2014 – 2017

STRATEGIC PLAN

for

INSTITUTO DE ASTROFÍSICA DE CANARIAS

Executive Summary

INSTITUTO DE ASTROFÍSICA DE CANARIAS

Fecha de preparación del Plan Estratégico: Marzo 2014

EXECUTIVE SUMMARY

The IAC Strategic Plan seeks principally excellence in science and to **strengthen and consolidate the IAC position as a centre of international reference for astrophysical research.**

The Strategic Plan involves exploration and discovery using major world facilities (such as the GTC, VLT 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, chemistry and geophysics.

The IAC Research Program will address key 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 achieve advances and breakthroughs in physical modelling, computer simulation and technology.

The IAC will continue to develop advanced instrumentation for major ground-based telescopes (GTC, VLT, E-ELT, WHT) and space observatories (Solar Orbiter, Euclid, JEM-EUSO, Plato). In the next four years the major technological activities will focus on cryogenic multi-object spectroscopy (EMIR), high spectral resolution (ESPRESSO, HORUS, HIRES), high spatial resolution imaging (GTCAO, AOLI) and 3D spectroscopy (HARMONI, WEAVE, NEFER, MIRADAS, MS-DESI). In addition, IAC aims to develop an active technology transfer program in close-collaboration with industry to develop payloads for small satellites and applications in biomedicine.

A very intense training program is proposed which would lead to at least 50 new PhDs in the four years period. The 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 on Astrophysics.

The IAC Outreach Plan aims to capture people's imagination, inspire teachers, encourage scientific vocation in students, and motivate talented graduates to enter the field, increase international cooperation, stimulate the industrial and technological environment, and excite the general public about science.

As regards the evolution of IAC Human resources for the next four years, a proposal is made to incorporate eight new permanent positions and to increase the number of temporary contracts by another six. So, the IAC staff would reach a total number close to 400 by 2017. A budgetary plan is proposed to recover by year 2017 the level of stable funding the IAC had in 2008, and consolidate as soon as possible a minimum budget of 16 M€/yr. This requires increments in the Consortium budget of approximately 2.2, 2.0 and 0.9 M€ in the next three years, respectively.

External funding allocated via competitive tenders ensures another 5 M€/yr till 2015 for the IAC Research and Technology Programme. Additional external funding will be actively pursued beyond 2015. Several new large-scale projects, which we designate as Large Institutional Projects (CTA, EST, LT2, GTCAO, IACTech, etc.) may generate additional external funding at a rate of up to 6 M€/yr if all of them were approved.

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1. *INSTITUTO DE ASTROFÍSICA DE CANARIAS.*

1.1. Vision, mission 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). The IAC's mission and main objectives, according to its statutes, is:

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 **mission** of the ***Instituto de Astrofísica de Canarias is*** to contribute towards worldwide scientific and technological excellence in astrophysics, by promoting research, technology development, training of graduate students, young researchers and engineers, outreach and technology transfer in many different areas, fostering a fruitful and stable environment of international collaboration.

It is the IAC's **vision** to:

- Perform top-class science to further our understanding of the formation and evolution of the universe, galaxies, stars and planets through different wavelength windows.
- Provide an "astronomical reserve" of international relevance and first-class scientific and technological environment in the Canary Islands.
- Promote the maintenance and installation of current and future state-of-the-art infrastructures and equipment, ensuring the best natural, technological and logistical conditions in the Canary Islands for astrophysical research.
- Foster an environment of stable international collaborations, favouring scientific leadership and the emergence of synergies among national scientific communities.
- Support education and training of early-stage researchers and technicians, and the transfer of knowledge among scientific communities.
- Contribute towards social awareness of research and the importance of a knowledge-based economy.

1.2. SWOT analysis

Following standard methodologies we have identified the strengths, weaknesses, opportunities and threats listed below:

Strengths

- Internationally competitive research and technology programme, spanning most areas of astrophysics.
- Recognition as 'Severo Ochoa Centre of Excellence' by Spanish Government
- Two observatories exploiting the extraordinary astronomical quality of the summits of the Canary Islands, protected by law
- Sustainable financing model, with core funding from national and regional government, and significant grant income
- Strong implementation 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

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, concerning areas as diverse as purchasing, building permits, and human resources
- Lack of flexibility in permanent staff appointments
- Limited possibility for negotiation of employment contract conditions
- Lack of internationally leading and widely identifiable 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 culture in UE donors and in the IAC to obtain private funding for science

Opportunities

- Attract new large international infrastructure projects: EST, CTA, LT2, …
- Full scientific exploitation of the GTC.
- Development of advanced instrumentation for coming projects
- Astrophysics as a priority under the RIS3. Access to Community funds
- IACTech as a hub element connecting with the private sector.
- Synergies between ground-based and satellite observations.
- Attract external grant income for job creation and investment in RTD
- Use local supercomputers and high-speed internet links to attract public and private RTD partners depending on heavy computer and data flow use
- Attract new international partners for infrastructures or collaborations

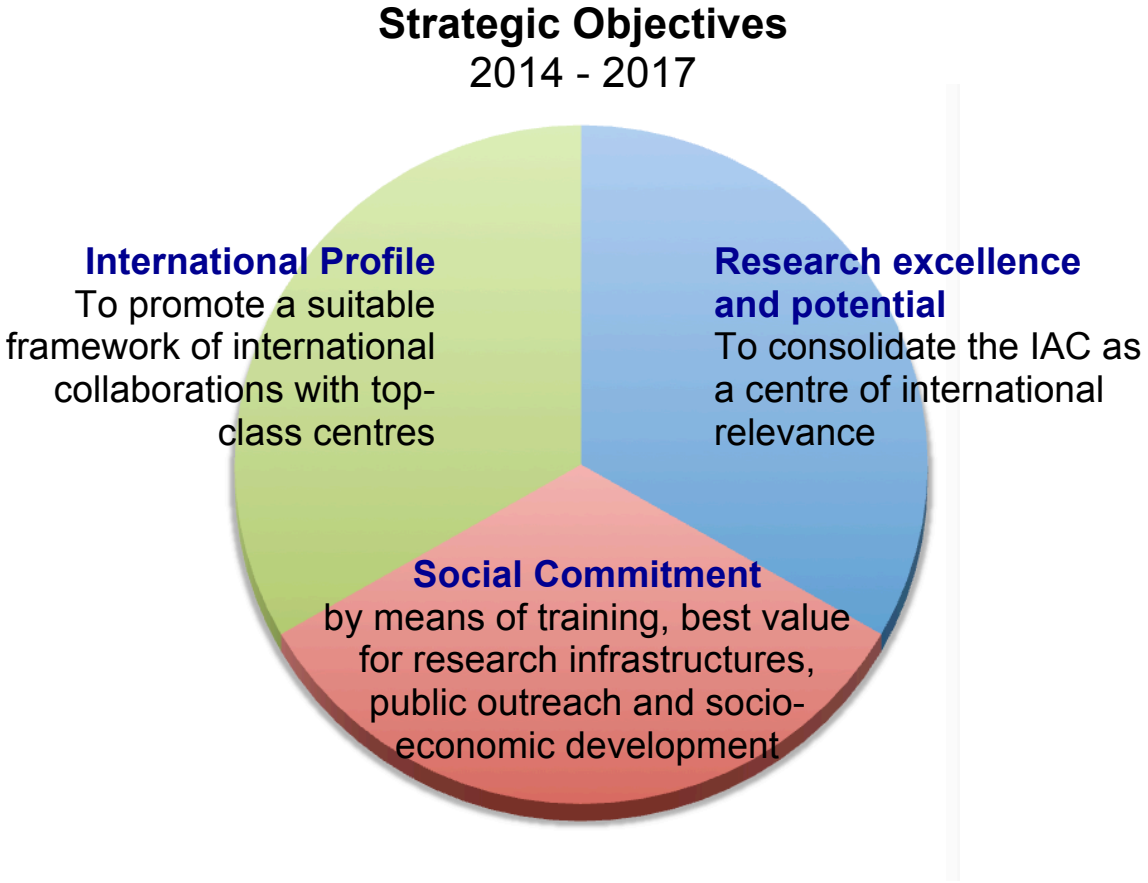
Threats

- Funding bellow sustainability levels in the past two years and in the present year
- Use of telescope facilities for research of low interest and poor quality.
- Loss of prominence as 1st-class centre attracting advanced instrumentation
- Inability to manage the funding obtained in relation to the corresponding commitments.
- Fail to attract and retain the best international facilities
- Lack of competitiveness in attracting external, and in particular European, grant funding
- Fail to attract top-level staff and students due to rigid and internationally uncompetitive employment conditions
- Political leadership at IAC board level can change to become insufficiently supportive of RTD objectives and ambitions

2. *THE 2014-2017 STRATEGIC PLAN*

2.1. Strategic Goals

The following major strategic objectives are proposed for the period 2014 – 2017. These objectives need to be suitably coordinated and implemented by means of appropriate strategies and actions, as described below.



Objective 1 -	**RESEARCH EXCELLENCE AND POTENTIAL:** to strengthen and consolidate the IAC position as a centre of international reference for astrophysical research.
Objective 2 -	**INTERNATIONAL PROFILE:** to promote a sustainable framework of international collaborations with the top-class research centres worldwide.
Objective 3 –	**SOCIAL COMMITMENT:** to train the next generation of researchers and engineers in this field; (2) to enable the best scientific and technological value for its research infrastructures and facilities; (3) to promote dissemination of science and public awareness; and (4) exploitation of its technological capabilities in terms of socio-economic development.

2.2. The Strategic Plan

The pursuit of the strategic objectives for the period 2014-2017 will be made through a work plan formulated in 6 major strategies.

- The first strategic line aims to intensify international cooperation and exploitation of observational facilities and personnel capabilities to achieve leadership in those 5 key research areas where the centre has obtained outstanding results in the recent past and where major achievements can be expected.

- The second and third strategies are mainly related to the technological and observational capabilities at the Canary Islands.

- The three last strategies are related to the beneficial outcome that can be obtained from this research and technological activity, in terms of training and public awareness under an international perspective; and in terms of the expected socio-economic development, mainly in the immediate geographic area, but oriented towards the global market.

Strategy A: A highly focused research programme. To achieve major advances in the understanding of the laws that govern the origin and evolution of the various forms of matter/energy in the Universe.

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.

Strategy C: 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 D: Training through research. 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 E: Public Outreach. To place the IAC as an international reference in the field of communication and dissemination of astronomy for a non-specialized audience.

Strategy F: Advanced instrumentation as a motor of socio-economic development. To promote the valorisation and commercialisation of technology in astrophysics and other related high-tech fields.

- Making use of the corresponding colour we represent above how these strategies are related with one or more of the aforementioned specific objectives: **blue** - excellence and potential; **green** – international profile; **red** – social commitment

2.3. List of actions

A total of 20 actions are designed to accomplish the strategic plan. These actions are grouped and listed below:

Research Programme:

Action 1	**Study of the magnetic fields in the Sun and the Sun-Earth connection.** To decipher the magnetism of the Sun, and in doing so to develop the tools needed for the exploration of the magnetic activity in other types of stars across the H-R diagram.
Action 2	**Exploring the diversity of Exoplanetary Systems.** Detection and characterization of exoplanets, with major focus on the detection and characterization of Earth-like planets
Action 3	**Research on Physics of Stars and the Interstellar Medium.** Understanding of stars as fundamental physical probes, and of the Interstellar Medium as their source and sink.
Action 4	**Understanding the evolution of galaxies across cosmic times.** From the structure of our Milky Way to the detection of presence of dark matter in the halos of galaxies.
Action 5	**Research on Very High Energy Astrophysics and Cosmology.** To study cosmic- and gamma-rays sources, exploring the Early Universe and the nature of dark matter and dark energy.

Observatorios de Canarias:

Action 6	**Ensuring a major role for the *Observatorios de Canarias* for the next decade of observational astrophysics.** To continue current operations and, especially, to attract the new generation of top-class telescopes (e.g. CTA, EST, LT2).
Action 7	**Ensuring the high quality of the *Observatorios de Canarias* for the next decade of observational astrophysics.** To maintain a permanent characterization and protection of the sky quality at the *Observatorios de Canarias* for astronomical research.

Gran Telescopio CANARIAS:

Action 8	**Consolidating Gran Telescopio CANARIAS as the Spanish flagship in visible and IR observational astronomy.**

Technological capabilities:

Action 9	**Specific cutting-edge technologies.** To achieve leadership in cryogenic technologies and high-spectral and high-spatial resolution techniques for ground-based observatories.
Action 10	**Space missions.** To increase and ensure the IAC participation in instrumentation on satellite missions.
Action 11	**3D spectroscopy**. To ensure leadership in the development of instruments for 3D spectroscopy.
Action 12	**Microwave polarization and interferometry.** To ensure leadership in the development of instruments for microwave astronomy.
Action 13	**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 14	**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 15	**Training through research.** Promoting the temporary recruitment of young postdocs and engineers, engaging them on collaborative RTD projects.

Public outreach:

Action 16	**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 17	**Design and development of advanced instrumentation in stable collaboration with industry** IACTech 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 18	**Human resources: Reorganization and consistency with international standards.** (1) To adapt the current structure of support staff as envisaged by the new statutes, as well as (2) to define and implement a new model for the temporary recruitment of young/senior researchers and engineers more consistent with international standards.
Action 19	**Efficient Management.** Consolidating the recently implemented model of project-oriented financial and economic management, fulfilling the new provisions for the estimated budget.
Action 20	**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.