic development.

- To promote the valorisation and commercialisation of technology in astrophysics and other related high-tech fields.

Strategy H: Improvement of the organizational efficiency.

- ● ● To implement the Strategic Plan with adequate management tools, dealing with diversity in the workforce and coordinate employee efforts for better efficiency, and

looking for methods to improve internal operations, eliminating inefficient and redundant processes, being open to adapt the organization to the new Public Administration requirements.

Making use of the corresponding colour for the major goals of the strategic plan we represent below how these strategies are related with one or more of the aforementioned specific objectives: **blue** - excellence and potential; **green** – training and social commitment; **yellow** – international profile.

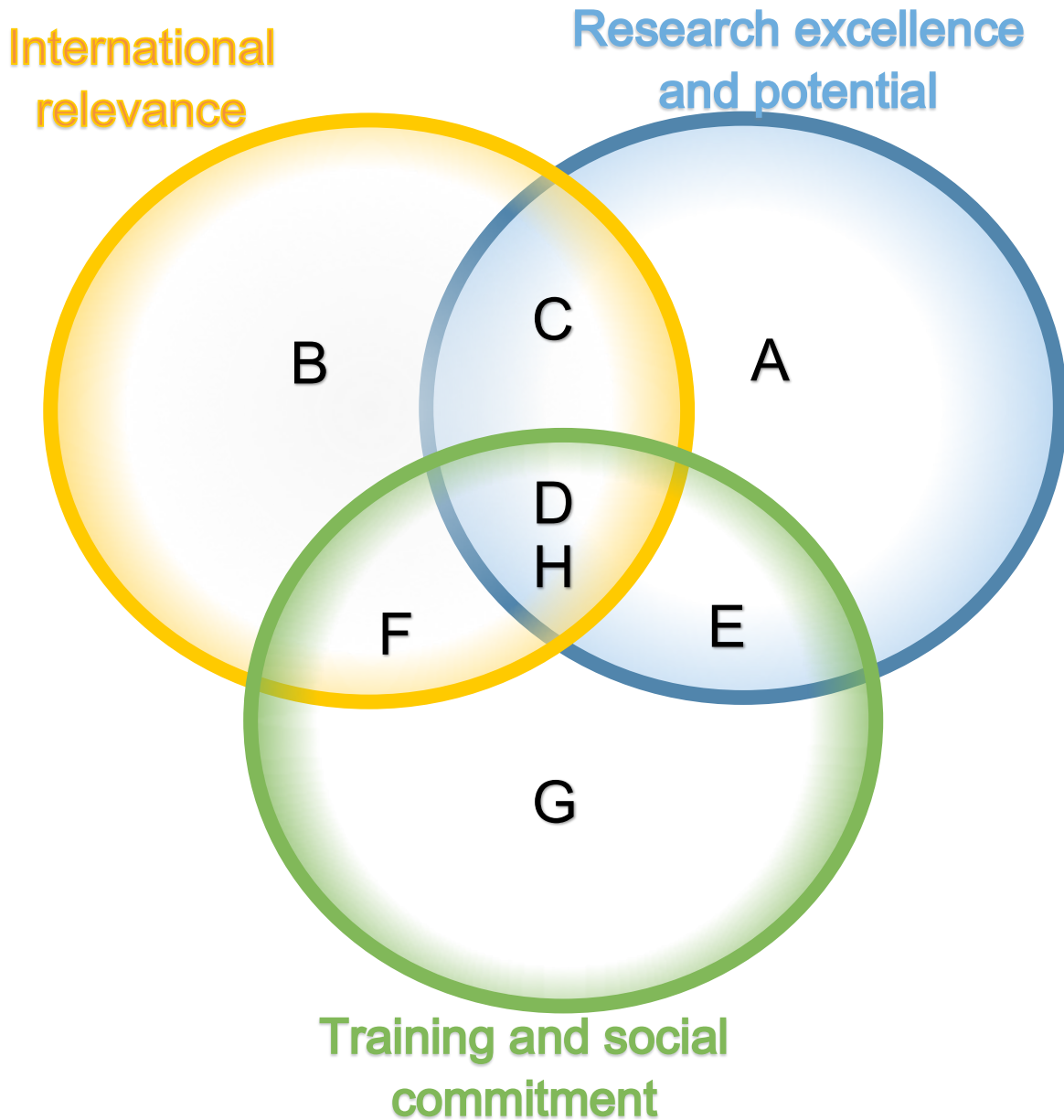


Figure 3.2

2.3. List of actions

Research Programme:	
Action 1	Study of the magnetism and dynamics of the Sun.
Action 2	Exploring the diversity of Planetary Systems.
Action 3	Research on Physics of Stars and the Interstellar Medium.
Action 4	Galactic and Extragalactic Astronomy.
Action 5	Research on Very High Energy Astrophysics and Cosmology.

Observatorios de Canarias:	
Action 6	Major leadership of the Observatories for the next decade

Gran Telescopio CANARIAS:	
Action 7	Consolidating Gran Telescopio CANARIAS as the Spanish flagship in visible and IR observational astronomy.

Technological capabilities:	
Action 8	Specific cutting-edge technologies. 8.1 To achieve leadership in cryogenic technologies 8.2 high-spectral and 8.3 high-spatial resolution techniques for ground-based observatories. 8.4 Laser communications with space 8.5 Thermal Infrared Detection Technology
Action 9	Space missions. To increase and ensure the IAC participation in instrumentation on satellite missions.
Action 10	Optical/IR instrumentation. To ensure leadership in the development of instruments for optical and IR astronomy.
Action 11	Microwave polarization, spectroscopy and interferometry. To ensure leadership in the development of instruments for microwave astronomy.
Action 12	General capacities - Technology To ensure the capacities (human and material) of the Technology Division to carry out their mission.

Training of researchers and engineers:	
Action 13	Master and Doctoral Programmes, Summer Programmes and Schools Supporting the Master and Doctorate in Astrophysics together with University of La Laguna, as well as the continuity of the Summer fellowships programme and the Canary Islands Winter School.
Action 14	Training through research. Promoting the temporary recruitment of young postdocs and engineers, engaging them on collaborative RTD projects.

Public outreach:	
Action 15	Increasing public outreach, especially at international level. To achieve the objective of increasing the presence of the IAC in the local, national and especially international mass media. Communication and dissemination of the RTD activities led by or with the participation of the IAC.

Socio-economic development:	
Action 16	Design and development of advanced instrumentation in stable collaboration with industry IACTEC will be set up as a technological centre associated to the IAC with the participation of private companies. Its activity will be focused on astrophysics, space and technology related fields.

Support actions:	
Action 17	Human resources: Reorganization and consistency with international standards. (1) To adapt the current structure of support staff as envisaged by the new statutes; (2) to define and implement a new model for the temporary recruitment of young/senior researchers and engineers more consistent with international standards; (3) new permanent positions as technical specialists in support of RTD activities; (4) a well-balanced distribution of the IAC staff.
Action 18	Efficient Management in a project-oriented organization. Consolidating the recently implemented model of project-oriented financial and economic management, fulfilling the new provisions for the estimated budget.
Action 19	The IAC and the Digital transformation Plan of the General Administration. The TIC Strategy The TIC Strategy, for the period 2015-2020, was approved at national level to improve the activity of the Administration and linked entities, to make it simple and efficient. The IAC will work on some specific issues to raise the digital transformation by the end of this multi-annual programme.
Action 20	Social Responsibility. Under this new programme the IAC will implement some actions on three different aspects: environment; equal rights and labour policies; and fair governance.
Action 21	Private sponsorship. A strategy for attracting private funding to undertake research projects with a long-term perspective, the support of scientific infrastructures, special research projects and training actions of particular relevance.
Action 22	New infrastructures: Building at the IAC HQ, IACTEC & CATELP. New facilities are foreseen to be built, or already in process, for the period 2018-2021.