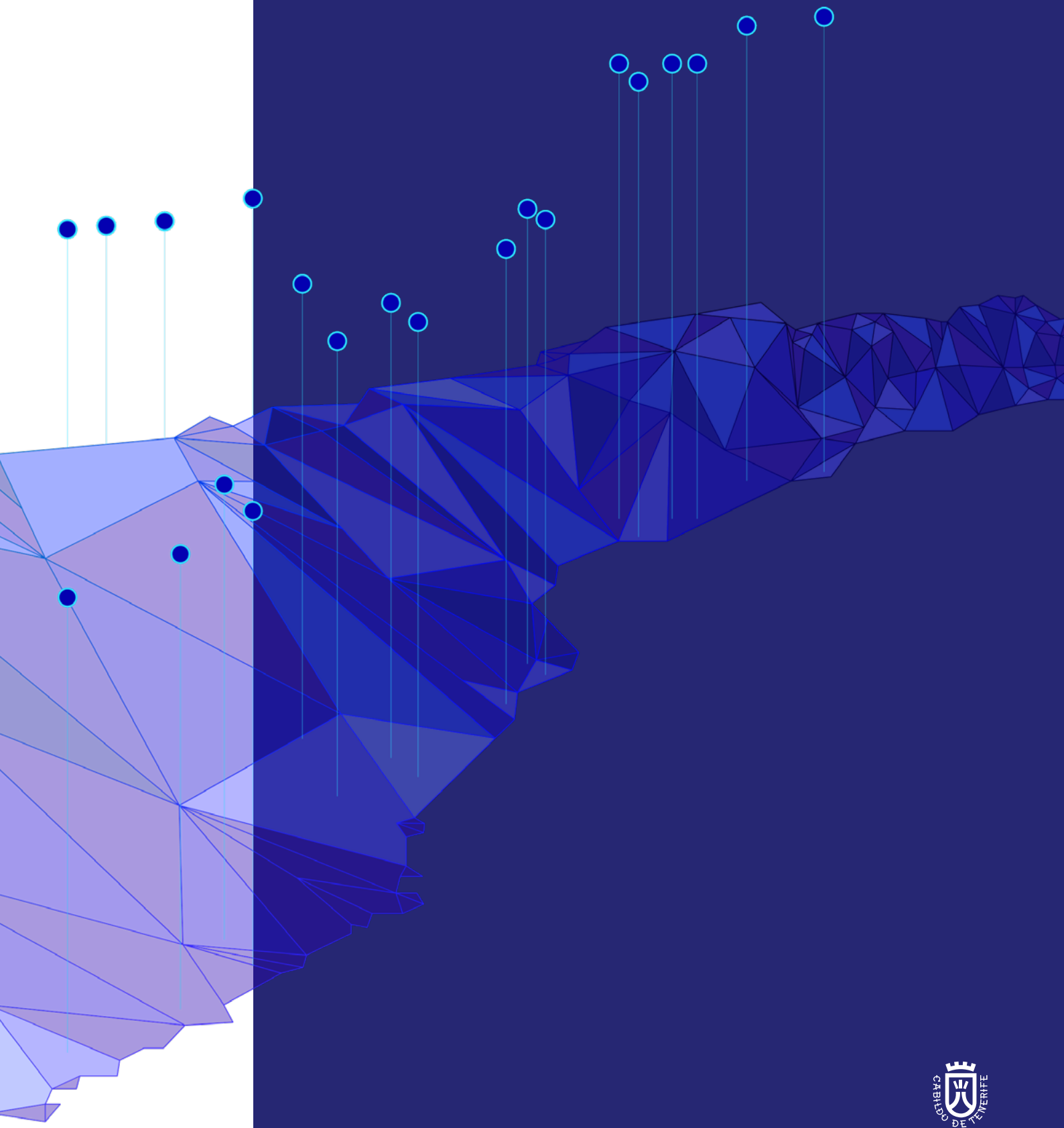
PCTT
Parque Científico y Tecnológico de Tenerife

Tenerife's innovation and technology infrastructures



Cabildo de Tenerife

Tenerife's innovation and technology infrastructures

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Tenerife's innovation and technology infrastructures

Contents

Foreword

There is a general consensus that the current social, environmental and competitiveness challenges must be tackled through the generation of knowledge and its transfer to all sectors of activity: through scientific progress and innovation.

The Island Council of Tenerife has a historical commitment to the modernisation and progress of Tenerife, including scientific and technological progress. In the strategic plans and actions of the Cabildo, innovation is present as a catalyst for the development and economic and social sustainability of the island, where the Science and Technology Park of Tenerife (hereinafter PCTT), has been characterised as a driving and transforming agent, leading and developing various plans in the field of innovation in the medium and long term.

The commitment to training for permanent innovation as a fundamental lever for improving the island's competitive positioning is one of the priorities of the Cabildo Insular de Tenerife, and to this end it has created training and education programmes in the field of innovation that make it possible to generate a culture of innovation in the whole of Tenerife society, in turn strengthening the synergies that are defined at island, regional, national and European level.

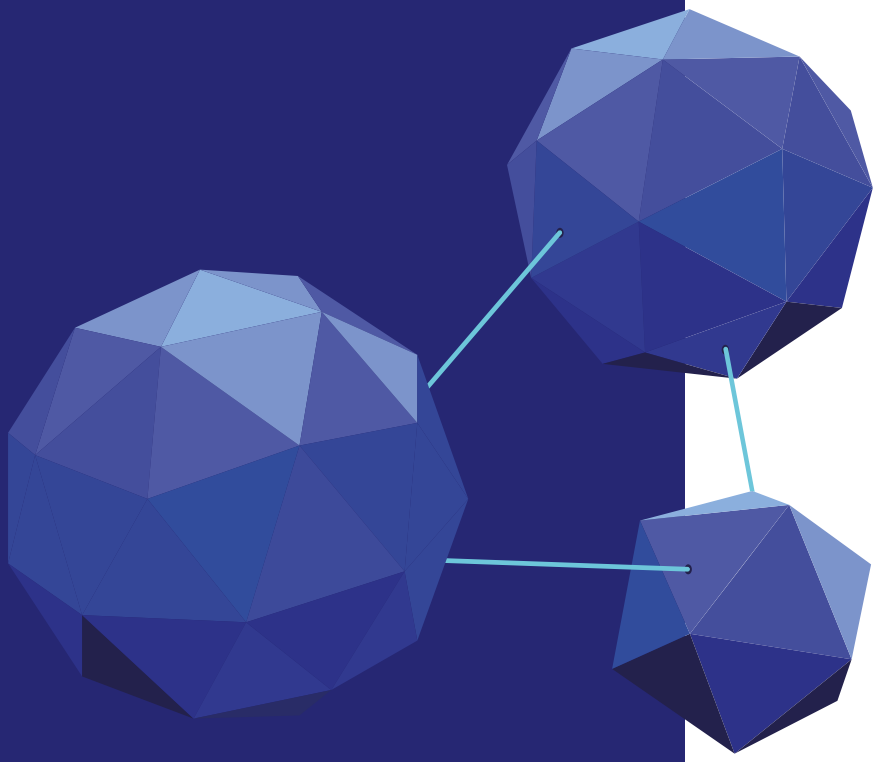
The current economic and social context leads us to focus on the set of transformations or changes in behaviour, projects and necessary social practices that, in addition to being novel in economic functioning, are fully aligned with the Canary Islands 2030 Agenda for Sustainable Development. It is important to consider the complex nature of the innovative process and the relationship between technological innovation and society. Innovation is not only the application of research and development results at a high level, but also the result of entrepreneurial, strategic, decision-making, organisational and imaginative capacities. For this reason, in the definition of projects and actions, the joint participation of the Administrations, the ecosystem of agents of change, as well as the people and territories towards which the different actions are directed is sought.

Likewise, as part of its strategy, the Cabildo of Tenerife has also provided the island with infrastructures of high technological value which, together with those existing in other institutions, entities and companies, position Tenerife as a perfect space for the research and development of technology-based companies.

This catalogue brings together all these infrastructures available for R&D&I, with the intention that companies (both those already established on the island and those interested in doing so) have at hand all the technological resources they can access to develop their research and/or projects if they decide to set up their company in Tenerife. Specifically, you will find 21 R&D&I centres, many of which are world leaders in research and 98 first class infrastructures.

Parque Científico y Tecnológico de Tenerife: PCTT

PCTT
Parque Científico y
Tecnológico de Tenerife



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The entity

Parque Científico y Tecnológico de Tenerife, S.A. (Tenerife Science and Technology Park), was set up on 12 January 2006 with the Cabildo de Tenerife being its majority shareholder. PCTT mission is to help diversify the economy of Tenerife by developing the culture of innovation as a key to improving competitiveness, bringing together at different PCTT sites, innovative and technological global companies and entities that carry out research, development or unique production of applied technology thus promoting the transfer of knowledge and the recruitment of specialised talent, in order make to local innovative or technology-based companies grow, development or unique production of applied technology, promoting the transfer of knowledge and the recruitment of specialised talent, with the aim of making local innovative or technology-based companies grow, boosting technological entrepreneurship and start-ups, and attracting global companies to the Tenerife Science and Technology Park sites.

Created in 2006, PCTT current shareholders are the Cabildo de Tenerife (99.2%), Ayuntamiento de Santa Cruz de Tenerife (0.26%), Autoridad Portuaria de Tenerife (0.26%), Gerencia de urbanismo de Santa Cruz de Tenerife (0.21%) and (0.07 %).

PCTT General objectives

- To create innovative spaces that encourage cooperation and the exchange of knowledge and technologies between research institutes and companies.
- To promote technology transfer and the development of technologies, as well as business and industrial commercialisation in Tenerife.
- To offer actions and services that stimulate the creation and successful development of innovative and technology-based companies.
- To attract and channel foreign investment based on knowledge, innovation, and technology.

PCTT Mission and vision

- Mission: To diversify Tenerife's economy by developing the culture of innovation as the pivot to improve competitiveness, bringing together in the PCTT sites, global innovative and technological companies and entities that carry out research, development or applied technology singular production, promoting knowledge transfer and the recruitment of specialised talent, with the aim of making local innovative or technology-based companies grow, promoting technological entrepreneurship and start-ups and attracting global companies to Tenerife Science and Technology Park sites.
- Vision: To turn Tenerife, and within the island, the Tenerife Science and Technology Park, into a Technology Hub from which to operate worldwide, a leading place in technology and innovation, where dreams, projects and companies can grow.

PCTT Business sectors

1. Astrophysics, Sustainability and Renewable Energies.
2. Biomedicine, Biotechnology and Health.
3. ICT, Software and Audiovisual.
4. Technologies applied to tourism.

Different reasons for setting up at PCCT include:

- Our geostrategic location: as a major tourist destination for Europe, with 12 million passengers a year, 160 direct air routes, 3 ports and 2 international airports.
- Our world-class connectivity and computing infrastructures.
- Having the best taxation in Europe:
- The Canary Islands Special Zone (ZEC): 4% Corporate Income Tax for registered companies.
- Free Trade Zone (FTZ): Import and export duty exemptions.
- 7% IGIC vs 21%VAT
- RIC (Investment Reserve): allows up to 90% tax savings.
- No tax withholding.
- Large deductions for investing in R&D, Innovation Activities (video games) and Audiovisual, up to 45%.
- Our cutting-edge research through the ULL, the IAC and ITER, among others.
- Our acceleration and support mechanisms for companies.
- Available specialised professionals.
- Our excellent quality of life.

Projects

INfuture Challenge

The "INfuture Challenge" aims to promote projects that contribute to the acquisition of skills and competences for innovation, the promotion of an entrepreneurial attitude, collaborative learning, and teamwork. This way, it will meet the need to adapt education to the current market, preparing young people and adults to be more active and innovative, aware of themselves and their island reality and how they can contribute to society through the development of their chosen profession.

The projects must be developed following the guidelines of the Cabildo de Tenerife, through the PCTT, on the basis of the INfuture challenges that are called annually within the framework of the programme for the promotion of innovation skills for students in state schools.

So, the identification of tasks attached to an annual theme (challenges) will be taken into account in order to provide solutions in line with the demands of these challenges as proposed by business sectors or the INFUTURE strategy itself, as well as to promote the following technological skills: robotics, programming, video game design, digital and audiovisual communication (creation of blogs, websites, videos and social networks), design and advertising, digital additive manufacturing, etc.

This project is aimed at students in Primary Education, Secondary Education, Higher Secondary Education, Vocational Training and Adult Education in state schools in the Canary Islands.

Teachers and students participating in the INfuture Challenge will have:

- PCTT monitoring and support to teachers and students in order to develop skills and competences for innovation or methodological approach in the classroom and for project management. Monitoring will be carried out through videoconferences or face-to-face, adapting to the current health situation and always in the presence of the participating teachers.
- The PCTT makes available to all participating centres a platform of educational and learning resources as a complement to help in the development of the annual theme challenges, as well as those resources necessary to carry out the research, documentation, prototyping and entrepreneurship (display) phases.
- During the school year, PCTT makes available to participating centres resources related to the challenge (virtual reality equipment, educational robotics resources, arduino and 3D manufacturing, software for the development of applications and gamification, etc.), which are on loan for the development of the projects. PCTT also provides the necessary consumables for the prototyping phases, subject to prior validation.
- During the development of the "Desafío INfuture" project, training sessions will be carried out aimed at acquiring and developing skills and abilities related to digitisation and Project-Based Learning (PBL), addressed to the participating teachers and coordinators. The training sessions will be 2.5-hour online training pills.
- Both the coordinating teachers and the teachers participating may voluntarily take specific training courses in the topic they decide to base their projects on to then submit them to the "Desafío INfuture" competition. Attendance at these training sessions will be counted as additional hours to the total number of hours of certification. Up to a maximum of 10 hours can be added up by attending 4 training pills.

FIRST® LEGO® League Canarias

FIRST® LEGO® League Canarias is the largest international robotics challenge for young people in the world. It is present in more than 90 countries and has more than 560,000 participants. Its aim is to encourage vocations in the field of science and technology, through the development of skills such as teamwork, innovation and creativity. Tenerife Science and Technology Park organises this tournament for the Canary Islands.

This project promotes interest in learning among young people, aged 4 to 16, by inviting them to participate in a science and technology project and competition.

At different age levels (Discover, Explore and Challenge), students will understand basic STEM concepts and apply their skills in an exciting competition while developing learning habits, confidence, and teamwork skills along the way.

CEDEi

A project to promote job creation of high technological value on the island of Tenerife, within the framework of the Centro de Excelencia de Desarrollo e Innovación CEDeI [Centre of Excellence for Development and Innovation]. This is a training programme aimed at people in the ICT sector in order to adapt their training and experience to the current demands of companies in the sector, thereby promoting the direct creation of qualified employment on the island.

Thus, the centre of excellence is conceived as a permanent infrastructure, the result of public-private collaboration, including both local and international ICT companies. Special emphasis is put on the development of services that may be of interest to companies, which would mean a net increase in the investment to be made on the island by these sectors that require skilled labour.

CEDeI is a training and employment programme that is providing Tenerife with a set of highly qualified professionals, trained in state-of-the-art technologies and development methodologies, securing their access to jobs in the profiles demanded by the sector for these professional positions. Therefore, there is a double objective. On the one hand, give the members of the training programme a real chance to start their career after the programme; on the other hand, the companies will be able to hire profiles that suit the actual needs of their companies.

PCTT Talks

Disruptive project that seeks to join forces in the themes and actions related to the digital skills and abilities needed in the new business ecosystem. A micro-talks project by different experts who talk about and deal with the new professional environments. This programme is linked to attracting people who are interested in joining the PCTT's training and learning programmes, especially those of the CEDeI.

PCTT Talks will deal with the following topics: Web programming, digital skills and abilities, digital content generation, audiovisual animation, cryptocurrencies and metaverse, among others.

Innovation Labs

A project developed by the Cabildo de Tenerife -through the Tenerife Science and Technology Park -, Fundación Scientia and the island's town councils. It is aimed at children and young people aged 8 to 17.

The aim of these innovation laboratories, INlab, is to promote skills in computational thinking and creativity, as well as scientific-technological vocations, among the island's young people.

In the innovation labs, digital platforms and the LEGO Spike Prime educational set are used to develop competencies in computational thinking, innovation, and creativity. The aim is to provide opportunities for training in new active project-based learning processes, incorporating science and technology.

The innovation laboratories are part of the INfuture STEAM programme of activities, whose goal is to create a learning scheme based on competences in science, technology, engineering, art and mathematics, especially aimed at children and young people in Tenerife. They complement formal education and are done in close cooperation with the island's educational institutions.

All INfuture STEAM actions have as a key element creating technological skills, fostering an entrepreneurial attitude, collaborative learning and teamwork. The aim is to help them identify, experience, and develop the skills that will help them choose their professional career.

At the INlab participating students will discover and experience the world of new technologies, boosting their ingenuity and creativity through dynamic workshops that seek to convey a passion for science, technology, engineering, and many other subjects in a cross-cutting manner.

PCTT and INCYDE Foundation Programmes

Training programmes called Self-employment and Business Consolidation, within the framework of the Youth Guarantee Programme for the integration of people under 30 years of age. The goal is to bring people into the labour market by means of entrepreneurship through projects that promote enterprising and develop entrepreneurial skills.

Specifically, the agreement signed between the Cabildo de Tenerife and the INCYDE Foundation includes four training itineraries aimed exclusively at people aged under 30, within the Youth Entrepreneurship Itineraries Programme (PIEJ); three training and support actions, within the Operational Programme for Employment, Training and Education (POEFE); and holding two Youth and New Employment Sources (NYE) Forums.

The Forums consist of conferences, inspirational talks, round tables, and presentations given by experts and entities that are world leading in new technologies and new sources of employment, which aim to analyse the current situation regarding employment and education, motivate and guide, but also involve young people registered in the SGJ and give them useful tools to find professional opportunities. The topics of the workshops will revolve around the title "Youth with a Future" New Sources of Employment.

The themes of the programmes (PIEJ and POEFE) will revolve around: Digital Marketing, Audiovisual Animation, Digital Content Generation (RRSS), E-commerce and ICTs applied to Tourism.

SME Training Programme: Digital Business Development with EOI

The Tenerife Digital Business programme is a practical course carried out between the School of Industrial Organisation and the Cabildo de Tenerife through the Tenerife Science and Technology Park, which offers SMEs workers in Tenerife the key tools to facilitate decision-making in a digital environment in continuous transformation. This course provides an understanding of what Digital Transformation consists of and provides the necessary resources to carry it out with the greatest guarantees.

This programme is part of the training and tutoring actions within the framework of the activities carried out by EOI within the Operational Programme for Employment, Training and Education, whose objectives are focused on improving the competitiveness of small and medium-sized enterprises, especially in terms of innovation, improvement and development of new products and services in Tenerife. The aim of this project is to improve the productive fabric through its diversification and organisational and technological modernisation, promoting the knowledge society and giving value to the qualification of human resources.

University Expert Degree in "Innovation and Technological Entrepreneurship".

The University of La Laguna, through the University Postgraduate and Doctorate School, will provide lecturers for the above-mentioned Expert Degree, and the Tenerife Science and Technology Park, will make available the facilities and services necessary to carry out the project, and external teaching staff specialising in the different subjects.

The course is aimed at professionals whose needs and expectations lie in the acquisition of skills and abilities to respond to the digital and technological revolution that is taking place in today's society, which demands deep changes in the way they act. The changes are reaching all areas of companies and all sectors of the economy. The new scenario brought about by technological advances is also generating new habits in the workplace, employees, and business models.

The main objectives of the University Expert course in Innovation and Technological Entrepreneurship are as follows:

- To promote technological innovation and entrepreneurship, through training in digital skills and abilities to suit the new social and economic context of the Canary Islands.
- To raise awareness of how innovation enables a greater degree of acquisition of means and resources for entrepreneurship.
- To foster the technological spirit in young people by making the new digital job enablers useful and viable.
- To boost local innovation and technology ecosystems by working with the companies that drive the island's ecosystem.
- To encourage the creation of new technological initiatives that germinate on the island, through training in specific

disciplines, giving rise to a collaboration between the Company/University/Cabildo, analysing the global market in which jobs will be created.

- To generate initiatives for the transformation of ideas into real projects that can be carried out, by fostering relationships with other key players in the social ecosystem.

WomenIN

The womenIN programme is presented as an innovative project that promotes business ideas in different areas of Tenerife, where women are promoted and given visibility in the field of entrepreneurship, management, and positions of responsibility in companies. It is a business acceleration programme aimed at women entrepreneurs, with the aim of boosting their business ideas through technical and professional advice, combined with specialised training sessions, which will guide them in the beginning of their entrepreneurial journey and increase their projects' chances of success.

During the development of the acceleration programmes entrepreneurs are selected to participate in the acceleration programmes, where they will receive specialised training in essential tools and skills for the validation and consolidation of the business ideas. They will also take part in an individualised follow-up programme. The members of the programme will attend both joint classes and individual tutorials in which various cross-cutting issues will be addressed in order to launch or consolidate the business idea.

At the end of all the training sessions, an event will be held to select the most feasible projects, which will be presented at a final public event (Demo Day). The aim of this event is to disseminate the programme as widely as possible and to reach out to the female entrepreneurial and business community.

The womenIN programme pursues the following goals:

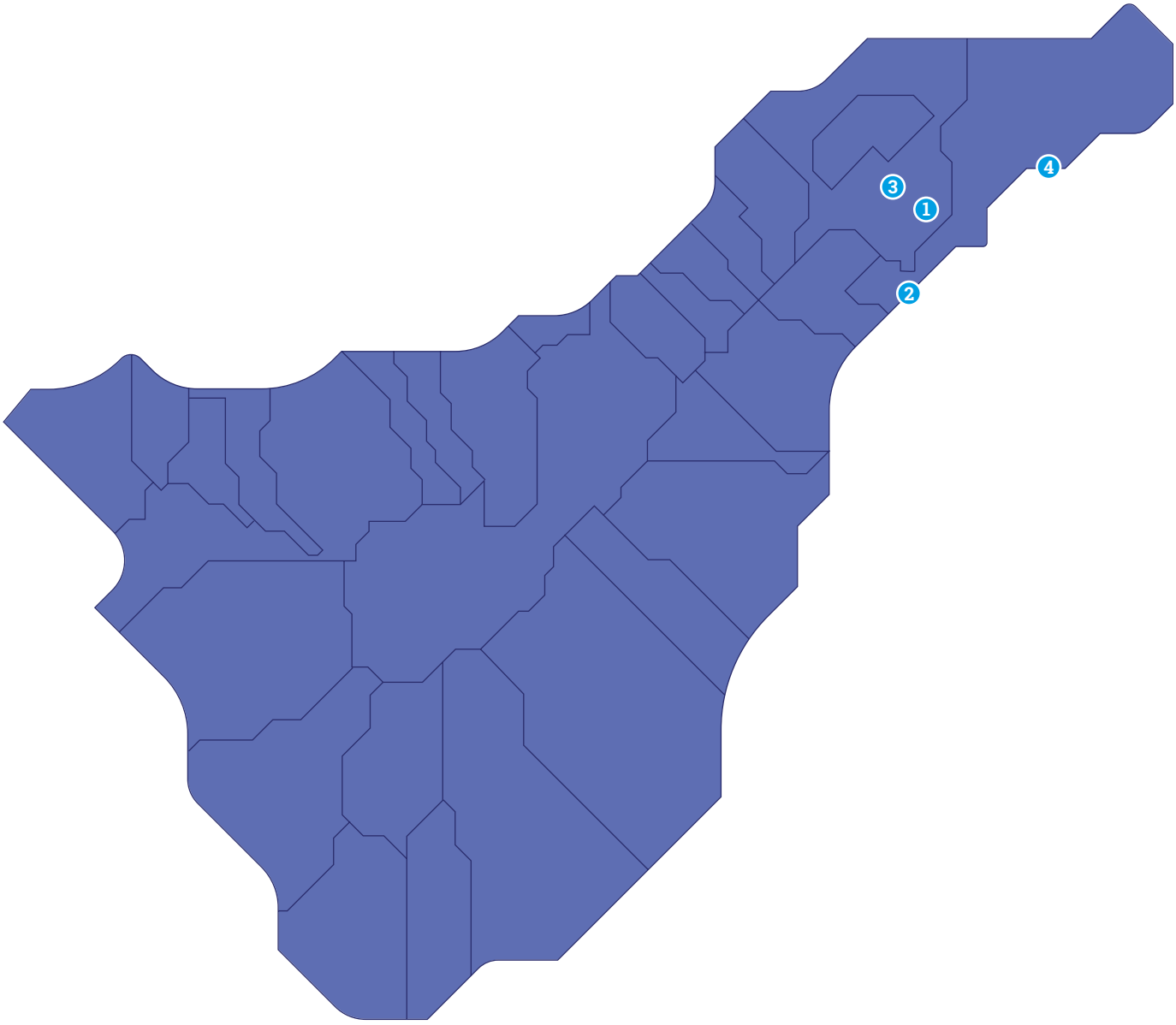
- To promote and give visibility to women in the field of entrepreneurship, as businesswomen and/or managers from the point of view of gender equality.
- To promote technological progress and local economic development on the island through the implementation of innovative projects promoted or led by women, or, where appropriate, with women playing a significant role as partners.
- To promote and give visibility to the career of successful women entrepreneurs, both at regional and national level.
- To establish synergies between entrepreneurs, successful businesswomen from Tenerife and women managers of national and international companies in order to create contact networks that favour the generation of new business opportunities in Tenerife.
- To work on the entrepreneurship and improvement of businesses' competitiveness of the primary sector, dealing with the following sectors: Agriculture, Agri-food, Livestock, Fishing and Rural Areas, as well as projects related to the primary sector.
- To promote the incorporation of innovation and new technologies in projects in the primary sector and projects related to these sectors.

PCTT Innovation Forum and Observatory

The PCTT Innovation Forum and Observatory is a disruptive initiative of open innovation between society and business, which relies on R&D&I to develop technological challenges and offer a greater contribution to Tenerife's society. Its objectives include the stimulation of feasible and sustainable business projects, through a full programme based on inspirational talks, workshops, round tables, networking areas and debates on the most innovative trends in the different sectors, promoting education, training and skills of entrepreneurs.

Tenerife Science and Technological Park Sites

- Las Mantecas Site (1)
  - IACtec
  - NanoTEC
- Cuevas Blancas Site (2)
  - Headquarters building
- Innovaparq ULL Site (3)
- Innovaparq Dársena Site (4)
- Infactory
- TFcoworkin



Las Mantecas Site

C/ Rectora María Luisa Tejedor Salguero, Parque Urbano Las Mantecas s/n, 38320, San Cristóbal de La Laguna. – Santa Cruz de Tenerife - Islas Canarias

Cuevas Blancas Site

Carretera Santa María del Mar, 22, 38111 Santa Cruz de Tenerife – Islas Canarias

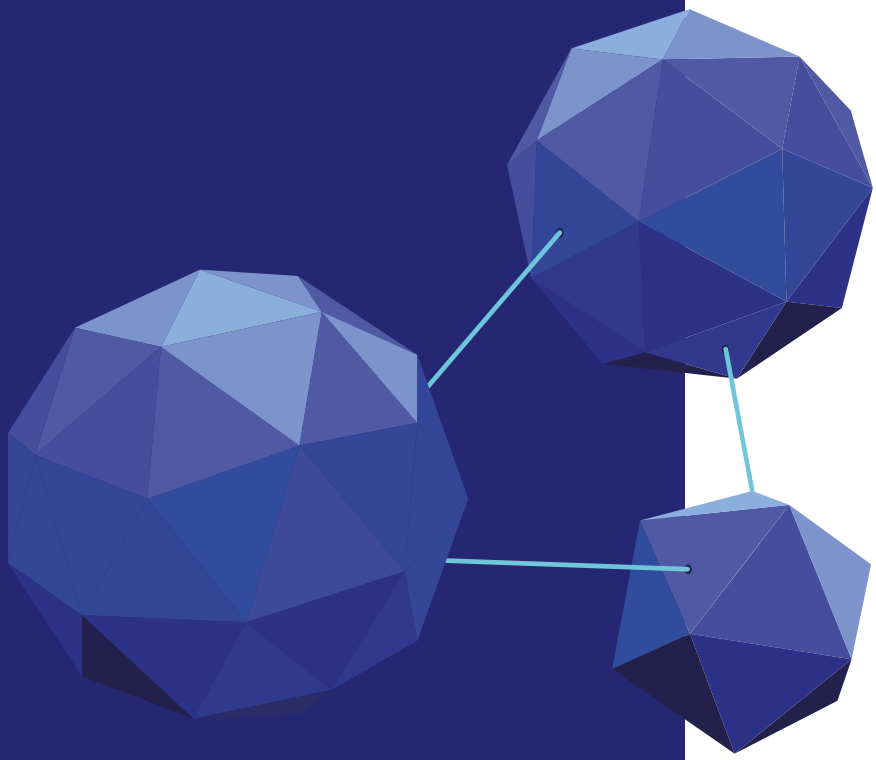
Innovaparq ULL Site

Avenida Trinidad, 61, 38204 San Cristóbal de La Laguna – Santa Cruz de Tenerife – Islas Canarias

Innovaparq Dársena Site

Dársena Pesquera, 38120, Santa Cruz de Tenerife – Islas Canarias

Cuevas Blancas Site



The entity

Cuevas Blancas will be the main site of Tenerife Science and Technology Park. In the first phase, it will house the PCTT Headquarters, which has already been built; in the second phase the Multi-companies Building and infrastructures for technology-based companies will be added. This makes this site an ideal ecosystem to set up technology-based companies.

HEADQUARTERS BUILDING

PCTT representative building which will house:

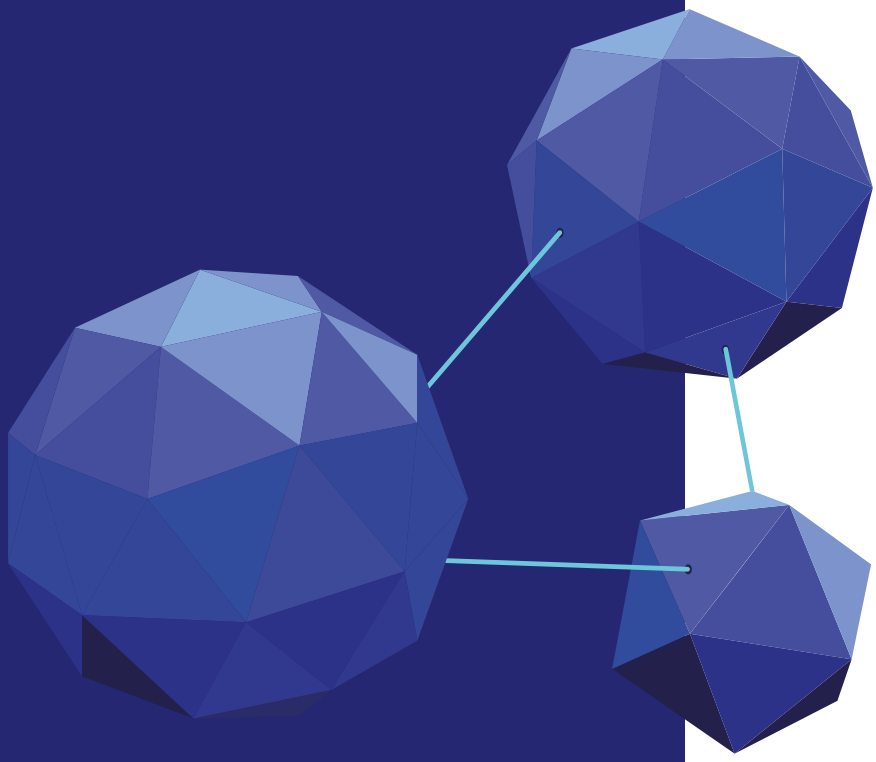
- Management offices of the Tenerife Science and Technology Park
- Offices to let
- Common-use infrastructures: training rooms, meeting rooms, assembly hall, etc.
- Specific services to enhance the quality of your stay in this site: nursery, gymnasium, cafeteria, etc.

MULTICOMPANY BUILDING

Phase II consists of the construction of the Multicompany building, which is made up of 3 modules and intended for large companies, multinationals, etc.

Edificio Multiempresas

Las Mantecas Site



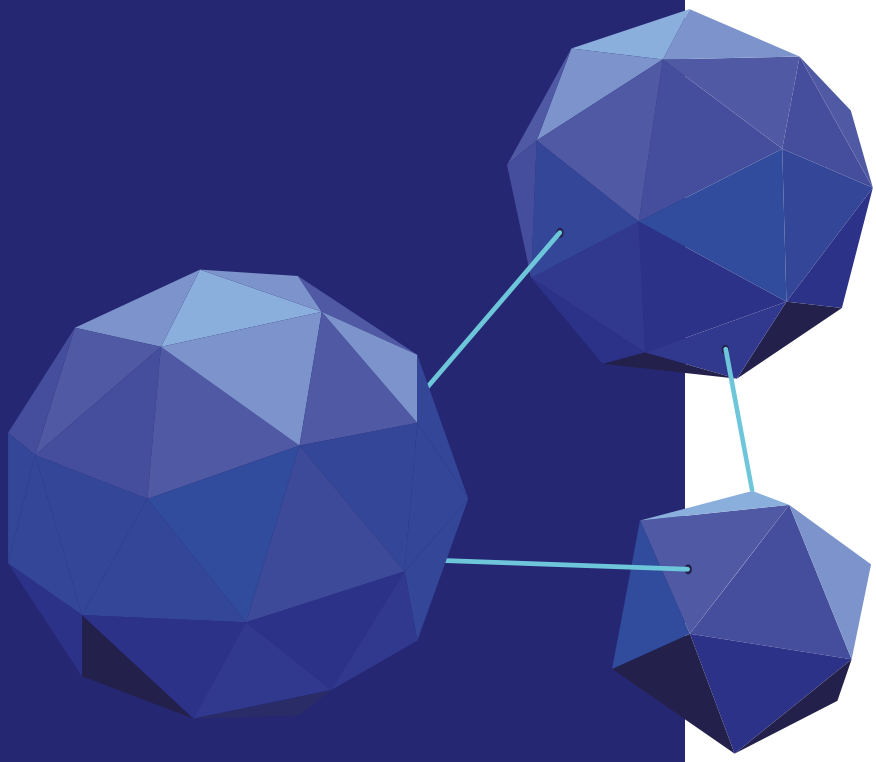
The entity

Tenerife Science and Technology Park's Las Mantecas site is located in La Laguna and is aimed at making Tenerife a leading centre for innovation and entrepreneurship. It is a modern 59,000 m² facility (including an annexed urban park) which includes an annexed urban park and two buildings that will be used to conduct research and carry out technological development and innovation projects, especially linked to nanotechnology, sustainability and astrophysics.

This site has two specialised buildings:

- IACtec, a technology centre related to the Instituto de Astrofísica de Canarias (IAC), will receive 454,463.87 euros. It focuses on astrophysics, space, and scientific instrumentation for sectors such as medicine, security and the environment. It carries out research programmes, mainly in the field of technologies for capturing and processing light and electromagnetic waves in general. It enables technological and business cooperation to take advantage of the knowledge gained by the IAC in the development of advanced scientific instrumentation, while contributing to industrial development and the commercialisation of products with high added value in the Canary Islands.
- NanoTEC, a scientific and technological centre dedicated to understanding the behaviour of new multifunctional materials at different scales. This centre is made up of three modules: Nanomac, for R&D&I activities related to nanotechnology, advanced materials, energy, and water; 'Sostiene', to focus on sustainability, the environment and climate change; and a third module with spaces for the promotion of synergies.

NanoTEC



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https://www.intechtenerife.es/centro-tecnologico-nanotec/

The entity

Centro científico y tecnológico (A science and technology) centre dedicated to understanding the behaviour of new multifunctional materials at different scales. Its objective is the preservation of water resources and the fight against pollution in different sectors such as industry, agriculture, urban planning, atmospheric and aquatic pollution, wastewater recycling, climate change, and environmental health.

It is made up of three modules: "Nanomac", for R&D&I activities related to nanotechnology, advanced materials, energy, and water; "Sostiene", for R&D&I activities in sustainability, the environment, and climate change; and a third module of spaces to encourage synergies between the two areas of knowledge and R&D.

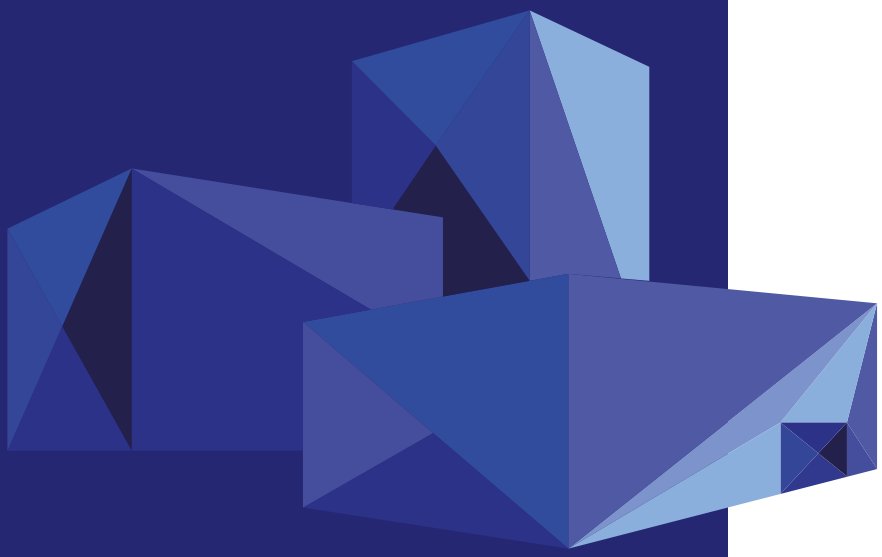
The Nanotec building consists of a ground floor plus 3 upper floors and a basement. The building has been designed as a large container for laboratories and other rooms that provide services for them. It is shaped as two prismatic pieces that meet at an acute angle to house a large facilities courtyard. The building's communications are arranged in two vertical communications cores, situated at the ends of the east container.

On the access floor, there are the installations rooms and the access to the outdoor car park. The outdoor car park blends in with the land, located in the northern part of the building. The administrative area and meeting rooms are in the prismatic piece to the east. Pedestrian access to the building is through this area, as some slopes ensure that the ground is at the same level. The laboratories are located on the first and second floors, each one of them forming a section within the prismatic pieces mentioned above and facing the large installations courtyard. The office and work area is situated around the perimeter. Each of the sets of laboratories has its own equipment area. In addition, between the installations courtyard and the corridor that connects the two parts of the building, there is another corridor common to the two sets of laboratories per floor.

In the south area on the ground floor there is an access for materials located next to one of the vertical cores, which contains a service lift. It connects with the inner courtyard through gates, where a hoist is used to transfer large machinery to the ground floor.

On the third floor, the spaces are divided into three areas: the first, in the east, the necessary installation machineries will be placed on bar gratings; in the second, the central installations yard; and in the third, in the west, there is a space available for the extension of the laboratories (not yet fitted out).

It houses the NanoTec + SOSTIENE headquarters. It is a Technology Centre, associated to La Laguna University, in the areas of environment, microbiology, chemical engineering and nanotechnology, aimed at companies in sectors with technological affinity.



Infrastructure

Basement

Cleanroom

The design of this room is ISO 7-certified and it includes the following equipment:

- Mobile Table 1500x750x900 surface in Acrylic
- Wall table with self-supporting structure
- Wall table supported on modules
- Wall services system
- Shelf
- Special 1800mm display case, for use in the following applications
- nanoparticles. Equipped with 4 230V-16A sockets, 1 thermal magnet, 1 water inlet, 1 nitrogen inlet, 1 compressed air inlet, 1 argon inlet with pressure reducer and 1 vacuum inlet with
- pressure reducer
- Extractor bracket
- Expansion outlet PVC 250 mm. diameter.
- Showcase fan
- Voltage socket 230V-16A White
- Modular Led Luminaire 1450mm Shelf
- Single lever mixer tap for water
- Tap for treated water
- Nitrogen inlet with pressure reducer s. front M
- Compressed air inlet with pressure reducer s. front M
- Vacuum inlet with pressure reducer s. front M
- Stoneware sink 1200x750 mm. sink bowl
- 400x400x250mm. and drainer
- 600x500x650 mm. suspended cupboard with door and drawer. Material: Melamine; Colour: White;
- Base cupboard with plinth, 1200x680x880
- mm. with 1 door. Material: Melamine; Colour: White with sink
- Mobile Table 1500x750x900 surface in Acrylic
- Special 1800mm display case, for use with
- nanoparticles. Supplied with 4 230V-16A sockets, 1 thermal magnet, 1 water connection, 1
- nitrogen inlet, 1 Compressed Air inlet, 1 Argon inlet with
- pressure reducer and 1 Vacuum port with pressure reducer
- Extractor bracket
- Expansion outlet PVC 250 mm. diameter
- Showcase fan
- Cabinet puller
- Expansion outlet PVC 110 mm. diameter
- Showcase fan
- Expansion outlet PVC 125 mm. diameter
- Basic start/stop and protection manoeuvre
- Acid cupboard 600x500x635mm
- 1102x502x635 Security Cabinet
- Reagent cupboard, 1200x500x2010mm. with blind hinged doors and lock.
- Melamine; White
- Reagent cupboard, 1200x500x2010mm. with blind hinged doors and lock.
- Melamine; White
- Metal shelving
- Emergency Floor Shower

First floor: Sustainability

Lab 1

UNION OF 3 FUME CUPBOARDS

Installation of joint ventilation for 3 fume cupboards by means of rigid polypropylene duct Ø355/315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

UNION OF 2 FUME CUPBOARDS

- Installation of joint ventilation for 2 fume cupboards by means of rigid polypropylene duct Ø315/250mm, from fume cupboard outlet to fan connection on the roof.
- Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.
- The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

Lab 2

UNION OF 3 FUME CUPBOARDS

Installation of joint ventilation for 3 fume cupboards by means of rigid polypropylene duct Ø355/315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

Lab 3

UNION OF 3 FUME CUPBOARDS

Installation of joint ventilation for 3 fume cupboards by means of rigid polypropylene duct Ø355/315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

Lab 4

UNION OF 2 FUME CUPBOARDS

Installation of joint ventilation for 2 fume cupboards by means of rigid polypropylene duct Ø315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

UNION OF 2 FUME CUPBOARDS

Installation of joint ventilation for 2 fume cupboards by means of rigid polypropylene duct Ø315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

Lab 5

UNION OF 2 FUME CUPBOARDS

Installation of joint ventilation for 2 fume cupboards by means of rigid polypropylene duct Ø315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

JOINING OF 2 FUME CUPBOARDS

- Installation of joint ventilation for 2 fume cupboards by means of rigid polypropylene duct Ø315/250mm, from fume cupboard outlet to fan connection on the roof.
- Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.
- The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

Lab 6

Individual ventilation installation for 6 fume cupboards by means of a rigid polypropylene duct of Ø250mm, from the outlet of the fume cupboards to the connection of the fans on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

For operation, each fume cupboard will have a flow regulation by means of a speed sensor, including a frequency inverter.

Second floor: Chemical engineering

Lab 1

UNION OF 3 FUME CUPBOARDS

Installation of joint ventilation for 3 fume cupboards by means of rigid polypropylene duct Ø355/315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

JOINING OF 2 FUME CUPBOARDS

Installation of joint ventilation for 2 fume cupboards by means of rigid polypropylene duct Ø315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

Lab 2

UNION OF 3 FUME CUPBOARDS

Installation of joint ventilation for 3 fume cupboards by means of rigid polypropylene duct Ø355/315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

The fume cupboards will be regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

Lab 3

UNION OF 3 FUME CUPBOARDS

Installation of joint ventilation for 3 fume cupboards by means of rigid polypropylene duct Ø355/315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

The fume cupboards will be regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

Lab 4

Individual ventilation installation for 4 fume cupboards by means of a rigid polypropylene duct Ø250mm, up to the connection of the fans on the roof.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

For operation, each fume cupboard will have a flow regulation by means of a speed sensor, including a frequency inverter.

Lab 5

UNION OF 2 FUME CUPBOARDS

Installation of joint ventilation for 2 fume cupboards by means of rigid polypropylene duct Ø315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable outdoor extractor fan, installing an expansion outlet at the fan outlet.

The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

UNION OF 2 FUME CUPBOARDS

Installation of joint ventilation for 2 fume cupboards by means of rigid polypropylene duct Ø315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable extractor fan outside, installing an expansion outlet at the fan outlet. The regulation of the showcases will be carried out by means of VAV (variable air volume) regulation valves, with a regulation system including a frequency variator.

Lab 6

UNION OF 3 FUME CUPBOARDS

Installation of joint ventilation for 3 fume cupboards by means of rigid polypropylene duct Ø355/315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable outdoor extractor fan, installing an expansion outlet at the fan outlet.

The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

UNION OF 3 FUME CUPBOARDS

Installation of joint ventilation for 3 fume cupboards by means of rigid polypropylene duct Ø355/315/250mm, from fume cupboard outlet to fan connection on the roof.

Installation of a suitable outdoor extractor fan, installing an expansion outlet at the fan outlet.

The fume cupboards are regulated by means of VAV (variable air volume) control valves, with a control system including a frequency converter.

SOLVENT CABINETS UNION (SUSTAINABILITY P1 AND CHEMICAL ENGINEERING P2)

Installation of joint ventilation of solvent cabinets under fume cupboards by means of rigid polypropylene duct Ø125mm, from the outlet of the cabinets to the fan connection on the roof.

Each laboratory will have its own flow restrictor.

Installation of a suitable outdoor extractor fan, installing an expansion outlet at the fan outlet.

SOLVENT CABINETS UNION (NANOTECHNOLOGY P1 AND ORGANIC INORGANIC CHEMISTRY P2)

Installation of joint ventilation in solvent cabinets under fume cupboards by means of rigid polypropylene duct Ø125mm, from the outlet of the cabinets to the fan connection on the roof.

Each laboratory will have its own flow restrictor.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

ACID CABINETS UNION (SUSTAINABILITY P1 AND CHEMICAL ENGINEERING P2)

Installation of joint ventilation in acid cabinets under fume cupboards by means of rigid polypropylene duct Ø125mm, from cabinet outlet to fan connection on the roof.

Each laboratory will have its own flow restrictor.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

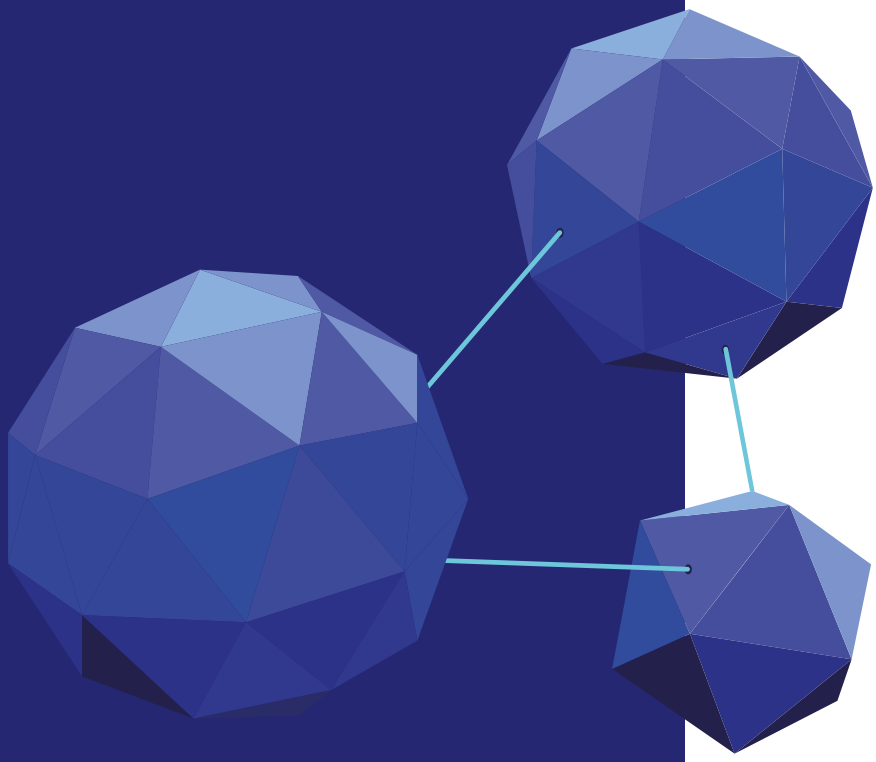
ACID ARMARIES UNION (NANOTECHNOLOGY P1 AND ORGANIC INORGANIC CHEMISTRY P2)

Installation of joint ventilation in acid cabinets under fume cupboards by means of rigid polypropylene duct Ø125mm, from cabinet outlet to fan connection on the roof.

Each laboratory will have its own flow restrictor.

Installation of a suitable exhaust fan outside, installing an expansion outlet at the fan outlet.

IACtec



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The entity

It is a technology centre of Tenerife Science and Technology Park associated to the Instituto de Astrofísica de Canarias (IAC) [The Canary Islands Institute of Astrophysics], whose activity focuses on astrophysics, space and scientific instrumentation for sectors such as medicine, security and the environment. It develops transferable R&D projects, mainly in the field of technologies for capturing and processing light and electromagnetic waves in general.

It allows technological and business cooperation to take advantage of the IAC's knowledge in the development of advanced scientific instrumentation while contributing to industrial development and the commercialisation of high added-value products in the Canary Islands.

IACtec is the space for technological and business cooperation of the Instituto de Astrofísica de Canarias (IAC), whose mission is to develop an innovative ecosystem in the Canary Islands for the transfer of high technology between the public sector and companies, taking advantage of the scientific and technological capital of the IAC.

IACtec provides an accessible environment with abundant human, scientific, technological, and financial resources: the ideal space for companies and institutions with a vocation for R&D to collaborate and develop new partnerships and innovative projects.

IACtec was created as a key strategic setting to develop talent and a dynamic and innovative production fabric in the Canary Islands and in Spain.

Areas and departments

IACTEC

IACTEC is the space for technological and business cooperation of the Instituto de Astrofísica de Canarias (IAC), whose mission is to develop an innovative ecosystem in the Canary Islands to transfer high technology between the public sector and companies, taking advantage of the scientific and technological capital of the IAC. It also provides an accessible environment with abundant human, scientific, technological, and financial resources: the ideal space for companies and institutions with a vocation for R&D to collaborate, developing new partnerships and innovative projects. IACTEC was created as a key strategic setting to develop talent and a dynamic and innovative production fabric in the Canary Islands and in Spain.

IACTEC, located in the Tenerife Science and Technology Park, started out by focusing on three lines of activity for which the IAC already has key capabilities in strategic disciplines such as optics, electronics, the development of specific software applications and precision mechanics. These lines are (1) Space, including a Micro-satellite programme and another for processing Earth Observation Data, (2) Medical Technology and (3) Large Telescopes. In addition, it is permanently seeking new niches to extend its technology transfer capacity to other disciplines apart from those mentioned above.

IACTEC aims to become a leading centre of international scope in the use of technologies for advanced optical systems. During the present decade, collaboration with the science industry and innovation activities will be strengthened. It will also contribute to the development of talent and a dynamic and innovative production fabric, in the Canary Islands and in the rest of Spain, by promoting the co-production of technological knowledge with technology-based companies, especially in the Astrophysics and Space sector, which the Canary Islands' RIS3 strategy prioritises. It will thus encourage the emergence of new business activities with high added value in the region.

Therefore, IACTEC focuses its activity on the application of advanced optical technologies for space sciences and scientific instrumentation in sectors such as medicine, safety, and the environment. It will carry out transferable R&D projects, mainly in the field of technologies for capturing and processing light and electromagnetic waves in general. It will enable technological and business cooperation to make the most of the IAC's know-how in the development of advanced scientific instrumentation while contributing to the industrial development and commercialisation of high value-added products in the Canary Islands.

IACTEC will be the IAC's spearhead for the socio-economic valorisation of R&D, nurturing the regional innovation ecosystem by supporting various business initiatives, creating highly skilled jobs and promoting technological valorisation and innovation.

Services

Design and development of satellite payloads

Taking advantage of its experience in designing optomechanical and optoelectronic instrumentation in extreme environments and in space, the IAC, through IACTEC, designs and builds payloads for earth observation from satellites in low orbits.

Design and development of medical instruments and applications

Image acquisition and processing technologies applied in astrophysics are equally useful in medical applications, for which IACTEC designs and builds prototypes for commercial use and to support sustainable growth in developing countries.

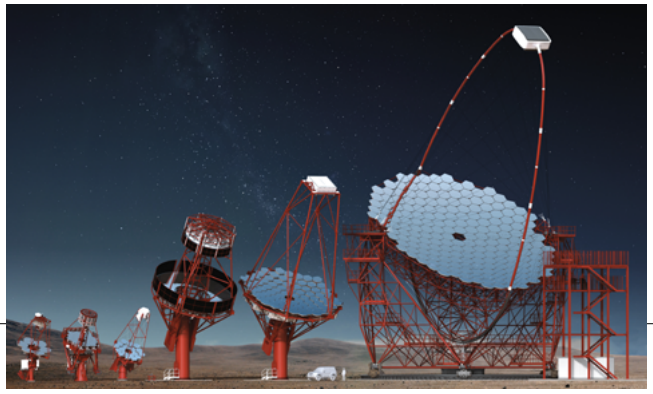
Implementation of large telescopic installations

With IACTEC acting as an integrating element of large telescope projects with the national and European science industry, the IAC designs and builds today's most ambitious telescopes in collaboration with international consortia: CTA, EST and NRT.

Projects

CTA

Cherenkov Telescope Array



CTA is a large-scale global project to build a new generation of Cherenkov telescopes dedicated to study the universe in very high-energy gamma-rays. It will be the largest, most sensitive, advanced instrument ever built for gamma-ray astronomy and the first ground-based observatory of its kind open to the world astronomical and particle physics communities.

The observatory has two sites, each in one hemisphere. In the northern hemisphere, CTA is located at the Roque de los Muchachos Observatory of the Instituto de Astrofísica de Canarias (IAC) on the island of La Palma (Spain). In the southern hemisphere, CTA is located at the Paranal Observatory of the European Southern Observatory (ESO) in the Atacama Desert (Chile).

CTA will host three types of telescopes: Large-Sized Telescopes (LSTs), Medium-Sized Telescopes (MSTs) and Small-Sized Telescopes (SSTs) to cover a wide range of gamma radiation from 20 GeV to 300 teraelectronvolts (TeV). The plan for the northern site includes 4 LSTs and 15 MSTs, while the southern site will have all three types of telescopes: 4 LSTs, 25 MSTs and 70 SSTs. Overall, CTA will have unprecedented accuracy and will be 10 times more sensitive than existing instruments.

The planning of the construction of the Observatory is managed by CTAO gGmbH, which is governed by the CTA Council consisting of shareholders and associate members from a growing number of countries. CTAO gGmbH works closely with the CTA Consortium, which includes more than 1,400 scientists and engineers from 31 countries involved in the scientific and technical development of CTA. An intergovernmental agreement is being prepared for the construction and subsequent operation of the observatory, for which a European Research Infrastructure Consortium (ERIC) is planned.

The construction of CTA will cost a total of more than 200 million euros, of which it is estimated that 90 million euros will be spent on the telescopes being installed in La Palma. The CTA-North network, which is expected to be operational in 2024, will have an estimated investment, both in the purchase of goods and services and in the hiring of personnel, of more than 2 million euros per year.

The IAC's actions in the CTA project are funded by the project "The four Large Size Telescopes (LST) of the CTA-North in the ORM" reference ESFRI-2017-IAC-12 of the Ministry of Science, Innovation and Universities, 85% co-financed with European Regional Development Funds (ERDF) of the Operational Programme for Intelligent Growth 2014-2020, with Co-funded by- from the Canary Islands Development Funds (FDCAN), from the Cabildo of La Palma (2016-2018), and funding from the Canary Islands Government, through the Canary Islands Agency for Research, Innovation and Information Society (ACIISI).

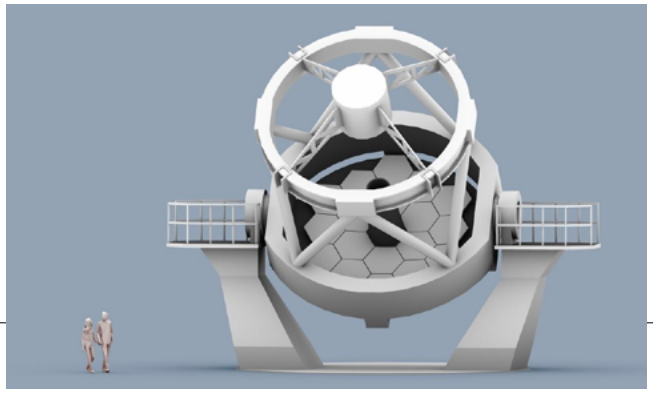
EST

Telescopio Solar Europeo

The European Solar Telescope (EST) (http://www.est-east.eu) will be the largest solar telescope ever built in Europe. With a 4.2-metre primary mirror and state-of-the-art technology, it will provide astronomers with a unique tool to understand the Sun and how it shapes space weather. A flagship of European solar physics since 2016 following its inclusion in the ESFRI roadmap, EST is a project led by the Instituto de Astrofísica de Canarias (IAC) and promoted by the European Association of Solar Telescopes (EAST). EAST brings together a community of more than 600 solar physicists from 24 institutions in 18 European countries, with the aim of providing solar astronomers with access to the best high-resolution ground-based observing infrastructures in the world. With a construction cost of approximately 200 million euros, this new telescope represents a major technological challenge in critical areas such as thermal control, adaptive optics, and instrumentation. Its construction offers a unique opportunity in terms of technological development, as well as the possibility of creating industrial contracts to improve European competence in the design and manufacture of mechanical structures, large format optical elements, high-speed detectors, precision scientific instrumentation or data management systems. There is unanimous agreement on the desired location for the EST: the Canary Islands Observatories. The European projects EST Design Study, SOLARNET, GREST and PRE-EST led by the IAC, together with the recent creation of the EST office, are helping to make this telescope a reality.

NRT

New Robotic Telescope



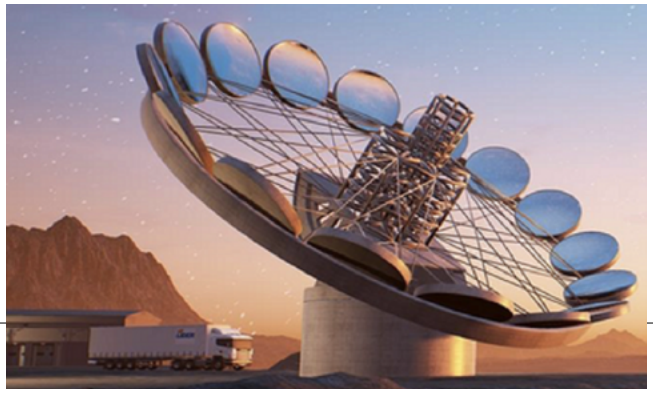
The NRT (New Robotic Telescope) is a project to design and build within five years a 4-metre telescope that will operate in a fully autonomous and robotic manner from the Observatorio del Roque de los Muchachos (ORM). This form of operation will make it the world's largest robotic telescope and, together with the exceptional astronomical observing conditions at the ORM, it will also be the best equipped to access important physical phenomena in the areas of gravitational waves, planets outside the solar system, supernovae and various other areas of what has become known as time-domain astronomy.

The consortium includes Liverpool John Moores University (LJMU), the University of Oviedo and the IAC. The project requires major technological advances in several areas of optics, mechanics, electronics, and software, in particular the development of a robust, reliable, and efficient control system. The innovative nature of the project regarding several aspects that may become standards for future developments fits perfectly with the objectives of IACTec.

With funding from the Government of the Canary Islands, in 2018 the first steps were taken to create the technical team that will be responsible for articulating the IAC's participation in the project. The team is currently made up of highly specialised engineers in the areas of systems, mechanics, and software. This group has worked closely with the LJMU team and has played an important role in the development of the first version of the preliminary design presented in December 2018. At the same time, there has been significant interaction with Spanish high-tech companies with a view to their getting involved in the project and possibly set up at IACTec.

ELF

Exo Life Finder



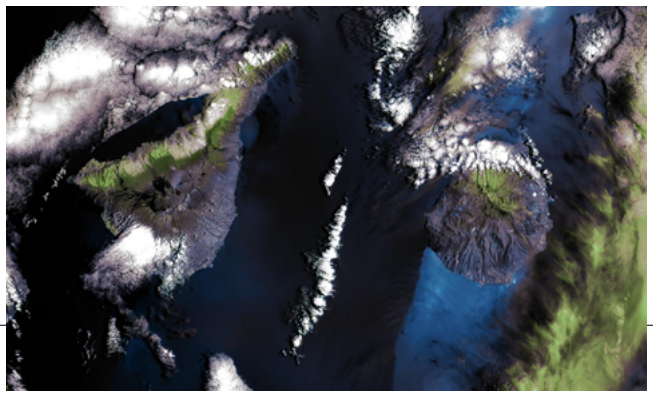
The Exo Life Finder is a telescope consisting of a large ring of small primary mirrors to achieve high angular spatial resolution with the main scientific goal of studying the atmospheres of exoplanets for biomarkers. ELF will function as an interferometer to eliminate the central bright star and reveal the nearby exoplanet.

The mini-ELF telescope consists of a series of 15 0.5 m mirrors, arranged off-axis in a circle of 3.5 m diameter, forming a common main parabola. mini-ELF is a project that is part of the IACTEC "Large Telescopes" together with the Cherenkov Telescope Array, the European Solar Telescope and the New Robotic Telescope.

Launching a High-Tech Incubator specialising in Astrophysics and Space in the Canary Islands

Astrophysics and space are two of the priority scientific areas in the smart specialisation strategy of the Canary Islands (RIS3). Moreover, they are strategic sectors for the Tenerife 2030 Area: Innovation, Education, Culture and Sports of the Tenerife Islands Council (from now on TF2030) whose main objective is to develop a culture of innovation on the island of Tenerife. In this regard, as there is no incubation centre in the Canary Islands for companies in these sectors, since 2018 the Cabildo de Tenerife, through INtech Tenerife in collaboration with IAC, has been working on a project to set up a High Technology Incubator in Astrophysics and Space, which will be located in an annex building and will have a strong link with IACTEC. The project is funded by the INCYDE Foundation. The main objective of this project is to carry out the necessary promotional activities to start-up and consolidate the incubator, with the ultimate aim of promoting entrepreneurship and the creation of companies in the Astrophysics and Space sectors.

IACTEC Espacio



IACTEC is largely dedicated to the space technology sector, a field in which the IAC has gained a great deal of experience through previous collaborations on European Space Agency (ESA) missions.

IACTEC-Espacio is the IACTEC project that will drive innovation and development related to the aerospace sector. Our initial focus will be on Earth observation, starting with the ALISIO-I mission and the SWIR DRAGO camera, with a view to developing our technological capabilities to apply them to space observation projects with this type of satellites.

ALISIO-I

ALISIO-I is the first fully developed mission at IACTEC--Microsatellites. It will be one of the pioneering nanosatellites observing the Earth in the shortwave infrared (SWIR) range. It does not yet have a launch date.

This mission has a twofold objective: to demonstrate the capability to observe the Earth in the SWIR range from a 3U+ nanosatellite (30x10x10cm) and to consolidate a multidisciplinary team capable of designing small satellite payloads following the strictest ECSS standards.

Observation in the SWIR band provides crucial information that is not available in the visible range. Analysis in this region of the spectrum allows, for example, to create vegetation indices, detect hot spots in fires and detect and characterise oil spills. Adding this observation band will significantly increase the number of applications available for use on small platforms.

DRAGO

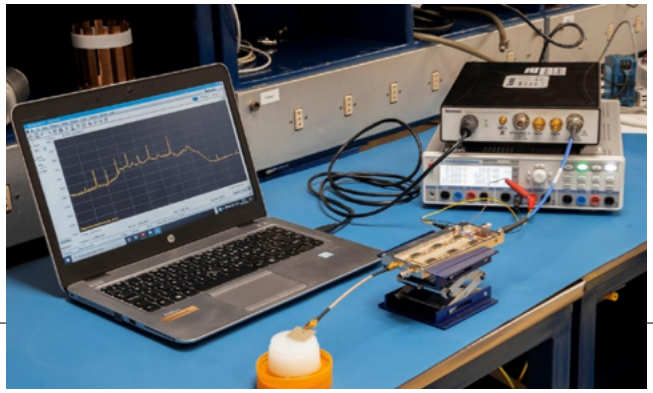
DRAGO (Demonstrator for Remote Analysis of Ground Observations) is an infrared camera entirely developed by the IACTEC-Microsatellites team. It was launched into space on 24 January 2021 aboard a SpaceX Falcon 9 rocket, integrated into a D-Orbit ION-mk02 satellite.

DRAGO is one of the first instruments to explore the use of uncooled InGaAs technology for Earth observation applications on board nanosatellites. Using this technology, the DRAGO camera operates by observing in two SWIR bands (centred at 1.1 and 1.6 -m) through a special filter placed on top of the sensor. The design has been carried out following the SWAP concept, so it can be easily integrated into a 3U nanosatellite (1.3U and <5.4W).

The camera also includes high-performance hardware and software, developed at IACTEC, for high-speed imaging (up to 160 fps). These electronic devices enable on-board image processing, including features such as super-resolution, compression, and encryption.

To guarantee a 3-year lifetime, sensitive electronic components have been protected and a special system has been developed to automatically isolate and recover from SEE events.

IACTEC Medical Technology



IACTEC's Medical Technology (TECMED) programme transfers technologies used in astrophysical research to the field of medicine, and is developing two systems operating in the visible, thermal infrared and microwave ranges. The staff of the Medical Technology team belong to the IACTEC Training Programme, funded by the Cabildo de Tenerife. Its results are being achieved thanks to the support of the Cabildo de Tenerife under the TFINNOVA Training Programme 2016-2021 of the Marco Estratégico de Desarrollo Insular (MEDI) Strategic Framework for Island Development and the Canary Islands Development Fund.

PINRELL

(Prototype for INfraREd analysis of Lower Limbs).

This is an Infrared Thermography system designed by IACTEC's Medical Technology programme to detect, analyse and evaluate different diseases, such as diabetic foot conditions. This prototype, developed especially for clinical use, is a tool designed for the early detection of possible injuries, infections and subcutaneous ulcers which are not visible on the feet of diabetic patients but can be detected by Thermal Infrared.

PINRELL uses three low-cost sensors to detect Visible (VIS) and Near Infrared (NIR) radiation ranging from 0.4µm to 0.86µm and Thermal Infrared (IR) from 8µm to 14µm. In the VIS and NIR range, the Intel RealSense D415 camera has been used. Its main feature is the generation of 3D depth information through two sensors and a NIR emitter, combined in a sensor in the visible range (multi-channel image). In the thermal IR range, the Thermal Expert Q1 camera has been used, which incorporates a microbolometer sensor with QVGA resolution in the 8 µm - 14 µm range and a thermal sensitivity (NETD) of less than 50 mK.

One of the keys to the PINRELL prototype lies in the desktop software application developed by the TECMED programme, which runs on different operating systems: Linux and Windows. It has been developed using open-source software (3D Slicer and PLUS) and uses different standard software architectures applied in the software industry. The PINRELL software application is responsible for data collection, image registration and analysis of the information received by applying various data analysis techniques such as segmentation, classical statistical algorithms and Machine (Deep) Learning. This way, the PINRELL system is able to create a database of multichannel medical images (VIS/IR/NIR) to develop algorithms for diagnosing and monitoring diabetic foot neuropathies, carrying out an analysis and monitoring of anomalous surface temperature patterns that are invisible to the human eye.

MICROWAVE

Microwave radiometry (MWR) is a non-ionising, non-invasive, passive and inherently safe technique to obtain subcutaneous body temperature measurements and deep temperature patterns. This technique will complement surface temperature measurements of biological tissues aimed at personalised diagnostics.

MWR uses radiometers, which are very low noise, very sensitive receivers capable of detecting small input signals, such as that radiated by human body tissues (approximately -174 dBm/Hz at 310 K or 37 ºC). The sensors developed at IACTEC operate in five frequency bands (1.5 GHz, 2.2 GHz, 2.7 GHz, 3.5 GHz and 4.3 GHz) which are discriminated by the use of filters. The receivers have been carefully designed by confining and integrating, in the corresponding operating bandwidth, the received signal and adapting it to the detection window of the microwave sensor. The multi-frequency system will provide a set of temperature measurements, dependent on the operating frequency, enabling the analysis of the internal temperature distribution of biological tissues.

MWR also requires the development of components that realistically simulate the behaviour of microwave energy inside biological tissues. These components are called phantoms and accurately simulate the dielectric properties of body tissues. They have been manufactured using common materials in varying concentrations to provide the desired elasticity, consistency, and durability. A set of phantoms has been developed that exhibit multi-layer and multi-modal capabilities, while anthropomorphic solutions are in the process of being realised. The phantoms are adapted for use in ultrasound imaging (ultrasound), which allows for the guidance of the microwave technique.

Medical Technology: MACBIOIDI.

Boosting the cohesion of the Macaronesian ORs through a common ICT platform for biomedical R&D&i

The MACbioIDi Project has 31 partners in the Canary Islands, Madeira, Azores, Cape Verde, Mauritania, Senegal, mainland Spain and the USA. Its objective is to develop medical technology and training programmes that can be used in the participating territories, paying attention to their social and business transfer. The collaboration is based on the open source 3D Slicer software platform, developed over the last 20 years and in continuous evolution, led by the Surgical Planning Lab at Harvard University and Brigham & Women's Hospital in Boston, USA, a partner of the MACbioIDi Project.

Infrastructure

LIFEM: Integrated Laboratory of Photonics, Optoelectronics and Opto-Mechanics of IACTEC

The LIFEM laboratory (Integrated Laboratory of Photonics, Optoelectronics and Opto-Mechanics) will provide IACTEC's new headquarters with the technical infrastructure needed to support strategic R&D activities.

LIFEM will be equipped thanks to funds provided to IAC by:

- The Ministry of Science, Innovation and Universities through the State Research Agency (through the competitive call "Scientific-technological equipment 2019"), ERDF funds, to be executed before the end of 2022,
- The Government of the Canary Islands through the Canary Islands Agency for Research, Innovation and Information Society (ACIISI), (through the competitive call "Equipment and infrastructures for public R & D 2019), ERDF funds, to be executed before mid-2022,

Cleanroom 1

- Dimensions (length, width and height): 31.8m x 8.2m x 6.4m.
- Equipped with a 5tm overhead crane.
- Visible from common areas (corridors, hall) through large windows. Cannot be darkened
- ISO7 cleanliness class.
- Equipped with general supplies (water, single and three-phase power, compressed air) and special gases (nitrogen, helium).

Cleanroom 2

- Dimensions (length, width and height): 26.6m x 9.3m x 6.4m.
- Equipped with a 5tm overhead crane.
- Blackout (allows testing in darkness).
- ISO7 cleanliness class (and within that classification, slightly better than in room 1, as it has more discharge pressure).
- Equipped with general supplies (water, single and three-phase power, compressed air) and special gases (nitrogen, helium).

In addition, the rooms will soon have four 4mx4mx2.5m modular booths with ISO6 (better than ISO7) cleanliness level, two of which can be darkened.

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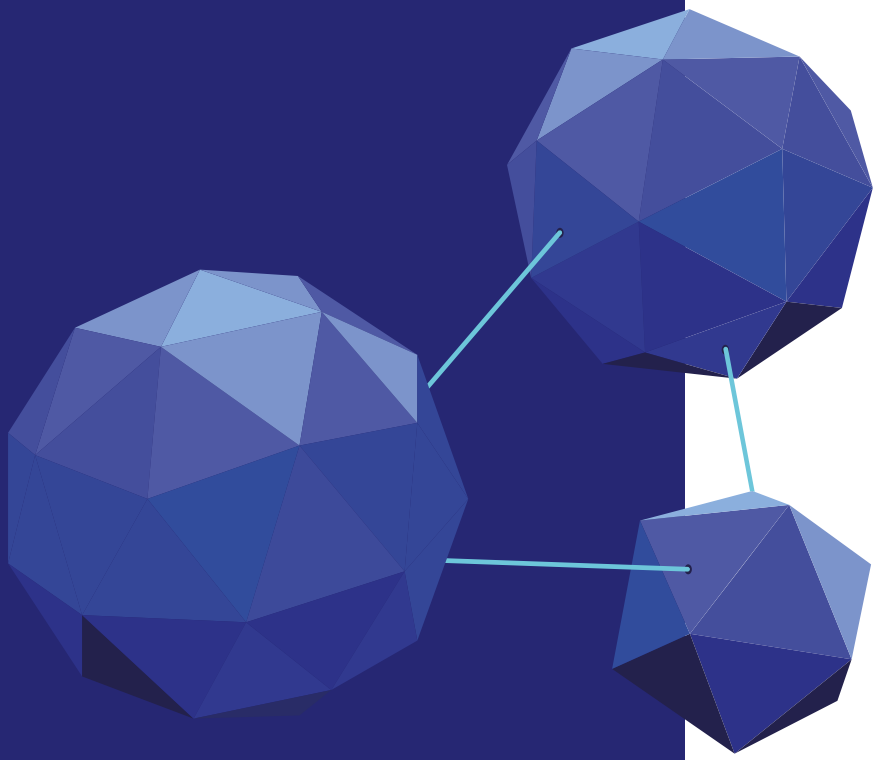
CEDel



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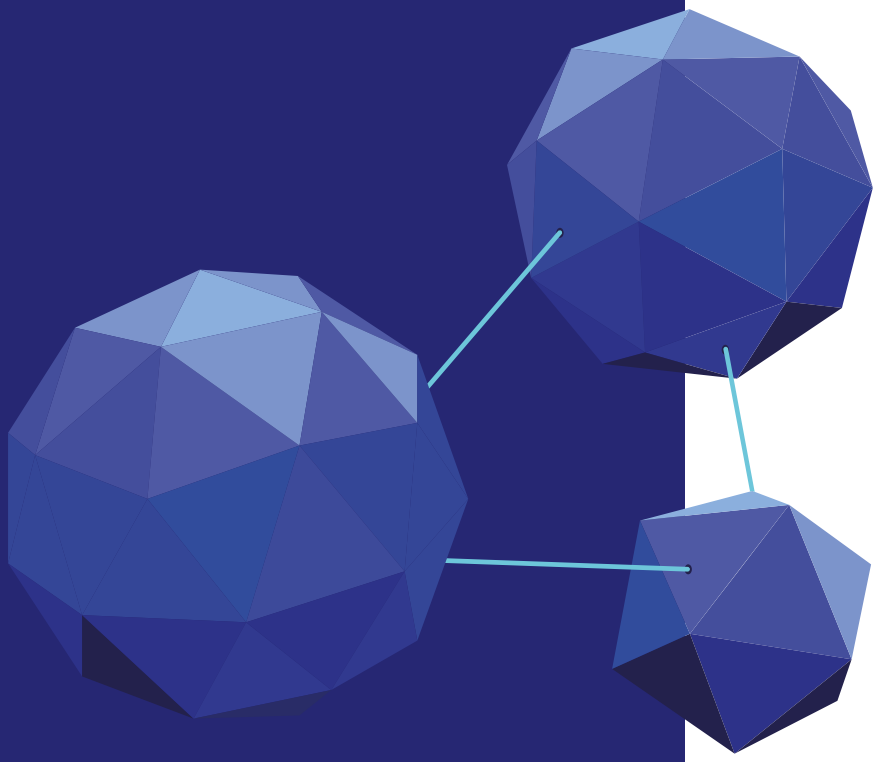
https://www.intechtenerife.es/cedei/

The entity

In the Canary Islands, and particularly in Tenerife, there is a range of infrastructures that can act as catalysts for a change of trend in economic activity. The deep crisis of recent years has brought to light the weakness of an economy based on a limited set of activities, basically concentrated in the 'services' and 'construction' sectors. In addition to the infrastructures, higher vocational training and the Canarian universities provide quality education. This suggests that a change of the productive model is possible and that it can be oriented towards a knowledge economy, and the intensive use of Information and Communication Technologies. In other words, there is an opportunity to promote a software development and telecommunications industry that provides services abroad. In this context, developing a work programme to promote job creation based on this type of industry as a first step towards the development of a growing economic activity in the ICT sector, has been positively valued. The main objective of the project, financed by the Cabildo de Tenerife, is to set up technology-related specialisation and training services, based on a training and employment programme. In short: improving and adapting the skills of professionals to the demand and requirements of high technology companies, minimising the difficulties to access the labour market and maximising the chances of taking part in the process of the digital transformation of businesses. Hence the need to set up the Centro de Excelencia de Desarrollo e Innovación (CEDeI) [Centre of Excellence for Development and Innovation] which is co-financed by the FDCAN Programme.

So far, Tenerife Science and Technology Park has issued 2 calls to apply for the CEDeI Programme in which 164 people registered, 126 of which were selected in the first phase; finally, 40 people were picked to participate in a training programme in collaboration with 6 companies that work in various sectors of interest for the economic development of Tenerife: ICT, Animation, Audiovisual Production and Online Training. The Tenerife Science and Technology Park will continue to support CEDeI as the best infrastructure to promote specialised talent on the island.

Innovaparq ULL Site



The entity

A business incubator located on the Central Campus of the University of La Laguna, at the Torre Profesor Agustín Arévalo (former "Torre de Química"). Tenerife Science and Technology Park refurbished the three upper floors of the building, which have a surface area of 549.03 m² each making a total of 1.647.09 m² so that technology-based or knowledge-intensive companies related to the University of La Laguna could set up here. They would be spin-offs stemming from research results or set up by student-entrepreneurs or by companies that collaborate with the University through scientific-technical assistance agreements or by incorporating students and PhD students into their staff.

There are 29 modular offices on the 5th, 6th and 7th floors of the building, some of which are equipped as Biotechnology laboratories. They can be rented for a period of 2 years (extendable).

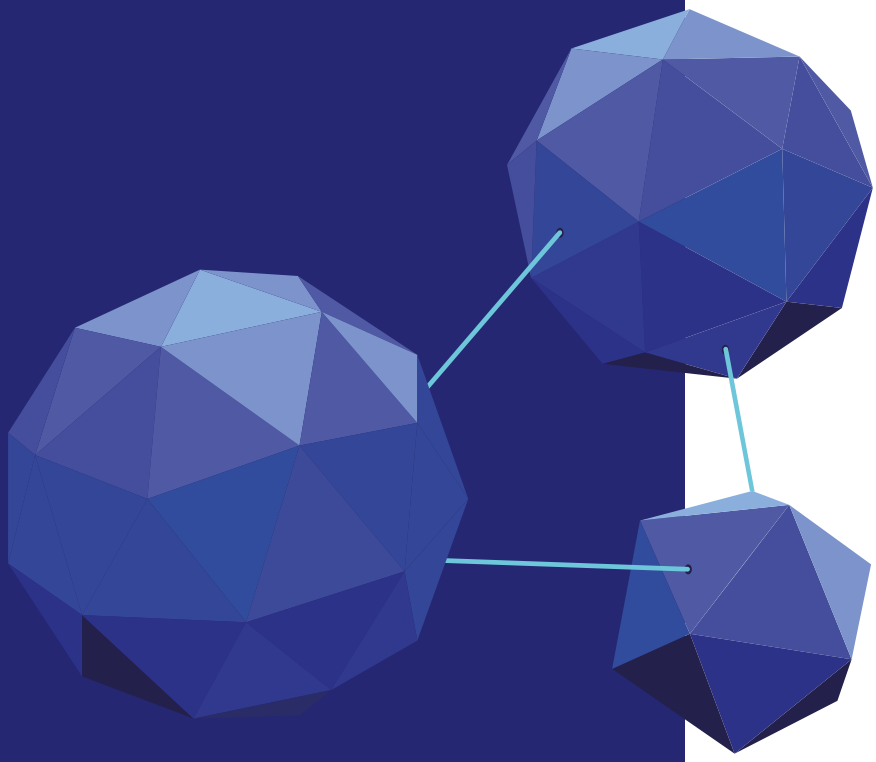
SERVICES AND EQUIPMENT

Rental of private modular offices or laboratories with a surface area from 25 to 72 m² equipped with office furniture (tables, chairs and drawer units) and Internet connection, with the right to:

- Use of common access areas:
    - Meeting and/or training room (10 hours/month)
    - Vending machines
    - Toilets

- Basic services:
    - Wifi connection
    - Accessible 24 hours a day, 7 days a week
    - 24-hour surveillance
    - Cleaning
    - Maintenance
    - Water, electricity, and air conditioning
    - Insurance

Innovaparq Dársena Site INfactory y TFCoworkIN



The entity

INfactory

The 3-storey INfactory business incubator offers for 2 years (extendable to 3 years) in rented offices. It is aimed at entrepreneurs and start-ups with innovative, technological or knowledge intensive business projects that can potentially be applied in the maritime and port sector.

INfactory has the following infrastructure:

FLOOR 0:
- Entrance hall, waiting area, lift
- Maker Lab, equipped with 3D printers and other complementary material.
- Children's computational thinking lab.
- 2 offices of 19 and 23 m² equipped with office furniture.
- Adapted toilets.

FLOOR 1:
- 7 offices between 19 and 23 m² equipped with office furniture.
- Adapted toilets.

FLOOR 2:
- 3 offices of between 26 and 30 m² equipped with office furniture.
- Training room - traiIN room - with capacity for 30 people.
- Meeting room -meetIN room- with capacity for 10 people.
- Office area -eatIN-.
- Relaxation area -chillIN-.
- Adapted toilets.

SERVICES

The accommodation service offered to entrepreneurs and companies includes:
- Office rental (19-30 m²):
- Office furniture (desks, chairs and drawer cabinets)
- Internet connection
- Common access areas:
    - use of traiIN training room, on request.
    - use of the meetIN meeting room, on request.
    - use of Computational Thinking Lab, on request.
    - use of Laboratorio Maker, on request.
    - use of office eatIN
    - use of chill-IN relaxation area
    - toilets, lift

The following basic services are included both in the offices and in the common areas:
- wifi connection
- 24/7 access
- 24-hour surveillance
- cleaning
- maintenance service (incidents)
- water, electricity, community and basic maintenance costs (air, low voltage and air conditioning).
- insurance
- video surveillance

TFcoworkIN

TF coworkIN is an open, flexible and dynamic workspace that the Tenerife Science and Technology Park makes available to professionals, freelancers and entrepreneurs, under the system of renting workstations by the hour, where innovative business projects are promoted under a culture of collaborative work.

Part of the activity applies to all business sectors, but there is another part that is oriented towards the maritime and port sector, taking advantage of the business opportunities offered by its location.

TF coworkIN is equipped with all the necessary equipment and resources to carry out professional activities:

- 43 "co-worker" workstations (ground floor) consisting of: desk, chair, Internet connection and power sockets.
- Modular work cubes: 3x3x3 m (ground floor), equipped with 3 desks and 3 chairs (booking requested).
- 60 lockers, with key system
- 1 training room (upper floor) - trainIN- room for 30 people equipped with tables and chairs, projection system and connectivity.
- Several open spaces or cubes for training, on request (ground floor)
- 1 meeting room (top floor) -meetIN room-, with capacity for 14 people, equipped with meeting table, monitor and connectivity for videoconferences via Skype, etc.
- Various open or cubed meeting spaces on request (ground

TFCoworking

floor).
- Presentation area, with stage and auditorium stalls (ground floor), on request.
- Adapted toilets.
- Video surveillance system.

The coworking service can be requested flexibly and automatically on a web platform of the Tenerife Science and Technology Park. Payment, according to the time of use required, can also be made through the same platform.

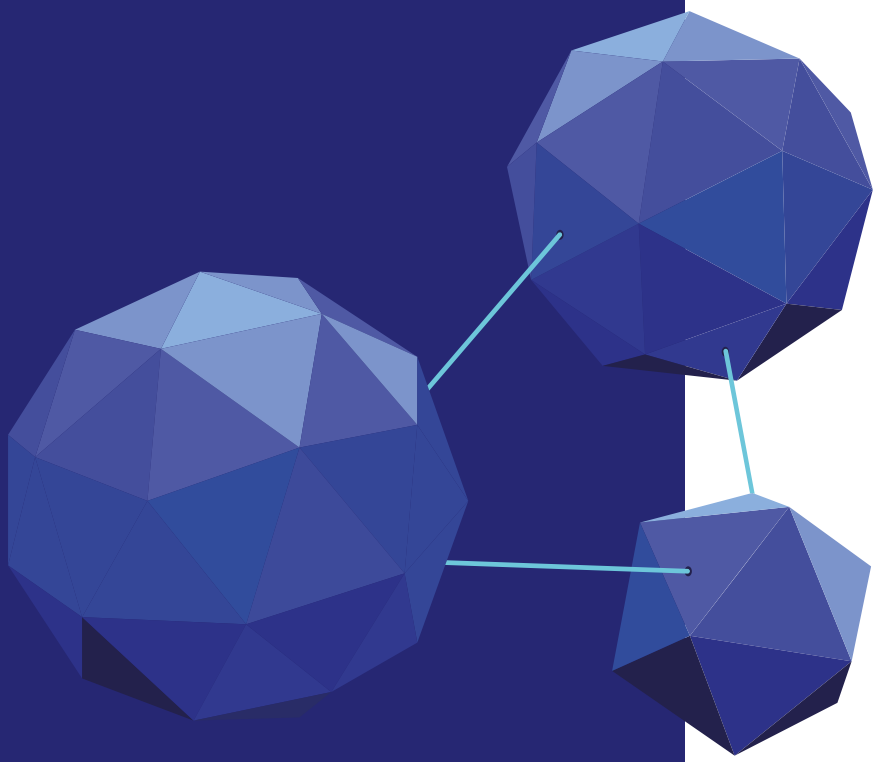
In addition, working in a space like TF coworkIN is a great value for coworkers, as it offers a wide range of training, networking activities and support programmes, most of which are free of charge for the coworker.

SERVICES

The coworking service includes:
- Co-worker or "cube" workstation in addition to:
- Use of meeting rooms, on request
- Office: open area with kitchenet equipment and vending machines.
- Use of training rooms, on demand
- Use of locker, on demand
- Use of presentation area, on request
- Access control to the coworking space by security code.
- 24/7 access.
- Internet access.
- Use of the kitchenet.
- Cleaning and maintenance of the space.
- Parking facilities.

Instituto Tecnológico y de Energías Renovables (ITER)

ITER
Instituto Tecnológico y de Energías Renovables



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Key words:

Earth Sciences
Public company
Ecology
Volcanoes
Renewable energies
Ecotourism
Geotourism
Climate change
Geoparks
Laboratories
Geochemistry
Volcanology

The entity

Three decades promoting sustainable development and innovation

Promoted by the Cabildo de Tenerife, the Institute of Technology and Renewable Energy [ITER] was created in 1990 with the aim of promoting sustainable development and innovation on the island of Tenerife.

Today, ITER is a leading international research centre in renewable energies, engineering, telecommunications, and the environment.

Since 1990, our work has focused on technological development and innovation, researching and developing new materials, processes and technologies, with the aim of contributing to the sustainable development of the island of Tenerife and improving its competitiveness.

From the technological point of view, we have evolved to suit a context in which activities are conducted by multidisciplinary teams and society's demands and expectations are increasing. Due to the fact that the New Information and Communication Technologies have acquired greater relevance in society in recent years, our activities in this field have grown exponentially.

Since setting up in 1990, we have actively participated in different European programmes, having developed more than 200 R&D&I projects with partners from most European regions. In turn, we have acted as technological and scientific advisor to many organisations, such as the European Commission, the Cabildo de Tenerife, the Agencia Española de Cooperación (AECID) [Spanish Cooperation Agency] and numerous governments and international institutions. In recent years, being aware of the importance of the Canary Islands as a tri-continental platform between Europe, America and Africa, we have carried out numerous international projects aimed at technology transfer and development cooperation, exporting know-how to other countries and archipelagos.

In 1990 we inaugurated our first wind platform, a 1.05 MW installation designed to study the operation and performance of different wind turbines. Since then, we have installed a total of 13 MW of wind energy and 41 MW of photovoltaic energy, being responsible for the installation of 35% of the total installed power of renewable origin on the island of Tenerife. In addition to these facilities, there are other infrastructures that have been developed over the years to support and promote our R&D activities, such as the D-ALiX High Availability Data Processing Centre, the Aerodynamic Tunnel for Civil Tests, the CCG-ITER Generation Control Centre or the Photovoltaic (SiCellLab), Chemistry and Isotope Gas and Groundwater Chemistry and Electronics laboratories.

On the other hand, with the aim of getting both the population of Tenerife and its visitors involved in our research and projects, we pay special attention to dissemination, education, and social awareness. An example of this is our informative facilities, made up of the Bioclimatic Houses Development, the Renewable Energy Walkway and our Visitor Centre, which receive more than 10,000 visitors a year.

The initial idea of the Cabildo de Tenerife was to promote the creation of an entity dedicated to R&D&I that would subsequently be able to finance itself in order to maintain its activity. We have achieved this objective and have consolidated and grown with our own resources, obtained through selling the energy produced in our wind farms and photovoltaic plants, carrying out R&D&I projects and providing consultancy and engineering services.

In these 25 years we have not only grown in facilities and personnel, but we have also branched out, making up the Grupo ITER, a group of entities dedicated to R&D&I, which has a multidisciplinary team of more than 200 professionals.

Areas and departments

Renewable energy

The Renewable Energies Area of ITER is made up of the Photovoltaic Energy, Wind Energy and Sustainable Architecture departments. Its lines of work include carrying out renewable energy projects, contributing to increase the weight of these energies in the energy balance of the island, as well as the promotion of energy efficiency and sustainable construction techniques. ITER has installed 44.3 MW of photovoltaic generation plants and 65.7 MW of wind energy installed in different parks.

This area also offers a series of services, including the design and manufacture of the necessary equipment (photovoltaic modules, structures, inverters, etc.) as well as the design of renewable energy installations, for which it has Project Management teams, a Renewable Installations Operation and Maintenance Centre and a Generation Control Centre (CCG-ITER).

Another major activity is the development of R&D&I projects in the area of Renewable Energies, which focus on the study and improvement of processes for obtaining clean energy from the main natural energy resources of the Canary Islands. Thus, it is committed to researching into third generation solar cells, which have great potential in terms of energy efficiency and low manufacturing costs; to developing smart grids to optimise energy supply; to applying robotics and automation solutions in the field of renewable energies; to integrating renewable energies in building and R&D&I in advanced techniques in sustainable architecture and town planning.

The Area also works in development cooperation and technology transfer with the ultimate goal of improving the living conditions of the local population in developing countries through the incorporation of renewable technologies.

Environment

The Environment Area in ITER was set up in 1997 with the purpose of contributing to sustainable development by improving the management to reduce volcanic risk; it also aims to contribute to the numerous benefits of the volcanic phenomenon, both in the Canary Islands and in other volcanically active regions, by advancing in and strengthening scientific knowledge, cooperation, training, and dissemination. It currently has three Departments, Volcanology, Environmental Quality and Geothermal & Water. Its scientific activities are related to:

- Volcanic risk, furthering citizens' scientific, technical knowledge and training in order to reduce volcanic risk.
- Geotourism, promoting the attractions of the Canary Islands and other volcanically active regions, including the protection of fragile environments, and strengthening the knowledge of geological heritage.
- Groundwater resources, learn more about the island's volcanic aquifers for better management of this important natural resource.
- Geothermal resources, detect and evaluate geothermal resources through R&D activities to enable the development of these energy resources.
- Environmental quality, analyse and evaluate emissions of atmospheric pollutants by natural and anthropogenic sources, as well as air quality.
- Agri-food traceability, strengthening scientific and technical expertise to protect producers and consumers from fraud by contributing to develop strict controls on the authenticity and geographical origin of products.
-

Technology

ITER's Technology Area is made up of a multidisciplinary and highly qualified team, involved in projects on ICT use and the latest technologies for society to face challenges such as climate change, the improvement of digital skills or the ageing of the population, among others.

It has high investment infrastructures, included under the ALiX initiative, which aims to establish the foundations on which ICT and the knowledge economy will be implemented.

We seek to promote the development of research projects both in other departments of the organisation and with external collaborations. Our work in Engineering (Electronics, IT or Telecommunications), as well as the use of cutting-edge R&D&I infrastructures, aims to overcome geographical, technological and development barriers.

Genomics

The Genomics area started to work in September 2016 as the Cabildo de Tenerife and ITER are committed to promote and develop research projects on the development of Precision and Personalised Medicine in the Canary Islands.

The activity of this area meets one ITER's social objectives, specifically, creating infrastructures, training scientific and technical personnel and exploiting the company's resources in Biotechnology as an industrial and commercial activity. So, the Genomics area has a Molecular Biology laboratory, equipped with new generation DNA sequencers and all the auxiliary instrumentation necessary for the preparation of nucleic acid libraries. In these modern facilities massive sequencing of nucleic acids can be performed by using different methodologies such as whole genome sequencing (WGS), whole exome sequencing (WES), transcriptomics (RNA-Seq), functional genomics (ChIP-Seq), etc. In addition to the use of standard sequencing protocols such as those mentioned above, ITER's Genomics laboratory can adapt and design specific protocols for singular projects with the support of its Molecular Biology laboratory.

The Genomics team is made up of scientific and technical staff specialising in Life Sciences, Biomedicine, Computer Science and Computer Engineering, among others. The network of collaborators includes academic and hospital institutions, and national and international scientific entities with which collaboration agreements have been signed to promote R&D&I projects in various fields where genomics offers innovative and efficient solutions. The team also collaborates in the training of new professionals through the Cabildo de Tenerife's Centro de Excelencia de Desarrollo e Innovación [Centre of Excellence for Development and Innovation].

The Genomics area does not perform on request sequencing for individuals. However, because it is both devoted to scientific research and service, it collaborates with the above-mentioned institutions in the design of adapted solutions, experiments, massive DNA sequencing, data processing and interpretation of the results.

This activity is channelled through various cohesion projects, including the development of the Massive Genomic Data Analysis Service, at the request of the Cabildo de Tenerife, which has multiple applications in various fields. Work is also underway in the research and development of population genetics and common diseases, in the study of somatic variation, in the application of new third-generation mass sequencing technologies, and the creation of an ecosystem of bioinformatics tools for processing BigData, among others.

Services

Energy audits

Energy audits consist of a systematic procedure to learn how much energy a facility consumes, identify, and assess energy saving opportunities from a technical and economic point of view.

The audits allow:

- To know the current energy situation and the operation and efficiency of existing equipment and installations.
- To measure and record the main electrical, thermal and comfort parameters.
- To analyse the possibilities for optimising the supply of electricity, fuel and water consumption.
- To analyse the possibilities of incorporating renewable energies.
- To propose improvements and carry out their technical and economic evaluation.

The energy audits we carry out comply with the quality standard UNE EN 16247 on Energy Audits drawn up by AENOR's Technical Committee for Standardisation 216.

SERVICES PROVIDED

The scheme used to conduct an energy audit is as follows:

- Initial phase: we analyse the current situation of the installations, type of company, situation, environment, energy supplies and energy consuming systems.
- Development phase: we measure the main parameters, analyse documentation and study opportunities for improvement.
- Final phase: we include the drafting of the technical and economic audit report with the foreseen situation, providing the necessary improvements to achieve energy, economic and environmental optimisation.

The services offered are mainly aimed at the following sectors:

- Energy audits in buildings.
- Energy audits in industry.
- Energy audits in public lighting.

Modelling workshop services

This workshop provides support to the rest of ITER's departments and also to third parties, both for the manufacture of small-scale models and full-scale prototypes in various fields of engineering.

To provide these services CAD/CAM technology machinery is available, such as CNC pantographs and 3D printers, complemented by a complete workshop with manual and electrical machinery.

The workshop is also able to manufacture tools and parts in FRP composite materials, plastic reinforced with synthetic fibres, such as carbon fibre reinforced epoxy, Aramid (Kevlar) or glass.

In addition, the workshop has the necessary tools to equip the models with electromechanical and/or pneumatic actuators when the situation requires it.

Climate services

ITER has substantial historical weather data (since June 2011) available to users upon request.

The meteorological variables collected by the two stations are as follows:

- Tower Station: Wind speed at 25 and 45 meters altitude (instantaneous, average, minimum and maximum value). Wind direction at 25 and 45 meters altitude, ambient temperature and relative humidity.
- SOLTEN station: wind speed (average, minimum and maximum value), wind direction, radiation (maximum, minimum and average value), ambient temperature and relative humidity.

The data can be requested in spreadsheet format (Excel) or in tables in a text document (Word), which is sent by e-mail. If the files are too large to be sent by e-mail, an internet address will be made available from which the files can be downloaded for a limited time.

Instant weather data are available on the ClimaTenerife website and the weather forecasts calculated by ITER for today and the next two days, both in graphs and video, are available in the Weather forecasts section.

Wind tunnel tests

The innovations introduced in the tunnel, both in the construction process and in the drive and control systems, make it highly competitive in terms of cost and performance. The different applications of this wind tunnel are as follows:

- Aeronautical Testing
- Civil Engineering.
- Architecture.
- Renewable Energies.
- Sports Training.
- Agricultural R&D.

In addition to the tests for in-house projects, tests at ITER's wind tunnel are also conducted for third parties. They can be carried out in two different ways:

- **Wind tunnel rental by the hour:** suitable for those clients who have experience in carrying out wind tunnel tests. In this case, the installation is rented together with the available instrumentation and a technician who will be in charge of the operation of the wind tunnel. The client will be in charge of programming and carrying out the tests, as well as analysing the data collected. In this case, placing the model in the test chamber can be contracted separately to be carried out by ITER personnel.
- **Testing under offer:** suitable for clients with no experience in this type of work, this system offers the execution of a complete project under a specific offer. In these cases, the wind tunnel staff is responsible for scheduling and carrying out the tests, as well as preparing a report of the results and conclusions after the tests.

ITER also has a Modelling Workshop where the models needed for the tests can be made.

Maintenance of installations

We have a qualified team who is highly experienced in the field of DPC infrastructures and renewable energy generation.

- Predictive maintenance: Periodic supervisions are carried out to analyse the state of the installations. Based on these results, preventive maintenance of the installations is programmed.
- Preventive maintenance: Periodic inspections and fine-tuning of the installations. These actions are programmed according to the specifications of each piece of equipment in order to keep them in top condition.
- Corrective maintenance: both scheduled and unscheduled actions are carried out to repair or replace faulty equipment.
- Technical maintenance: These actions are carried out so that equipment or installations comply with current regulations or mandatory standards.
- 24×7 team: A 24×7 team of technicians is available to solve incidents at any time.

Design and development of electronic circuits

ELECTRONIC CIRCUIT DEVELOPMENT AND PRODUCTION SERVICES

Either for specific final applications or because they were necessary for other projects, the Electronics Department has developed several electronic products. These products have been made from scratch, covering all phases from conception and design to prototype construction and manufacturing.

The specification is taken as a starting point to produce an electronic schematic. Some parts may require simulation. If any part requires it or the circuit is simple, a prototype can be put together with a PCB made "in situ" or a drilling circuit. Generally, except in emergencies, the printed circuit boards are ordered from the CAD-CAM design to an external company. SMT assembly for single units or small series is done by hand and depending on the quantity, the method may vary. Although automatic machinery is available, it would only be used for large series.

Thanks to the acquired know-how related services can be offered. The services include any of the individual phases or all together, from design to final production. For example, the client can order a printed circuit board from a schematic and assemble it themselves, or order a prototype, or a fabrication. They can also order a proven circuit design and manufacture it by themselves.

In short, those who do not have electronic capacity at any level have the chance of materialising their ideas through this service.

ELECTRONIC WORKSHOP SERVICES

While not a core activity, certain electronic workshop services or specific repairs could be performed. For example, electrical measurement and thermography services can be provided. Also, automatic cutting and stripping of cables, as well as crimping of certain types of terminals.

HPC computing

SUPERCOMPUTING

The supercomputing service offers the possibility of running intensive high-performance calculations using Teide supercomputer's infrastructure, from simulations of the evolution of the Universe to the design of more efficient industrial pieces.

It is available for university research teams, national and international research centres or companies that need this type of system for their research, development, or innovation projects.

The SLURM task scheduler allows optimising the use of the available resources among all users while maintaining the quality of service policies, optimising the system's energy consumption and allowing a later report of infrastructure usage.

The request for services is made through a form (teidehpc.iter.es/es/formulario-de-servicio). Once the form has been received, ITER will issue a binding offer for all the services requested. This offer will be valid for a maximum of one month. After the client accepts offer, ITER will proceed to assign a time frame for the performance of the work requested, which will be communicated to the client by mutual agreement.

Before the client formally accepts the offer, he/she will have the right to test the infrastructure in order to verify its suitability for their needs. For these tests, the client will be provided with the minimum infrastructure necessary with the requested configuration in order to be able to verify it meets the requirements of the applications to be executed. This configuration will be available for 7 working days, which may be extended if the evolution of the tests so recommends. In no case will the trial period be used to provide a service to third parties.

The client may request the reservation of capacities, so that for a period of time agreed between the parties, these resources are reserved. If interested in this option, it should be indicated in the "Remarks" section of the service request form and will be taken into account when the offer is presented.

CLOUD COMPUTING

The Cloud Computing service offers the possibility of isolating the computing environment in order to use the infrastructure available on the Teide supercomputer through the use of virtualisation.

It is available for university research teams, national and international research centres or companies that need this type of system for their research, development, or innovation projects.

Users will be able to access the infrastructure using a web portal through which they can manage their environment, access, create, delete, or modify the characteristics of their virtual machine, network, and storage.

Billing will be done on the basis of resource utilisation, taking into account the number of cores or nodes used, memory, storage, networks or specific configurations during a certain period of time. Also, a capacity reserve can be requested, so that during a period of time agreed between the parties, these capacities are available for use.

TeideHPC's cloud environment is implemented with OpenNebula software that allows to provide private, public or hybrid cloud services.

Connectivity Services - Dark Fibre

INSTITUTE OF TECHNOLOGY AND TELECOMMUNICATIONS OF TENERIFE (IT3)

It is a neutral telecommunications operator created by ITER with the mission of promoting and developing the internal and external connectivity of the island of Tenerife through its participation in various local and international projects aimed at expanding and promoting the Information Society in Tenerife and, by extension, in the rest of the Canary Islands.

IT3 is deploying a dark fibre ring: Anillo Insular de Telecomunicaciones de Tenerife (from now on AITT) over the road and rail infrastructures of the island of Tenerife, open to all operators on an equal basis to promote competition.

In its initial phase, this ring will link the metropolitan areas of Santa Cruz de Tenerife and San Cristóbal de La Laguna with the NAP, the anchorage point for numerous submarine telecommunications cables.

In successive phases the ring will be closed around the island and extended inland in order to offer broadband connectivity and access to each and every municipality in Tenerife.

DESCRIPTION OF THE IT3 NETWORK

The electronic communications services network developed and operated by IT3 is a totally passive fibre optic network, intended to be rented as dark fibre optic. IT3's objective is to extend the fibre optic infrastructure throughout all the municipalities of Tenerife with the aim of extending and promoting the information society.

In addition to the sections shown in the previous image, IT3 offers its customers the possibility of building new specific sections, necessary for the customer's connection to the existing network, under conditions that will be detailed below.

The IT3 network runs underground in both road and rail infrastructures in Tenerife. It is a ring network with a maximum capacity of 504 optical fibres and with all its sections redundant.

The component optical fibres are compatible with the technical requirements for the transmission of signals by third parties according to the following standards:

- General, trunk and access sections: ITU-T G.652d.
- Special sections for submarine cable termination: ITU-T G.655c.

SERVICES

The services offered by IT3 to the wholesale telecommunications infrastructure market consist of making a certain number of fibre pairs along its network available to its customers as dark fibre.

The service can either be rented or purchased via the Assignment of Use of the fibre for a determined period of time (IRU). Either way, the service includes the maintenance of the fibre in accordance with Service Level Agreements (SLA) that will be detailed in the appropriate section.

Two different types of service are envisaged, each corresponding to a type of optical fibre and a geographical area:

1. DARK TRANSPORT FIBRE:

This service allows customers to have a physical fibre optic connection between two designated points, by connecting the different fibre optic sections that make up the IT3 network. This physical fibre optic connection is available to customers so that they can establish the necessary connections and services by connecting the telecommunications equipment they deem appropriate.

This service is offered to electronic communications operators in general. Its geographical scope extends over the entire IT3 network.

2. TERRESTRIAL TERMINATION OF SUBMARINE CABLE:

This service allows operators to establish a fibre optic connection between their Beach Man Holes (BMHs) and their technical centres for the control and operation of these submarine systems.

It is aimed at electronic communications operators that moor their submarine cables at BMHs (Beach Man Holes) under the coverage of the IT3 network. Its geographical scope is therefore limited to the routes necessary to connect each BMH to its corresponding technical centre.

Dark Fibre Transport Service

The dark fibre transport service is defined as the constitution of a fibre optic transmission medium between two interconnection points. This transmission medium is made up of the physical connection (fusion) of optical fibre spans along the IT3 network.

The delivery of the dark fibre transport service includes all activities necessary to constitute the physical connection by means of fibre optic cable between the agreed interconnection points.

The customer may make use of this transmission medium during the contracted period by connecting the necessary telecommunications equipment to it. It is not permitted, however, to sublet or transfer to third parties all or part of the transmission medium or the different channels or wavelengths into which it may be broken down.

SUBMARINE CABLE TERRESTRIAL EXTENSION SERVICE

The terrestrial submarine cable extension service is defined as the fibre optic connection between the mooring box of a submarine cable and the technical centre from which the submarine cable is operated and monitored.

The delivery of the terrestrial submarine cable extension service includes all activities necessary to constitute the physical connection by means of fibre optic cable between the technical centre and the mooring box.

The customer may make use of this transmission medium during the contracted period by connecting the necessary telecommunications equipment to it. It is not permitted, however, to sublet or transfer to third parties all or part of the transmission medium or the different channels or wavelengths into which it may be broken down.

SERVICE LEVEL AGREEMENT

Objectives

The IT3 quality objectives for the provision of Dark Fibre Transport and Submarine Cable Extension services on point-to-point links, redundant or not, are determined in a commitment on the following parameters:

- The quality, stability and safety of the different elements that make up the infrastructure.
- The lead time for delivery of the links in the existing infrastructure.
- Breakdown repair time.
- The carrying out of programmed work.
- The availability of links.

IT3 manages the entire execution of the installation that is the object of this offer. IT3 therefore acts diligently in the execution of the same, procuring the supply, execution, and proper completion of the same, under the terms and conditions described, providing said services directly or through subcontracting. If applicable, the subcontractors selected by IT3 shall be duly authorised and qualified for the provision of said functions, and under no circumstances shall the Client be held liable for said choice, lack of execution or negligent execution of the obligations assumed by IT3 and the subcontractors chosen by the latter.

RESPONSE TIMES TO ESTABLISH INITIAL SERVICE

For the services offered, and in relation to the study, contracting and establishing new services, IT3 undertakes to comply with the following times:

- **Feasibility Study:** Time from receipt of the operator's request until the feasibility of the requested sections is answered. Project execution times are not included: ten (10) working days.
- **Service Registration:** Time from receipt of the registration request by the operator until the service is installed and activated. Project execution times are not included: twenty-two (22) working days.
- **Service Availability:** Total time that the operator is guaranteed to have the service available with correct operation: 99.73% (8,616h).

NETWORK MAINTENANCE

IT3 provides Corrective Maintenance and Preventive Maintenance services throughout its Network and up to the end of its responsibilities, either in the distribution boxes where the service is delivered or in the optical dispensers in the customer's rooms.

With regard to Corrective Maintenance, the SLAs (Service Level Agreements) are determined for carrying out repairs to breakdowns and for the procedure to report incidents and processing them.

- **Corrective Maintenance:** All those activities related to solving, either definitively or palliatively, an incident detected by IT3 or by its clients. Should IT3 be the first to detect it and react accordingly before the customer detects it, the Corrective Maintenance applied will be "Proactive". In the case of the customer detecting the failure and informing IT3 so that it can repair it, the Corrective Maintenance applied will be "Reactive". In general, all activities in this group may be proactive or reactive, depending on who identifies the incident.
- **Preventive Maintenance:** All those activities carried out to prevent incidents. In other words, activities that are focused on preventing a network incident. Customers would always be warned of any Preventive Maintenance activity that IT3 may carry out, whenever there is a risk that the service may be affected. Before performing any of these operations, a notification will be sent, in the form of Scheduled Work, in which the affected customer or customers will decide the moment when this cut will affect their service the least.

Software development

In ITER's Development Department we have a highly qualified team with sufficient knowledge and experience to tackle the development of custom applications that provide the best solution to the needs of our customers.

ITER carries out software development activities for R&D&I projects in collaboration with other entities, for ITER's internal use or under contract to third parties.

ITER's experience in the field of application development covers a wide range of uses and capabilities:

USES

Audiovisual solutions

Audiovisual solutions at ITER began in 2010 with the development of the user interface and the deployment of IPTV in the company's bioclimatic homes.

However, its most outstanding activity started in 2014 following a proposal from the Cabildo de Tenerife for the development of a virtual multimedia room with an Internet presence to provide complete information on its management and activity to the public in the form of an on-line television channel, Tenerife TV.

This activity increased in 2018 when the Cabildo de Tenerife suggested going a step further and expand the project to Tenerife TV, a DTT (Digital Terrestrial Television) and OTT (Over The Top) channel aimed at education and culture for broadcasting to Tenerife society. This DTT channel has the particularity of being technologically innovative in the television sector; a broadcasting system and continuity of programming developed specifically in a totally virtualised environment, a singularity that makes it unique in Spain, which provides added value and allows the system to be offered as a SAAS (Software as a Service).

Adapted technologies for people with disabilities

Products such as DiLO, Advant +, Tango:H or adapro developed in collaboration with different entities, within the framework of R&D&I activities, provide tools to improve the quality of life of people with special needs, for whom technology offers support in their daily activities.

SCADA systems

Developing supervision applications has arisen naturally as a complement to ITER's activity in the installation, operation and maintenance of power generation facilities. This has provided us with an extensive knowledge base and a set of state-of-the-art applications and tools for communication, supervision, control, and information analysis of a wide range of electrical systems.

Specific control systems

As a fundamental element of some of the R&D&I projects developed by ITER's different areas, software applications are deployed to control, monitor and manage self-driving vehicles, prototypes of solar aircraft or electric cars. The innovative nature of the company and the need to be in permanent contact with the latest technologies allows the development of systems such as a passive people control system that, by means of facial recognition, detects intrusions by people from outside the company or acts in line with its presence control, successfully resolving 90% of the recognitions it carries out.

Integral solutions

ITER's knowledge base and multidisciplinary capacity in different areas has led to the development of software in the construction of complex solutions that interconnect diverse hardware and software environments.

e-Government and Open Government

Due to the close relationship of ITER's with the Cabildo de Tenerife the development of solutions for the Administration is another basic pillar of the company. Under this premise, the corporate websites of several Tenerife town councils have been implemented, in some cases integrating electronic administration.

In the field of Open Government, and within the international framework to provide public administrations with elements that favour management transparency, the Cabildo de Tenerife's on-line television platform, Tenerife TV channel, has been deployed. It allows live streaming of the plenary sessions of the Cabildo and any other important event, while at the same time storing and categorising the audiovisual material of the Cabildo to make it available to the public.

On the other hand, a collaborative portal has also been developed for internal transparency through the permanent section "Cabildo Abierto" on the Corporate Intranet and within the scope of the Cabildo 's open government policies.

In addition, consultancy work was carried out to create the data map of the Cabildo de Tenerife aimed at the publication of content on the Internet under the "Open Data" umbrella. Likewise, in the area of "Transparency", an analysis was made of the information to be published in accordance with the current legislation on Transparency which would lead to the development and implementation of the Transparency portal of the Cabildo .

Business management applications

The need to interact with ITER's own management at all levels involves having to operate on specific applications present in the market; parameterising, developing modules and even connection applications with these environments. In this way, administrative management systems have been connected with project management, document managers, GIS tools, Business Intelligence tools, etc..

Network Monitoring Centre

We have a 24×7 team that carries out monitoring and incident management work uninterruptedly 365 days a year.

- **Infrastructure supervision** Continuous supervision is carried out by means of specific monitoring systems adapted to each type of equipment (DPC infrastructure, transmission equipment, renewable energy generation). We also have several Supervision Systems (BMS and SCADA) in which the supervision of both DPC infrastructures and renewable energy generation is integrated.
- **Monitoring of customer services:** Apart from the infrastructure we also continuously monitor the services provided to our customers.
- **Incident management:** When any type of incident is detected in the monitoring system, it is recorded and followed up until it is solved, complying with the service levels agreed with the client.

DPC hosting service (Housing)

Our main objective is to offer our customers high-availability hosting services and an environment of competitive supply of mass communications with the outside world, prioritising the following three concepts as the main features to offer to the information and communications technology (ICT) market:

- Very high levels of safety, cooling, and electrical availability.
- Weather resistance and autonomy in case of environmental catastrophes.
- Provide high levels of connectivity and quality of communications based on carrier neutrality.

HOUSING

Our datacentre seeks to comply with the strictest quality, connectivity, and high availability commitments. This type of service is designed for those clients who wish to host their technological platforms in a secure, robust and highly available environment. D-ALiX offers various types of housing, depending on the needs of each client:

- Frames.
- Private cage.
- Private suite
- Private room.

REMOTE HANDS

Our technicians have the experience and training to meet the specific requirements of our customers and are available 24x7x365. Some of the interventions that our technicians can perform are:

- Any task that requires the presence of a level 1 technician, who will carry out the tasks according to the client's instructions.
- Reception of customer equipment, as well as imaging of datacentre equipment and space.
- Cross-connect from the customer's equipment to the patch panel.

WAREHOUSE

In order to offer a service to suit our customers as far as possible, D-ALiX has warehouses where customers can store their materials. Depending on the period and volume, we can offer two types of storage:

- **In-site:** Physical storage to house equipment inside the datacentre, oriented to short-term storage.
- **Off-site:** Physical storage to house equipment in external facilities of the datacentre, oriented to high volume and/or long-term storage.
-

OFFICE SPACE

For those clients hosted in our facilities, workspaces are offered in the DPC facilities.

Connectivity services - Carrier capacity circuits

CanaLink is the first neutral and independent national operator that connects the Canary Islands with mainland Spain by means of submarine broadband communications. Canalink's objective is to improve the quality and competitiveness of the sector by providing new alternatives to those operators present or with expansion plans in the Canary Islands.

CanaLink's objectives are:

- Liberalising the telecommunications market between the Canary Islands and mainland Spain, opening up the foreign market to Canary Islands companies and vice versa.
- Improving the quality of telecommunications between the islands and the outside world.
- Increasing the competitiveness of ICT services, admitting alternative operators, ending the telecommunications monopoly in the Canary Islands and lowering wholesale prices.
- Expanding the presence of the Canary Islands on the map of intercontinental submarine communications.

CanaLink provides services to operators who in turn provide services to the end user, supporting:

- Carrier capacity services over submarine cables.
- Operation and Maintenance of submarine and terrestrial backbone networks.
- Housing telecommunications equipment in data processing centres (Andalusia and mainland Spain).
- Turnkey projects for national or international subsea systems.
- Supplying and commissioning telecommunications systems.

Guided tours

ITER has a Visitor Centre and a Renewable Energy Walk where various installations are on display to introduce the public of all ages to the interesting world of renewable energies.

As a result of the measures taken to curb the spread of the coronavirus outbreak, these facilities will remain closed to the public but, as we are committed to environmental education and scientific dissemination in the area of renewable energies, ITER offers virtual guided tours to these facilities, both for organised groups and individuals.

If you would like to book a guided tour, please see the characteristics of our tours and make your reservation through the tour booking calendar below.

- Guided tours of ITER are free of charge.
- Duration of the guided tour: approximately 1 hour.
- Platform used: Google Meet.
- Requirements: Computer with audio and video and internet connection.
- School groups from 5th grade onwards.

CCG-ITER

In 2011, Red Eléctrica de España (REE) [Spanish Electricity Network] empowered CCG-ITER as a delegated generation office to liaise with the control centres of the system operator.

According to Royal Decree 413/2014, all production facilities using renewable energy sources, cogeneration and waste in electricity systems in non-peninsular territories, with installed power exceeding 0.5 MW, and those with installed power of less than 0.5 MW but forming part of a group whose total installed power exceeds 0.5 MW, must be attached to a Generation Control Centre (CCG) and have Real-Time Telemetry (TTR).

CCG-ITER offers the necessary services so that production facilities from renewable energy sources comply with the provisions of the Royal Decree.

SERVICES PROVIDED

- **Attachment to the Generation Control Centre and real-time telemetry service (TTR).**

It includes the configuration of the communication between the installation and the CCG-ITER servers, the start-up of communications with REE for TTR and CCG assignment, operational and technical tests, and certification of assignment to the CCG.

- **Adaptation of facilities**

In the event that the installation does not have the necessary infrastructure to register for the service.

Renewable energy projects and installations

ITER has more than 20 years of experience in the field of renewable energies, sustainable construction and energy efficiency. In the field of renewable energies, ITER has designed and installed a total of 13MW of wind energy and 41MW of photovoltaic energy.

ITER's multidisciplinary team of professionals has extensive experience in engineering, installation and operation and maintenance services, which ensures high standards of quality and innovation in our projects. In particular, the operational procedures for installation and maintenance reduce costs, maximising the profitability of the facility.

ITER has also developed a centralised 24×7 facility monitoring system that allows continuous monitoring of the available resources, optimising the management and performance of the facilities.

Types of installations:

- Grid-connected installations.
- Self-consumption installations.
- Isolated installations.

SERVICE PROVISION

ITER offers a wide range of services that can be contracted independently or under the turnkey or EPC mode. These services are:

- Technical, legal and economic advice on stand-alone and grid-connected photovoltaic installations.
- Technical and economic feasibility analysis.
- Design and engineering of photovoltaic projects.
- Administrative processing.
- Manufacture of photovoltaic modules.
- Manufacture of grid-connected inverters.
- Design of customised structures.
- Executing engineering.
- Operation and Maintenance O&M.

Energy rehabilitation of buildings and urban regeneration

The Energy Rehabilitation of Buildings and Urban Regeneration service includes:

- The refurbishment of existing buildings on the basis of energy efficiency and environment-friendly measures.
- Urban regeneration based on sustainable urban planning criteria incorporating two main conditions: efficiency and habitability.

SERVICES PROVIDED

In the field of energy refurbishment of existing buildings, the services offered include:

- Inventory and diagnosis of buildings.
- Carrying out preliminary studies of intervention and feasibility of actions.
- Improving the energy efficiency of the thermal envelope.
- Improving the distribution of uses and interior connections, improving habitability and interior flows.
- Improving heating and lighting energy efficiency.
- Replacing conventional energy with renewable energies

Urban regeneration services include:

- Projects aimed at reorienting cities and neighbourhoods towards a more sustainable model.
- Proposals and solutions in mobility, energy and urban planning.
- Assessment and design of integrated urban regeneration plans and programmes with sustainability indicators.
- Revitalisation of historic city centres, vulnerable neighbourhoods, run-down estates and mature or developing tourist settlements, based on energy efficiency and respect for the environment.

Sustainable architecture projects

Architecture and urban planning projects whose design follows the principles of sustainability, seeking to reduce the environmental impact of the construction sector and the energy consumption of buildings.

SERVICES PROVIDED
Our projects are based on:

- Urban planning developed according to the characteristics of the site and the potential for achieving urban habitability and the efficiency of the urban system.
- Near-zero consumption in buildings without affecting the comfort and health of the inhabitants.
- The application of bioclimatic building systems and subsequent monitoring in use.
- The incorporation of ecological and technological materials.

Testing platform

The Energy Efficiency Monitoring and Validation Service is part of the Prototype Test Platform (P3) of ITER, which provides all the necessary technological infrastructure to carry out energy efficiency performance studies aimed at prototypes.
The service consists of:

- 48,790 m² of urbanised area dedicated to monitoring prototypes for their development and optimisation in real conditions of use.
- 24 Bioclimatic building models offered for rent.
- Weather stations and sensors.
- Humidity, air speed and temperature sensors.
- Infrastructure for monitoring, data collection, processing and transmission.

SERVICES PROVIDED
The services offered by the Prototype Test Platform are provided according to the following options:

- Tailor-made service: This is the most common type of request and the most appropriate in order to obtain the most impartial results possible. In this modality, both the installation area and the type of auxiliary equipment required are agreed upon, including the method for monitoring, collecting, processing, and transmitting the data.
- Partial service: This is the type of application offered to install prototypes that include either auxiliary equipment, monitoring and data collection equipment or both. In this modality, the installation area is agreed upon, as well as the infrastructure necessary for the correct operation of the complementary devices.

Photovoltaic device fabrication and characterisation laboratory

The services of manufacturing and characterisation of photovoltaic cells and technological certification for the use of photovoltaic laboratory equipment are part of the activities of the Photovoltaic Laboratory (SiCell-Lab), a state-of-the-art technological infrastructure that occupies 390 m² and is located in the ITER engineering building complex.

The services consist of:

- Equipment for the manufacture of photovoltaic devices.
- Equipment for the electrical and optical characterisation of photovoltaic devices.

SERVICES PROVIDED

The Photovoltaic Laboratory (SiCell-Lab) offers the following types of services:

- Service with technical support: Given the inherent complexity of the manufacturing and/or characterisation processes, all the actions are carried out exclusively by the laboratory staff.
- Mixed service: When any of the tasks require the participation of outside personnel, these may be carried out under the supervision of laboratory staff, after obtaining the corresponding Certificate of Use for the equipment in question.
- Certification of Use Service: required to perform any task in the laboratory by non-laboratory personnel. It is offered in the form of a technical evaluation and includes a theoretical and practical course if necessary.

Testing and validation

The Testing and Validation Service for photovoltaic devices is part of ITER's Prototype Test Platform (P3), which provides all the necessary technological facilities to carry out studies on the operation of photovoltaic devices aimed at prototypes.

The service consists of:

- A 3000 m² area dedicated to the installation of prototypes for outdoor testing.
- Equipment for energy supply and evacuation.
- Weather stations and sensors.
- Auxiliary instrumentation development laboratories.
- Infrastructure for monitoring, data collection, processing and transmission.

SERVICES PROVIDED

The Prototype Test Platform offers the following types of services:

- Tailor-made service: This is the most common type of request and the most suitable in order to obtain results that are as impartial as possible. Both the installation area and the type of auxiliary equipment required are agreed upon, including the methodology for monitoring, collection, processing and transmission of the data collected.
- Partial service: This is offered to install prototypes that include either auxiliary equipment, monitoring and data collection equipment or both. The installation area is agreed upon, as well as the infrastructure necessary for the correct operation of the complementary devices.

Technical audits

The optimally functioning of a photovoltaic installation depends on an adequate design during the project phase, a correct installation during the execution phase and an accurate management of the operation and maintenance during the operation phase.

During this last phase, which lasts at least 25 years, the owner of a photovoltaic installation often does not know whether their installation is producing the amount of energy for which it was designed and whether or not there are circumstances that reduce the potential energy it could generate.

This is why ITER offers a "technical audits of photovoltaic installations" service whose main objective is for the owner to know the state of operation of their installation, to detect and identify possible causes of poor performance, as well as to have a report drawn up by an independent company in order to claim possible guarantees.

SERVICES PROVIDED

Our experience in the installation, operation and maintenance of more than 40MW of photovoltaic installations allows us to offer a high-quality service to meet the client's needs.

We are able to prepare from basic billing verification reports to complete reports analysing the performance of your photovoltaic installation by means of on-site measurements and checks, taking radiation data by means of calibrated photovoltaic cells, checking measurements at string level, detecting hot spots by means of a thermographic camera, etc.

Projects

Koinos

Body temperature estimation and facial recognition access control system

FACT SHEET

- Acronym: KOINOS
- Partners: Instituto Tecnológico y de Energías Renovables (ITER).
- Duration: 2019-2020
- Budget: Internal
- Funding: Internal

PROJECT SUMMARY

The aim of this project is to provide a security system to detect potential alerts based on the processing of images (video) from security cameras, always in compliance with the LOPD [Law on the Protection of Personal Data] in force. Pattern detection algorithms will be used in images that are capable of generating events in unexpected or risky situations in an unsupervised manner.

The project started with the development of a prototype of a facial recognition lock. The prototype was installed and integrated into the existing access control system and after a validation phase, it is being used regularly by the company's staff.

Subsequently, due to the needs deriving from the crisis caused by the outbreak of the SARS-COV virus, work was redirected to the development of a multifunctional control point, with the following features:

- Access control and clocking-in system for the working day of ITER employees through the implementation of facial recognition algorithms. To register the user in the system, through artificial intelligence techniques a process is carried out to generate the coding of image identification characteristics that are not recognisable by a human. The encoding of each of the images is encrypted and subsequently added to the system's user register, associating the user's identity with the encoding. The system, completed and validated, allows for the recording of the working day using technology that does not require physical contact.
- Body temperature estimation system to control and activate the action protocol in the event of a device being presented. By analysing a high-resolution thermographic image, the user's body temperature is estimated without the need for contact or staff intervention in taking the measurement.

In order to implement it, impact report on the use of this technology has been prepared to make sure that it does not infringe or violate any rights of staff or external visitors, thus complying with the data protection law in force.

Three control points have been developed and installed that take care of body temperature estimation and access control by facial recognition. Once the administrative procedures for their use have been completed, they will be operational, covering the company's needs in this area.

Marysol

Visitor assistant robot

FACT SHEET

- Acronym: MARYSOL
- Partners: Instituto de Astrofísica de Canarias (IAC), Museos de Tenerife and Instituto Tecnológico y de Energías Renovables (ITER).
- Duration: 2017-2021
- Budget: Internal
- Funding: Internal

PROJECT SUMMARY

ITER has a Visitor Centre and a Renewable Energy Walk with different installations to show the public of all ages the interesting world of renewable energies. With the aim of introducing a technological element to the visits, which is one of the lines of activity of the company, developing a courtesy robot to complement the information conveyed by the staff was proposed.

The development of the "robot assistant for visits" project has been articulated through a collaboration agreement between the Cabildo de Tenerife's Museum organisation, and the public companies Grantecan S.A. and ITER.

Marysol, ITER's version of this robot assistant, is a robot with a two-wheeled drive system that can navigate the visitor centre autonomously, being able to perceive and avoid obstacles while moving around and at the same time interact with the setting through voice commands and a touch screen interface.

Conceptually, the robot will serve as a platform for future development and all the resources and results generated will be made available to other users and/or entities. That is why we opted for a modular development method, participating in all the phases of the process and using open source development tools and libraries. To manufacture it, we used additive manufacturing and 3D techniques that minimise costs so that it can be economically replicated by any other entity or person.

To implement the autonomous movement planning system in an area or enclosure, the static and dynamic elements of its environment were taken into account. Through sensory fusion, information from ultrasound sensors is combined to detect dynamic obstacles and information from the stereoscopic camera is used to navigate the environment.

As for the structure, the robot is mounted on a modular design. Once the design was confirmed, the parts that make up the structure were manufactured using 3D printing and laser and CNC cutting techniques.

It is expected to be further developed by adding the following functionalities:

- Voice control to interact with and command the robot.
- Visual communication system to provide feedback to the user.
- Introducing computer vision techniques for the recognition of people, object tracking, etc...
- Developing content for playback and display on the robot's monitor.

SIGAE

Intelligent management system for energy storage

FACT SHEET

- Acronym: SIGAE
- Partners: Instituto de Tecnología y Energías Renovables (ITER)
- Duration: Structural
- Budget: Internal
- Funding: Internal

PROJECT SUMMARY

Energy systems generate, transport, convert and consume energy. They span a wide range of domains, including electrical power systems, thermal systems used for heating and cooling, and fuel systems such as natural gas or hydrogen networks. In addition, a large number of interrelated domains influence the operation of these energy systems, including communications, water and transportation networks.

Moreover, energy systems can operate at a variety of scales, from a small, individual consumer to communities and cities, to larger regions spanning transmission networks.

Energy storage is a fundamental and critical element in the operation of these energy grids. In medium-sized grids, a battery bank control system is required to control the frequency and timing of charging and discharging of the battery bank elements.

These battery management systems (BMS) normally focus their decision-making algorithms on optimising the resource from a performance and lifetime perspective of the individual element. However, for an efficient management of the storage resource, it is not only important to assess the use of the resource in a near time horizon, but it is also essential to foresee the energy needs in the next hours or days.

The Robotics Unit is working on the application of Artificial Intelligence techniques using deep reinforcement learning algorithms to obtain a predictive model that optimises energy storage resources by automating their use.

For this purpose, several training models have been developed using different agents and environments for ITER's energy system modelling. Based on historical data of energy consumption and generation, these models have been trained to be able to make autonomous decisions not only evaluating the short term, but also being able to identify patterns of behaviour for more intelligent decision-making over more than 24 hours.

The execution of two trained models is currently in the validation phase in order to assess their efficiency, after their execution over a long period of time. We are also working on the training of other models that can adapt to changes in the conditions of the working environment due to the unavailability of resources.

On the other hand, work is being done to include other time series of multiple relevant meteorological parameters to generate models for autonomous decision making in different modes of operation.

Delfos

Predictive system of energy consumption and generation

FACT SHEET

- Acronym: DELFOS
- Partners: Instituto Tecnológico y de Energías Renovables (ITER)
- Duration: 2020-2022
- Budget: Internal
- Funding: Internal

PROJECT SUMMARY

One of the issues that prevents more aggressive growth in energy markets is the lack of efficiency in energy generation, consumption and storage. The continuous increase of renewables in the energy mix adds more and more randomness and complexity to the system as it depends on environmental circumstances. The development of new, more accurate and scalable procedures for forecasting the evolution of demand and production would allow for better planning and operation of the different elements that make up the system.

ITER sells the energy produced by its facilities on the national electricity market through an authorised trading company. In order to maintain consistency between the forecast of energy produced and that which is subsequently delivered to the marketer, estimates are required for a time horizon from 24h to 120h.

The estimated value provided by the energy supplier is critical, as the closer it is to reality, the lower the cost of deviations in the energy sales price and therefore the higher the turnover for the sale of energy.

On the other hand, knowing in advance the energy production forecasts for more distant time horizons, weeks or months, provides added value when planning maintenance of the equipment. These forecasts will make it possible to identify time periods in which a production stoppage will have less impact.

The aim of this project is to minimise the error in the prediction of exported energy in order to obtain the most accurate estimate possible of the amount of energy delivered to the market, both from wind farms and photovoltaic plants, and thus minimise the penalty for the differences between the forecast reported and the energy delivered.

Historically, a statistical model based on a polynomial curve has been used to obtain a value that in many cases differs significantly from the energy delivered in the following 24 hours. By developing and executing predictive algorithms, time series estimates are produced for different time horizons, both to generate the different renewable energy sources and for energy consumption in ITER's facilities. Therefore, historical generation and consumption data obtained from the different energy meters and weather forecast data will be used to feed time series prediction models.

Nexo

Data acquisition, monitoring and control system

FACT SHEET

- Acronym: NEXO
- Partners: Instituto Tecnológico y de Energías Renovables (ITER)
- Duration: Structural
- Budget: Internal
- Funding: Internal

PROJECT SUMMARY

ITER's energy resources are geographically distributed. Access to information on the data associated with them is carried out remotely and automatically by means of queries to the measurement equipment of each of the energy installations.

The main objective of this structural project is to upgrade the digital infrastructure that acquires and stores data from ITER's power generation facilities: wind farms and photovoltaic plants. For this reason, the Robotics Unit is working on the development and deployment of a versatile, scalable and easy-to-maintain system that acts as an interface for the data of the entire energy infrastructure and the data related to the generation and consumption of energy.

To implement it, queries to field equipment (meters, network analysers, stations, etc.) are centralised in an IoT server via different communication protocols: Modbus, IEC870-5, SNMP, etc... Once the data from the remote equipment has been consulted, the server saves a copy of these in a database and manages and deals with requests from other agents or services that make use of the data.

The devices integrated in Nexo are classified by criteria such as location, type of energy and meter, manager, operator, etc., greatly facilitating the management of the information associated with the devices. In addition, the data recorded in the IoT server will be accessible through one or more interfaces (APIs). Access to the data in a secure and coordinated manner, such as that provided by the system, allows the operator to configure access to suit the needs of the services or data users.

On the other hand, the implemented system will allow a more efficient monitoring of the data and events generated by the integrated equipment. By means of exhaustive real-time control of the incidents and events that may occur in both communications and measurement equipment, a notable improvement is obtained in decision-making in the face of of unforeseen events or in the preventive maintenance of the equipment.

The system resulting from the Nexo project will be versatile enough to capture and process different types of data. It will be possible to integrate any type of remote equipment, not only those related to electricity generation and consumption.

VYE System

Integrated system for predicting vineyard crop yields using drones and spectral cameras

DATOS

- Acronym: VYE SYSTEM
- Reference: RTC2019-006949-2
- Partners: Instituto Tecnológico y de Energías Renovables (ITER) and the Universidad Politécnica de Valencia (UPV).
- Duration: 01/07/2020 - 30/09/2022 (27 months)
- Budget: 574,725.55 €.
- Co-funders: Challenges Collaboration 2019. State R+D+I Program Oriented to the Challenges of Society.

PROJECT SUMMARY

The general objective of VYE SYSTEM is to obtain an innovative, accurate, low cost and in real time system for predicting the expected yield of a vine crop before the harvest (at least one month in advance) that displays its results on a digital platform so that producers can optimise their resources.

To achieve this, the new VYE SYSTEM will be based on the use of unmanned aircraft or "drones", with multispectral cameras incorporated to capture information through images that will be processed by means of a complex algorithm to calculate different parameters and indices related to the level of crop yields. The algorithm will also have neural networks, which will be trained in the field with the calculation of spectral parameters and the contrast of these with the recorded crop yields. Once the data has been processed and the result obtained, a yield map will be generated that will be available on the digital platform by means of different devices.

The new VYE SYSTEM will be made up of three different subsystems (hardware, communication and software) plus a digital platform.

- The HARDWARE SUBSYSTEM will consist of a drone as the main element with a multispectral camera of five spectral bands attached in order to collect information from the land. An adaptation kit will link both elements and some other auxiliary elements.
- The COMMUNICATION SUBSYSTEM will transfer all the information captured by the hardware subsystem to the cloud, either with an intermediate control centre or directly.
- The SOFTWARE SUBSYSTEM will process and analyse all the information received in order to predict the harvest yield, both per hectare and in total. It will use mathematical image processing algorithms and Artificial Intelligence (AI) techniques based on the above-mentioned Neural Network.
- The DIGITAL PLATFORM will display the results in real time in a simple and easy to understand manner. It will be accessible on different devices such as computers, mobile phones, etc. At the same time, the digital platform will provide access to historical records of measurements taken, data analysis, among others. This will be the main tool of the service offered to end users, i.e. a SaaS type service will be provided.

AiSoVol2

Adaptive photovoltaic generation solution for use in buildings and distributed generation

FACT SHEET

- Acronym: AISOVOL2
- Reference: RTC2019-006994-3
- Partners: Instituto Tecnológico y de Energías Renovables (ITER) and Centro Nacional de Energías Renovables (CENER) [National Renewable Energy Centre].
- Duration: 01/06/2020 - 31/12/2023
- Budget: 768,516.50 €.
- Co-funders: Challenges Collaboration 2019. State Programme for R&D&I Oriented towards the Challenges of Society. Ministry of Science and Innovation.

PROJECT SUMMARY

The future of photovoltaic energy is considered to lie in its integration in buildings. This is currently a growing market with an expected penetration rate of 13% by 2022. So, photovoltaic is a technology that will play a key role in the urban and environmental development of cities, driving the construction or adaptation of so-called near-zero energy buildings.

In response to this market trend and the national and European objectives in the energy sector, the AISOVOL2 project, a photovoltaic generation solution for use in buildings and distributed generation, is being developed. This project aims to respond to the need for innovative photovoltaic solutions that allow a more intensive and multifunctional use of the available surface area in buildings, achieving sustainable cities.

The main objective of the project is to develop and manufacture an adaptable and multi-purpose photovoltaic module, which increases the architectural resources available for both building-adapted photovoltaic technology and technology integrated into the building structure itself, using cutting-edge materials and the latest photovoltaic technology, such as bifacial cells. This will allow for the evolution of research into alternatives that meet the trends in the photovoltaic market and the requirements of professionals in the construction industry.

This is also a continuation of research undertaken with the AISOVOL Project, which proposed the manufacture of a modular photovoltaic module to be integrated and easily adapted for use as an architectural element by replacing some of the components that make up a conventional photovoltaic module, the most notable modification being the replacement of tempered glass with compact polycarbonate.

In AISOVOL2, alternatives are introduced in the design of the photovoltaic module that make it possible to overcome the difficulties encountered during the first project, based on the experience acquired during its execution. The alternative materials proposed follow the previous project in terms of the features of the photovoltaic module to be manufactured adding innovation as it takes advantage of the development of new cutting-edge materials specially designed for the photovoltaic sector and the latest market trends, bifacial technology.

It also includes carrying out the necessary tests that commercial products of this technology must pass. Specifically, compliance with the standards for crystalline silicon photovoltaic modules established by IEC 61215 in terms of design qualification and approval will be verified. The feasible products obtained will be suitable for commercialisation.

On the other hand, the project is completed with the design and manufacture of a monitoring and recording system for the characterisation and qualification of photovoltaic modules by means of field tests. This system will complement the work carried out in the previous AISOVOL project, which did not include field tests, enabling the comparison in performance of the two designs.

It will also allow a study of the performance of bifacial modules to assess the influence of certain installation parameters, such as mounting height, tilt or ground reflectivity. Thus, the objective of the monitoring system is to obtain information on the practical performance of the module during real daily operation, with changing irradiance and temperature conditions, usually very different from those established in the measurement standards for this technology. Likewise, thanks to the continuous determination of the IV characteristic curve of the photovoltaic modules to be carried out by this system, it will be possible to detect various types of problems in the panel elements, such as excessive internal resistance or a group of defective cells.

CAV-TH

System for the control and management of turbines in hydroelectric power plants.

FACT SHEET

- Acronym: CAV - TH
- Reference: RTC2019- 006947-3
- Partners: Universitat Politècnica de Valencia and ITER.
- Duration: 01/07/2020 - 31/12/2023 (42 months)
- Budget: 449,118.2 €.
- Co-funded by: Challenges Collaboration 2019. State R+D+I Program Oriented to the Challenges of Society.

PROJECT SUMMARY

Hydropower is already considered one of the main sources of renewable energy in Spain, with up to 20,380 MW of installed capacity, according to data from 2008. This means that this type of energy is already the third most used in our country, only behind combined cycle (26,284 MW) and wind energy (23,466 MW). Furthermore, it should be noted that this is a sector with a clear upward trend, as in the last 13 years (2006, 17,018 MW), the installed power figures have increased by almost 20%.

Hydropower is generated in installations known as hydroelectric power stations. In a hydroelectric power plant, water, falling between two levels, is passed through a hydraulic turbine which transmits the energy to a generator where it is transformed into electrical energy. Due to their cost and function, turbines are considered to be of vital importance in the production of electrical energy, and the maximum level of service must be maintained throughout their useful life.

One of the main problems found in hydraulic turbines is the appearance of cavitation phenomena, being one of the main causes of failure in this type of elements. Cavitation is the result of the reduction of the liquid pressure as a consequence of a sudden change in flow velocity, which leads to vapour cavities forming inside the liquid. Also, cavitation does not follow a constant formation pattern and can occur in different forms depending on the type of cavitation at work.

The general objective of CAV - TH is to develop a new hydroelectric power plant turbine monitoring system that can detect, in real time and in any type of turbine on the market:

- the risk of the occurrence of cavitation phenomena
- the existence of the phenomenon prematurely and reliably
- the type of cavitation, quantifying its intensity

To successfully achieve the objective described, the new CAV-TH system will be developed as a solution, based on real-time monitoring of the vibrations and pressure fluctuations produced in the turbine along with a powerful algorithm for operational modal analysis techniques of the records, and a mathematical model, calibrated and validated, which allows the solution to be applied to any type of turbine and also makes it a predictive solution.

Based on the algorithms developed, every existing cavitation typology will be identified, as each of them is associated with a certain frequency band. Likewise, in order to make the system more accurate, a pressure sensor will detect the fluctuations recorded in this parameter, to support the classification of those types of cavitation that are detected at low frequencies. Subsequently, the amplitude of the frequency spectrum will be measured to quantify the intensity and severity of each type of cavitation, which will increase, but without changing its shape, as the severity of the phenomenon increases. The results of the solution will be displayed on a cloud-based digital platform to allow potential customers to directly access the results obtained in each monitored turbine.

Cicona

New integrated solution for wind turbine shallow foundations

FACT SHEET

- Acronym: NEXO
- Partners: ITER
- Duration: Structural
- Budget: Internal
- Funding: Internal

PROJECT SUMMARY

With 23,484 MW of accumulated power, wind energy was the second largest source of electricity generation in Spain in 2018, covering up to 19% of the total energy consumed in the country. As economic levels have recently increased and improved in Spain, it has been necessary to seek alternative energy sources that are more sustainable and have better economic prospects in the medium and long term than traditional sources. This situation has paved the way for wind energy to penetrate in the Spanish market, positioning itself as the leading sustainable energy source. Over the last 10 years, the sector has grown at a rate of more than 10% per year, reflecting a clear upward trend. So, Spain has been able to position itself as a clear reference in the field of wind energy worldwide, being the fifth country in the world in terms of installed capacity, only surpassed by nations of greater size and economic potential such as China, the United States, Germany and India. Furthermore, in terms of sustainability, wind energy saves Spain the emission of more than 25 million tonnes of CO2 per year.

However, little progress has been made in the development of new construction materials so that wind turbine foundations can be built more efficiently. It is estimated that the price of concrete and steel for the construction of foundations ranges between 20 and 40% of the total cost of a wind farm, so it is urgent to optimise the materials used in order to reduce the cost of these elements.

In this scenario the consortium has detected the opportunity to carry out the new CICONA solution, based on the development of a new UHPC style concrete adjusted to market price, which will allow optimising the design of the foundation saving huge amounts in terms of concrete volume and reinforcement. This new solution will also feature an optimised foundation calculation software to provide an enhanced design of the foundation considering, among other variables, the type of ground where the foundations will be laid, the key dimensions of the wind turbine, or the operating conditions.

Two important innovations stand out in this new solution: 1) a new concrete dosage with UHPC characteristics that has the ideal properties for the manufacture of wind turbine foundations at market price. And 2) A tool for the optimised design of wind turbines considering the new concrete developed, which will have an important mathematical basis, as it will include a large number of numerical models and mathematical studies of different, strategically selected foundation scenarios.

The general objective of CICONA is the optimisation and improvement, both technically and economically, of the current wind turbine foundations systems. It is based on a new low-cost concrete, with improved mechanical performance compared to the concretes conventionally used. By integrating this new material into the foundation systems used, and by means of the appropriate mathematical and numerical modelling, the geometry of the current foundations will be optimised having a direct impact on their cost as it will save concrete volume and reinforcement. The numerical modelling developed will be integrated into a new user-friendly software so that the optimised foundation can be immediately obtained.

VidDATA

System for the control and management of turbines in hydroelectric power plants.

FACT SHEET

- Acronym: VidDATA
- Reference: RTC2019-006948-7
- Partners: Instituto Tecnológico y de Energías Renovables (ITER) and Universidad de La Laguna (ULL).
- Duration: 01/11/2020 - 30/06/2023 (36 months)
- Budget: 574,119.48 €.
- Co-funded by: Challenges Collaboration 2019. State R+D+I Program Oriented to the Challenges of Society.

PROJECT SUMMARY

Vineyards, like other agricultural production, are affected by climate change despite technological improvements. Therefore, the quality of wine production can be threatened because changes in climate affect the quality and quantity of grapes, causing changes in alcohol production and in acid and sugar concentrations. In the Canary Islands, this is a problem of great interest, since despite the small size of the islands and their complex orography, they have eleven Protected Designations of Origin (DO).

vidDATA is presented to address the above-mentioned issues. It is an agroclimatic and support service that integrates high-resolution climate information, as well as cost estimates, through the use of new technologies such as Big Data and Machine Learning. It aims at helping both agricultural insurers and the Canary Islands wine sector to make decisions and develop strategies to adapt to climate change.

The goal of VidDATA is to develop an intelligent platform to aid vineyard management and to offer high-resolution climatic information to the wine sector. This information will be used to obtain agroclimatic models and indices of climatic and agroclimatic extremes that are directly or indirectly associated with variations in vine productivity. Both the climatic information and the intelligent assistance for planning the work to be carried out in the vineyards can be marketed as an agroclimatic service that will help the client to make decisions regarding sowing and harvesting management, irrigation, appropriate types of grapes and other components. The use VidDATA in other crops on the islands will be evaluated, as well as its possible application in other places with the same orographic complexity as the Canary Islands.

This project would provide the wine sector with both an agroclimatic service and a support system for decision-making, thus avoiding the threat posed by climate change, minimising costs and risks by improving production management and the quality and quantity of the final product.

The vidDATA project is carried out through a series of main tasks that include selecting and evaluating agricultural, meteorological and climatic data, obtaining the indices of climatic extremes and simulation of vine yields.

In addition, simulations will be carried out on the basis of the high-resolution weather research and forecasting model (WRF) and will be validated with the indices obtained through the first simulation method. Once the data to be used in the system have been processed and adapted, an artificial intelligence tool will be designed for the digital platform so that the end user has access to the appropriate agroclimatic information.

Other tasks to be carried out during the implementation of the project are the technical and economic coordination of the project, market research, as well as marketing strategy and competition research.

EELabs

Laboratories to measure the energy efficiency of artificial night-time lighting in protected natural areas in Macaronesia

FACT SHEET

- Acronym: EElabs
- Ref. No: MAC2/4.6d/238
- Partners: Instituto de Astrofísica de Canarias (IAC), Universidad de Las Palmas de Gran Canaria (ULPGC), Instituto Tecnológico y de Energías Renovables (ITER), Sociedade Portuguesa para o Estudo das Aves (SPEA-Madeira), Sociedade Portuguesa para o Estudo das Aves (SPEA-Azores)
- Duration: 08/10/2019 - 31/10/2022
- Budget: 1,241,586.40 €
- Co-funded by: Interreg Madeira-Azores-Canary Islands Territorial Cooperation Programme (MAC) 2014-2020. 2nd Call. Axis 4- Preserve and protect the environment and promote resource efficiency.

PROJECT SUMMARY

The loss of darkness due to the increasing use of Artificial Night Light (ANL) has a dangerous, though neglected, impact on natural ecosystems. In certain conditions it is so weak that humans cannot detect it, but 30% of vertebrates and 60% of invertebrates - nocturnal and highly sensitive to light - are threatened.

The aim of EELabs is to maximise the energy efficiency of new lighting technologies - mainly LEDs - while minimising their effect in the form of light pollution - sky glow - on natural ecosystems in Macaronesia. EELabs will propose activities to acquire an in-depth knowledge of both LED lighting and Macaronesian natural ecosystems in order to achieve sustainable growth so that increasing LAN, a consequence of economic development, does not compromise natural spaces through an excessive rise in light pollution.

SPECIFIC OBJECTIVES:

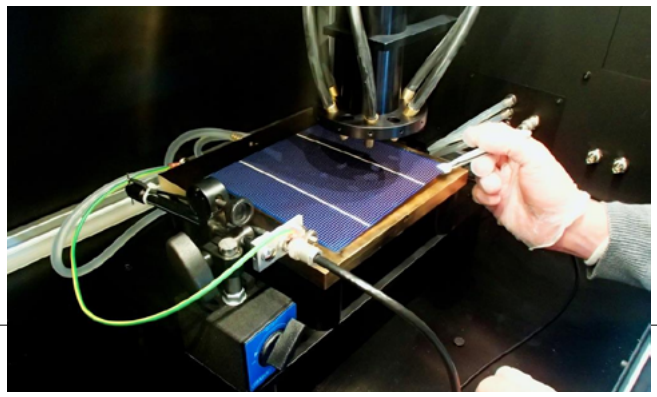
- Specific objective 1: set up Light Pollution Laboratories (LPL). They will be non-intrusive and located in protected natural areas of Macaronesia.
- Specific Objective 2: Making at least four Light Pollution Experiments (LPEs) with research/dissemination activities.
- Specific Objective 3: Extending the sky protection legislation currently in place in the Macaronesian municipalities where LPLs will be installed.

PROJECT BENEFICIARIES:

- Administrations: Administrations of regions and municipalities where the LPLs will be set up.
- Local Populations: reducing light pollution in municipalities and associated natural areas.
- Scientific Community: improving the quality of the skies for astronomical observations and for animal and plant habitats.

MACLab-PV

Improvement of R&D&I capacities and infrastructures in the renewable energy and energy efficiency sector in the Canary Islands and Senegal.



FACT SHEET

- Acronym: MACLAB-PV
- Ref. No.: MAC2/1.1a/395
- Partners: ITER, Agencia Insular de Energía de Tenerife, Fundación Canaria (AIET) [Tenerife Energy Agency], Centre d'Etudes et de Recherches sur les Energies Renouvelables - UCAD (CERER), Agence pour l'Economie et le Maîtrise de l'Energie (AEME).
- Duration: 2019-2022 (36 months)
- Budget: 639,688.36 €.
- Co-funded by: Interreg Madeira-Azores-Canary Islands Territorial Cooperation Programme (MAC) 2014-2020. 2nd Call. Axis 1 - Strengthening research, technological development and innovation.

PROJECT SUMMARY

MACLAB-PV seeks to enhance the scientific, technological, demonstration and innovation infrastructures and capacities of the participating regions, aiming for excellence in research and innovation in the renewable energy and energy efficiency sector. The project will lead to a more specialised scientific community that effectively meets the real needs of the sector in the cooperation area, improving its competence at international level and enabling greater implementation of renewable energies.

Actions will be carried out aimed at improving the R&D&I capacities of the partners and the participating regions, promoting the implementation of new lines of research to meet the needs of their respective socio-economic sectors. In order to make these new R&D&I lines a reality, investments will be made in the technological improvement of renewable technologies laboratories and scientific facilities. Similarly, new field R&D&I units on energy efficiency will be promoted and educational tools on renewable technologies, energy saving and efficiency will be designed and manufactured. In addition, technical and scientific advice will be provided to public authorities, competent bodies and citizens. In parallel, actions will be carried out to improve capacities and technology transfer between the research community, universities and public administrations in addition to activities to disseminate and raise awareness of regional scientific work. Actions for the exchange and joint training of research and teaching staff, using the improved and implemented R&D&I infrastructures will also be carried out.

OBJECTIVES:

The general objective of the MACLAB-PV project is to promote excellence and the application of scientific and technological activity in the renewable energy and energy efficiency sector, contributing to the sustainable development of the Canary Islands and Senegal.

In addition, the following specific objectives are pursued:

- SO 1: Improving research activity and scientific and technological infrastructures to meet the needs of the sector.
- SO 2: Strengthening the capacities of research, technical and teaching staff
- SO 3: Strengthening the capacities of public authorities and encouraging the public to come closer to scientific activity

ACTIVITIES:

- Activity 1 - Diagnosis and launching of new R&D&I lines of action
- Activity 2 - Creating, strengthening and optimising laboratories and scientific and technological facilities
- Activity 3 - Exchange and joint training actions for research, technical and teaching staff
- Activity 4 - Designing, developing and implementing technology tools for renewable energy and energy efficiency training
- Activity 5 - Advice, technology transfer and awareness-raising for public authorities and citizens

Grider

Smart grid management with renewable energy production estimation based on high-resolution mesoscale modelling

FACT SHEET

- Acronym: GRIDER
- Reference: RTC-2017-6409-3
- Partners:
  - Instituto Tecnológico y de Energías Renovables (ITER) – Project co-ordinator
  - Universidad de La Laguna (ULL)
- Duration: 39 months (from 1-10-2018 until 31-12-2021)
- Budget to be financed: 865,385.00 €.
  - Grant: 217.128,99 €
  - ERDF reimbursable advance: 210.277,25 €
  - Loan: 0,00 €
  - Own Contribution: 270.031,86 €
- Funding: Call for proposals Challenges-Collaboration 2017. State R+D+I Program Oriented to the Challenges of Society. State Scientific, Technical and Innovation Research Plan 2013-2016.

PROJECT SUMMARY

The GRIDER project has been designed with two research objectives and a third, more development-oriented objective. The first objective in the field of research is to provide as much meteorological information as possible with the best quality allowed by current techniques, as well as its implications for renewable energy resources.

Although the scientific interest of this type of study is clear, the social and economic interest that these results may have, are even more decisive. One of the main goals is to contribute to the generation of meteorological information with the appropriate spatial and temporal resolution, in order to make it available to all those social and economic agents who require it. In addition, the information from the models used to carry out the meteorological regionalisation will be translated into those data or variables that are of direct interest to these agents. Thus, beyond the typical variables obtained from the simulations, such as temperature, precipitation, wind, etc., useful information will be generated to estimate renewable energy resources.

On the other hand, research is also being carried out into techniques that help to resolve one of the most pressing needs of today's society, which is to reduce the consumption of fossil energy. Its use produces the emission of gases that pollute the atmosphere and are toxic to life, depleting reserves in the short or medium term and polluting more than other products that could have been used instead. Yet our entire economy is based on massive consumption of fossil energy: energy from coal, oil and natural gas accounts for 88% of total primary energy consumption. The use of fossil fuels as a source of energy needs to be phased out. In this project, information technologies are seen as an essential part of meeting these two needs. In this context, Smart Grids are a form of efficient electricity management that uses information technology to optimise distribution.

Finally, developing products and services that use the large amount of information obtained from the results of the previous objectives is also proposed. The purpose of this development is to have end-user-oriented products.

The Consortium that will develop the GRIDER project is made up of the ITER (project leader) and the University of La Laguna, which participates through the Grupo de Simulación de la ULL y del Grupo de Observación de la Tierra y la Atmósfera (GOTA). [University of La Laguna's Simulation Group and the Earth and Atmospheric Observation Group.]

MPM-System

Monitoring system for port docks to maintain their structural safety in the event of soil liquefaction phenomena.

FACT SHEET

- Acronym: MPM - SYSTEM
- Reference: RTC-2017-6114-2
- Partners:
    - Instituto Tecnológico y de Energías Renovables (ITER) – project co-ordinator
    - Universitat Politècnica de València
- Durationn: 48 months (1/01/2018 – 31/12/2021)
- Budget to be financed: 630.712,96 €
    - Grant: 278.512,00 €
    - ERDF reimbursable advance: 131.157,00 €
    - Loan: 0,00 €
    - Own contribution: 221.043,96 €
- Funding: Call for proposals Challenges-Collaboration 2017. State R+D+I Program Oriented to the Challenges of Society. State Scientific, Technical and Innovation Research Plan 2013-2016.

PROJECT SUMMARY

The general objective of the MPM-SYSTEM project is to develop a low-cost system to detect and monitor liquefaction phenomena in port docks, which also allows the diagnosis of its structural effects on them. This system could be marketed as a service to make the information available to the client remotely and in real time, acting as a key tool for its maintenance.

The proposed solution consists of a kit that includes all the necessary elements to be installed on the port dock and a digital platform, hosted in the cloud, which receives and processes the records, making the results immediately available to the client, who can access them from anywhere in the world.

So, MPM-SYSTEM introduces two key innovations in the field of maintenance of port structures: firstly, monitoring the liquefaction phenomenon in real time, by means of continuous recording without human intervention at a low cost for the client; and secondly, creating an information management system on the detection and effects of soil liquefaction on the port quay, which is delivered as a service to the end client.

The solution means the client will save not only in terms of diagnosis efficiency, which will enable them to act quickly in maintenance, but also in terms of the cost of continuously assessing damage to the structure by other means.

The MPM-SYSTEM Consortium is made up of ITER (project leader) and the Universitat Politècnica de València, which will provide the project with multidisciplinary teams of experts in all the fields involved in the project.

The budget of the MPM-SYSTEM project is € 630,712.96. A balanced budget distribution between the partners has been proposed to ensure the technical and economic feasibility of the project at all times.

M3-Control

Remote monitoring system of groundwater abstraction volumes for effective control of abstractions and improved water resource management.

FACT SHEET

- Acronym: M3-CONTROL
- Reference: RTC-2017-6113-2
- Partners
    - Instituto Tecnológico y de Energías Renovables (ITER) – project co-ordinator
    - Universitat Politècnica de València
- Duration: 36 months (1/1/2018 – 31/12/2020)
- Budget to be financed: 636.666,88 €
    - Grant: 279.995,50 €
    - ERDF reimbursable advance: 126.651,50 €
    - Loan: 0,00 €
    - Own contribution230.019,88 €
- Funding: Call for proposals Challenges-Collaboration 2017. State R+D+I Program Oriented to the Challenges of Society. State Scientific, Technical and Innovation Research Plan 2013-2016.

PROJECT SUMMARY

The general objective of M3-CONTROL is to develop a low-cost solution to control groundwater abstraction by means of remote readings of the flow meters in the abstraction installations, which also makes this information available to potential clients via a remote digital platform. The solution could be marketed as a service that would allow the abstraction owner to avoid having to periodically report abstracted flows to the control body, while at the same time providing the latter with a key tool for the management of water resources in its region.

The proposed solution consists of a kit that is installed on the flow meter of the abstractions to be controlled and a Big Data digital platform hosted in the cloud through which a service is offered that will allow the abstraction owner to avoid having to periodically report the abstracted flows to the control body, while the latter will have a key tool for the management of the water resource in its region for the administration.

M3-CONTROL introduces two new key innovations in the field of groundwater abstraction control: firstly, monitoring groundwater abstraction by continuous recording without human intervention. This comes at a low cost to the client through the existing flow meter; and secondly, creating an information management system on the flow rates extracted from groundwater wells which is delivered as a service to the end client.

The M3-CONTROL Consortium is made up of the ITER (leader of the project) and the Universitat Politècnica de València, which will provide the project with multidisciplinary teams of experts in all the fields involved in the project.

The budget of the M3-CONTROL project is 636,666.88 €. A balanced distribution of the budget between the partners has been considered in order to guarantee the technical and economic viability of the project at all times.

Massive Genomic Data Analysis Service

OBJECTIVE

The main objective of this massive analysis of genomic data service is to develop research projects and offering services aimed at bringing Tenerife and, by extension, the whole of the Canary Islands, closer to the implementation of Personalised Medicine. This service is being structured through an ITER department, the Genomics Division, in three areas:

- recruiting staff with the right professional background;
- setting up a molecular biology laboratory adapted for massive DNA sequencing;
- adapting the Teide-HPC high-performance computing infrastructure for the use of bioinformatics data processing tools.

MAIN ACTIONS AND PARTNERS

Currently, the massive genomic data analysis service is developing the necessary protocols for routine massive sequencing of complete genomes and exomes (the part of the genome that codes proteins). In January 2017, the first advances made by this new division of ITER were made public: the sequencing of the first 10 complete human genomes carried out for the first time in the Canary Islands, under quality and reproducibility conditions.

Once the initial installation and tuning phase of the above-mentioned technologies has been completed, the ITER team will be able to expand its activity by developing initiatives not only through the participation of the massive genomic data analysis service and the dissemination of its results, but also through the organisation and participation in activities for the promotion of education, training, research, development and innovation in Biotechnology. The initial pilot project started in 2016 thanks to ITER's increase of capital authorised by the Cabildo de Tenerife. It has become a viable project for the future thanks to the scientific and research activity of the team behind it. It should be noted that the initial activity in the pilot project has been shared as scientific contribution in various relevant national and international forums.

All this activity places Tenerife and the Canary Islands on the national and world map of centres of excellence that promote research related to Personalised Medicine.

It should also be noted that all the activity promoted by the Cabildo de Tenerife has been ahead of outstanding recent initiatives at national level. We would highlight the alignment with the Proposal of Recommendations for a Personalised Precision Medicine

National Strategy (MPP), drawn up in 2017 by a prestigious team of experts in different fields of knowledge linked to Biotechnology through the Roche Institute Foundation. The study highlights, specifically in "Area 6, on Research and Innovation (R&I)", the consensus that is beginning to exist in our country for the design and development of various PPM strategies, among which the "promotion of studies to characterise genetic variability in healthy populations (healthy phenotype)" stands out. This consensus was also endorsed by the Parliamentary Commission on Precision Medicine in the Spanish Senate during the 2017-2018 biennium, whose objective is to analyse the future of PPM and its impact on the National Health System and its funding.

M3-Control

Remote monitoring system of groundwater abstraction volumes for effective control of abstractions and improved water resource management

m-{omics}SEP

FACT SHEET

- Acronym: M3-CONTROL
- Reference: RTC-2017-6113-2
- Partners:
  - Instituto Tecnológico y de Energías Renovables (ITER) – project co-ordinator
  - Universitat Politècnica de València
- Duration 36 month (1/1/2018 – 31/12/2020)
- Budget to be financed: 636.666,88 €
  - Grant: 279.995,50 €
  - ERDF reimbursable advance: 126.651,50 €
  - Loan: 0,00 €
  - Own contribution: 230.019,88 €
- Funding: Call for proposals Challenges-Collaboration 2017. State Programme for Research, Development and Innovation Oriented towards the Challenges of Society. State Plan for Scientific-Technical Research and Innovation 2013-2016.

PROJECT SUMMARY

M3-CONTROL general objective is to develop a low-cost solution for the control of groundwater abstractions, by means of the remote reading of the flow meters of the abstraction installations, and which also makes this information available to potential clients via a remote digital platform. The solution could be marketed as a service that would allow the abstraction owner to avoid the obligation to periodically report abstracted flows to the control body, while at the same time providing the latter with a key tool for the management of water resources in its region.

The proposed solution consists of a kit that is installed on the flow meter of the abstractions to be controlled and a Big Data digital platform hosted in the cloud through which a service is offered that will allow the holder of the abstraction to avoid the obligation to periodically report the abstracted flows to the control body, while the latter will have a key tool for the management of the water resource in its region for the administration.

M3-CONTROL introduces two new key innovations in the field of groundwater abstraction control: firstly, the monitoring of groundwater abstraction, by continuous recording and without human intervention, at low cost to the client through the instrumentation of the existing flow meter; and secondly, the creation of an information management system on the flow rates extracted from groundwater wells which is delivered as a service to the end client.

The Consortium that is going to develop M3-CONTROL is made up of the Instituto Tecnológico y de Energías Renovables, S.A. (leader of the project) and the Universitat Politècnica de València, which will provide the project with multidisciplinary teams of experts in all the fields involved in the project.

The budget of the M3-CONTROL project is € 636,666.88. A balanced distribution of the budget between the partners has been considered in order to guarantee the technical and economic viability of the project at all times.

¡PARTY! DE LA ENERGÍA

ENERGY PARTY! Education project

FACT SHEET

- Partners: ITER and Tenerife Energy Agency (AIET).
- Duration: September 2016 - June 2017 (10 months)
- Budget: €7,395.00 €
- Funding: Call for Grants for Educational Projects 2016. Fundación CajaCanarias.

PROJECT SUMMARY

A large-format floor game that will allow students to learn about renewable energies and energy saving through play.

The Energy Party aims to introduce students to the interesting world of renewable energies and energy saving in a more active, participatory and playful way. This learning resource allows game and learning dynamics with large groups and the participation of different game teams simultaneously. It is also designed to be adapted to the 5th and 6th grade of primary school.

The physical characteristics of the Energy Party, being a large-format floor set, will allow it to be used not only during learning activities at the ITER's educational facilities, but also to be taken to external learning activities, such as trade fairs and environmental events.

The project, which will run from September 2016 to June 2017, has obtained the support of the Fundación CajaCanarias through its Call for Aid for Learning Projects 2016, and also has the collaboration of the Tenerife Island Energy Agency, which is a partner in the project.

UDIgen

Development of a genomic diagnostic unit

FACT SHEET

- Acronym: UDIGEN
- Reference: RTC-2017-6471-1
- Partners:
    - Instituto Tecnológico y de Energías Renovables (ITER) – project coordinator
    - Universidad de La Laguna (ULL)
    - Fundación Canaria de Investigación Sanitaria (FUNCANIS)
- Duration: Septiembre 2018 – Diciembre 2021
- Budget to be financed: 904.828,99 €
    - Grant: 431.346,30 €
    - ERDF reimbursable advance: 80.037,70 €
    - Loan: 0,00 €
    - Own contribution: 393.444,99 €
- Funding: ERDF/ Ministry of Science, Innovation and Universities - State Research Agency. Challenges-Collaboration Call 2017 - State R+D+I Program Oriented to the Challenges of Society. State Scientific, Technical and Innovation Research Plan 2013-2016 - Ministry of Economy and Enterprise (MINECO) of the Spanish Government.

PROJECT SUMMARY

The overall objective of the UDIGEN project is to develop an integrated genomic analysis platform, from sequencing to interpretation, to facilitate genetic counselling in order to reduce the time between the suspicion of genetic disease and a definitive diagnosis.

UDIGEN will carry out its activities on the basis of experience in:

- a retrospective orthogonal validation study in patients who already have a genetic diagnosis
- a population-based study on reference samples, and
- a study of patients with evidence of a disease caused by genetic conditions.

As a result of the experience, the routine use of exome sequencing is expected to be introduced as a first-line test to support the diagnosis of genetic disorders, which will reduce time and costs until a definitive diagnosis is obtained. In addition, software tools will be developed for the management, consultation and interpretation of genetic variation and its connection with diseases through efficient Big Data analysis procedures.

MAIN ACTIONS AND PARTNERS

UDIGEN will mainly focuses on exome analysis, being the only new generation massive DNA sequencing platform with sufficient capacity to carry out these genetic analyses in the Canary Islands.

The project is designed around ITER's supercomputing and massive sequencing infrastructures. On the other hand, it is supported by the proven experience of the collaborating partners, the University of La Laguna (ULL) and the Canary Islands Foundation for Health Research (FUNCANIS), in the development and adaptation of Big Data tools integrated into the platform for the analysis and interpretation of human genetic variation.

UDIGEN will carry out its activities on the basis of the experience in:

- a retrospective orthogonal validation study in patients who already have a genetic diagnosis
- a population-based study in reference samples
- a study of patients with evidence of genetic disorders

As a result of the experience, the routine use of exome sequencing is expected to be introduced as a first-line test to support the diagnosis of genetic disorders, which will reduce time and costs until a definitive diagnosis is obtained. In addition, software tools will be developed for the management, consultation and interpretation of genetic variation and its connection with diseases through efficient Big Data analysis procedures.

Geoatlantic

Boosting local ecosystems for the use of geothermal energy in communities

FACT SHEET

- Acronym: GeoAtlantic (EAPA_527/2016)
- Partners: Concello de Ourense, Instituto Tecnológico y de Energías Renovables (ITER) de Canarias, Centro Tecnológico de Eficiencia y Sostenibilidad Energética (EnergyLab); Associação de Municipios da Cova da Beira (AMCB); Centre for Renewable Energy Research (CIENER) del Instituto de Ciência e Inovação em Engenharia Mecânica e Engenharia Industrial (INEGI) de Portugal; Universidade de Porto; Islay Energy Trust- IET; Argyll, Lomond and the Islands Energy (ALIENERGY); Eden Project- EP; Agence Locale de l'Energie et du Climat-ALEC; Cork Institute of Technology (CIT); European Heat Pump Association (EHPA) and the Geothermal Resources Department of the Portuguese company EDA RENOVÁVEIS. In addition, as partners are the Associação das Agências de Energia e Ambiente (Rede Nacional), the Direção Regional da Energia da Região Autónoma dos Açores, the Municipal Chamber of Ribeira Grande de Açores and the Municipal Chamber of Povoaçao de Açores.
- Duration: 01/09/2017 to 31/08/2021
- Budget: 2,867,469.64 €.
- Funding: INTERREG Atlantic Area Programme.

PROJECT SUMMARY

The GeoAtlantic project: 'Boosting local ecosystems for the use of geothermal energy in the communities', within the framework of the INTERREG Atlantic Area Programme, aims to promote the use of geothermal energy in communities of the Atlantic Area (37 Atlantic regions of five countries: France, Ireland, Portugal, Spain and the United Kingdom), thus contributing to the objectives of economic, social and territorial cohesion.

The general objective of GeoAtlantic is to promote the use of geothermal energy through the joint development of tools and methodologies to create the necessary conditions to favour the energy transition in the Atlantic Area through the implementation of favourable local ecosystems to boost local geothermal resources.

To materialise this objective, the following activities are foreseen: (1) Fostering the knowledge of initiatives, technologies and the latest developments to boost local ecosystems in favour of energy transition and increasing geothermal energy, (2) Empowering communities and local authorities, through training and advice at different levels, (3) Fostering research and transfer competences and capacities at local level to reinforce the geothermal energy sector chain and (4) Fostering local policy frameworks and joint support instruments between the different actors in the Atlantic Area to promote energy transition and the promotion of geothermal energy.

ITER, as a local partner in the Canary Islands, has developed geochemical prospecting in different mining areas in Tenerife and Gran Canaria for geothermal exploration purposes. These works have shown which areas could potentially show a higher probability of harbouring hidden geothermal resources. The future work ITER proposes includes studies of zones of the Atlantic Area with the capacity to host medium-high enthalpy geothermal resources. To this end, it will develop geochemical campaigns of diffuse degassing of CO2 and other volatiles in the surface soil environment on the island of La Palma (Canary Islands), on the island of Terceira (Azores) and also a complete hydrogeochemical study of different points of thermal waters in Galicia with the aim of evaluating the geochemical and isotopic composition of dissolved gases in these thermal waters.

MAIN RESULTS:

- 4 Technology transfer experiences
- 8 Territories mapped for geothermal potential
- 36 Stakeholders to implement good renewable energy practices
- 2 Regional policies for the use of geothermal sources
- 8 Territories with improved local energy policy thanks to project results

TFVINOS

Application and use of strontium isotope systematics as a "fingerprint" of Tenerife wines.

PROJECT SUMMARY

The project "APPLICATION AND USE OF STRONTIUM ISOTOPES SYSTEMATICS AS A "TRACEABLE FINGERPRINT" OF TENERIFE WINES", is part of the Strategic Framework for Island Development (MEDI) 2016-2025. It is co-funded by the Tenerife Innova Programme 2016-2021 coordinated by the Cabildo de Tenerife's Tenerife 2030 Area and the Canary Islands Development Fund (FDCAN). The project aims to establish the application of strontium isotope systematics (87Sr/86Sr) as a potential and effective tool for determining the origin, traceability and authenticity of Tenerife wines. This project aims to comply with the Designation Control Law that regulates the use of regional names for wines and guarantee their origin through established chemical methodologies in order to provide a guarantee of quality to consumers.

Concern for food security and the environment is a priority for advanced societies, which need to accelerate a technological transition that promotes a sustainable economy and enables them to meet the environmental, economic and social challenges regarding (a) sustainable production and management of agriculture, livestock, aquaculture, forest resources and fisheries, the agri-food chain and its traceability, crop and forest protection, animal health and welfare, biomass production and transformation, and climate change mitigation and adaptation; (b) the growing demand for healthier, safer and higher quality food and bio-products for non-food and energy use. The aim of this project is to establish a traceability system that is more demanding than the legislation on food hygiene or agri-food quality and that encourages an increase in the competitiveness of companies linked to the wine industry.

ITER's fluid geochemistry laboratory will be equipped with a thermal ionisation mass spectrometer (TIMS) to determine isotope ratios (87Sr/86Sr), which will be the first instrument of its kind in the Canary Islands. At present, the laboratory already has the instrumental capabilities to analyse the strontium (Sr) content of Tenerife wines using an Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES). The wine samples, as well as their main characteristics, for subsequent chemical (Sr content) and isotopic (87Sr/86Sr) analysis will be provided by Tenerife's five protected designation of origin. It is also intended to recruit two PhD graduates, one with experience in the use of thermal ionisation mass spectrometry (TIMS) and a second with experience in the use of Inductively Coupled Plasma Mass Spectrometry (ICP-MS).

TFAGUAS

Development and implementation of innovative techniques to assess salinisation in coastal aquifers in Tenerife.

PROJECT SUMMARY

The project "DEVELOPMENT AND IMPLEMENTATION OF INNOVATIVE TECHNIQUES TO ASSESS SALINISATION IN TENERIFE COASTAL AQUIFERS" is part of the Strategic Framework for Island Development (MEDI) 2016-2025 and is co-funded by the Tenerife Innova Programme 2016-2021 coordinated by the Cabildo de Tenerife's Tenerife 2030 Area and the Canary Islands Development Fund (FDCAN).

The main objective of the project is to evaluate and analyse the potential of isotope geochemistry systematics in order to develop a useful and effective tool for determining marine infiltration in coastal aquifers in Tenerife.

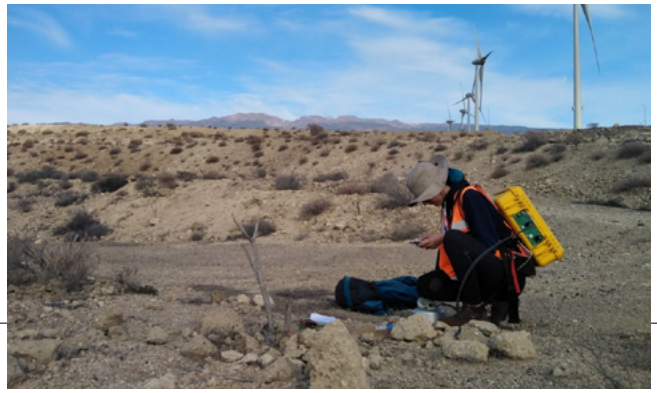
For many years, the lack of adequate groundwater research in the Canary Islands has been evident, and there are still important questions that need to be resolved. Identifying and quantifying the origin of salinisation, as well as determining the residence time of groundwater in our volcanic aquifers are two priorities on the research agenda in the Canary Islands' water resources.

A broad knowledge of these two aspects will be very important to plan the future exploitation of the island's volcanic aquifers. This task can be carried out through the study of isotopes from the natural environment which act as indicators and tracers of the hydrological system. The lack of technical resources and specialists in the Canary Islands imply a delay in scientific-technological development in this area, even though the Canary Islands is a unique laboratory in the world for the study of groundwater in volcanic terrain due to the large investments made by the private sector to collect it.

In the discussion and search for the origin of salinisation, strontium isotopic determinations (87Sr/86Sr) are a useful and effective tool for the following reasons: (1) the existence of an 87Sr/86Sr isotopic signature characteristic for the natural environment of the Canary Islands that is differentiated from the natural continental environment, and (2) the "non" existence of a strontium isotopic fractionation process associated with physical, chemical, and biological mechanisms that govern the mobility of strontium (Sr) and its respective isotopes (87Sr and 86Sr) in the natural environment.

TENAIR

Detection, monitoring and measurement of atmospheric pollutants of anthropic origin in Tenerife.



PROJECT SUMMARY

The "TENAIR project (Detecting, monitoring and measuring atmospheric pollutants of anthropogenic origin in Tenerife) was set up with the general objective of contributing to detect, monitor and measure atmospheric pollutants generated by the main anthropogenic activities on the island of Tenerife. This project aims to provide additional and complementary information to that already available to other administrations on the sources of atmospheric pollutants on the island as well as to apply the use of cutting-edge techniques for the study of air quality in Tenerife.

The content and development of this educational programme includes the following activities:

- Evaluating uncontrolled biogenic emissions of biogas and other toxic gases into the atmosphere from Tenerife landfills.
- Carrying out specific studies on the level of atmospheric pollutants through the use of a mobile unit owned by the Cabildo de Tenerife, which has sensors for the continuous measurement of atmospheric pollutants (particles, SO2, NOx, O3, CO and CO2).
- Assessing the level of volatile organic compounds (VOCs) at three locations on the island of Tenerife.
- Measuring SO2 emissions from the main industrial sources (refinery and thermoelectric power stations at Granadilla and Caletillas, etc.) using remote optical sensors such as COSPEC and miniDOAS.
- Optimising the use of remote optical sensors such as open field Fourier transform infrared spectrometry (OP-FTIR) to assess air quality on the island of Tenerife.

This action is financed by the Cabildo de Tenerife under the TF INNOVA 2016-2021 programme, included in Axis 1 of the Strategic Framework for Island Development (MEDI) 2016-2025, and the FDCAN funds of the Government of the Canary Islands.

SEAFUEL

Sustainable integration of renewable fuels in local transport systems

FACT SHEET

- Acronym: SEAFUEL
- Partners: National University of Ireland Galway (NUI Galway), Comharchumann Fuinnimh Oileáin Árann Teoranta, University of Liverpool, Action Renewables, HyEnergy Consultancy Limited, Logan Energy, ITER, Tenerife Energy Agency (AIET) and Madeira Regional Energy Agency.
- Associated partners: European Hydrogen Association, Enagas, EMEC, Hydrogen Green Power, Cabildo de Tenerife, Comhairle Cathrach na Gaillimhe (Galway City Council), Hyundai Canarias and the Port Authority of Santa Cruz de Tenerife.
- Duration: December 2017- January 2022
- Budget: 3,647,632.96 €.
- Funding: INTERREG Atlantic Area Programme 2014 - 2020 (1st Call - year 2016). Priority 2 - Promoting resource efficiency. Specific Objective: 2.1. Promote renewable energies and energy efficiency.

PROJECT SUMMARY

SEAFUEL aims to use the renewable resources of the Atlantic Area to fuel local transport and support a low carbon economy. The project will make use of the partners' experience and renewable energy infrastructures -wind, solar and marine- to demonstrate the viability of hydrogen as a fuel to be used by local transport authorities in isolated regions. The success of the project will promote a sustainable transport system that can be adopted by other Atlantic regions.

The innovative approach of the project is based on connecting the fuel stations to solar panels, wind turbines and sea energy systems, generating the hydrogen fuel depending on the availability of resources.

Taking into account ITER's experience and R&D capabilities, the project has chosen the island of Tenerife as a laboratory for the installation of a pilot plant, which will try to demonstrate the technological, social and economic viability of implementing renewable fuels for transport. So, the first renewable hydrogen plant in the Canary Islands will be set up and will supply a fleet of plug-in hybrid electric-hydrogen vehicles for maintenance work on renewable installations.

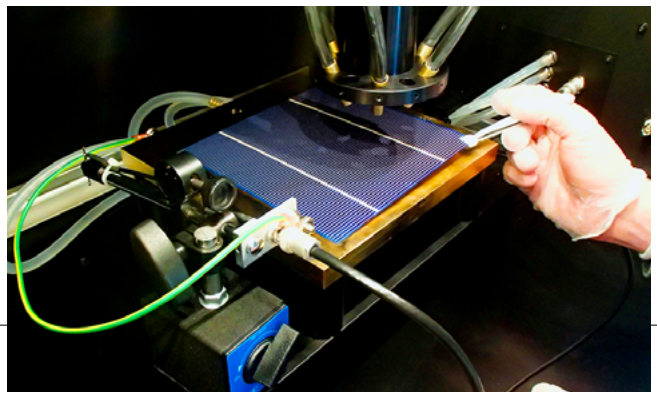
OBJECTIVES:

The overall objective of the SEAFUEL project is to demonstrate the feasibility of powering local transport networks using fuels produced from renewable sources and seawater, with no net carbon footprint as promoted by the Europe 2020 strategy "Resource Efficient Europe".

The project will cover technological innovation through the development of a demonstration plant, the establishment of a framework for the implementation of public policies, and a sustainability analysis on the production, distribution and use of hydrogen as an alternative fuel in remote regions of the cooperation area (Atlantic Area).

The energy required for the production of this fuel will be provided by renewable resources available in the Atlantic Area, such as solar, wind and marine energy.

SiNARQ



The SiNARQ project is funded under the 2013 call of the State Programme for Research, Development and Innovation oriented to the Challenges of Society, within the framework of the State Plan for Scientific and Technical Research and Innovation 2013-2016.

This project aims to manufacture crystalline silicon (c-Si) and a-Si:H photovoltaic cells in thin film on glass, with improved efficiency through the addition of a down-converting photovoltaic film (LFB) in the device. The cells will be assembled in the ITER module factory and integrated into bioclimatic buildings.

The main objectives of the project are as follows:

- Complete silicon PV cell manufacturing and a-Si:H steps at ITER.
- 0.4-0.5 percentage point increase in efficiency of PV devices with LFB.
- Integrating photovoltaic devices and single glazing with LFB in bioclimatic buildings.
- Obtaining an international patent.
- Designing the industrial production line integrating the LFB and associated economic-business study.

The project is led by the University of La Laguna (ULL), with ITER and the Fraunhofer Institut für Solare Energiesysteme (ISE-FhG) as collaborators.

Interreg

Projects funded under the Interreg Madeira-Azores-Canarias (MAC) 2014-2020 territorial cooperation programme.
Second call of the INTERREG MAC Territorial Cooperation Programme, 2014-2020.

MACLAB-PV PROJECT - IMPROVEMENT OF R&D&I CAPACITIES AND INFRASTRUCTURES IN THE RENEWABLE ENERGY AND ENERGY EFFICIENCY SECTOR IN THE CANARY ISLANDS AND SENEGAL (MAC2/1.1A/395)

- General Objective: To promote excellence and applicability of scientific and technological activity in the renewable energy and energy efficiency sector, contributing to the sustainable development of the Canary Islands and Senegal.
- Partners: Instituto Tecnológico y de Energías Renovables, S.A. (ITER), Agencia Insular de Energía de Tenerife, Fundación Canaria (AIET), Centre d'Etudes et de Recherches sur les Energies Renouvelables - UCAD (CERER), Agence pour l'Economie et le Maîtrise de l'Energie (AEME).
- Budget: 639,688.36 €.
- Co-funded by ERDF (85%): 543,735.11 €.
- Priority Axis of the CSTP OMC 2014-2020: Axis 1 - Enhancing research, technological development and innovation.
- More information in MACLAB-PV project.

VOLTURMAC PROJECT - STRENGTHENING VOLCANO TOURISM IN MACARONESIA (MAC2/4.6C/298)

- General Objective: to contribute to the strengthening of the conservation, protection, promotion and development of the natural and cultural heritage associated with the volcanic phenomenon in Macaronesia through the promotion of volcano tourism.
- Partners: Instituto Volcanológico de Canarias (INVOLCAN), Instituto Tecnológico y de Energías Renovables (ITER), Universidad de La Laguna (ULL), Cabildo de Tenerife (Consejería Insular del Área de Planificación del Territorio, Patrimonio Histórico y Turismo) [Land Planning, Historical Heritage and Tourism Office], Cabildo de El Hierro (El Hierro Geopark), Cámara do Comercio e Industria da Madeira, Associação Regional de Turismo, Turismo dos Açores, Universidade de Cabo Verde (UniCV), Cámara de Turismo de Cabo Verde, Laboratorio de Engenharia Civil de Cabo Verde.
- Budget: 1,964,660.94 €.
- Co-funded by ERDF (85%): 1,669,962.36 €.
- Priority Axis of the OMC TCP 2014-2020: Axis 4 - Conserving and protecting the environment and promoting resource efficiency.
- More information on VOLTURMAC project.

VOLRISKMAC II PROJECT - STRENGTHENING R&D&I CAPACITIES FOR BUILDING RESILIENCE TO VOLCANIC EMERGENCIES IN MACARONESIA (MAC2/3.5B/328)

- General Objective: To strengthen R&D&I capacities for the development of resilience to future volcanic emergencies in Macaronesia.
- Partners: Instituto Volcanológico de Canarias (INVOLCAN), Instituto Tecnológico y de Energías Renovables (ITER), Agencia Insular de la Energía de Tenerife (AIET), Centro de Informação e Vigilância Sismovulcânica dos Açores (CIVISA), Universidade dos Açores (UAc), Fundação Gaspar Frutuoso, Instituto das Florestas e Conservação da Natureza (IP-RAM), Universidade de Cabo Verde (UniCV) and Laboratorio de Engenharia Civil de Cabo Verde.
- Budget: 1,609,702.51 €.
- ERDF Co-funded by (85%): 1,368,247.14 €.
- Priority Axis of the OMC TCP 2014-2020: Axis 3 - Climate change and risk management.
- More information on the VOLRISKMAC II project.

EELABS PROJECT - LABORATORIES TO MEASURE THE ENERGY EFFICIENCY OF ARTIFICIAL NIGHT-TIME LIGHTING IN PROTECTED NATURAL AREAS IN MACARONESIA (MAC2/4.6D/238)

- General Objective: To maximise the energy efficiency of new lighting technologies - mainly LEDs - while minimising their effect in the form of light pollution - sky glow - on natural ecosystems in Macaronesia.
- Partners: Instituto de Astrofísica de Canarias (IAC), Universidad de Las Palmas de Gran Canaria (ULPGC), Instituto Tecnológico y de Energías Renovables (ITER), Sociedade Portuguesa para o Estudo das Aves (SPEA-Madeira), Sociedade Portuguesa para o Estudo das Aves (SPEA-Azores).
- Budget: 1,241,586.40 €.
- Co-funded by ERDF (85%): 1,055,361.23 €.
- Priority axis of the OMC TCP 2014-2020: Axis 4- Preserve and protect the environment and promote resource efficiency.
- More information on the EELabs project.

PLANCLIMAC PROJECT - JOINT PLANNING, MONITORING AND OBSERVATION, IMPROVEMENT OF KNOWLEDGE AND AWARENESS OF CLIMATE CHANGE RISKS AND THREATS IN MACARONESIA (MAC2/3.5B/244)

- General Objective: To take advantage of the scientific knowledge and technological capacity in the Macaronesian Region to provide tools that enable to implement adaptation policies and preparedness for the natural risks inherent to Climate Change.
- Partners: Viceconsejería de Medio Ambiente del Gobierno de Canarias [Government of the Canary Islands' Environment Office] (lead beneficiary), Address Regional de Ambiente de Azores, Secretaria Regional do Ambiente e Recursos Naturais de Madeira, Universidad de Las Palmas de Gran Canaria (ULPGC), Universidad de La Laguna (ULL), Instituto Tecnológico y de Energías Renovables (ITER), Instituto Tecnológico de Canarias (ITC) and Ministry of Agriculture and Environment of the Republic of Cabo Verde.
- Budget: 1,815,199.85 €.
- Co-funded by ERDF (85%): 1,542,919.87 €.
- Priority Axis of the OMC TCP 2014-2020: Axis 3 - Promoting climate change adaptation and risk prevention and management.
- More information in PLANCLIMAC project.
- First call of the Territorial Cooperation Programme INTERREG MAC, 2014-2020.

SOSTURMAC PROJECT - SUSTAINABLE ENHANCEMENT OF THE NATURAL AND ARCHITECTURAL HERITAGE AND DEVELOPMENT OF LOW CARBON TOURISM INITIATIVES IN THE CANARY ISLANDS AND CAPE VERDE (MAC/4.6C/115)

- General Objective: To promote sustainable actions that enhance the value of the natural and architectural heritage of the cooperation area, favouring its conservation and providing added value to its sustainable tourism and cultural offer.
- Partners: Instituto Tecnológico y de Energías Renovables (ITER), Agencia Insular de Energía de Tenerife, Fundación Canaria (AIET), Fundación Centro Internacional para la Conservación del Patrimonio (CICOP), Ministério do Ambiente, Habitação e Ordenamento do Território, Câmara Municipal de São Filipe. Ilha do Fogo, Universidade de Cabo Verde, Instituto Nacional de Investigação e Desenvolvimento Agrário, Parque Natural de Fogo.
- Budget: 935,567.26 €.
- Co-funded by ERDF (85%): 795,232.171€.
- Priority Axis of the OMC TCP 2014-2020: Axis 4 - Conserving and protecting the environment and promoting resource efficiency.
- More information on the SOSTURMAC project.

PLASMAC PROJECT - CLOUD PLATFORM FOR THE IMPROVEMENT OF SOCIAL ASSISTANCE IN MACARONESIA (MAC/5.11A/197).

- General Objective: To improve the social assistance care offered to the population of Macaronesia through a set of technological tools brought together in a cloud platform that allows creating dashboards, sharing of information and data, and promoting participation and collaboration.
- Partners: Cabildo de Tenerife (leader), Instituto de Atención Socio-Sanitaria de Tenerife (IASS), Ayuntamiento de San Cristóbal de La Laguna, Instituto Tecnológico y de Energías Renovables and Universidad de Madeira.
- Budget: 640,690.79 €
- Co-funded by ERDF (85%): 544,587.18 €.
- Priority Axis of the OMC TCP 2014-2020: Axis 5 - Improving the institutional capacity and efficiency of public administration Conserving and protecting the environment and promoting resource efficiency.
- More information on the PLASMAC project.

VOLRISKMAC PROJECT - STRENGTHENING OF R&D&I CAPACITIES TO MONITOR VOLCANIC ACTIVITY IN MACARONESIA (MAC/3.5B/124).

- General Objective: To strengthen capacities for monitoring volcanic activity in order to improve the early warning system for volcanic eruptions and volcano seismic crises, as well as the management of volcanic crises in Macaronesia.
- Partners: Instituto Volcanologico de Canarias (INVOLCAN), Instituto Tecnológico y de Energías Renovables (ITER), Agencia Insular de Energía de Tenerife (AIET), Centro de Vulcanologia e Avaliação de Riscos Geológicos da Universidade dos Açores (CVARG), CIVISA - Centro de Informação e Vigilância Sismovulcânica dos Açores, Insitituto das Florestas e Conservação da Natureza (IPRAM).
- Budget: 1,590,032.51€.
- Co-funded by ERDF (85%): 1,351,527.63 €
- Priority Axis of the OMC TCP 2014-2020: Axis 3 - Promoting climate change adaptation and risk prevention and management.
- More information on the VOLRISKMAC project.

SOSTURMAC

Sustainable enhancement of natural and architectural heritage and development of low-carbon tourism initiatives in the Canary Islands and Cape Verde

FACT SHEET

- Acronym: SOSTURMAC
- Partners: Instituto Tecnológico y de Energías Renovables (ITER), Agencia Insular de Energía de Tenerife, Fundación Canaria (AIET), Fundación Centro Internacional para la Conservación del Patrimonio (CICOP), Ministério do Ambiente, Habitação e Ordenamento do Território (DNA), Universidade de Cabo Verde (UNICV), Instituto do Patrimonio Cultural (IPC), Instituto Nacional de Investigação e Desenvolvimento Agrário (INIDA), Câmara Municipal de São Filipe. Ilha do Fogo (CMSF), Parque Natural de Fogo (PNF).
- Duration: 2017-2019 (36 months)
- Budget: 935,567.26 €.
- Funding: Interreg Madeira-Azores-Canary Islands Territorial Cooperation Programme (MAC) 2014-2020. Axis 4 - Conserving and protecting the environment and promoting resource efficiency.

PROJECT SUMMARY

This project aims to add value to the tourism offer of the Canary Islands and Cape Verde by orienting it towards new market trends linked to scientific and nature tourism and the environmental awareness of travellers. The aim is to turn ecotourism into an opportunity for socio-economic improvement and environmental conservation in the cooperation area.

Through these actions key natural and architectural heritage elements will be detected with regard to their conservation and potential as a tourist attraction. They will also enable their reassessment and reinterpretation through techniques that contribute to the efficient management of their own resources and to sustainability. In this regard, the revalued architectural heritage resources will be included in Tenerife's Cultural Heritage Management (CICOP) and A Cultural Heritage Manager for Cape Verde will be created. In addition, a sustainable pilot intervention will be carried out to improve the heritage environment of the city of São Filipe, on the island of Fogo. On the other hand, a "Zero CO2 modular tourist accommodation" will be designed as a new ecotourism product that can be replicated in the cooperation area, and innovative ICT tools for the management of this type of accommodation will be identified and optimised. As a pilot experience, a "Zero CO2 Tourist Information and Interpretation Point of Natural Heritage" will be designed and installed in Fogo Natural Park, (Fogo Island, Cape Verde). This centre will be designed to be easily moved in case of volcanic eruption, as it will be installed in an area of high volcanic risk. In addition, actions will be carried out to optimise the subsequent tourist dynamization of the new values and products developed as well as to promote the conservation of the heritage values of both regions.

GENERAL OBJECTIVE:

Promote sustainable actions that enhance the value of the natural and architectural heritage of the cooperation area, favouring its conservation and providing added value to its sustainable and cultural tourism offer.

SPECIFIC OBJECTIVES:

- Specific Objective 1: To enhance the architectural heritage from a sustainable point of view.
- Specific Objective 2: Revalue natural heritage from a sustainable point of view, promoting the development of low-carbon tourism products.
- Specific Objective 3: Promote the integration of the new values and products developed in tourism dynamics and encourage the conservation of heritage values.

ACTIVITIES:

S.O. 1: Revaluing architectural heritage in a sustainable way

- Activity 1 - Detecting key architectural resources and their interpretation from an energy perspective to include them in a heritage manager.
- Activity 2 - Establishing criteria for sustainable architectural heritage intervention and restoration
- Activity 3 - Sustainable intervention to improve the heritage environment of the city of São Filipe, on the island of Fogo.

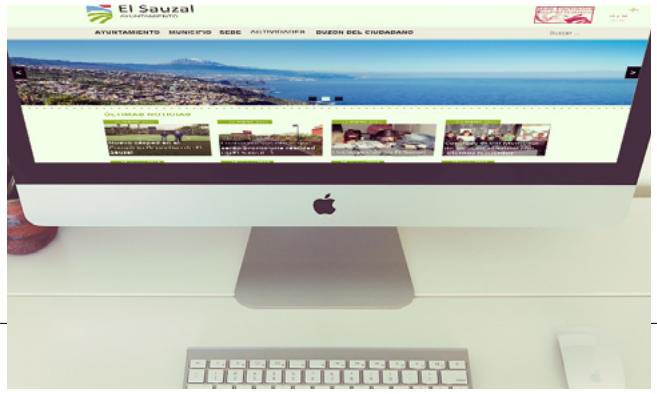
E.O. 2: Enhancing the sustainable value of natural heritage by promoting the development of low-carbon tourism products.

- Activity 4 - Designing the "Zero CO2 modular housing" and its possible configurations
- Activity 5 - Identifying and optimising ICT tools suitable for the management and marketing of "Zero CO2" tourist accommodation
- Activity 6 - Designing and setting up a "Zero CO2 Tourist Information and Natural Heritage Interpretation Point" in Fogo Natural Park.

S.O. 3: Promoting the integration of new values and products

developed in the tourism dynamics and encouraging the conservation of heritage values.

- Activity 7 - Designing complementary activities and material to promote tourism of the developed products and their integration in the tourism offer.
- Activity 8 - Promoting the conservation of the heritage of both regions through dissemination and capacity building actions.



Municipal modernisation

The Cabildo de Tenerife, through the Unidad de Modernización y Asistencia Técnica Municipal [Unit for Municipal Modernisation and Technical Assistance] (UMAM), has signed several agreements with ITER with the aim of achieving greater efficiency in the use of public resources to articulate modernisation and municipal technical assistance.

From 2006 to 2014, ITER collaborated with the Plan de Modernización Continua del Cabildo de Tenerife (PMC) [Continuous Modernization Plan] in the actions undertaken to modernise Public Administration of the Canary Islands.

In 2014, the agreement was renewed to update the municipalities' web portals and new municipalities joined the project. In 2016 an addendum to the agreement was signed with the aim of extending municipal coverage and improving the scope of the project.

Actions being carried out include:

- Services provided on municipal portals and websites, including design, development and maintenance.
- Advice and support in the implementation of different technological solutions for internal municipal management made available to local councils by other public administrations.
- Hosting, support and maintenance of the collaborative environment used by the UMAM of the Cabildo in its daily management.
- Establishing a Municipal User Service Centre to resolve incidents.

SPITERM

Experimental design and development for the production of spirulina using low enthalpy geothermal resources.

FACT SHEET

- Acronym: SPITERM
- Partners: Instituto Tecnológico y de Energías Renovables [ITER], Agencia Insular de Energía de Tenerife (AIET) and Banco Español de Algas-FCPCT-ULPGC.
- Duration: 2016-2019 (4 years)
- Budget: 1,724,520.01€.
- Funding: Call for proposals Retos-Colaboracion. State R+D+I Program Oriented to the Challenges of Society. State Scientific, Technical and Innovation Research Plan 2013-2016. Ministry of Economy and Competitiveness.

PROJECT SUMMARY

The SPITERM project aims to take advantage of the characteristics of the low-enthalpy geothermal waters of the galleries on the island of Tenerife to reduce the costs of commercial production of the microalgae Spirulina (the trade name given to some species of the genus Arthrospira), for which market demand keeps growing.

The general objective of the project is to determine the sustainable inter-annual production of Spirulina microalgae on a pilot plant scale, taking advantage of mineral salts, gases (CO2) and the temperature of geothermal water to reduce the cost of culture media and boost production in photobioreactors as opposed to conventional systems. This will reduce the technological costs of production by approximately 25% and obtain a biomass of high commercial value due to its protein, phycobiliprotein, polyunsaturated fatty acids and antioxidant substances content.

The Canary Islands is the most competitive European region for Spirulina cultivation, as it has high annual irradiation and temperature rates, as well as unpolluted salty or brackish water. In this case, it is a question of using an available and manageable natural resource, a clean and renewable energy.

OBJECTIVES:

The general aim of the project is to take advantage of the characteristics of the low enthalpy geothermal waters of the galleries on the island of Tenerife to reduce the costs of commercial production of Spirulina microalgae.

In order to achieve this objective, the following specific objectives are proposed:

- Using geothermal energy and naturally occurring CO2 to optimise the photosynthetic process for the growth of Spirulina algae.
- Designing and manufacturing a photobioreactor-type cultivation system with high volumetric productivity and efficient light energy conversion.
- Monitoring the physicochemical parameters of the water in the selected gallery throughout the duration of the project in order to know the concentrations of salts to be added.
- Formulating the culture medium based on the classical recipe of the Spirulina-modified medium used in the Spanish Algae Bank (www.marinebiotechnlogy.org).
- Selecting the Spirulina strain best suited to the processing medium, cultivation conditions (natural irradiation and geothermal water temperature) and cultivation system.
- Training technical staff to carry out plant maintenance, Spirulina production and biomass processing.
- Testing other raceway and thin-layer cultivation systems to compare the efficiency of the designed system.
- Evaluating the full potential of this idea for the island of Tenerife as a possible new economic activity for the island.

VERTEGAS

Estimation of methane emissions to the atmosphere from landfills in Spain

FACT SHEET

- Acronym: VERTEGAS
- Reference: CTM²016-77651-R
- Partners: Instituto Tecnológico y de Energías Renovables [ITER]
- Duration: 2017-2020 (4 years)
- Budget: €120,000
- Funding: State R+D+I Program Oriented to the Challenges of Society (Individual Type). National R&D&I Plan 2013-2016. Ministry of Economy and Competitiveness.

PROJECT SUMMARY

The main objective of this project is to estimate the uncontrolled diffuse emission of methane to the atmosphere from landfills in Spain and to create a standardised service applicable to any Spanish and/or foreign landfill to determine this emission.

The aim of the project is to create a standardised service that can be applied to any Spanish and/or foreign landfill to determine the emission of the biogas it produces. The materialisation of this project will have important technical and environmental implications.

The results and knowledge derived from this research project will be translated into the creation of a service for potentially interested landfills, both operational and decommissioned, with the aim of regulating uncontrolled biogas emission levels. Landfills are real chemical and biological reactors that introduce a large number of pollutants into the environment in the form of gases (carbon dioxide -CO2-, methane CH4-, volatile organic compounds, etc.) and leachates. In order to control the emission of these pollutants into the atmosphere, biogas extraction systems are implemented in landfills to recover the gases generated by the decomposition of waste in landfills. However, despite technical efforts to minimise gas emissions to the atmosphere, there is a percentage of so-called uncontrolled or diffuse emissions that escape to the atmosphere through the surface of the landfill.

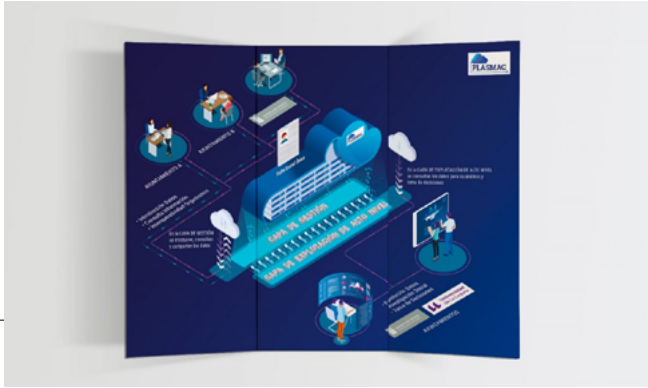
It is necessary to evaluate the efficiency of gas control systems in order to understand each and every one of the factors that can improve and optimise the control of biogenic emissions from landfills. Studies of the spatio-temporal distributions of biogas components will facilitate both the understanding of how landfill degasification takes place and the provision of advice to public and private entities to establish efficient biogas extraction systems. The aim is not only to minimise the atmospheric pollution produced by them, but also to achieve higher levels of controlled emissions, which would translate into the possibility of achieving higher levels of energy production.

On the other hand, it is an established fact that the estimates that have been made and published in the State Register of Emissions and Pollutant Sources (PRTR-Spain) of the Ministry of Agriculture, Food and Environment of the Government of Spain of greenhouse gas emissions, especially of CH4 by some landfills in the Canary Islands, are overestimated due to the use of analytical protocols and methodologies based on mathematical models. For example, the diffuse emission of CH4 that appears in the PRTR-Spain for 2005 for the landfill of Arico (Tenerife) is 3120 tonnes/year, while studies carried out in the only operational cell of this landfill by personnel of the present consortium gave an experimentally measured value of 51.1 tonnes/year. This implies that if the estimates of uncontrolled diffuse emission are in fact much lower than those estimated by mathematical modelling, the efficiency of the extraction system is much better than is being appreciated. On the other hand, as far as non-methane volatile organic compounds (NMVOCs) are concerned, given the lack of legislation for landfills, methodologies for their determination should be developed. Therefore, a review of these suspect data is needed.

Subsequently, through this know-how the intention is to generate a service in the form of a Spanish Standard (UNE) that will be made available to interested parties to improve public information. If possible, we will also try to make it part of the Best Available Techniques (BAT).

PLASMAC

Cloud platform for the improvement of social assistance and labour integration in Macaronesia.



FACT SHEET

- Acronym: PLASMAC
- Partners: Canary Islands Employment Service, Fundación Canaria para el Fomento del Trabajo (FUNCATRA) [Canary Islands Foundation to Promote Employment], Instituto de Tecnología y Energías Renovables (ITER) and University of Madeira.
- Duration: 2017-2021
- Budget: 674,356.43€.
- Funding: Interreg Madeira-Azores-Canary Islands Territorial Cooperation Programme (MAC) 2014-2020. Axis 5 - Improving the institutional capacity and efficiency of the Public Administration to conserve and protect the environment and promote resource efficiency.

PROJECT SUMMARY

The PLASMAC project aims to fulfil an aspiration shared by all democratic governments of our time. It does not matter whether we are dealing with a local, regional or state government since at any administrative level, increasing the welfare of its citizens is a priority. One of the fundamental ways to achieve it is through much more agile and personalised social assistance policies and programmes. The project will bring together social, organisational and technological efforts to provide the governments of the participating regions with a cloud-based platform that will enable them to be more effective, efficient, proactive and open when making decisions in the design of their social assistance public programmes and policies, enabling them to act in a preventive and proactive manner.

The general objective of the project is to improve the social assistance offered to the population of Macaronesia through a set of technological tools brought together in a cloud platform that allows creating dashboards, sharing information and data, encouraging participation and collaboration.

The PLASMAC project is divided into the following set of activities to be carried out during the three milestones into which the project is divided:

- Exchanging information between social work units to unify and standardise criteria.
- Preparing the necessary documentation addressed to public administrations and other institutions.
- Developing an international event on good practice in social care.
- Legal and policy analysis.
- Analysis and design of data and information release processes.
- Quality and Technological Security Audits.
- Uploading initial data, parameterisation work and implementation of the cloud platform.
- Testing the cloud platform.
- Commissioning the platform.

SIMMULA

Predictive maintenance system for wind turbines

FACT SHEET

- Acronym: SIMMULA
- Reference: RTC-4879-3
- Partners: Instituto Tecnológico y de Energías Renovables [ITER] and Universidad Politécnica de Valencia (UPV).
- Duration: 2016-2018 (30 months)
- Budget: 473,810.55 €.
- Funding: Challenges-Collaboration Programme of the National R&D Plan 2013-2016 of the Ministry of Economy and Competitiveness through ERDF funds.

PROJECT SUMMARY

Despite the many benefits of wind energy and the 20-year useful life of wind turbines, the highly variable load conditions they are subjected to, their large number of systems and devices and the continuous evolution towards larger wind turbines are the main causes of faults and defects that require numerous operations to maintain their service and safety. These maintenance operations have a high cost, which ranges between 10-20% of the total cost of energy of a wind farm, reaching up to 35% when wind turbines are around 20 years old.

In this situation, it is observed that the gearbox of a wind turbine, despite being a system that is less likely to fail than other systems, requires more maintenance time, which translates into higher maintenance costs and economic losses for wind farm owners.

Nowadays, the maintenance philosophy used to carry out these operations on the gearbox is either corrective and/or preventive, which means repairs can only be made once failure has occurred which makes maintenance operations very costly.

The SIMMULA project proposes an innovative monitoring system, capable of reporting any anomaly in the different parts that make up the gearbox, in order to carry out maintenance operations prior to the failure of the element as a whole (predictive maintenance philosophy) and avoiding the stoppage of the wind turbine for a long period of time. So, by carrying out maintenance operations before an advanced stage of failure, maintenance costs and operations can be optimised, and economic losses reduced.

Thus, the general objective of the SIMMULA project is to develop a new system for monitoring the gearbox of wind turbines that is capable of detecting automatically and in real time, through the use of wireless accelerometers placed on the gearbox casing, defects in the different elements of the system by studying the vibration response recorded.

SMARTLODGING4GUEST

Maximising and personalising guest comfort in hotel accommodation by means of intelligent and automated management systems through big data analytics and IoT.

FACT SHEET

- Acronym: SMARTLODGING4GUEST
- Partners: ITER, Magtel Operaciones, and Sieltec Canarias.
- Subcontracted technology centre: CTIC
- Duration: 2016-2018
- Budget: 1,515,498.00€.
- Funding: Co-funded by CDTI and ERDF

PROJECT SUMMARY

The aim of the SMARTLODGING4GUEST project is to optimise the comfort of hotel guests without compromising sustainability and energy efficiency.

SMARTLODGING4GUEST aims to optimise the comfort of hotel guests by making their stay unique. This is achieved not just by a personalised treatment by hotel staff, but by making the hotel itself intelligent and adaptable to the behaviour, usage patterns and preferences of the guest. Moreover, this must be achieved without undermining the energy efficiency of the building.

The consortium developing SmartLodging4Guest is made up of several companies with multidisciplinary teams of experts in all the fields involved in the project. The project is led by the Instituto Tecnológico y de Energías Renovables [ITER] and Magtel Operaciones S.L. and Sieltec Canarias S.L. participate as partners while CTIC Centro Tecnológico is the subcontracted technology centre.

The project's actions are implemented in the Canary Islands and Andalusia.

It is divided into the following set of activities to be carried out during the three milestones in which the project is divided (2016, 2017 and 2018):

- Activity 1 Project management.
- Activity 2 Requirement analysis.
- Activity 3 Data acquisition and parameter monitoring system
- Activity 4 Intelligent data analysis
- Activity 5 Data acquisition and parameter monitoring system
- Activity 6 Actuation and visualisation system design
- Activity 7 Testing and validation.

HELIODRON

Development of a solar powered unmanned aircraft for surveillance missions

FACT SHEET

- Acronym: HELIODRON
- Partners: Instituto Tecnológico y de Energías Renovables (ITER), Fundación Centro Tecnológico de Componentes (CTC) and Aerosertec.
- Duration: 2016-2018 (27 months)
- Budget: 775,542.10€.
- Funding: Challenges-Collaboration Programme of the National R&D Plan 2013-2016 of the Ministry of Economy and Competitiveness through ERDF funds.

PROJECT SUMMARY

The main objective of the HELIODRON project is to develop a solar powered unmanned aircraft with approximately 2-metre wingspan that can be used for different surveillance missions and equipped with the necessary instrumentation to carry it out. It will serve not only for prevention, but also to manage incidents or catastrophes that may occur.

The advantage of this type of aircraft over other surveillance systems is mainly that the manufacture and operation costs are low, they are readily available, in addition to their long range.

The solution adopted a priori is a small solar powered aircraft with a wingspan of about 2 metres, designed for a flight altitude of up to 3,000 metres and a maximum operating speed of 20 m/s, which can be quickly available if needed.

In addition to developing the solar aircraft prototype, the project will also develop the instrumentation needed to carry out the surveillance mission. It should be noted that the project requires specific developments adapted to the singularities of solar energy, which on the one hand allows great flight autonomy -essential in surveillance missions- but on the other hand, means that all the systems on board the aircraft, whether for flight or perform its mission, must be of very low weight and energy consumption.

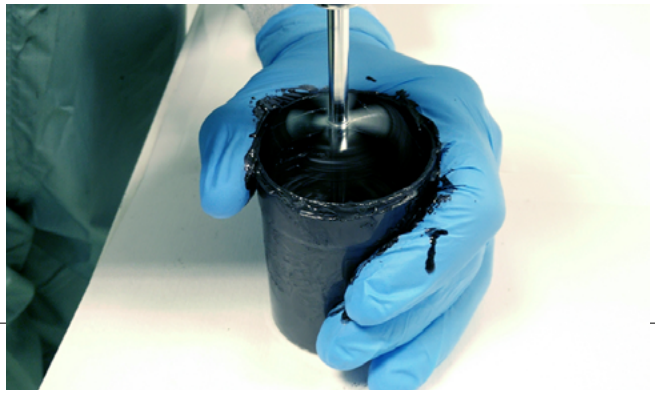
The consortium formed for the development of the HELIODRON project includes ITER, the Components Technology Centre Foundation (CTC) and Aerosertec.

CTC will be in charge of developing a redundant navigation system that has a low cost, size and power consumption, while at the same time can offer higher accuracies than commercial systems of equal or higher cost. Position estimates better than 1 metre and better than 1° in orientation are expected to be achieved for the typical dynamic operating conditions of a UAV. In the specific case of the solar-powered aircraft being used in surveillance and disaster management, the proposed navigation system offers an important contribution compared to the use of a low-cost commercial systems, as it not only increases the level of integrity, but also the accuracy and availability of the solution under all circumstances. This not only improves the aircraft's flight capability, but also translates directly into better geolocation of singular points, enabling the emergency services to respond quickly and manage the available resources better.

Aerosertec is participating in the project to carry out the structural design of the aircraft, which in this case requires extremely light and robust materials.

With the development of the project, the consortium members expect to generate at least 2 patents, 2 direct jobs and 4 indirect jobs.

The execution and justification of the Heliodron project has been completed. It was funded through the call for Collaboration Challenges projects in 2016. The validation tests carried out prove its operability. Several expressions of interest have been received from local companies and research organisations for the application of the result.



Conductive inks

So far, the deposition of the metal contacts in third generation cells has been carried out by thermal evaporation techniques. However, this type of technology generates a substantial cost overrun in the manufacturing chain. Therefore, in order to enable the commercial- scale production of this type of devices, it is necessary to evaluate the introduction of alternative metallization techniques, easily scalable and capable of reducing the inherent manufacturing costs. One such technique is screen-printing for metallization.

ITER's Solar Cells Laboratory has been working on this type of metallization since 2015, initially testing different types of commercial pastes, such as silver and aluminium pastes, commonly used in the metallization of crystalline silicon solar cells, as well as silver inks, normally applied in the manufacture of electrical contacts on plastic surfaces. Current efforts are focused on the study of inks made from graphite powders, epoxy resin and anhydride solvents, given their low cost and process temperatures.

The research and development work has enabled the laboratory to present its results in different forums, by participating in conferences and publishing articles.

- Technical and technology magazine. October 2016. Development of conductive inks for the screen-printing metallization of perovskite solar cells. Review of the progress made by the SiCellab photovoltaics laboratory in the development of conductive inks for third generation cells.
- Conductive inks with epoxy resin-based vehicles for perovskite screen printing metallization. It evaluates different inks prepared from graphite powders, epoxy resin and anhydrous solvents for screen printing. [Local] [EUPVSEC].
- Screen printing for Perovskite solar cells metallization. Provides new advances in metallization processes from silver pastes and inks using the screen-printing method. [Local] [EUPVSEC].
- Conductive inks with epoxy resin-based vehicles for perovskite screen printing metallization as a viable and low-cost alternative to thermal evaporation. This paper presents new advances in the research carried out by ITER's photovoltaic cells laboratory (SiCelLab) to develop inks for the metallization of substrates using the screen-printing technique. These inks use vehicles composed of epoxy resins and non-polar anhydrous solvents and are used to metallise solar cells based on perovskite thin films. [Local] [EUPVSEC].

PROCIVMAC

Environmental management for the prevention of natural disasters in Macaronesian municipalities

FACT SHEET

- Budget: 182,707.94 €.
- Funding: OMC Programme 2007-2013
- Ref. No: MAC/3/A270
- Acronym: PROCIVMAC
- Duration: 18 months, from 2 July 2014 to 31 December 2015.
- Principal Investigator: Dr. Nemesio M. Pérez

PROJECT SUMMARY

The PROCIVMAC project began as a result of the increase in natural disasters in the world. Its purpose is to act preventively in this type of situation in the Macaronesia region. The main beneficiary of this project is the Macaronesia population, as it focuses on knowing the risk situations to which the population is exposed, training personnel who make decisions in the face of these disasters and the population in general.

The purpose of this training is to provide the municipal technicians responsible for risk management with tools to improve environmental management and to introduce measures to prevent and reduce risk situations.

The project includes the exchange of experiences and concerns between the different local authorities in Macaronesia, progress in the preparation of risk maps and a study of natural risks in the region. It also includes the organisation of Conferences/Forums on actions in the field of environmental management and the implementation of dissemination and awareness programmes.

The geographical scope of the project is the archipelagos of Madeira, the Canary Islands and Cape Verde and the partners involved are ITER, the Associação de Municípios da Região Autónoma da Madeira (AMRAM) and the Câmara Municipal do Sal.

MAIN OBJECTIVE:

Promote good practices and encourage environmental management in order to reduce natural disasters in Macaronesia.

SECONDARY OBJECTIVES:

- Understanding the risk situations in the municipalities of Macaronesia.
- Training municipal technicians in order to raise awareness and improve environmental management to prevent risk situations in the event of natural disasters.

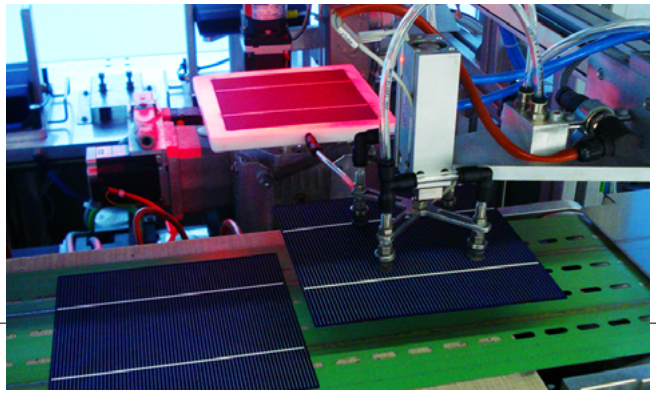
In this case, several activities have been carried out:

- Technical assistance during the last eruption of the Fogo volcano from November 2014 to the end of February 2015.
- Sharing experiences with security and emergency forces in Cape Verde, from 6 to 10 March 2015.

Two congresses:

- Organising a congress in Cape Verde to commemorate the first anniversary of the last eruption on 23 November 2014.
- Attending the training sessions on emergency planning organised by the Association of Municipalities of the Autonomous Region of Madeira (AMRAM) in December 2015.

AiSoVol



Project AiSoVol (Photovoltaic generation solution for use as an alternative construction material in buildings) proposes the experimental development, manufacture and testing in a controlled environment of a modular, integrable and multi-purpose photovoltaic panel, capable of facilitating its use as an architectural element. Thus, the manufacture of a "plug&play" photovoltaic module will be implemented based on the design, manufacture and testing of photovoltaic modules by encapsulating their constituent electrical elements (cells and interconnections) with low-temperature sandwich lamination techniques, using different types of transparent thermoplastics instead of tempered glass, cohesive materials and structural fibre lattices, inspired by sail-making technology, thus avoiding the need to use aluminium frames. This type of solution will enable the manufacture of lighter photovoltaic modules with different geometries and different degrees of structural flexibility.

In addition, to facilitate the electrical connectivity of the module, a prototype junction box will be developed that can be located on the outer edge of the photovoltaic module, also allowing ventilation to ensure the integrity of the protection diodes housed inside.

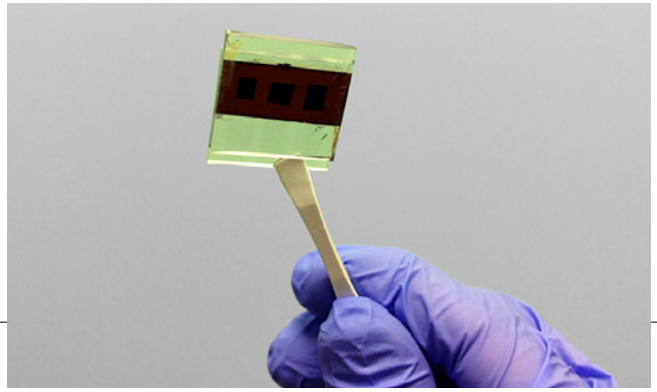
Finally, and in compliance with the provisions of the Technical Building Code (CTE), including the correction of errors established in the BOE 08/11/2013, the final product will be adapted to meet the minimum requirements established in the Documento Básico de Ahorro de Energía [Basic Document on Energy and Saving], helping to achieve a rational use of the energy necessary in buildings. The solution contemplates the inclusion of a rear insulating sheet attached to the back sheet of the photovoltaic module, which allows the energy demand of the building's thermal envelope to be adequately limited, based on its insulation and inertia characteristics, air permeability and exposure to solar radiation, complying with the thermal transmittance values defined in the CTE.

The AiSoVol Project (Photovoltaic generation solution for use as an alternative construction material in buildings) is co-financed by ERDF funds, within the State R+D+I Program Oriented to the Challenges of Society, Challenge 3: Safe, efficient and clean energy challenge.

The project, which began on 1 October 2015 and will end on 30 September 2018, involves ITER as coordinator and the National Renewable Energy Centre, CENER-CIEMAT Foundation. This project, co-financed by the European Union, has a total budget of 1,008,543.07 €, 849,495.70 € of which were obtained through the above-mentioned call, with a grant of 488,632.08 €.

Perovskita

Perovskite - Perovskite-based photovoltaic solar cells R&D&I project



The Perovskite project of the Department of Photovoltaics is a line of Research, Development and Innovation that aims to obtain high efficiency and low-cost photovoltaic cells, based on the use of hybrid organic/inorganic materials, such as the active (or light-collecting) layer.

This technology, which has evolved rapidly over the last decade and now boasts laboratory efficiency records of over 20%, is particularly attractive because its production processes is relatively simple. These processes consist of arranging their constituent elements in the form of thin layers deposited on transparent substrates, which reduces both material and manufacturing costs.

The objectives of the project are focused on achieving advances that will allow this technology to be included in the commercial sector. To this end, the work focuses on three areas:

- Improving the synthesis of the structures of the deposited layers, enabling cells efficiency to increase, reducing light and electrical losses.
- Studying methods for the deposition of the layers that make up the structure of the photovoltaic device itself.
- Evaluating the behaviour of this type of structure over time and in relation to its exposure to atmospheric agents.

The research and development work of this project has allowed the laboratory to present its results in different forums, through participating in conferences and publishing articles. The latest contributions are listed below, in chronological order:

- A one-step deposition method assisted with non-polar washing solvent treatment for producing uniform thin layers of perovskite validated through ellipsometry. This article summarises the methodology developed by the solar cell laboratory (SiCellLab), which has been validated through the use of spectral ellipsometric characterisation, in order to evaluate the optical properties and thickness of lead methylammonium iodide (CH3NH3PBI3) thin films deposited from solutions of their precursor chemicals, through spin coating on glass substrates by the one-step method, assisted with non-polar solvent washing treatment. [Local] [EUPVSEC]
- Optimising the deposition of thin layers of organic-inorganic hybrid perovskite methylammonium lead iodide (CH3NH3PbI3) on large surfaces through their optical properties. The article proposes a method to optimise the deposition of perovskite layers on large surfaces, up to 75 mm x 75 mm. [Local] [EUPVSEC].
- I Jornadas de Investigación en "Ingeniería industrial, informática y medioambiental" at the University of La Laguna. 22 April 2016. Manufacturing perovskite-based photovoltaic cells in a cleanroom. Link.
- Adapting a crystalline silicon solar cell laboratory to produce perovskite solar devices. It shows the adaptations carried out in the photovoltaic laboratory, originally designed for the research of crystalline silicon cells, in this new line of research. [Local] [EUPVSEC]

This action is co-financed by the MEDI-FDCAN Programme 2016-2025 and is included in the Strategic Framework for Island Development (MEDI) 2016-2025 of the Cabildo de Tenerife.

PRONTAS

This project, led by ITER and involving the UPM through the School of Aeronautical and Space Engineering and the company Aernnova Engineering Solutions, aims to build a 16-metre solar-powered unmanned aircraft. ITER is responsible for the energy and autonomous navigation systems, UPM for the aerodynamic design and Aernnova for the structural design. The aircraft is powered exclusively by solar energy captured through the photovoltaic cells that cover its wings. It has a storage system that allows it to fly at night and in low-radiation conditions. It is intended to be a fully autonomous aircraft, with the capacity to fly uninterruptedly for the duration of its mission, for which it has a navigation system that can follow a predefined trajectory or one commanded from a ground station. Both the navigation system and the technique for laminating the photovoltaic cells on the wings have been developed by ITER in previous projects related to PRONTAS (EVAS and PROAVISOL).

Among the applications envisaged for this type of aircraft are earth observation missions, surveillance (borders, fires, roads, major events) or the management of any type of disaster, for example when access to the affected areas has been destroyed or access for people could be dangerous.

PhotoBAT

Solar photovoltaic installation of 5 MWN + 5 MWH of storage in Arico.

The project, co-financed by the MEDI-FDCAN Programme 2016-2025, proposes a pilot model to test the technical and economic feasibility of undertaking medium-large solar installations connected to the grid without specific subsidised remuneration, according to the current legislative framework.

In this regard, it is necessary to design an installation model in which technological and management efficiency is prioritised, but in which execution and operating costs are significantly reduced in order to obtain a guaranteed minimum profitability that makes the project attractive to potential future investors.

Therefore, the energy production cost criterion will be essential in order to offer a competitive selling price with reasonable margins that allow for adequate profitability.

In order to guarantee these goals are met, both the support structures and the grid connection inverters will be manufactured by ITER. In addition, part of the photovoltaic modules required for this project will be produced in ITER's photovoltaic module factory, which came into operation in 2008.

An action plan will also be developed to allow the installation to be carried out in an efficient manner, minimising time and costs, and optimising the human and material resources available.

The entire platform will be installed on land located in the municipality of Arico and will consist of 50 solar photovoltaic plants of 100 kW nominal power each, giving a total platform power of 5 MW nominal and 7 MW peak.

Thus, electrically, the platform will be divided into two groups: one with 20 solar plants and the other with 30. Each of them will be connected to a prefabricated transformation centre (with a capacity of 2,000 kVA and 3,000 kVA respectively).

This action is aimed at developing a more sustainable energy model that favours the creation of a local economy with high added value. This will result in a diversified economy based on technology, innovation, and knowledge, job creation and reduction of external energy dependence, shaping a more efficient electricity system with the consequent economic saving and environmental benefits.

The proposed actions will be carried out guaranteeing the technical and economic efficiency of the whole and will seek to create a replicable model that will help to boost local economic development.

This action is co-financed by the MEDI-FDCAN Programme 2016-2025 and is included in the Strategic Framework for Island Development (MEDI) 2016-2025 of the Cabildo de Tenerife

Energy management system

Energy storage system, load management and consumption reduction programme

ITER has been working on high-power battery storage systems for several years. The development of the TEIDE100 photovoltaic inverter model with a power of 100kWn and its subsequent adaptation for bidirectional AC/DC operation has enabled the development of its own battery storage system. In addition, ITER currently has such a system that includes a battery bank with a storage capacity of 536 kWh. This bank, which has been used in the operational tests, is the basis of the pilot installation for the proposed system and will form part of the final system.

The aim is to develop an integrated system to accumulate and manage loads that allows a more efficient management of energy, providing a reduction of consumption in ITER.

This is a pilot project whose results are expected to be replicated in industrial systems. Three actions are envisaged:

Storage will allow energy to be available to compensate for any consumption peaks and to smooth out its time profile as required.

Load management will make it possible to adapt, as far as possible, certain consumption to availability and, where appropriate, the price of energy.

The energy reduction programme will replace some lighting systems with modern, more efficient ones.

The proposed storage system will consist of stationary lead-acid batteries with a total capacity of 3.8 MWh and 7 inverter-charger units for the power of just over 1.1 MW, although the power will be limited to 1 MW to suit the planned connection point. These capacities would be expandable by adding elements.

The inverter-charger is an in-house development that allows the generation of AC current on the grid from DC energy stored in batteries, and alternatively the charging of these batteries in DC by obtaining AC energy from the grid. In addition, it operates at unity power factor and without distortion, unlike other types of rectifiers. The variant also incorporates electrical switchgear that allows it to operate at a higher power (160 kW) than the TEIDE100 model.

This project is also an important step in the development of ITER storage systems. Managing the system according to renewable energy production, instantaneous consumption, load management and forecasts (weather, scheduled work) is a real technological challenge and involves complex hardware, communications and software control mechanisms.

This action is co-financed by the MEDI-FDCAN Programme 2016-2025 and is included in the Marco Estratégico de Desarrollo Insular (MEDI) [Strategic Framework for Island Development] 2016-2025 of the Cabildo de Tenerife.

D-AliX

Low enthalpy open-loop geothermal air-conditioning system to improve energy efficiency in the cooling of the D-ALiX datacentre

Low enthalpy geothermal energy bases its applications on the capacity of the subsoil to accumulate heat and maintain a fairly constant temperature at 10 to 20 metres depth throughout the year.

The technology developed for harnessing low-enthalpy geothermal energy is the renewable geothermal heat pump. This technology can extract heat from the earth's subsoil in order to heat a fluid with high compressibility and a low vaporisation point and transfer it to a facility in winter; and reverse the process, that is, transfer the heat to the ground in summer, thus cooling down facility. Through the different heat pump systems, the heat contained in low temperature bodies, such as soils, shallow aquifers, etc. can be extracted and economically used.

Taking into account its operation, one direct application would be installing it to improve the energy efficiency of the air conditioning system at ITER's Datacenter.

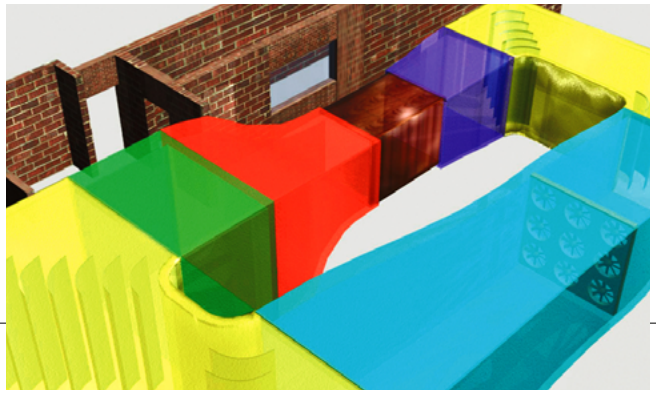
This building has a complex redundant air-conditioning system, thanks to which the main air flows are balanced in order to obtain optimum temperature values, which are necessary for the correct operation of the equipment.

So, installing an open-circuit geothermal exchange system is planned in parallel with the existing production equipment. This system will produce chilled water at the setpoint temperature, covering the base demand of the DPC up to the design power. Demands exceeding this threshold will be covered by the existing chillers. In this way several objectives will be covered:

- A significant reduction in electricity consumption and related costs, emissions, and primary energy consumption.
- A reduction in the number of compressor start-ups of existing chillers and their maintenance and equipment replacement costs.
- Increased redundancy of the installation.

The proposed solution is based on the construction of a supply well to collect the necessary water and a re-injection well to return the water after the energy has been used.

This action is included in the Strategic Framework for Island Development (MEDI) 2016-2025.



BRASILSAT

BRASILSAT: Wind tunnel + tests in the wind tunnel

ITER in collaboration with the company Ingeniería y Proyectos Viento and the Escuela Técnica Superior de Ingeniería Aeronáutica y del Espacio of the Universidad Politécnica de Madrid, have been awarded a contract with the company BrasilSat Harald to develop a project to install a Wind Tunnel in the city of Curitiba in Brazil, which is part of a macro-project to facilitate Internet access across the country.

BrasilSat conducted tests of the satellite dishes it manufactures in the ITER Wind Tunnel in November 2014. It then took the final decision to award the contract to the consortium in which ITER participates.

This project includes both the wind tunnel design project and its specific instrumentation. Among the tasks to be carried out, ITER will be responsible for the structural calculation of the tunnel and preparing all the project plans, as well as developing the software for data acquisition and processing, for the operational control of the tunnel and for the six-component balance. On the other hand, the aerodynamic design of the tunnel, including the power plant, the design and calibration of the balance and the wind tunnel calibration tests will be carried out by the other two members of the consortium.

The test chamber will be 2.4×2.4 m² in section and 5 m long, with a maximum operating speed of 65m/s. The tunnel will be designed for two main applications: parabolic antenna and blunt body testing, and aeronautical testing. Both types of tests have different flow quality requirements, measured in terms of the level of turbulence and non-uniformity of the flow. In the case of parabolic antennas and similar objects, medium quality will be required, with turbulence level and non-uniformity under 2% and a maximum speed of 60 m/s, while aeronautical tests need high airflow quality, with these levels being under 0.5% and a maximum operating speed of 65 m/s.

To measure the forces acting on the bodies under test, a 6-component balance will be designed, which follows the criterion of isostatic decomposition of the system of forces, which are measured by means of six bars working under tension-compression, each of which have a load cell. This balance shall also incorporate mechanisms to vary the angle of attack and lateral angle of the tested object.

Aeroviav

AEROVIAV is a railway research project whose objective is to design two new solutions to mitigate the aerodynamic phenomena in the ballast tracks of High-Speed Lines that reduce their maximum performance as a result of rolling material passing on them at speeds above 250 km/h, the most relevant one for us being the so-called ballast lift or ballast flight.

The project leader is Foresa, which together with ACCIONA and Metalúrgica Cuevas form the backbone of AEROVIAV, with ITER acting as subcontractor among other organisations.

The objective of the task developed by ITER is the full-scale evaluation of the solutions developed during the project to minimise aerodynamic effects on railway lines on high-speed ballast, based on three possible scenarios: no solution, a physical solution and a chemical solution.

During the first phase, tests were carried out in the wind tunnel consisting, firstly, of reproducing the phenomenon of ballast flight in order to validate the test model to then evaluate how effective the physical and chemical solutions developed are. Based on the results obtained in this first phase, it was redesigned, and a second series of tests were carried out.

The second phase consisted of the evaluation of these same solutions on a real section of track, which were carried out at the Testing and Validation Centre in Brihuega, on the Madrid-Barcelona high-speed railway line. In this case, a procedure similar to that of the wind tunnel was carried out; firstly, a study of the initial conditions (no solution) was carried out, and then the physical and chemical solutions were tested.

STiRPE

Towards an intelligent transport system in housing estates and pedestrian precincts

The project is part of the "Intelligent, Sustainable and Integrated Transport" challenge, listed in the framework document “State Scientific, Technical and Innovation Strategy 2013-2020". The aim is to make progress in solving the difficulties that currently prevent autonomous vehicles from being a viable alternative to conventional transport. In this regard, the project establishes three main objectives:

- Establishing and validating a test environment for autonomous vehicles.
- Improving sensing systems, with the common denominator being to undertake the fusion of heterogeneous information sources and separate devices.
- Advancing aspects of sustainability and energy efficiency. The problem of providing a service through a fleet of these vehicles is considered.

To address these objectives, this project is presented in coordination with a team consisting of:

- University of La Laguna Robotics Group (GRULL)
- Innnovation Centre for the Information Society (CICEI)
- ITER, Instituto Tecnológico y de Energías Renovables.

Isla Renovable

Dissemination and awareness of the importance of renewable energies on islands.

The aim of this project is to disseminate the importance of Renewable Energies on islands due to the singularities associated with isolated electricity systems that make them completely different from those territories that are electrically interconnected. Energy management is of vital importance in any electricity system, but especially in isolated systems, where connection with other electricity systems cannot be used to improve the stability of the whole.

The aim is to bring the non-specialised population closer to the technologies associated with energy generation with renewable resources, the factors that determine their maximum level of penetration in the electricity system and the environmental and economic benefits of their use on islands.

To achieve this objective, the interactive multiplatform game ISLA 100% has been designed and implemented, which is available in Spanish and English for download as a mobile application on Android and iOS devices, as well as for online play from the project's website.

The methodology and didactic resources are based fundamentally on the use of new technologies for the dissemination of scientific content and on the use of an interactive simulation game as a didactic tool. The aim is to allow the user to choose different ways of solving the same problem, in an attractive and simple way, while facilitating the exchange of experiences and debate among users.

THE GAME ISLA 100%

In the game ISLA 100%, the user starts from a virtual island powered exclusively by conventional energy sources and the objective is to achieve the highest penetration of renewable energies in the electricity system, always satisfying the island's energy demand and at reasonable costs. The application has three levels of difficulty, corresponding to islands with different populations, energy consumption or renewable resources.

The game has been designed to maximise its didactic use, as a tool for the teacher to show how an isolated electrical system works and the importance of managing it correctly. In order to optimise this use, a teaching manual and a series of complementary tutorial videos have been designed to help the teacher or facilitator. In addition, sessions will be held to promote the application with secondary school groups and the general public, as well as training sessions in the Centros del Profesorado (CEP) [Teacher Centres] in Tenerife.

Gobierno Abierto

The purpose of the Collaboration Agreement is to establish the conditions of collaboration to store data and information of the Cabildo de Tenerife and to make it available to the citizens of Tenerife, within the framework of the Cabildo's Open Government actions.

The agreement includes, among others, the following actions:

- Definition of technological strategies, identifying good practices and existing technological alternatives, promoting public availability of information and data related to the management of public services and the activity of the Cabildo, in accordance with international Open Data standards.
- Advice and technical support to the Cabildo de Tenerife in capturing the information and data to be made available.
- Making audiovisual content of the Cabildo's activity available to the public, publishing it on an institutional digital platform on the Internet.

The agreement aims to identify best practices and existing technological alternatives, and to provide advice and technical support to the different areas and services of the Cabildo in the capture of information and data that will be made available to the public following Open Data standards.

This action, aimed at producing the open data map and developing the open data portal, will prioritise the publication of at least two datasets of the institution.

The scope of action for the preparation of the Cabildo Insular Open Data Map will be the Corporation's Services, and specifically those data that are susceptible of publication whether they are included or not in the Services' databases, but which are not included in the Corporation's centralised databases, will be identified; the data to be included are those which constitute a quantifiable result of any activity carried out in the Services.

Euro-Solar Programme

Technical support in the development of the Euro-Solar programme activities.

GENERAL OBJECTIVE

The general objective of the EURO-SOLAR Programme was to promote renewable energies in the 8 most disadvantaged countries in Latin America (Bolivia, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Paraguay and Peru) in order to contribute to improve living conditions in rural communities, supporting them in their fight against poverty, isolation and marginalisation caused by their socio-economic conditions.

SPECIFIC OBJECTIVE

The specific objective of the EURO-SOLAR Programme was to provide a renewable source of electricity for strictly community use to rural communities with limited or no access to electricity. The Programme involved the installation of 600 electricity production kits based 100% on renewable sources. The final beneficiaries of the Programme are estimated at more than 300,000 people in 600 rural communities, with no previous connection to the electrical grid.

EURO-SOLAR is a comprehensive programme, as it was not limited to installing and commissioning the equipment, but also included training for community members in the management and maintenance of the kits and support for the development of basic services in the areas of education and information technology, health promotion and social and productive activities.

ACTIVITIES AND RESULTS

ITER participated in the procurement tender process, preparing the detailed technical specifications of the equipment, advising the EuropeAid Co-operation Office during the bid evaluation process, and evaluating the tendered systems to ensure compliance with the technical requirements. For the evaluation phase, prototypes of the short-listed systems were assembled at the ITER site and tested for technical reliability and compatibility for one month.

Development of a web application to manage equipment installation in the communities. This application had a public area with general information about the programme and the status of the installation, and a private area with the following tools:

- Content manager to ensure the correct development of the project: installation process, user training and operation and maintenance.
- Installation and equipment reception check sheets, available online in order to be able to check each of the installations.
- User management.
- Maintenance alert messages.
- Messaging service, news service, forum service for communities to interact and warranty and after-sales information service.
- Tracking form for facility monitoring.

Once the equipment was installed in the communities, the provisional reception of the kits was carried out. In this process, ITER sent highly qualified technical staff to the communities to carry out the first checks and train the local teams. The entire process was managed and documented from the web application.

Once the installations were validated, remote monitoring was carried out using the internet connection of the communities and the monitoring forms.

Weather forecasts

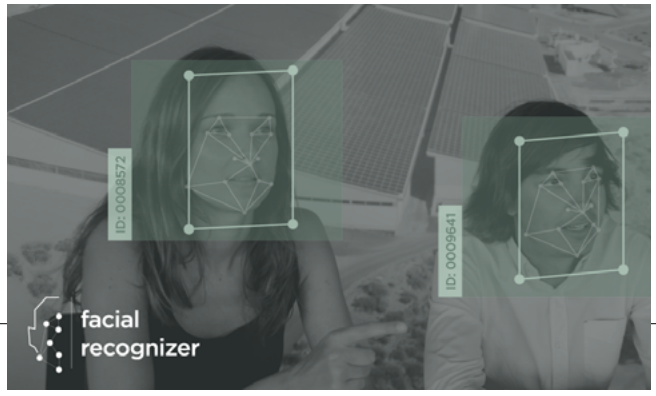
In collaboration with the University of La Laguna's Grupo de Observación de la Tierra y la Atmósfera (GOTA), a weather forecasting model based on the WRF (Weather Research and Forecast) model was implemented. This tool is a valuable starting point for carrying out various analyses and predictions at different geographical locations.

Since its commissioning, wind speed predictions in a high-resolution domain have been used to make a very accurate estimate of the electrical power expected to be generated by the wind farms available in ITER.

In addition, the development of meteorological forecasts allowed collaboration with the Volcanological Institute of the Canary Islands (INVOLCAN) to give support during the volcanic eruption on the island of Fogo (Cape Verde) between December 2014 and February 2015. In this expedition, knowing the direction and strength of the wind in the area of the eruption was vital, as the dispersion of the gases resulting from the eruption was a conditioning factor when it came to moving personnel to the area.

A visualisation tool was also implemented, which generates daily forecast videos with different parameters (rain, wind, temperature, etc.) and publishes them on the project's YouTube channel.

Facial recognition



With the aim of complementing ITER's presence control systems as well as acting as a passive system to control visits to ITER, a project was started to research and develop a facial recognition application that is sufficiently accurate and self-sufficient to be able to:

- Complement current presence systems with access for ITER staff.
- Detect possible intruders and raise alarms.
- Take a count of the capacity in the different buildings and industrial units of the company.

For this purpose, our own facial detection and recognition algorithm was developed with a reliability of around 90%.

The system has been initially designed so that the burden of facial recognition does not fall directly on the client application, but on servers, thus increasing the speed of detection and allowing its integration in thin clients with a view to including them in other subsystems that do not have a high computational capacity.

On the server side, it is planned to integrate it into Teide-HPC in order to exploit its full potential and reduce the processing times required by the algorithm to the minimum possible.

TICa

Accessible information and communication technologies

The TICa project is part of the Transnational Cooperation Programme MAC 2007-2013.

ITER and the Instituto de Acçao Social Direcçao Regional da Solidariedade e Segurança Social are involved in the implementation of the TICa Project as collaborating partners with Sinpromi being the lead partner.

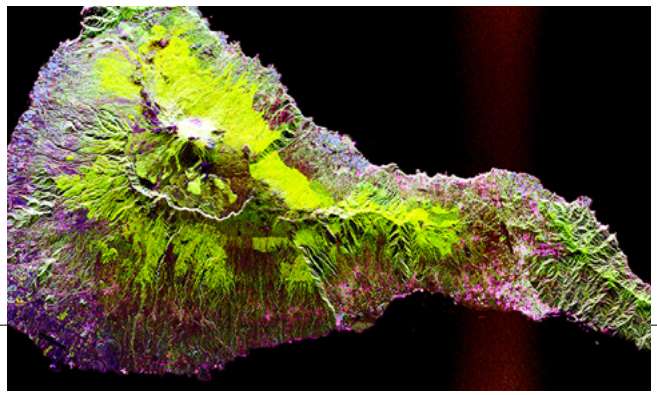
The main objectives of the project are:

- Promoting and managing comprehensive training, vocational guidance and integration programmes within the framework of employment.
- Promoting the removal of physical barriers and the implementation of accessible environments, providing information and technical support to individuals and public or private entities.
- Promoting the use of New Technologies, as well as the development of Teletraining and Teleworking Projects.
- Encouraging the full participation of people with disabilities in society, promoting their access to cultural resources and the enjoyment of sport, tourism and leisure.
- Disseminating knowledge about Disability in society and the promotion of Design for All.
- Promoting the commercialisation of products made by people with disabilities in Occupational Centres and Special Employment Centres.
- Promoting the Commercial and Services Area of the Company, carrying out activities assigned to Special Employment Centres.

Technological development and the convergence of new platforms have contributed to create a new scenario: the information society, characterised by massive diffusion of computing, telematics and audiovisual media which provide us with new communication channels and immense sources of information. Therefore, technologies can be a powerful tool to compensate inequalities as they generate new opportunities for education, employment, leisure and communication for people with functional diversity, contributing to their social integration and to the improvement of their quality of life.

However, there is a problem that directly affects this field of action: the need for ICTs (Information and Communication Technologies) to be implemented with basic accessibility conditions in order to avoid functional diversity translating into inability to access technologies, thus preventing them from bridging the digital divide.

Isla 100



Isla 100 is a tool developed by ITER to analyse different scenarios that evaluate the annual energy mix of an isolated community on an hourly basis to help in planning the incorporation of renewables and storage.

The process of supplying a community of 10,000 inhabitants with renewable energy sources is completely different from that of a community of half a million. For an appropriate integration scheme of renewables, strategies should be developed regionally taking into account local characteristics. They should specifically reflect the needs and behaviour of the daily and seasonal consumption curve, considering economic development and human needs, which have a major impact on energy consumption. In addition, supplying a large area with renewable energies in an autonomous way is a technical, human and decision-making challenge.

The main technical challenge is the analysis of solutions for regulation, integration, and storage, which are the principal obstacles for the large-scale deployment of renewable energy-based technologies. Several aspects need to be considered, including for example the use of fuel cells, hydrogen storage, batteries, storage through hydropower, thermal storage, etc.

The main difficulty for the large-scale integration of renewable energy sources with variable output (resource-dependent, such as wind and photovoltaics) is that energy storage is indispensable and must be able to supply peak demand during a period when the resource is scarce. The development of efficient storage systems is vital for the stability, security and efficiency of an isolated power system as it must be sized in such a way that peak energy requirements can be met in adverse weather conditions.

A carefully studied procedure is therefore required for the sizing of the storage, balancing powers that are capable of supplying the peak demands. In addition, the costs of each system must be taken into account to balance the total investment. In some cases, it will be more convenient to increase the installed wind capacity, even if energy is wasted, but reducing the cost of the storage system significantly.

To analyse all these scenarios, ITER developed a tool years ago, Tenerife 100, which studies the island's energy mix on an hourly basis, and how this mix varies by introducing different renewables and storage systems. This tool, which is constantly being updated, allows data from any other location (now called Isla100) to be entered for the relevant analysis.

The results of the recurring analyses provide a valuable technical and political tool for planning the penetration of renewable energies into existing electricity grids. It will also lead to the identification of existing barriers for large-scale integration and implementation of renewable energy technologies.

Patrones de diseño

Design patterns to optimise energy consumption and sustainable energy generation in single-family houses in hot climates.

Design patterns to optimise energy consumption and sustainable energy generation in single-family houses for hot climates' is a project funded by the Subprogramme of Applied Industrial Research within the 2008 National Programme of Applied Research Projects of the Ministry of Science and Innovation of the Government of Spain.

The project is based on monitoring energy consumption and comfort in different types of bioclimatic housing, under real conditions of use, with the purpose of carrying out a comparative study between them to develop design guidelines and strategies to integrate active solar systems and home automation systems based on real energy efficiency data.

- Identifying, cataloguing, and analysing the different housing types and natural conditioning techniques.
- Monitoring of indoor and outdoor comfort parameters (temperature, humidity, air flow, etc.) and energy consumption in each of the dwellings that form part of the study.
- Using the data collected through monitoring to obtain real and sufficiently reliable information on the final energy savings obtained through the application of home automation systems and bioclimatic principles.
- Defining the integration models of passive and active solar energy strategies with parameters including climatic conditions, typologies, and systems.

Carrying out a technical-economic study to determine the profitability of the investment in home automation equipment.
This monitoring has allowed us to verify and adapt construction models and equipment so that all the typologies examined respond optimally with respect to user comfort with the minimum use of additional conditioning.

New wind farms

In 2007, a public tender was called for the allocation of wind power capacity in the form of new wind farms intended to discharge all the energy into the Canary Islands' electricity systems, announced by the Order of 27 April 2007. The total capacity put out to tender was 440 MW, 170 MW of which corresponded to the island of Tenerife.

According to the Order of 29 December 2009 (BOC 08 of 14/01/2010), ITER received a wind farm allocation for three wind farms of 18.4 MW each, two which were promoted by an Economic Interest Grouping (EIG) of which it is a member:

- 18.4 MW wind farm on the grounds of the Environmental Complex of Arico (Tenerife), in particular near the Lomo del Arrastradero area, in the municipality of Arico (promoted by ITER).
- Areté and La Roca Wind Farms (each with 18.4 MW), both located in the Granadilla Industrial Estate, on plot no. 26,327, within the SP1 and SP2 sector, in the municipality of Granadilla de Abona. The developer of these facilities is PARQUES EÓLICOS DE GRANADILLA A.I.E., which is owned by three public companies: ITER S.A. (Cabildo de Tenerife), GRANADILLA DE SUELO SUR S.L. (Granadilla Town Council) and POLÍGONO INDUSTRIAL DE GRANADILLA (Cabildo de Tenerife, Government of the Canary Islands, Granadilla Town Council and SEPES).

The three wind farms will each consist of eight ENERCON E-70 wind turbines, each with a rated output of 2.3 MW, arranged in two rows of machines. Each wind turbine has its own integrated transformer station, which raises the voltage to 20 kV. As the wind farm is connected to the electricity grid at 66 kV at the future SE ABONA 220/66 substation, an intermediate 66/20 kV substation is required.

This action is co-financed by the MEDI-FDCAN Programme 2016-2025 and is included in the Strategic Framework for Island Development (MEDI) 2016-2025 of the Cabildo de Tenerife.

TENERIFE ENVIRONMENTAL COMPLEX WIND FARM

The location of this park, in addition to the favourable wind conditions in the area, is conditioned by the compatibility of land use. The Arico Environmental Complex is located in an area of excellent wind potential and, as it is a waste treatment complex, the impact on the environment would be minimal, due to the existing infrastructure and the high anthropic impact on the area. On the other hand, the location of this wind farm is not only compatible with the land use planning, but it is also fully compatible with the activities carried out in the complex.

With regard to the Arico Environmental Complex, the benefits of this wind farm will contribute to the implementation of measures to mitigate the possible environmental effects of the complex, as well as to landscape restoration, in addition to urban planning and improvements to its infrastructure. Furthermore, through this wind farm, the Arico Environmental Complex will contribute to the production of clean and non-polluting energy in a location with high energy consumption and at the same time with high potential for renewable energy.

The wind farm will provide clean electricity to 12,854 households during its 25-year lifetime, avoiding the production of 43,575 tonnes of CO2 and 154 tonnes of SO2 per year.

ARETÉ AND LA ROCA WIND FARMS IN GRANADILLA INDUSTRIAL ESTATE

The Granadilla Industrial Estate is located in an area of excellent wind potential and, as it is an industrial complex, the impact on the environment would be minimal, due to the existing and planned infrastructures and the high anthropic impact on the area. The benefits of this wind farm will contribute to implementing in the Industrial Estate measures to mitigate potential environmental effects, as well as to landscape restoration, in addition to urban planning and infrastructure improvements. In addition, the Granadilla IP will contribute to the production of clean and non-polluting energy in a location with a high energy consumption and at the same time with a high renewable energy potential.

When planning the location of the wind turbines, in addition to taking into account the conditions set out in the Wind Energy Competition, the Urban Development Plan of these areas was considered, so that the wind turbines would always be located outside the blocks or in the green or common areas, and along the roads (with the pipelines running parallel to them), minimising the impact and making their use compatible.

The parks will provide clean electricity to around 25,000 households during their 25-year lifespan, avoiding the production of almost 100,000 tonnes of CO2 and 300 tonnes of SO2 per year.

Htress

Hybrid renewable energy systems for the supply of services in rural settlements of Mediterranean partner countries

The Hyress project's strategic objective was to remove knowledge barriers regarding the installation of hybrid systems based on renewable energies. As a demonstration, "mini-grids" based on renewable energies were installed in remote villages in the Mediterranean Partner Countries (MPC).

The hybrid systems envisaged in the framework of this project consisted of combinations of photovoltaic plants, small wind turbines or hydropower. Three systems combining these different technologies were designed and installed in rural villages in Egypt, Tunisia and Morocco. The design of these systems was based on modularity, resilience and simplicity of use, as well as requiring very little maintenance.

Once they were installed and put into operation, they were monitored in order to assess the technical performance of the equipment as well as the social scope of the installations.

As the working teams were conceived, the aim was to transfer knowledge from the European countries to the Mediterranean partners, developing good practices to replicate the project in other areas.

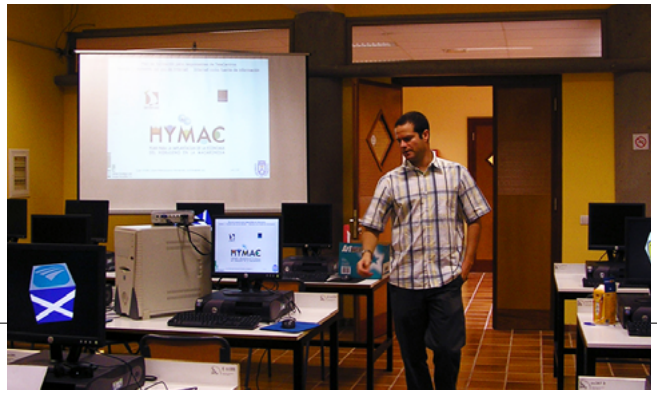
ITER, in collaboration with ANME, designed and installed a pilot plant in the village of Ksar Ghilène in the province of Kèbili in south-eastern Tunisia, a village with about 50 houses and a number of common services, including a mosque, a school, a health centre and public toilets.

The project, which ran from October 2006 to September 2010, was funded by the European Commission's Sixth Framework Programme, International Scientific Cooperation (INCO) within the field of specific measures to support Mediterranean Partner Countries (MPC).

The project coordinator was Athens University of Agriculture (AUA), and ITER participated as a partner together with Egypt's University of Alexandria (AU), Cadi Ayyad University of Marrakech (FSSM) in Morocco, the Institut für Solare Energieversorgungstechnik (ISET) in Germany, Tunisia's National Agency for Energy Conservation (ANME), the WIP company from Germany and the Clean Power Ltd Partnership (CP) from Greece.

HYMAC

Plan for the implementation of the Hydrogen Economy programme in Macaronesia: stationary applications



The main objective of the HYMAC project "Plan for the Implementation of the Hydrogen Economy in Macaronesia: Stationary Applications" was to identify technologies for the production, storage and use of hydrogen, both centralised and decentralised, and as fuel for land transport.

To achieve this objective, the problems and challenges posed by each of these technologies were analysed, the existing lines of research, finally trying to summarise the most suitable primary energy sources for each case, the expected investment and operating costs, the foreseeable timeframe for their commercialisation and the impact of each of them in terms of CO2 emissions (and therefore their potential savings over traditional technologies based on fossil fuels). Finally, a Perception Programme was carried out in order to involve citizens in the effort to achieve a new "Hydrogen Economy".

The project was funded by the Community Initiative INTERREG IIIB – MAC and ended in November 2006. The University of Las Palmas de Gran Canaria coordinated the implementation of the project, having as partners ITC, ITER, UNELCO, Electricidade Dos Açores (EDA), the Government of the Canary Islands, the Cabildo de Lanzarote, the Mancomunidad Intermunicipal del Sureste de Gran Canaria, the Federación Ecologista Canaria Ben Magec, the company Air Liquide, the Agência Regional da Energia e Ambiente da Região Autonoma da Madeira (AREAM), the Laboratório de Ambiente Marinho e Tecnología - Açores (LAMTec), the Compañía Transportista de Gas de Canarias (GASCAN) and the Cabildo de Tenerife.

The Tenerife Energy Agency participated in the Perception Programme of the project, by means of a Collaboration Agreement with ITER, to carry out various informative-educational actions during 2006 aimed at the general public and the educational sector, at all levels:

- Adapting the informative material to the reality of the islands and advising the rest of the partners.
- Producing an information leaflet entitled "The Hydrogen Revolution".
- Creating an information poster on hydrogen technology.
- Publishing the informative-educational material produced. 2,000 units of the Informative Triptych were printed, and 300 CDs were published with all the materials prepared by the Perception Programme project partners: AIET Triptych; Educational Guides; Technical Sheets on production, safety and Hydrogen Economy; and Evaluation Questionnaires.
- Distributing the material in different forums and using different media (Teachers' Centres, Schools, Fairs and Congresses, visits to ITER, downloading from the website, etc.).
- Practical workshops and talks on Hydrogen, in parallel to the other activities carried out by AIET, such as the talk "Renewable Energies, Hydrogen and Energy Situation in Tenerife" in the Teachers' Centre of La Laguna, on 28th April 2006, for 40 teachers from all over the Canary Islands.
- Presentation of the actions carried out in Tenerife at the Energy and Environmental Education Congress, held in Murcia in November 2006, by means of a Poster and a Paper read to the Congress.
- Presentation of a poster on the actions carried out in Tenerife at the Jornadas Interinsulares de Educación Ambiental, which took place in Tenerife from 20 to 23 February 2008.

FotoSil

Photoluminescent ions for the formation of third-generation silicon-based photovoltaic cells

The FotoSil Project "Photoluminescent ions for the formation of third generation silicon-based photovoltaic cells" was funded by the Ministry of Science and Innovation, within the National Plan for Scientific Research, Development and Technological Innovation, 2008-2011, Sub-programme for scientific and technological actions in Science and Technology Parks, INNPLANTA 2011. The total grant amounted to €808,088.00 (2011-2013), 70% of which came from the European Commission's European Regional Development Fund (ERDF).

Solar photovoltaic energy is one of the renewables energies that is in continuous evolution. A basic issue to optimise is the development of more efficient and cheaper photovoltaic cells. Achieving these improvements in technology is a key issue in order to favour the large-scale integration of this energy.

The overall objective of the FotoSil project was to manufacture more efficient, low-cost silicon photovoltaic cells using third-generation cell technology in order to improve photon absorption and obtain more efficient emitters.

To achieve this goal, it was necessary to develop different processes and technologies: Firstly, processes to manufacture high-efficiency photovoltaic cells that also reduce production costs. To this end, the processes for the formation of photovoltaic cells on monocrystalline substrates were analysed in order to try to transfer and adapt these processes to multicrystalline substrates. Currently, most photovoltaic cells are manufactured on multicrystalline substrates because they are cheaper, although their quality is lower than monocrystalline substrates.

Secondly, processes to obtain more efficient emitters. Having more efficient emitters would lead to an electrical improvement in the photovoltaic cell. This improvement was approached from two starting points: on the one hand using amorphous silicon sheets on textured surfaces; and on the other hand, using selective emitters under the metal contacts to favour current generation. Finally, intrinsic amorphous silicon film deposition processes. The aim was to create an amorphous silicon interlayer in order to improve the emitter response to the most energetic photons in the UV-VIS range.

In addition to improving and developing processes, work was also done on the development of third-generation cell technology. So, the behaviour of photoluminescent materials such as rare earths and silicon nanostructures was studied to act jointly as photoconverters in order to increase the efficiency of photoconversion, therefore cell performance.

MACSEN-PV

Study of alternatives and technology transfer to implement renewable energies as part of the electricity supply in Tenerife and Senegal and pilot project for a grid-connected installation (MAC/3/C179).

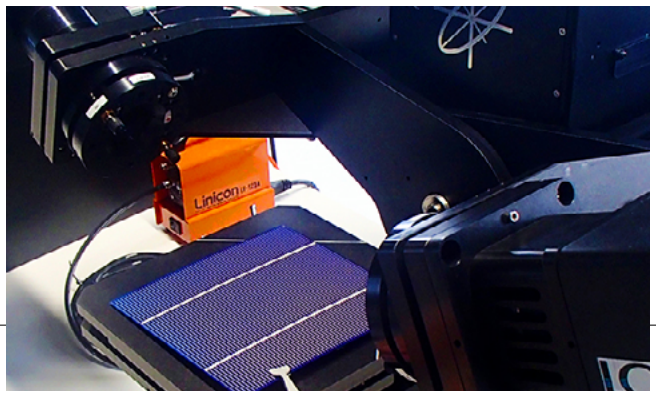
This project, conceived as a platform for technical cooperation in the field of the integration of renewable energies in electricity grids between the Canary Islands and Senegal, began in October 2010 and ended in June 2013. Its main objective was to improve the capacity of public authorities and local technicians to favour the implementation of renewable energies for electricity supply in these regions. The MACSEN-PV project was co-funded by the European Programme MAC 2007-2013 and the partners involved were: Instituto Tecnológico y de Energías Renovables (ITER), Agencia Insular de Energía de Tenerife, Fundación Canaria (AIET), Agence Sénégalaise d'Électrification Rurale (ASER) and the Centre d'Etudes et de Recherches sur les Energies Renouvelables (CERER).

During the first phase of the project, a sectorised assessment of the energy situation in both regions was carried out, leading to the preparation of 12 reports analysing the energy sector, which made it possible to identify resources availability, forecasts for growth in energy demand, the existing legislation, the main needs of the electricity market and the existing training deficiencies. Based on the conclusions of these preliminary reports, various materials and tools have been prepared for technicians from the competent public institutions and teachers. Specifically, a "Guide on Integration of Renewable Energies in the Electricity Supply and Isolated Applications for the Public Manager", a series of 16 "Support materials for Secondary and University teachers" and a support video for teachers "Training itineraries of the ITER installations - MACSEN-PV Project" have been produced. These materials have been specifically given out to the beneficiaries of the actions during the Technical Seminars, which were held both in Tenerife and Senegal. However, they are available for download on the project website in Spanish and French (http://macsen-pv.iter.es). On the other hand, an On-Line Advice Office was set up on the project website, where documentation, links and tools related to energy planning, teaching and training, and employment opportunities in the sector are available.

The project culminated in the grid connection of a 3 kWp mixed photovoltaic installation at the CERER headquarters in Dakar, which was inaugurated by Senegalese and Tenerife government authorities in December 2012. This photovoltaic installation is a milestone in the development of renewable energies in Senegal, as it is the first renewable installation to be connected to the conventional Senegalese electricity grid. This system will be used as a starting point to promote the future integration of distributed renewable energy systems into the Senegalese electricity grid. It aims to be the solution to the Senegalese model, which is based on isolated mini-grids. In addition, the installation will serve as a demonstration and training platform for local technicians through CERER. This is why ITER has adapted its design, specifically considering the peculiarities of the Senegalese grid, and to maximise its demonstrative and educational use.

It is worth highlighting the great national and international recognition and visibility achieved by the project, as evidenced by its more than 200 appearances in the media of various kinds, its presence in more than 45 external international events, as well as in three articles in popular science publications.

UVSiTE



The UVSiTE project is funded within the 2013 Call for Research Projects of the Fundación Obra Social CajaCanarias.

UVSiTE aims to improve the energy efficiency of silicon-based photovoltaic cells and modules by integrating a new type of down-converter film. This process will allow the capture of high-energy photons in order to increase quantum efficiency at certain wavelengths.

The objectives of the project are as follows:

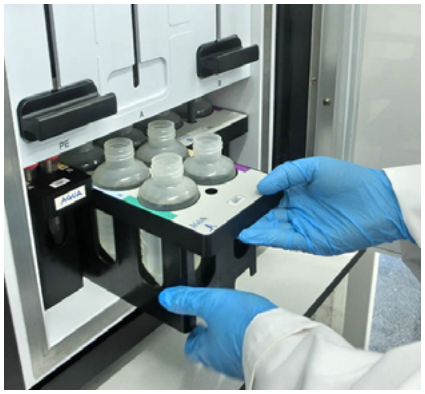
- Manufacturing a new type of down-converter film for standard silicon photovoltaic cells and modules to increase the device's efficiency by at least 0.3 percentage points compared to the efficiency obtained without the down-converter film.
- Designing the procedure for the photoconverter film to be integrated into the production process of standard photovoltaic cells and modules for silicon technology.
- Ensuring that the increased efficiency achieved with the photoconverter foil offsets, in terms of additional revenue from increased electricity production, the additional costs introduced in the manufacturing process.
- Achieving that the film offers a PV module durability similar to the standard durability offered in the market (25 years).

Furthermore, the processes will also consider production costs, product durability and waste generation, both during its manufacture and at the end of its lifespan, applied to the photovoltaic technology manufacturing sector, its quantification, impact, reduction, recovery and recycling, as well water and its reuse within the manufacturing process.

This three-year project is led by the University of La Laguna with the collaboration of ITERand the Fraunhofer Institut für Solare Energiesysteme. It will end in December 2016.

Infrastructure

Massive sequencing laboratory



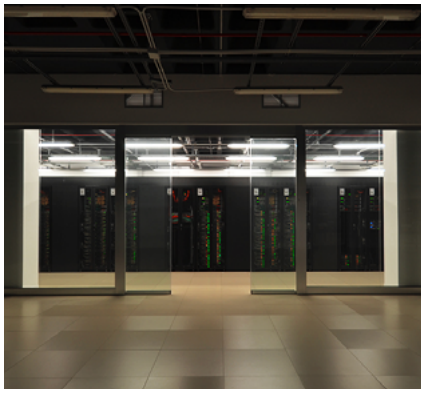
The Genomics facilities are divided into two sections: the Molecular Biology laboratory, located in the main ITER building; and the supercomputing infrastructure, located in the NAP building.

The laboratory is divided into three compartmentalised rooms: the Molecular Biology laboratory, the sequencing room, and the office area. Thus, the workflow in the Genomics area begins with sample preparation in the Molecular Biology laboratory, continues with mass sequencing in the sequencing room, and data processing on the Teide-HPC supercomputer, and ends in the office area, where the data are processed by the Genomics scientific team.

Equipment

- 1 COVARIS M²20 Focused-ultrasonicator (COVARIS Inc.)
- 1 CFX96 Touch Real-Time PCR detection system (BioRad)
- 2 Mastercycler pro S (Eppendorf)
- 1 Qubit 3.0 Fluorometer (Thermo Fisher Scientific)
- 1 Agilent 4200 TapeStation system (Agilent Technologies)
- 1 cBot 2 System (Illumina, Inc.)
- 1 MiSeq Sequencing system (Illumina, Inc.)
- 1 NextSeq550 sequencing system (Illumina, Inc,)
- 1 HiSeq 4000 sequencing system (Illumina, Inc.)
- 1 MinION sequencing system (Oxford Nanopore Technologies, Ltd.)
- 1 Freedom EVO100 automation system (TECAN)

Teide HPC



Teide-HPC (High Performance Computing) is a fundamental part of the ALiX project to implement infrastructures aimed at creating an industrial fabric around Information and Communication Technology (ICT) in Tenerife.
The Teide supercomputer, the second most powerful in Spain, offers researchers, companies in the Tenerife Science and Technology Park, (PCTT) and the University of La Laguna, high processing capacity to improve and extend the national and international scope of research. It is also present in the top500 list of the most powerful supercomputers in the world, occupying 138th place in the November 2013 list.
To implement this infrastructure, ITER has received a total of 8.5 million euros in the framework of the INNPLANTA programme of the Ministry of Innovation and Science, from ERDF funds to acquire scientific-technological infrastructures for R+D+i.
Teide-HPC is a general-purpose high-performance computing infrastructure with the following features:

CÓMPUTO

Three types of computing platforms are available:

- 1028-node Sandy Bridge platforms with two Intel Xeon E5-2670 processors 32 GB / 64 GB memory
- 72-node Ivy Bridge platforms with two Intel Xeon processors E5-2670v2 32 GB of memory
- Fat nodes, 3 nodes with four Intel Xeon E5-4620 processors 256 GB memory

STORAGE

- Almacenamiento NetApp con capacidad de 500TB netos, configurada en formato NetApp storage with a capacity of 500TB net, configured in cluster format with all elements redundant to cope with possible hardware failures,

with global spare disks.
- Lustre parallel storage will also be available for applications requiring a high number of I/O operations.

NETWORK
- Teide-HPC has a network topology where four specific purpose networks are defined. A dedicated storage network, a dedicated management network, an out of band network and a low latency Infiniband QDR network at 40Gbps for computation.
- As security measures Teide-HPC has IPSec tunnels, VPN connections and the possibility of establishing private VLANs for its clients.

CONNECTIVITY
- Teide-HPC connects to the internet through the Spanish academic and research network, RedIris, via a 10 Gb link. It also has connectivity through the ALiX project.
- For data transfers, transfer nodes are available that allow large amounts of data to be copied to user space by directly accessing the data backbone.

D-Alix

One of the differentiating elements of our datacentre is its location. D-ALiX is located in ITER grounds, next to the Granadilla Science and Technology Park. In addition, the Reina Sofia airport (Tenerife South) is less than 10km away and Granadilla seaport is nearby. A second airport, Los Rodeos (Tenerife North), is less than an hour's drive away and the seaport of Santa Cruz de Tenerife is just over 50km away. The facilities are easily reached via the TF1 motorway.

NEUTRALITY

Its strong neutral character gives our customers the possibility to choose their connectivity provider freely. This feature, together with the facilities that serve as a submarine cable mooring station, makes D-ALiX the world's first neutral submarine cable station.

LEVEL OF RELIABILITY

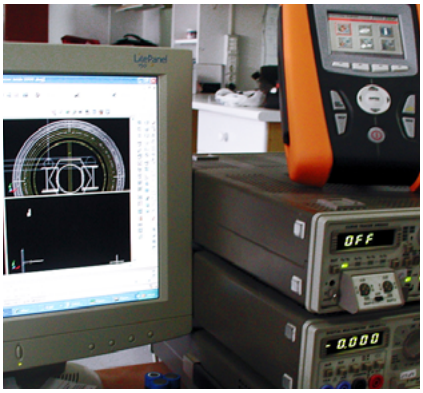
D-ALiX meets the requirements of the international data centre market with a TIER III+ facility, achieving TIER IV configuration in the electrical system.

MODULARITY

A data centre must be designed in a completely modular way so that it can be successively expanded in the most flexible and effective way, in order not to lose new customers and stagnate in its first phase indefinitely. On the other hand, high scalability allows to adapt to each new customer, optimising the necessary investment according to their requirements.

D-ALiX is installed inside a reinforced industrial building, under the concept of a "bunker within a bunker". This concept, in addition to reducing the necessary investments (CAPEX) while maintaining the required quality levels, results in greater modularity by designing a datacentre that grows horizontally instead of floor by floor. This in turn allows for a reduction in operational expenditure (OPEX).

Electronics laboratory



Research, development and innovation (R&D&I) are the main basis of ITER's work. The activities of the electronics laboratory are carried out under this philosophy. This is located in one of the ITER facilities and its main objective is to design, build and test both circuits and electronic devices, based on analogue and digital electronics.
Our highly qualified staff with many years of professional experience enables us to develop our own electronic technology. On the one hand, the facilities are prepared to design test and manufacture small series of electronic circuits. In addition to this, the laboratory is used as a support service for different ITER projects and activities, one of its main lines of work being the development of systems to convert and store energy from renewable sources.

LABORATORY EQUIPMENT

Circuit manufacture:

- Equipment for SMT surface mounting (screen printing, pick&place, oven) and insertion (manual soldering)
- Cable processing equipment (cutting, stripping and termination application)
- Materials and components

Equipment and tools for prototyping and testing:

- CAD/CAM software for circuit boards
- Basic equipment: power supplies, measuring devices, oscilloscopes, analysers...
- Workshop for PCB prototyping by chemical and milling method
- Stock of components for circuit prototyping
- Power elements: IGBT modules, high power reactors, racks and miscellaneous switchgear
- Energy converter equipment
- Mechanical workshop
- Tests with a small number of photovoltaic modules possible
- Availability of connection to photovoltaic plants with a capacity >100 kW

Sicell Lab - Photovoltaic Laboratory

The ITER Photovoltaic Laboratory, known as SiCell Lab, is a cutting-edge scientific-technological infrastructure designed to contribute to develop and strengthen new manufacturing techniques for photovoltaic cells based on crystalline silicon and new materials. Its dimensions and modular nature make it flexible and adaptable to new processes, such as research with new materials for use in photovoltaic technologies.

The main lines of research have been developed in the field of photovoltaic cells based on crystalline silicon. In addition, a new line of research has been initiated based on the study of emerging materials and, specifically, those known as perovskites due to their crystalline structure.

In order to be able to evaluate and analyse each of the phases of the construction process, the laboratory is designed as a scale system for an industrial production line, where the manufacturing and characterisation processes of the devices can be carried out. The infrastructure has two work areas, one to manufacture photovoltaic cells (ISO7 Cleanroom) and the other one for characterisation.

LABORATORY EQUIPMENT:

Manufacturing Laboratory - Cleanroom:

The ISO 7 cleanroom (class 10,000) has a total surface area of 65m² and is equipped as follows:

- System for cleaning and texturing substrates. Chemical bench - Achiever, MEI.
- Ultrasonic bath. ULTRASONS-HD, JP Selecta.

- Production and supply of pure water type II (E-POD) and ultra-pure water type I (Q-POD). Milli Q-Integral 3, Millipore.
- Spin-On deposition system. HD 300, SPS poles.
- Rapid thermal process diffusion furnace. TM 100BT, LPT THERMPROZESS.
- Baking chain oven. Hengli, Torrey Hills Technologies, LLC.
- Muffle furnace. CWF 11/13, Carbolite.
- Drying oven. Conterm 19, JP Selecta.
- Open chamber PECVD system for chemical vapour deposition. Vision 300 MK II, Advanced Vacuum.
- Screen printing system for printing metal contacts. 485 - Screen Printer, HMI.
- Three roller mill. ESG65, Shanghai Espread.

Characterisation Laboratory:

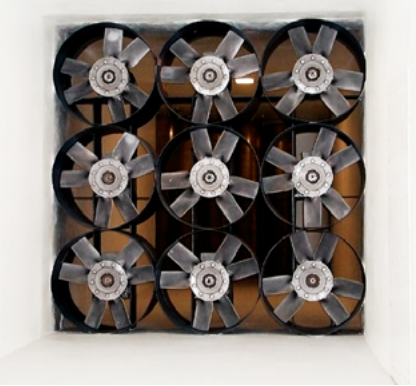
The characterisation laboratory has a total surface area of 110m² and is equipped as follows:

- Spectral Response System. PVE 300, Bentham.
- Optical Fluorimeter System. FLUOROSENS M11, Gilden Photonics.
- Ellipsometer. ESM-300, J.A. Woollam.
- Microwave photocurrent decay measurement device (MWPCD). WT-2000PVN, Semilab.
- Semiconductor characterisation system. SCS-4200, Keithley.
- Pulsed laser kit with 2D processing scanner and opto-mechanical components. Powerlase.

Auxiliary equipment:

- Air conditioning and filtering system.
- Particle counting system.
- Closed water circuit system with chiller.
- Deionised water recirculation system.
- Corrosive liquid evacuation system.
- Compressed air distribution line.
- Distribution line for a mixture of 2% silane gas and nitrogen (cabinet gas).
- Distribution line for a mixture of 20% oxygen gas and tetrafluormethane.
- Nitrogen gas distribution line 99.9980 % (technical).
- 99.9995 % (ultrapure) nitrogen gas distribution line.
- Nitrogen Protoxide gas distribution line.
- Ammonia gas distribution line.
- Toxic gas abatement system.
- High temperature fume extraction system.
- Toxic fume extraction system.

Wind tunnel



The wind tunnel is a facility to obtain a rectilinear and uniform air flow at a controlled speed in the test chamber, which allows to study the effect of wind on real objects or scale models. For aeronautical purposes, this flow must have a quality that is determined by its uniformity and turbulence level.

TECHNICAL CHARACTERISTICS

- Closed circuit.
- Test chamber: 2×2m² section and 3m long.
- Maximum operating speed in the chamber: 56 m/s, or 48 m/s in aircraft configuration.
- 9 fans of 22 kW each (24m3/s and 500 Pa pressure increase).
- Aeronautical tests: flow uniformity > 99.5% and turbulence level < 0.5%.

APPLICATIONS:

- Aeronautical Testing
- Civil Engineering.
- Renewable Energies.
- Sports Training.
- Architecture.

INSTRUMENTATION:

- 220 kW frequency inverter: regulates the rotational speed of the fans, allowing to control the speed of the air flow in the test chamber.
- Six-component balance.
- Scanivalve system (pressure scanner).
- Hot-wire anemometer.
- Pitot tubes.
- Pressure comb.
- Visualisation systems.

Bioclimatic houses

This urban complex, consisting of 24 single-family homes, has been developed under the criteria of bioclimatic architecture, optimising its adaptation to the environment and climate, minimising its effects and reducing energy consumption for air conditioning. In addition, small-scale renewable energies have been implemented in the houses to meet the demand of the complex.

The 24 dwellings were selected as the best examples of bioclimatic houses in an international competition promoted by the Cabildo de Tenerife and ITER and endorsed by the International Union of Architects.

The houses have an average built area of 110-120 m² and are different in design, which makes the development a great space for disseminating and raising awareness of the application of bioclimatic principles in construction.

Its main peculiarity is that it has been designed as a full-scale laboratory, which allows monitoring the various bioclimatic techniques selected, with the aim of studying and disseminating these techniques among the specialised public and the general public. To this end, it has an automation and technical energy management system and a monitoring system with temperature sensors, relative humidity sensors and air flow meters.

The aim of the data collection system is to improve the indoor comfort of dwellings by, firstly, publishing the parameters obtained and, secondly, the action of the user who implements one or other bioclimatic strategies aimed at redirecting the situation towards the comfort zone. This allows to actively manage the house's energy efficiency. In turn, this system communicates with a general communications network that allows access to the information from the homes and from any PC connected to ITER's

LAN, simply by using a Web browser.

In order to be able to evaluate the real functioning of each dwelling, the dwellings need to be occupied, which is why the houses are offered on a short-term tourist stay basis (http://casas.iter.es). This way, users' profile is as broad as possible, so the physical monitoring parameters can be integrated with the circumstantial, physiological, psychological, and sociological parameters thanks to the data provided by the users. Linking parameters makes the construction solutions and equipment parameterized more specific and exportable.

THE MAIN ACTIVITIES CARRIED OUT IN THE COMPLEX ARE:

- Energy assessment carried out by simulation or under real operating conditions by implementing sensors inside and outside the building.
- Defining models to integrate passive and active solar energy strategies, on small and large scales.
- Optimising designs, models and energy elements used in buildings.
- Demonstrating the operation of energy-efficient buildings through objective and quantified data to help raise awareness among groups and users.
- Optimising techniques to integrate, plan and construct large-scale renewable energy facilities.
- Testing the performance of buildings under different consumption patterns and user habits.
- Dissemination of renewable energy and energy efficiency techniques.

Weather stations

ITER has a number of weather stations that measure meteorological parameters of wind, solar radiation, humidity and temperature.

The Meteorological Station "Torre" is located at UTM coordinates 351180.54-3105916.74 at an elevation of 34 metres above sea level. All the sensors are placed along a metal lattice tower approximately 45 metres high. At the top of the tower, at the same level as the wind turbines hub, is the WindSonic sonic sensor that measures wind direction and speed. The remaining sensors (cup anemometer, wind vane, and humidity and temperature sensors) are located at a height of 25 metres.

The SOLTEN weather station is positioned at UTM coordinates 350115.35-3106285.03 at an altitude of 103 metres above sea level. It is a roof-mounted station equipped with an anemometer/ vane, thermo-hygrometer, LM35 type temperature sensor, pyranometer and a sensor to estimate fouling.

Both stations are connected in real time to the ITER data service and are available for public consultation through the ClimaTenerife website.

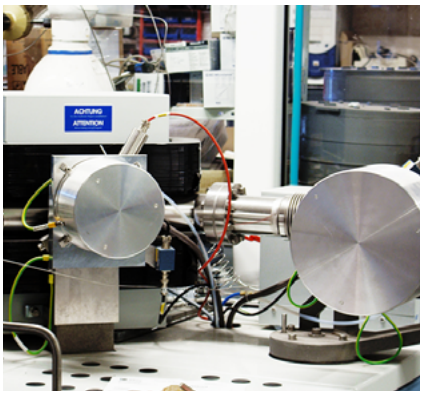
WEATHER FORECASTING SERVICES

In addition, ITER has implemented a weather forecasting system to improve the management of its renewable energy facilities. Predictions are calculated on a day-to-day basis on ITER's Teide supercomputer using the WRF (Weather Research and Forecasting) numerical weather prediction model. This work is carried out in collaboration with the Grupo de Observación de la Tierra y la Atmósfera (GOTA) [Earth and Atmosphere Observation Group] of the University of La Laguna.

You can consult the weather forecasts calculated by ITER for today and for the next two days, both in graphs and in video, through the Meteo Teide-HPC section.

The Climate Services section provides detailed information on the meteorological variables collected by the two stations and the forecasting system and the corresponding data series.

Gas and groundwater isotope and chemistry laboratory



The ITER Gas and Groundwater Chemistry and Isotope Laboratory is a scientific-technological infrastructure designed for the chemical and isotopic characterisation of gases and groundwater, as well as other environmental matrices.
The laboratory has the following equipment:

LABORATORY INSTRUMENTS

- Portable dual-channel gas micro chromatographs model VARIAN 4900 and VARIAN 490 with TCD detector
- Portable dual-channel gas micro chromatograph model VARIAN 2003P with TCD detector
- VARIAN 3800 gas chromatograph with TCD and FID detectors
- VARIAN 3900 gas chromatograph with TCD detector
- VARIAN Saturn 2000 gas-mass chromatograph with ion trap analyser
- Liquid chromatograph DIONEX 500DX
- Liquid Chromatograph METROHM 861 Advanced Compac IC
- Automatic titrator METROHM 716 DMS Titrino
- Perkin Elmer Optima 3300DV ICP
- Stable isotope ratio mass spectrometer MAT 253
- Noble gas mass spectrometer HELIX SFT
- Quadrupole mass spectrometers model Pfeiffer Omnistar 422

FIELD WORK INSTRUMENTS

- Portable equipment for diffuse flux measurement of CO2 and H2S equipped with a portable infrared spectrophotometer model LICOR LI-800 and electrochemical H2S sensor ALPHASENSE
- Portable Mercury Vapour Analyser Model JEROME 431-X
- Portable Hydrogen Sulphide Analyser Model JEROME 631-X
- SARAD portable radon gas detector model RTM²010-2
- FLIR IR Thermal Camera Model P65
- Portable remote optical sensors for environmental quality and volcanic-hydrothermal gas emission studies
- Correlation spectrometer (COSPEC IV and V)
- Optical Differential Absorption Spectrometer (UVDOAS)
- Miniaturised Optical Differential Absorption Spectrometer (miniDOAS)
- Fourier Transform Infrared Spectrometer (FTIR)
- Dimmable diode laser (TDL) gas sensor
- Network of 13 geochemical stations in the Canary Islands to measure gases and volatiles installed.
- Network of 10 geodetic stations in the Canary Islands for the measurement of deformation.
- 8 webcams network for volcanic surveillance installed in Tenerife

Anillo Insular de Telecomunicaciónes de Tenerife

The Anillo Insular de Telecomunicaciones de Tenerife (AITT) [Tenerife Telecommunications Ring] is a fibre optic ring around the island of Tenerife that is managed and operated by the Instituto Tecnológico de Telecomunicaciones de Tenerife (IT3). The first phase of the ring connects the metropolitan area of the island with the D-ALiX datacentre while passing through 12 municipalities. IT3 is a neutral telecommunications operator created by the Cabildo de Tenerife as part of the ALiX project.

In its second phase, the ring will be closed around the entire island of Tenerife, reaching the 31 municipalities of the island. The infrastructures managed and operated by IT3 are available on a neutral, transparent and non-discriminatory basis to all telecommunications operators wishing to provide their services in Tenerife.

Canalink - Canarias Submarine Link

Canalink, one of the companies belonging to the ITER group, is the owner of a submarine fibre optic cable system linking the Canary Islands with the Iberian Peninsula and the west coast of Africa. It also has exchange agreements with other operators and participates in submarine cable consortia with the aim of interconnecting Europe with Africa and turning Tenerife, more specifically the D-Alix data processing centre, into a massive neutral traffic exchange centre.

UNDERWATER NETWORK

The submarine network consists of the links between Tenerife and Cadiz, Tenerife and La Palma and Tenerife and Gran Canaria. These links allow Canalink to sell both capacity and point-to-point circuits between the main islands of the Canary archipelago and the Iberian Peninsula.

In turn, the link with the Iberian peninsula has a branch line linking Cadiz with Morocco, which is used exclusively to serve the largest operator in Morocco.

All cables are equipped with the latest technology, carrying lambdas or channels up to 100G, allowing Canalink to make the most of the available bandwidth.

Canalink is also an active participant in the WACS and ACE submarine cable consortia, providing connectivity to most countries on the West African coast, Paris and Lisbon.

TECHNICAL CENTRES AND SUBMARINE CABLE STATIONS

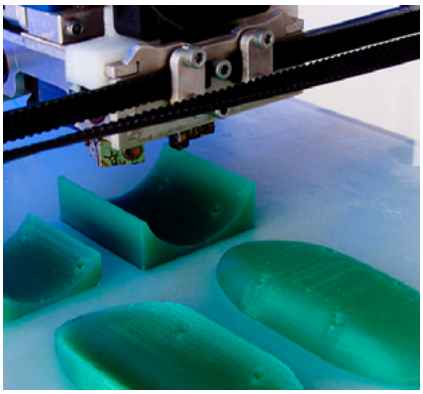
Canalink is present in the Canary Islands through its technical centres and submarine cable stations designed to be able to host third parties in its technical rooms.

All systems and infrastructures are redundant. Generating sets, rectifiers with battery banks in duplicate (A+B), UPS (A+B), precision air conditioning systems and remote supervision and management systems are available, making Canalink's centres perfect sites for other operators to house their equipment.

On the Spanish mainland, it also has two large cable stations with the same characteristics as its mirror centres in the Canary Islands and, in addition, through its terrestrial network, the service is extended to several of the most important centres in Seville, such as Telvent's CPD in Seville. Also, on demand for the time being, services could be delivered in Madrid.

Internationally, Canalink's main point of presence is Telvent Lisbon, a data centre reached via the WACS and ACE submarine cables.

Modelling workshop



ITER has a modelling workshop to manufacture mock-ups to be tested in the wind tunnel as well as prototypes developed in-house.

CAPACITIES

- CAD/CAM technology: three-dimensional modelling and production of prototypes, moulds and various tools.
- 3D printing: additive manufacturing technology with thermofusible materials, especially suitable to produce small prototypes.
- CNC milling machine: used in the manufacture of tools and prototypes in medium/high-strength materials such as plastics, wood, aluminium, copper, etc.
- Composites: together with the ability to make tools using CAD/CAM technology, the workshop has various devices to make the tools needed to manufacture parts and moulds in composites technique, using epoxy and polyester resins with glass fibre, carbon and Kevlar reinforcements.

The workshop works in combination with the maintenance department when requirements exceed the capabilities of the modelling workshop. It also has a workshop for metal structures, machining workshop, aluminium and wood carpentry staffed by highly experienced professionals.

Wind farms

ITER currently has three active wind farms: the 2.83 MW Experimental Platform, the 4.8 MW MADE wind farm and the 5.5 MW Enercon wind farm. They are all in the process of repowering. In the near future, three new wind farms that were awarded power in the last tender called by the Canary Islands Government will be installed.

2.83 MW EXPERIMENTAL PLATFORM

Since its installation in 1990, the experimental platform has produced a total of 74 GWh.

The 2.83 MW Experimental Platform was financed in collaboration with various organisations (ITER, Cabildo de Tenerife, Government of the Canary Islands, UNELCO and the European Union). Its main objective has been to study the operation of different types of wind turbines, both in terms of power and of manufacture, origin and technology. The total nominal power of this platform is 2.83 MW and is made up of 9 different wind turbines that were installed between 1990 and 1993, with power ratings ranging from 150 to 500 kW. The technology used is different for each of them, with horizontal and vertical axis turbines, fixed pitch and variable pitch, and asynchronous and synchronous generators. There are also notable differences in diameter and height. These parameters range from 25 to 40 metres in diameter, and from 25 to 42 metres in height. Currently, the operating power of the wind farm is around 1.8 MW.

In accordance with the Order of 6 October 2004 of the Local Ministry of Industry, Commerce and New Technologies of the Canary Islands Government, which establishes the technical and administrative conditions for the repowering of existing wind farms, ITER and ECYR have signed a cooperation agreement to repower the above-mentioned wind turbines jointly, thus making the most of the wind potential in the area and replacing the obsolete technology of the above-mentioned wind farms with the latest generation technology. The repowering will consist of the installation of 1 ENERCON E-70 wind turbine with a rated power of 2000 kW.

4.8 MW WIND FARM

Since its installation in 1996, the MADE wind farm has produced a total of 165 GWh.

The 4.8 MW wind farm was installed in 1996 by the SPV "EÓLICAS DE TENERIFE AIE", 50% owned by ITER, 50% by MADE and UNELCO and subsidised by MINER. At the beginning it consisted of 16 MADE AE-30 wind turbines of 300 kW nominal power each, which were replaced in 1999 by 8 MADE AE-46 wind turbines of 600 kW nominal power

each.

Through a brief dated 17 May 2007, and in compliance with the provisions of the Order of 15 November 2006 of the Ministry of Industry, Commerce and New Technologies of the Canary Islands Government, which establishes the technical and administrative conditions for the repowering of existing wind farms, Eólicas de Tenerife AIE requested administrative authorisation and project approval for the repowering of the Granadilla III wind farm, through the replacement of the existing wind turbines in the current wind farm with 4 ENERCON E-82 wind turbines.

5.5 MW WIND FARM

The Enercon Wind Farm has produced a total of 175 GWh since its installation in 1998.

The 5.5 MW wind farm is a self-financed ITER project that was installed in 1998. It consists of 11 ENERCON E-40 wind turbines of 500 kW nominal power. The estimated annual energy production is 16.5 Gwh.

According to Article 7 of Decree 53/2003 of 30 April 2003, which regulates the installation and operation of wind farms in the Canary Islands, the unit power of wind turbines may be increased by replacing them with new ones, and the power may be increased up to a limit of 50% of the total power of the wind turbines replaced.

In this framework, the existing wind farm is to be repowered with a 9.75 MW wind farm (5 ENERCON E-70 of 2 MW each) in the Granadilla Industrial Estate.

Technological unit

ITER, being aware of how important it is to spread knowledge about renewable energies and the role that technology infrastructures can play in the field of training, has designed and developed a Technological Demonstration Unit on Renewable Energies. This unit aims to be a teaching resource to help teachers in theoretical and practical training in the field of renewable energies.

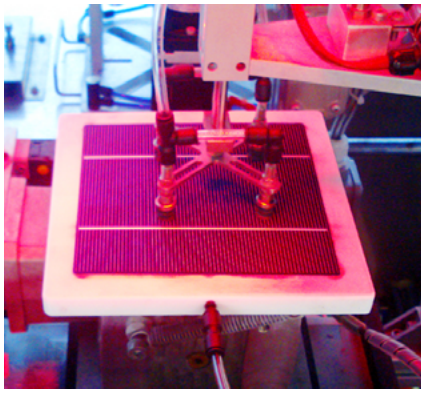
The Renewable Energy Technological Unit consists of didactic equipment to show how different types of renewable energies in isolation and/or integrated into a network operate. It is made up of the following components:

- Photovoltaic solar energy module.
- Mini-wind energy module.
- Mini-hydro power module.
- Energy consumption module.

The unit is equipped with all the control devices necessary for the students to learn correctly. Multiple operating scenarios can be simulated on a small scale in such a way that a wide variety of practices can be carried out in a short period of time.

The Renewable Energies Demonstration Technology Unit is available at ITER facilities to be used by technical staff upon request. To send the request or for any enquiry about the unit, you can contact us through the REQUEST section in the side menu.

Photovoltaic module factory



Due ITER's requirements for its projects, a photovoltaic module factory has been set up, which not only supplies ITER but also allows it to continue and expand the research that the Institute has been developing in this field.

The factory is located in a 125-metre long and 20-metre wide building divided into three sections: one to store raw materials, a second section for manufacturing and the third to store photovoltaic modules. It is a 2500 m² surface area, with 1500m² dedicated to store raw materials and finished photovoltaic modules, and 1000m² used as manufacturing area, in which 2 assembly lines are distinguished, north and south.

Each line consists of two cell welding machines, a cell positioning robot, tables for placing the glass and checking the modules, and a laminating machine to shape the module. Both lines converge in a machine dedicated to test and classify the modules before placing the aluminium frame and packaging.

In 2008, this photovoltaic module factory came into operation at the ITER facilities. The operators' experience and a deeper knowledge of the machinery have allowed us to have the capacity to manufacture 60 MW per year fully guaranteeing the quality in the final product.

The Renewable Energies Demonstration Technology Unit is available at ITER facilities to be used by the technical staff upon request. To send the request or for any enquiry about the unit, you can contact us through the REQUEST section in the side menu.

Visitor Centre

Together with the Renewable Energies Walk, the Visitor Centre is part of the ITER outreach facilities and was designed by César Ruiz-Larrea, the architect that won the 25 Bioclimatic Dwellings competition.

This bioclimatic building, whose main characteristic is that it blends in with its surroundings, welcomes visitors to the Institute and has an exhibition area that aims to draw the visitor's attention to the energy issue and ITER's main projects and activities. The centre also has a conference room with a capacity for 200 people equipped with two simultaneous translation booths and a projection booth, as well as two multi-purpose rooms and an area to rest.

Delegated generation control centre for the electricity network

ITER Generation Control Centre (CCG-ITER) supervises in real time the operation of 145 renewable electricity production facilities, totalling more than 51 MW.

It operates 24 hours a day, 365 days a year and manages data from 3 wind farms, 7 photovoltaic plants and more than 135 individual photovoltaic installations of different groups.

Renewable energies have certain unique characteristics, mainly due to its dispersed generation, the variability of its production determined by changing environmental conditions, the uncertainty in its prediction and the technology used in many of the generators. All these variables must be taken into account to guarantee the required levels of supply quality, including the correct balance between production and electricity consumption.

According to Royal Decree 413/2014, all production facilities using renewable energy sources, cogeneration and waste, in electricity systems in non-mainland territories, with installed power exceeding 0.5 MW, and those with installed power under 0.5 MW but forming part of a group whose total installed power exceeds 0.5 MW, must be attached to a Generation Control Centre (CCG) and have Real-Time Telemetry (TTR).

The large number of generators in the electricity system requires a secure and efficient interlocution between REE and the generators as well as their assignment to Generation Control Centres. The GCCs receive information from the generators assigned to them, transmit it to the Renewable Energy Control Centre (CECRE) and, if necessary, transmit the CECRE's orders to the generators to ensure that renewable energy can be safely integrated into the electricity system.

The GCCs must have an adequate connection with REE's control centre, have sufficient control, command and monitoring capacity over the generation assigned to them and have the appropriate training of their human resources to guarantee a secure interlocution with Red Eléctrica and its functionality 24 hours a day, every day of the year.

Renewable Energy Walk

Inaugurated in 1998, the Paseo de Energías Renovables [Renewable Energies Walk] was designed, promoted, and implemented by ITER and the Cabildo de Tenerife. It is an open-air route equipped with technological elements that represent the use of different renewable energy sources and is divided into thematic areas.

LAS DIFERENTES ÁREAS TEMÁTICAS DEL PASEO SON:

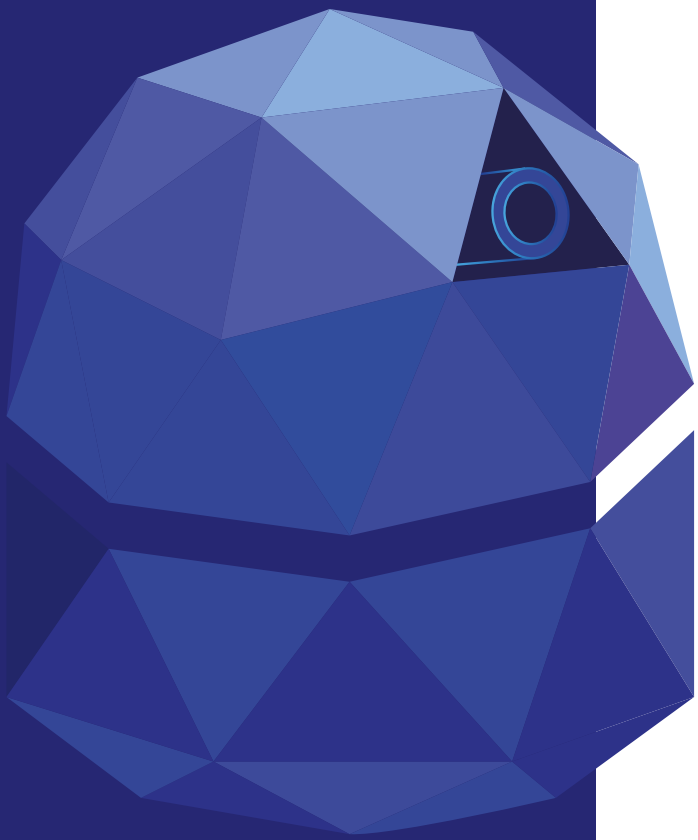
- Introduction to energy
- Solar Thermal Energy.
- Photovoltaic Solar Energy.
- Wind Energy.
- Other energies (mini-hydro, biomass, geothermal, etc.).
- Energy Saving Measures

In each of these areas, there are two types of exhibition elements:

- Renewable energy devices, most of which are prepared for the public to interact with them.
- Explanatory panels, with information about the theme of each area and the elements contained in them.

The Renewable Energy Walk is a single-track walkway, which can be walked along the banks of the stream that runs through it.

If you would like to take a guided tour of this facility, you need to make a reservation through the visit reservation calendar available on the Visits section of our website.



Equipment

MASSIVE SEQUENCING LABORATORY

- 1 COVARIS M²20 Focused-ultrasonicator (COVARIS Inc.)
- 1 CFX96 Touch Real-Time PCR detection system (BioRad)
- 2 Mastercycler pro S (Eppendorf)
- 1 Qubit 3.0 Fluorometer (Thermo Fisher Scientific)
- 1 Agilent 4200 TapeStation system (Agilent Technologies)
- 1 cBot 2 System (Illumina, Inc.)
- 1 MiSeq Sequencing system (Illumina, Inc.)
- 1 NextSeq550 sequencing system (Illumina, Inc,)
- 1 HiSeq 4000 sequencing system (Illumina, Inc.)
- 1 MinION sequencing system (Oxford Nanopore Technologies, Ltd.)
- 1 Freedom EVO100 automation system (TECAN)

ELECTRONICS LABORATORY

Circuit manufacture:
- Equipment for SMT surface mounting (screen printing, pick&place, oven) and insertion (manual soldering)
- Cable processing equipment (cutting, stripping and termination application)
- Materials and components

Equipment and tools for prototyping and testing:
- CAD/CAM software for circuit boards
- Basic equipment: power supplies, measuring devices, oscilloscopes, analysers...
- Workshop for PCB prototyping using chemical method and milling machine
- Stock of components for circuit prototyping
- Power elements: IGBT modules, high power reactors, racks and miscellaneous switchgear
- Energy converter equipment
- Mechanical workshop
- Tests with a small number of photovoltaic modules possible
- Availability of connection to photovoltaic plants with a capacity >100 kW

PHOTOVOLTAIC LABORATORY

Manufacturing Laboratory - Cleanroom:
- System for cleaning and texturising substrates. Chemical bench - Achiever, MEI.
- Ultrasonic bath. ULTRASONS-HD, JP Selecta.
- Production and supply of pure water type II (E-POD) and ultra-pure water type I (Q-POD). Milli Q-Integral 3, Millipore.
- Spin-On deposition system. HD 300, SPS poles.
- Rapid thermal process diffusion furnace. TM 100BT, LPT THERMPROZESS.
- Baking chain oven. Hengli, Torrey Hills Technologies, LLC.
- Muffle furnace. CWF 11/13, Carbolite.
- Drying oven. Conterm 19, JP Selecta.
- Open chamber PECVD system for chemical vapour deposition. Vision 300 MK II, Advanced Vacuum.
- Screen printing system for printing metal contacts. 485 - Screen Printer, HMI.
- Three roller mill. ESG65, Shanghai Espread.

Characterisation Laboratory:
- Spectral Response System. PVE 300, Bentham.
- Optical Fluorimeter System. FLUOROSENS M11, Gilden Photonics.
- Ellipsometer. ESM-300, J.A. Woollam.
- Microwave photocurrent decay measurement device (MWPCD). WT-2000PVN, Semilab.
- Semiconductor characterisation system. SCS-4200, Keithley.
- Pulsed laser kit with 2D processing scanner and opto-mechanical components. Powerlase.

Auxiliary equipment:
- Air conditioning and filtering system.
- Particle counting system.
- Closed water circuit system with chiller.
- Deionised water recirculation system.
- Corrosive liquid evacuation system.
- Compressed air distribution line.
- Distribution line for a mixture of 2% silane gas and nitrogen (cabinet gas).
- Distribution line for a mixture of 20% oxygen gas and tetrafluormethane.
- Nitrogen gas distribution line 99.9980 % (technical).
- 99.9995 % (ultrapure) nitrogen gas distribution line.
- Nitrogen Protoxide gas distribution line.
- Ammonia gas distribution line.
- Toxic gas abatement system.
- High temperature fume extraction system.
- Toxic fume extraction system.

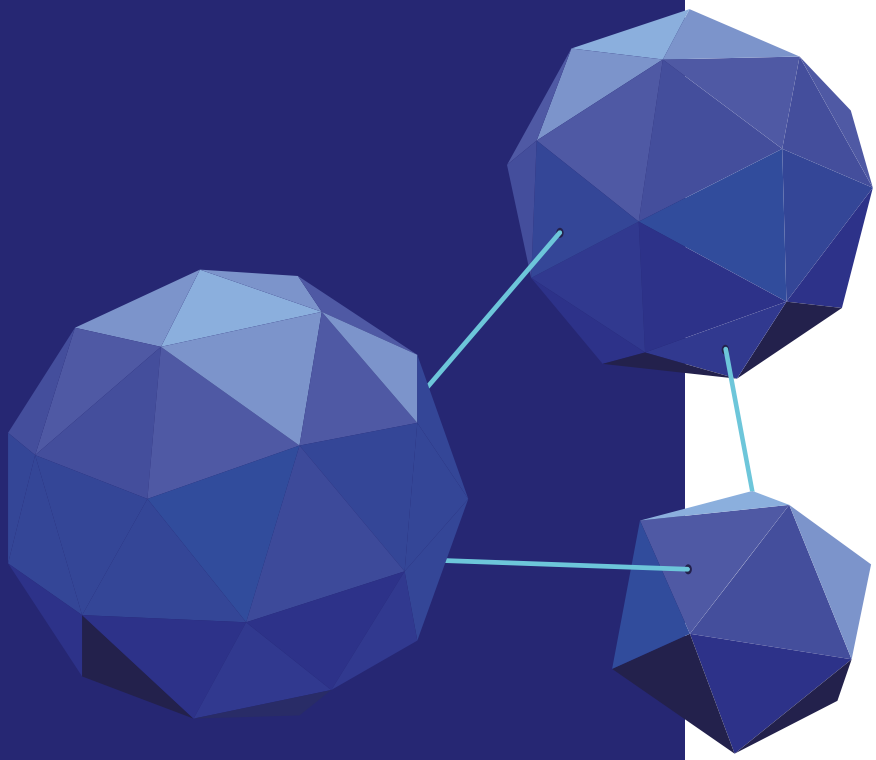
GAS AND GROUNDWATER CHEMISTRY AND ISOTOPE LABORATORY

- VARIAN 4900 and VARIAN 490 portable dual-channel gas

microchromatographs with TCD detector
- Portable dual-channel gas microchromatograph model VARIAN 2003P with TCD detector
- VARIAN 3800 gas chromatograph with TCD and FID detectors
- VARIAN 3900 gas chromatograph with TCD detector
- VARIAN Saturn 2000 gas-mass chromatograph with ion trap analyser
- Liquid chromatograph DIONEX 500DX
- Liquid Chromatograph METROHM 861 Advanced Compac IC
- Automatic titrator METROHM 716 DMS Titrino
- Perkin Elmer Optima 3300DV ICP
- Stable isotope ratio mass spectrometer MAT 253
- Noble gas mass spectrometer HELIX SFT
- Quadrupole mass spectrometers model Pfeiffer Omnistar 422

Field work equipment
- Portable equipment for diffuse flux measurement of CO2 and H2S equipped with a portable infrared spectrophotometer model LICOR LI-800 and electrochemical H2S sensor ALPHASENSE
- Portable Mercury Vapour Analyser Model JEROME 431-X
- Portable Hydrogen Sulphide Analyser Model JEROME 631-X
- SARAD portable radon gas detector model RTM²010-2
- FLIR IR Thermal Camera Model P65
- Portable remote optical sensors for environmental quality and volcanic-hydrothermal gas emission studies
- Correlation spectrometer (COSPEC IV and V)
- Optical Differential Absorption Spectrometer (UVDOAS)
- Miniaturised Optical Differential Absorption Spectrometer (miniDOAS)
- Fourier Transform Infrared Spectrometer (FTIR)
- Dimmable diode laser (TDL) gas sensor
- Network of 13 geochemical stations in the Canary Islands to measure gases and volatiles installed.
- Network of 10 geodetic stations in the Canary Islands for the measurement of deformation.
- Network of 8 webcams for volcanic monitoring installed in Tenerife

INVOLCAN



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otai@iac.es
Oficina de Transferencia y Acciones Institucionales

https://www.iac.es/

The entity

Instituto Volcanológico de Canarias (INVOLCAN)

The National Volcanology Centre or Instituto Volcanológico de Canarias (INVOLCAN) is an entity unanimously requested by the Senate (02/11/2005), the Parliament of the Canary Islands (11/01/2006) and the Congreso de los Diputados (02/12/2009) with the aim of contributing to improve volcanic risk management in Spain (i.e. the Canary Islands; the only volcanically active region in Spain with volcanic risk), and to optimise the management of the numerous benefits of living in a volcanic area (geothermal resources, geotourism, etc.). Its mission and vision are to contribute to the sustainable development of the Canary Islands and other volcanic regions.

MISSION

To improve and optimise the management of volcanic risk in Spain as well as in other regions and/or countries with volcanic risk, especially those that have strong cultural and historical ties with Spain, through advancement of scientific knowledge, cooperation, training and dissemination. Also, to contribute to improving the management of the many opportunities offered by living in a volcanically active region to strengthen the economy and businesses related to the tourism, energy, and environmental sectors through the promotion of geotourism, geothermal energy and other geological resources.

VISION

To become and consolidate itself as an international benchmark entity in the management of volcanic phenomena in volcanically active regions, promoting the exchange of knowledge between research groups and reinforcing cooperation as a working method, in order to increase its international visibility and contribute to the sustainable development of volcanic regions.

WHERE DO WE WORK?

INVOLCAN has a team of professionals with extensive experience in scientific collaboration projects carried out in more than 20 countries and/or volcanically active regions over the last 15 years (Antarctica, Argentina, Azores, Cape Verde, Cameroon, Canary Islands, Costa Rica, Ecuador, El Salvador, France, Germany, Galapagos, Guatemala, Equatorial Guinea, Iceland, Italy, Japan, Mexico, Nicaragua, Papua New Guinea, Philippines, Spain, Democratic Republic of Congo, and Rwanda).

Active Volcanoes Research Program

Projects

TF Assistance

Tenerife Volcano Disaster Assistance Team

The "TENERIFE VOLCANO DISASTER ASSISTANCE TEAM" project is part of the Strategic Framework for Island Development (MEDI) 2016-2025 and is co-financed by the Tenerife Innova Programme 2016-2021 coordinated by the Tenerife 2030 Area of the Cabildo de Tenerife and by the Canary Islands Development Fund (FDCAN). The main objective of the project is to strengthen the role of scientific cooperation between Tenerife and other volcanically active regions in order to contribute to reduce volcanic risk in these regions. The ITER/INVOLCAN scientific team has the capacity to respond rapidly to volcanic crises that may arise anywhere in the world and to provide scientific assistance. These scientific cooperation actions are also very useful for the continuous training of the ITER/INVOLCAN scientific team since they give them the opportunity to carry out scientific collaboration work in more active volcanic systems than those existing on the island of Tenerife. This helps improve the team's capacity to act should volcanic activity reactivate in the Canary Islands, and especially in Tenerife. Through this project proposal, which contributes to cooperation and continuous training, the ITER/INVOLCAN scientific team is encouraged to participate in international conferences where they would have the opportunity to present their scientific work related to volcanic risk management in order to convey to the international community the know-how developed in Tenerife to reduce volcanic risk. The activities carried out within the framework of this project in 2017 related to the goals and objectives described above were as follows:

- Scientific-technical assistance to the La Universidad de las Fuerzas Armadas (ESPE) [University of the Armed Forces] of Ecuador to reinforce the geochemical monitoring programme of the Quilotoa and Cuicocha crater lakes, Ecuador, from 18 September to 10 October.
- Scientific-technical assistance to the Nicaraguan Institute of Territorial Studies (INETER) of Nicaragua to reinforce the geochemical monitoring programme of the Cerro Negro and Masaya volcanoes from 20 November to 3 December.
- Scientific-technical assistance to the University of the Philippines to reinforce the geochemical monitoring programme of the Taal volcano from 13 to 24 November.
- Scientific and technical assistance in the Azores from 26 to 30 September.
- Technical assistance for the Cumbre Vieja seismic volcanic crisis, La Palma.
- Continuous on-site training by INGV scientific staff, Italy, December 2017.
- Participation in the international scientific congress of the European Geophysical Union EGU- 2017 held from 23 to 28 April in Vienna, Austria.
- Participation in the 13th Gas Field Workshop of the International Association of Volcanology and Chemistry of the Earth Interior (IAVCEI) held from 24 September to 3 October in Ecuador.
- Participation in the IAVCEI international scientific congress held from 14 to 18 August in Portland, USA.
- Participation in the 9th Jeju Water World Forum held from 18-22 September in Jeju, South Korea.
- Participation in the international scientific congress of the American Geophysical Union (AGU) 2017 held from 12 to 16 December in New Orleans, USA.

TFVolcano

Optimisation of the Early Warning System for Volcanic Surveillance on the Island of Tenerife

The project "OPTIMISATION OF THE EARLY WARNING SYSTEM FOR VOLCANIC SURVEILLANCE ON THE ISLAND OF TENERIFE (TFVOLCANO)" is part of the Strategic Framework for Island Development (MEDI) 2016-2025 and is co-financed by the Tenerife Innova Programme 2016-2021 coordinated by the Tenerife 2030 Area of the Cabildo de Tenerife and by the Canary Islands Development Fund (FDCAN). The main objective of the project is to improve and optimise the multidisciplinary volcanic monitoring programme in Tenerife. During the course of the project, new stations of the geochemical, geodetic and geophysical network were maintained and installed, and periodic observation campaigns were carried out in the main volcanic systems of the island, the three ridges and Teide. Finally, this project has enabled dissemination activities, attendance at national and international congresses and the publication of the results obtained in scientific journals in the Citation Index.

The activities carried out within the framework of the project "OPTIMISATION OF THE EARLY WARNING SYSTEM FOR VOLCANIC MONITORING ON THE ISLAND OF TENERIFE (TFVOLCANO)" in 2017 were as follows:

- Operation and maintenance of the permanent instrumental network made up of geochemical, geodetic and geophysical stations (continuous mode recording) to strengthen the seismic-volcanic monitoring of Tenerife.2.
- Carrying out periodic scientific observation campaigns (discrete mode recording) to strengthen the seismic-volcanic monitoring of Tenerife, given that the results of these campaigns are important for volcanic monitoring and cannot be obtained through permanent instrumental networks.
- Promoting geochemical, geodetic, geophysical and geological research.
- Attending the European Geophysical Union EGU-2017
- Participating at the 13th AVCEI Gas Field Workshop
- Participating in the IAVCEI International Scientific Conference
- Attending the American Geophysical Union 2017 conference (AGU-2017)

1. Coordinating, organising and programming activities aimed at strengthening education, training and public awareness of Tenerife residents on the volcanic phenomenon and volcanic risk management.
   - Participating in La Orotava Science Fair.
   - Training talk on the volcanic phenomenon to the of Tenerife Deaf People Association (ASORTE).
   - Educational talks during the celebration of the European Night of Volcanoes held in the municipality of La Orotava.
   - Radio and television interviews.
   - Meeting at the Real Sociedad Económica de Amigos del País de Tenerife (RSEAPT).
   - Presentation of the 2017 VOLCANIC CALENDAR published by INVOLCAN.
   - Volcanic exhibitions and talks in educational centres on the island of Tenerife.
   - Dissemination activity with the Military Emergency Unit (UME) in Tenerife.
   - Broadcasting through RNE's radio programme PLANETA VIVO RADIO with INVOLCAN.
   - Broadcasting through TVE's TELEPLANETA programme with INVOLCAN.
2. Monthly volcanic surveillance bulletin of Tenerife, which can be downloaded from the INVOLCAN website.
3. Advice to the Cabildo de Tenerife on all aspects related to the reduction of volcanic risk in Tenerife.

TFGeoturismo

Strengthening the economy and businesses related to Tourism in Tenerife by promoting Volcano tourism

The project "STRENGTHENING THE ECONOMY AND BUSINESSES RELATED TO TOURISM IN TENERIFE BY PROMOTING VOLCANO TOURISM", is part of the Strategic Framework for Island Development (MEDI) 2016-2025 and is co-financed by the Tenerife Innova Programme 2016-2021 coordinated by the Tenerife 2030 Area of the Cabildo de Tenerife and by the Canary Islands Development Fund (FDCAN). The main objective of the project is to promote and develop emerging geotourism products through the promotion of volcano tourism and contribute to strengthening Tenerife's economy and businesses. To this end, different activities have been proposed related to the three aspects mentioned in the previous paragraph that are related to the reassessment of the natural and cultural heritage regarding Tenerife's volcanoes.

This project envisages the materialisation of four activities which, as a whole, aim to strengthen the island's economy and businesses linked to the exploitation of volcano tourism.

ACTIVITY 1.- AUGMENTED VIRTUAL REALITY TO SHOW VOLCANIC PHENOMENA.

One of the weaknesses of active volcanoes that are not erupting is that visitors cannot experience the power of nature through an eruption. In order to turn this weakness into a strength, one of the activities to be developed in this project is to show tourists the different volcanic processes that can be recognised in Tenerife through augmented virtual reality that includes image and sound.

ACTIVITY 2.- MAKING A DOCUMENTARY ABOUT THE TEIDE VOLCANO.

Despite its tourist importance (international, national and local), proof of which is the 2.5 million average number of annual visitors, Tenerife does not currently have a specific product that is easy for tourists to buy and that promotes its strengths and opportunities as a geo tourist attraction. Therefore, the aim of this activity is to create a 35-minute documentary about Teide, reflecting all the natural and cultural values of the stratovolcano from the perspective of volcano tourism.

ACTIVITY 3.- URBAN GEOTOURISM IN MUNICIPALITIES OF TENERIFE

The aim of this activity is to design several urban geotourism routes in different municipalities of Tenerife, by creating 10 routes in the towns of La Laguna, La Orotava, Puerto de La Cruz, San Juan de La Rambla, Garachico, Icod de Los Vinos, Santiago del Teide, Adeje, Adeje-Arona and Granadilla de Abona. In order to achieve this, their geomorphological heritage needs to be assessed both in terms of the natural outcrops where it is present (volcanoes, lava flows, volcanic tubes, cliffs, ravines, beaches, etc.) by selecting different geomorphosites, and of the relief elements recognisable in the urban layout of the streets or in the tangible immovable cultural heritage.

ACTIVITY 4.- WEEKLY GRAPHIC NEWS GAUYOTA-TENERIFE IN 8 LANGUAGES

Guayota-Tenerife-on line is a weekly bulletin published by INVOLCAN on the seismic-volcanic activity in Tenerife in eight languages (Spanish, English, German, French, Italian, Portuguese, Dutch and Polish) (https://www.involcan.org/guayota-tenerife/). The aim of the newsletter is to provide the economic and business fabric of the island with weekly updated information on volcanic risk in Tenerife and at the same time, inform visitors about of volcanic alert level on the island in relation to safety, just like hotels and other tourist establishments have weather information to help tourists organise their activities in Tenerife.

TFGeotermia

Geothermal development in Tenerife

The " GEOTHERMAL DEVELOPMENT IN TENERIFE" project is part of the Strategic Framework for Island Development (MEDI) 2016-2025 and is co-funded by the Tenerife Innova Programme 2016-2021 coordinated by the Tenerife 2030 Area of the Cabildo de Tenerife and by the Canary Islands Development Fund (FDCAN). The main goal of the project, which is innovative in terms of energy use in Tenerife, is to materialise the design and experimental development of a geophysical and geochemical methodology to explore high enthalpy geothermal resources in Tenerife. This will enable to subsequently develop geothermal energy on the island. The results of this project will contribute to promoting the transition towards a safe, sustainable and competitive energy system that will reduce dependence on fossil fuels through a significant advance in knowledge about the high enthalpy geothermal resources existing in Tenerife. This proposal is aimed at guaranteeing the energy supply, increasing the contribution of emerging energy technologies efficiently and competitively and favouring their integration into the Canary Islands energy system so that they contribute to improve security of supply, to diversify supply sources and to protect the environment.

The activities of the "GEOTHERMAL DEVELOPMENT IN TENERIFE" project are the following:

- Detailed geochemical prospecting in selected mining areas in Abeque, Berolo and Garehagua (Tenerife).
- Geochemical study of 3He/4He isotope ratios in gases and groundwater in Tenerife.
- Study of magnetotellurics in Tenerife through controlled source soundings (CSMT) and natural source magnetotellurics (MT).
- Defining the surface structure of the crust through inversion of dispersion curves by cross-correlation of the seismic noise and of the lower crust through inversion of the receiver functions.
- Spatial characterisation of Tenerife's microseismicity by estimating energy release and the Gutenberg-Richter parameter b and defining the stress field through the inversion of the focal mechanisms.
- Generating an integrated thermo-structural model of the crustal structures of Tenerife.

TFGravímetros

Development of a Superconducting Gravimeters Network in Tenerife

The project "DEVELOPMENT OF A SUPERCONDUCTOR GRAVIMETERS NETWORK IN TENERIFE", is part of the Strategic Framework for Island Development (MEDI) 2016-2025, and is co-financed by the Tenerife Innova Programme 2016-2021, coordinated by the Tenerife 2030 Area of the Cabildo de Tenerife and by the Canary Islands Development Fund (FDCAN).

In recent years, superconducting gravimeters have been increasingly used for volcano monitoring, as well as for other scientific and industrial applications. The principle of operation of this equipment is based on the magnetic levitation of a sphere by the effect of an electric current flowing along a superconducting coil, cooled to a temperature of 4ºK through a cooling system based on liquefied helium. This technology achieves temporal stability in the measurements of an order of magnitude

higher than can be obtained with traditional gravimeters. The technical characteristics of this type of equipment are as follows:

- Accuracy of at least 0.1 microGal.
- Maximum drift of 0.5 microGal/month.
- GPS timing system.
- Lossless liquefied helium-based refrigeration system.
- Sensor for atmospheric pressure measurement.
- Thermal insulation chamber.
- Possibility of connection via TCP/IP protocol for system monitoring.
- Automatic e-mail alert system in case of refrigeration system failure.
- Software for data processing.

The only requirement to install this equipment is having a stable power supply, a maximum temperature of 35ºC and an internet connection. As the main objective of this instrumentation is volcanic monitoring, its location will have to be as close as possible to the volcanically active areas of Tenerife. For example, in the vicinity of the Teide peak there are several sites that meet these requirements, among others the Izaña astronomical observatory and Teide National Park's visitor centre. The precise location will be established according to the result of numerical simulations, requirements and logistics, taking into account that all equipment can be easily moved from one site to another if necessary.

The implementation of a Superconducting Gravimeter Network (RGS) in Tenerife would have a strong scientific impact for volcanic monitoring as well as for water resources research. The added value of implementing this network would be the benefit both for INVOLCAN and for other entities in Tenerife involved in the management of the islands' resources.

The scientific-technological impact is detailed below regarding the two lines of research of this project.

VOLCANIC MONITORING

Volcanic risk in Tenerife continues to increase as a result of the continuous growth in population and tourist flows (Burns et al., 2018). As the Canary Islands are the only volcanically active region in Spain, developing activities aimed at reducing volcanic risk is of fundamental. Undoubtedly, one of the most effective actions for volcanic risk reduction is the development of an advanced volcanic monitoring system and, above all, R&D activities that can provide the earliest possible warning of a possible volcanic eruption.

The use of microgravimetry in the field of volcanic monitoring is a powerful tool for understanding the processes of magma ascent preceding volcanic eruptions (Rymer, 1994), as well as the dynamics of hydrothermal systems (Gottsmann et al., 2007).

Since their first use, superconducting gravimeters (Goodkind and Warburton, 1975) have demonstrated an accuracy and stability of measurements that no other technology has been able to achieve so far (Warburton et al., 2010, Riccardi et al., 2011). This is why superconducting gravimeters have opened new horizons in the study of active volcanoes (Carbone et al., 2017). The sensitivity of this instrumentation makes it possible to detect magma movement down to the lower crustal depths, making it possible to provide a much earlier warning than other geophysical and geochemical techniques, and even earlier than other gravimeters. For example, the intrusion of a small amount of magma (0.05 km3) could be detected at a depth of more than 20 km by a superconducting gravimeter and only at about 4 km by a traditional gravimeter.

In volcanically active systems, gravity field variations can also be related to perturbations in the hydrothermal system caused by the injection of magmatic gases into the system. For example, Gottsmann et al. (2006) proved that, according to data from 4 microgravity campaigns between May 2004 and July 2005, there was a migration of hydrothermal fluids towards the Teide peak, probably caused by a possible magmatic intrusion at depth. After this study, it was discovered that a small ground uplift in the Teide area had occurred in the same period (Fernández et al, 2009).

The interpretation of microgravity data, together with other geophysical and geochemical parameters, allows a better understanding of the volcanic phenomenon. Undoubtedly, the creation of a RGS in Tenerife could boost R&D activities in the field of volcanic monitoring and, in general, the study of the dynamics of active volcanic systems.

MONITORING AND ESTIMATION OF WATER RESOURCES

Another topic of interest would be the study of groundwater resources (Jacobs et al., 2010). The aquifers of volcanic islands have hydrogeological peculiarities that make these resources more vulnerable than in other geological contexts (Custodio et al., 2016). In addition, the constant increase in the population of the islands and the tourist flow are leading to a depletion of water resources (Aguilera-Klink et al., 2000). For this reason, the monitoring of water table variations, in order to estimate the rate of decrease of the phreatic surface, is extremely important to plan actions aimed at protecting these resources, which are of vital for Tenerife's population.

In addition, superconducting gravimeters will be used as a non-invasive tool to measure water table variations (Maliva & Missimer, 2012).

Although the main beneficiary of the CSR is the Volcanological Institute of the Canary Islands (INVOLCAN), the development of this project will also benefit other entities in Tenerife:

- INVOLCAN frequently welcomes undergraduate and postgraduate students to carry out their internships, final degree and master's theses on R&D&I activities developed at INVOLCAN. In fact, for obvious geographical reasons, many students come from the University of La Laguna (ULL). Consequently, conducting R+D+i activities related to the use of the RGS in Tenerife and the analysing the data it acquires will, in turn, boost the scientific training of these students.
- Developing a RGS in Tenerife would undoubtedly be beneficial for the activities of the Special Plan for Civil Protection and Emergency Care due to Volcanic Risk in the Canary Islands Autonomous Region (PEVOLCA), whose functions are defined in DECREE 73/2010 of the Regional Ministry of the Presidency, Justice and Security of the Government of the Canary Islands: "to establish the organisation and procedures for action by public and private resources and services to deal with emergencies

due to volcanic risk". Early warning for a volcanic eruption in Tenerife is necessary for the PEVOLCA to be able to optimally manage a possible volcanic emergency in Tenerife.

- The Consejo Insular de Aguas de Tenerife is the body designated by the Cabildo de Tenerife to direct, order, plan and manage the water resources of the island. The application of microgravity as a non-invasive technique to assess Tenerife's water resources could certainly be of direct benefit to the activities carried out by the Cabildo.

TFResilience

"Strengthening the resilience of the municipalities of Tenerife against the volcanic threat".

The project "STRENGTHENING THE RESILIENCE OF THE MUNICIPALITIES OF TENERIFE AGAINST THE VOLCANIC THREAT" is part of the Strategic Framework for Island Development (MEDI) 2016-2025 and is co-financed by the Tenerife Innova Programme 2016-2021 coordinated by the Tenerife 2030 Area of the Cabildo de Tenerife and by the Canary Islands Development Fund (FDCAN). Its main line of action is for Tenerife citizens to take part in the collective responsibility of establishing disaster-resilient municipalities, therefore, public education and awareness is essential. The entire population must be aware of the hazards and risks to which they are exposed if they are to be better prepared and take the necessary measures to cope with potential natural disasters. Awareness raising, capacity building and education programmes are key to mobilising citizen participation in natural risk reduction strategies. This will help citizens to respond to early warnings.

Volcanic risk is the most common natural risk in this region - differentiating us from the rest of Spain - given that the Canary Islands are the only volcanically active region in Spain. However, the citizens living in these islands do not have enough general knowledge of the volcanic phenomenon and the extent that it has had and could have in the Canary Islands. Among the islands most likely to host an eruption in the future is the island of Tenerife, which has recorded historical eruptions, the last one being the eruption of Chinyero in 1909.

Therefore, the population in the Canary Islands must be informed about the geological environment that surrounds them, the volcanic hazards to which they could be exposed, the guidelines to reduce volcanic risk and know the volcanic phenomenon in the Canary Islands and what is currently being done on the islands to reduce this volcanic risk. In order to further this informative and educational work on the volcanic phenomenon and volcanic risk management in the Canary Islands INVOLCAN carries out two main activities that make up the basis of this project:

Activity 1. Producing the educational programme "The Canary Islands: a volcanic window on the Atlantic".

Activity 2. Producing the weekly graphic report on the seismic-volcanic activity on the island of Tenerife: "Guayota".

GEOTHERCAN

Experimental development of 3D models for the characterisation of geothermal reservoirs in the subsoil of the Canary Islands through the combined use and application of geophysical, geochemical and geological methods.

FACT SHEET

- Funded by: Partly co-financed by the European Regional Development Funds (ERDF) of the European Union and by the Ministry of Economy and Competitiveness (MINECO).
- Coordinator: Instituto Tecnológico y de Energías Renovables (ITER)
- Participating entities:
  - Petratherm, España S.L.
  - Instituto Volcanológico de Canarias (INVOLCAN)
  - University of La Laguna (ULL)
  - University of Barcelona (UB)

PROJECT SUMMARY

The aim of this project is to conduct an experimental study of 3D models to characterise the geothermal deposits in the subsoil of the islands of Tenerife, Gran Canaria and La Palma, in the Canary Islands, in order to enable the subsequent development of geothermal energy in the archipelago. Coordinated by ITER, the other participants are Petratherm, España S.L., Instituto Volcanológico de Canarias (INVOLCAN), University of La Laguna (ULL) and University of Barcelona (UB).

This project has involved the creation of a public-private research group or consortium to contribute to the promotion of research, development and technological innovation in the field of geothermal energy, and thus favour stable, medium-term cooperation between public and private agents through the execution of R&D projects.

The results of this project will contribute to guaranteeing energy supply, increasing the contribution of emerging energy technologies in an efficient and competitive manner, favouring their integration into the Canary Islands energy system so that their contribution improves supply certainty, diversification of supply sources and environmental protection.

The lines of research of this project are also unique, as this is the first time they have been used. At present, geothermal energy is still a renewable energy in a very incipient state in our country and its development will depend to a large extent on the adequate definition of its resources, which requires innovative technology that has not yet been applied in Spain.

The aim of this project is therefore to use innovative geothermal exploration methodologies in those areas with thermal anomalies both at surface and at depth in the Canary Islands. The proposed methodologies will be applied prior to carrying out geothermal boreholes and will help enormously in the optimal location of these boreholes and in evaluating the geothermal potential of the selected areas.

ELECTROVOLCAN

Design and experimental development of prototypes to generate electricity by thermoelectric effect in superficial geothermal anomalies of volcanic origin: application in the volcanic systems of Timanfaya (Lanzarote) and Teide (Tenerife).

FACT SHEET

- Acronym: ELECTROVOLCAN
- Reference: RTC-2017-6628-3
- Partners:
  - Instituto Tecnológico y de Energías Renovables (ITER) - Project Coordinator
  - Instituto Volcanológico de Canarias (INVOLCAN)
  - Agencia Insular de Energía de Tenerife (AIET)
  - Universidad Pública de Navarra (UPNA)
  - Instituto Geológico y Minero de España (IGME)
- Duration: 01/09/2018 - 31/08/2021
- Fundable budget: 1,254,649.36 €.
  - Grant 620,232.41€.
  - ERDF reimbursable advance: 151,625.10 €
  - Loan: 0,00€ 0,00
  - Own contribution: 482,791.85 €.
- Funding: Call for proposals Challenges-Collaboration 2017. State R+D+I Program Oriented to the Challenges of Society. State Scientific, Technical and Innovation Research Plan 2013-2016.

PROJECT SUMMARY

High enthalpy geothermal energy is a renewable energy source mainly linked to volcanoes. Currently, one of the challenges facing the Europe and Spanish Science, Technology and Innovation strategy is to determine the benefits of using this type of endogenous energy to generate electricity efficiently, sustainably and cleanly from an environmental point of view and at competitive prices. In the Canary Islands, the use of indigenous renewable energies is essential, both for strategic and cost reasons. At present, its implementation is around 9%, compared to 17% in mainland Spain. The current island government, which took office in July 2015, is politically committed to bridge this gap. Both wind and solar energy are discontinuous energies, while geothermal energy is always present and can support the above-mentioned energies.

Conventional geothermal energy is based on drilling boreholes 1500-2500 m deep to obtain steam at temperatures ranging from 100º to 300 ºC that can generate electricity by turbining the fluid generated. In the Canary Islands and in many other active volcanic systems, these temperatures are already found at the surface, but no attempt has ever been made to harness thermoelectricity to exploit this important calorific potential. The surface geothermal anomalies in the Timanfaya area on the island of Lanzarote are the most important in the world, to the point of recording 200 ºC at the surface and 600 ºC at a depth of 10 m in the area of Islote Hilario.

Therefore, the first and main objective of this project is to develop, for the first time in the world, a Seebeck effect thermoelectric generator (GTE) capable of generating renewable electricity from volcanic heat reaching the surface, with minimal environmental impact. To this end, two types of installations for two applications of this technology are to be developed:

Thermoelectric generators to produce electricity from high temperature geothermal energy. The intention is to build 2 prototypes with a total electrical power of 1kW capable of operating in a temperature range of 200ºC to 600ºC, which are the conditions found in certain areas of Lanzarote in the first 10 m of depth.

A GTE device capable of supplying year-round electrical power to volcanic surveillance monitoring facilities, making them self-contained. This device must be resistant to the acidic fumarolic environment that normally prevails in active volcanic environments and be able to operate with hot source temperatures below 100ºC. For this reason, it will be installed in the crater of Teide, the only Spanish volcano with these characteristics. This type of autonomous device would be very useful, for example, at the Gabriel de Castilla Antarctic base, located on a highly dangerous active volcano that can only be monitored from November to February, during the Antarctic campaign. It could also be marketed as an autonomous volcano monitoring station on the world's active volcanoes, a very important aspect that is currently unresolved.

These thermoelectric prototypes can also serve as a basis for other industrial applications discussed in the report.

This project aims to evaluate the total energetic potential of the volcanic area involved in the two eruptions of the 18th and 19th centuries in Lanzarote. Previous studies have already identified 11,700 m² of thermally anomalous areas in Timanfaya, but a geo-referenced thermal infrared flight is needed to delimit the full extent of the thermal anomaly.

The unit output of the thermoelectric devices multiplied by the extent of the thermal anomaly on the surface will make it possible to evaluate the total energy potential of the area. Initial calculations indicate a potential of more than 150 MWe while the maximum power demand on the island is 230 MWe. In terms of energy, the expected results are even more impressive, as geothermal energy would provide 24 hours a day of operation throughout the year, which would mean an annual generation of constant electrical energy of 1,300 GWh. Bearing in mind that the

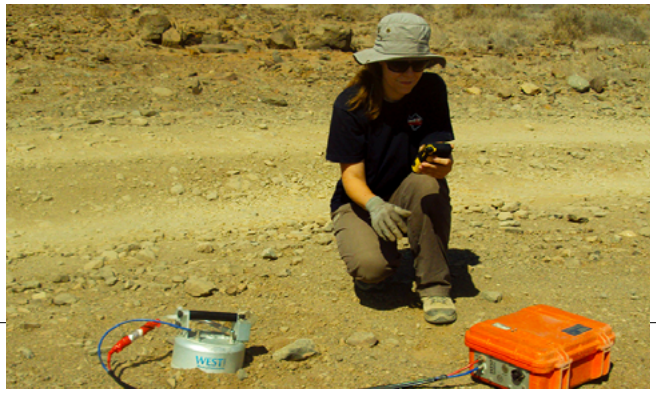
electricity consumed in the whole of the Canary Islands in 2016 was 8,778 GWh, the application of this technology on a large scale would represent a very significant contribution of renewable energy of geothermal origin, this being the only renewable energy that guarantees a constant supply.

Carrying out this project will allow the analysis of experimental yields and detailed costs of this new technology with the precise calculation of the resulting price per kWh (LCOE, Levelized Cost of Energy), in order to compare it with that of other renewables. A priori and as described in section 2 of this report, it is expected to cost around 5 cents per kWh, therefore within the margins of photovoltaic or wind energy, with the added advantage of its constant availability over time, without depending on environmental variability like wind and photovoltaic energy.

The results of the project will be replicable in other volcanic territories with geothermal anomalies associated with recent volcanism. Therefore, patents related to thermoelectric technology are foreseen: those applicable to surface geothermal energy where it exists, the construction of autonomous stations for monitoring active volcanoes, as well as its application in the use of waste heat from certain industrial facilities.

TERMOVOLCAN

Design and Experimental Development of a Multiparametric Methodology for the Exploitation of Hidden High Enthalpy Geothermal Resources in the Canaries



FACT SHEET

- Acronym: TERMOVOLCAN
- Reference: RTC-2017-6627-3
- Partners:
  - Instituto Tecnológico y de Energías Renovables (ITER)
  - Instituto Volcanológico de Canarias (INVOLCAN) - Project coordinator
  - Agencia Insular de Energía de Tenerife (AIET)
  - Instituto Geológico y Minero de España (IGME)
  - Bosch i Gimpera Fundación de la Universidad de Barcelona (FBG-UB)
- Duration: From 01/09/2018 to 31/08/2022
- Fundable budget: 1,649,644.43 €
  - Grant 894,574.47 €
  - ERDF Reimbursable Advance: 105,432.30€.
  - Loan: 0,00€ 0,00
  - Own contribution: 649,637.66 €
- Funding: Call for proposals Challenges-Collaboration 2017. State R+D+I Program Oriented to the Challenges of Society. State Scientific, Technical and Innovation Research Plan 2013-2016.

PROJECT SUMMARY

The main objective of this project is to strengthen and carry out a more detailed study using innovative geophysical and geochemical techniques to explore high enthalpy geothermal resources on the islands of Tenerife, Gran Canaria and La Palma, enabling the further development of geothermal energy in the Archipelago and thereby reducing its energy dependence.

The proposed methodologies will be applied prior to carrying out geothermal boreholes and will greatly assist in the optimal location of the boreholes, as well as in re-evaluating the geothermal potential of the selected areas.

This project is partially a continuation of the project "GEOTHERCAN: Experimental development of 3D models for the characterisation of geothermal reservoirs in the subsoil of the Canary Islands through the use and combined application of geophysical, geochemical and geological methods", (ref. IPT-2011-1186-920000) already completed in 2015. The actions of this new project complement those carried out in GEOTHERCAN and seek to reduce uncertainty in the location of future exploratory boreholes and increase the exploration area in Gran Canaria and La Palma. The results of this project, together with the information obtained in GEOTHERCAN, will promote the future development of the first high enthalpy geothermal plant in Spain, acting as a driving force for the incipient geothermal sector and as a stimulus for the development of geothermal energy.

The installation of the first geothermal plant in the Canary Islands will provide an important boost to related sectors, such as research centres in knowledge of the subsoil, drilling companies and project development engineering companies, thereby creating quality jobs.

The project will be replicable to other similar volcanic areas

in mainland Spain, in places with calc-alkaline volcanism in the southeast and alkaline volcanism in the areas of Ciudad Real and Catalonia, as well as in other volcanic areas on the planet with geothermal anomalies (Azores Islands, Cape Verde, Aeolian Islands and volcanic zones of Italy, Greek Islands, Galapagos, etc.).

The aim of this project is to obtain a 3D model of the high-enthalpy geothermal resources present in Gran Canaria and La Palma by means of geochemical and geophysical studies in the surface environment. In the case of Tenerife, the island on which most of the work on the geothermal resources of the Canary Islands has focused, the aim is to greatly reduce the uncertainty for the location of future exploratory boreholes.

Volturmac

Strengthening volcano tourism in Macaronesia

FACT SHEET

- Acronym: VOLTURMAC
- Ref. No: MAC2/4.6c/298
- Partners: Instituto Volcanológico de Canarias (INVOLCAN), Instituto Tecnológico y de Energías Renovables (ITER), Universidad de La Laguna (ULL), Cabildo de Tenerife (Consejería Insular del Área de Planificación del Territorio, Patrimonio Histórico y Turismo), Cabildo de El Hierro (El Hierro Geopark), Cámara do Comercio e Industria da Madeira, Associação Regional de Turismo, Turismo dos Açores, Universidade de Cabo Verde (UniCV), Cámara de Turismo de Cabo Verde, Laboratorio de Engenharia Civil de Cabo Verde.
- Duration: 2019-2022 (36 months)
- Budget: 1,964,660.94 €.
- Co-funded by: Territorial Cooperation Programme INTERREG V A Spain-Portugal MAC 2014-2020. 2nd Call. Axis 4 - Preserve and protect the environment and promote resource efficiency.

PROJECT SUMMARY

VOLTURMAC (MAC2/4.6c/298) is a project funded by the INTERREG V A Spain-Portugal Territorial Cooperation Programme MAC 2014-2020.

The general objective of VOLTURMAC is to contribute to strengthening the conservation, protection, promotion and development of the natural and cultural heritage related to Macaronesia volcanoes through the promotion of volcano tourism.

This project aims to analyse, evaluate and identify the potential of volcano tourism in Macaronesia, create tourist itineraries and geo-routes that enhance the natural and cultural resources of the volcanoes in Macaronesia. It also seeks to promote and strengthen training on the natural and cultural resources related to volcanic phenomena in Macaronesia's tourism sector.

SPECIFIC OBJECTIVES AND ACTIVITIES

- Specific Objective 1: To analyse, evaluate and identify the potential of volcano tourism in Macaronesia.
- Activity 2.1.1 - SWOT analysis on volcano tourism in Macaronesia.
- Activity 2.1.2 - Identification, characterisation, mapping and assessment of sites of geological-geomorphological interest (SGEIs).
- Activity 2.1.3 - Selecting the most representative, best preserved LIGs with the highest volcano tourism potential.
- Specific Objective 2: Creating tourist itineraries and geo-routes that enhance the natural and cultural resources of the Macaronesia volcanoes.
- Activity 2.2.1 - Designing, creating and reassessing volcano-tourist and landscape itineraries in Macaronesia in both natural and urban areas.
- Activity 2.2.2 - Developing material necessary to strengthen the content of the volcano-tourist itineraries in Macaronesia (topo-guides, QR codes, panels, apps, etc.).
- Activity 2.2.3 - Enhancing the natural and cultural assets of the volcanoes of Macaronesia through the generation of tourism products: cultural, landscape, gastronomy, etc.
- Specific Objective 3: Promoting and reinforcing training on the natural and cultural resources linked to the volcanic phenomenon in the tourism sector in Macaronesia.
- Activity 2.3.1 - Strengthening programme on the knowledge of natural and cultural resources linked to the volcanic phenomena for all actors involved in tourism.
- Activity 2.3.2 - Training programme on volcano tourism for business operators in the tourism sector.
- Activity 2.3.3 - Training and reinforcement programme on volcanic phenomena for tourist guides.

Planclimac

Joint planning, monitoring and observation, improving knowledge and awareness of climate change risks and hazards in Macaronesia

FACT SHEET

- Acronym: PLANCLIMAC
- Part No: MAC2/3.5b/244
- Partners: Viceconsejería de Medio Ambiente del Gobierno de Canarias (lead beneficiary), Address Regional de Ambiente de Azores, Secretaria Regional do Ambiente e Recursos Naturais de Madeira, Universidad de las Palmas de Gran Canaria (ULPGC), Universidad de La Laguna (ULL), Instituto Tecnológico y de Energías Renovables (ITER), Instituto Tecnológico de Canarias (ITC) and Ministerio de Agricultura y Ambiente de la República de Cabo Verde.
- Duration: 2019-2022 (36 months)
- Budget: 1,815,199.85 €.
- Co-funders: Territorial Cooperation Programme Interreg Madeira-Azores-Canary Islands (MAC) 2014-2020. 2nd Call. Axis 3 - Promoting adaptation to climate change and risk prevention and management.

PROJECT SUMMARY

Adaptation to climate change should be understood as a continuous process, which arises as an anticipated response to a modification of various sectors and earth systems due to changes in climate and its natural instability. Therefore, when we talk about time horizon, we are referring to the final stabilisation levels of greenhouse gases in the atmosphere.

This is why there is a need to create a body that produces up-to-date information on the variability of our ecosystems and territories, which will allow us to generate dynamic action plans in accordance with the constant changes that the planet is undergoing in general, and finally, with a lasting character over time.

The overall objective of the PLANCLIMAC project is to harness the scientific knowledge and technological capacity of the MAC Region to provide tools to facilitate the implementation of adaptation policies and preparedness for natural hazards inherent to climate change.

The planned actions will take place in the Canary Islands, Madeira, the Azores and Cape Verde. The project manages to generate an entity that goes beyond the regional scope of each territory, covering a larger area and including places located on the African continent. However, due to the characteristics of the project, which combines mitigation and adaptation actions regarding climate change, its repercussions reach both Macaronesia and the rest of the world's population.

SPECIFIC OBJECTIVES:

Specific Objective 1 (SO1): Creating an independent body called the "Macaronesia Climate Change Observatory", which will enable the adoption of corrective and preventive measures and provide tools for managing natural risks caused by climate change in the Macaronesian region.

Specific Objective 2 (SO2): Improved knowledge of physical, chemical, biological and anthropogenic indicators of climate change to warn of adverse natural phenomena.

Specific Objective 3 (SO3): Raising awareness among the population and socio-economic actors in the MAC Region of the risks associated with climate change, through a training programme, exchanging experiences and implementing a climate change adaptation plan.

SPECIFIC OBJECTIVES:

- Specific Objective 1 (SO1): Creating an independent body called the "Macaronesia Climate Change Observatory", which will enable the adoption of corrective and preventive measures and provide tools for managing natural risks caused by climate change in the Macaronesian region.
- Specific Objective 2 (SO2): Improved knowledge of physical, chemical, biological and anthropogenic indicators of climate change to warn of adverse natural phenomena.
- Specific Objective 3 (SO3): Raising awareness among the population and socio-economic actors in the MAC Region of the risks associated with climate change, through a training programme, exchanging experiences and implementing a climate change adaptation plan.

ACTIVITIES:

S.O. 1: Creating an independent body called the "Macaronesia Climate Change Observatory", which will enable the adoption of corrective and preventive measures and provide tools for managing natural risks caused by climate change in the Macaronesian region.

- Activity 2.1.1: Setting up the Macaronesia Climate Change Observatory, defining committees and their functions. Establishing links with entities of similar characteristics that are already consolidated and aim to achieve the same general objective.
- Activity 2.1.2: Macaronesian Climate Change Inventory: Creating a publicly accessible database of all information in the MAC Region related to studies, research theses, dissemination materials, etc. on climate change that has

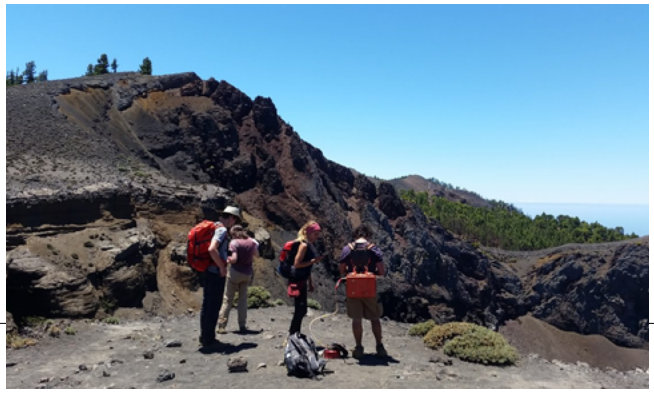
been produced in the last 10 years.
- Activity 2.1.3: Effect of climate change on desertification. Analysis of the causes and processes generating this phenomenon. Flood risk management in relation to climate change impact studies on flooding in coastal areas and streams.

O. E. 2: Improving knowledge of physical, chemical, biological and anthropogenic indicators of climate change to warn us of adverse natural phenomena.
- Activity 2.2.1: Setting up a WRF model in each of the regions of interest and obtaining climate projections throughout the 21st century using the climatic conditions of the Canary Islands.
- Activity 2.2.2: Climate effects and their consequences on the Macaronesian marine environment. Implementing an observation network and oceanographic campaigns to determine values and variables in physical-chemical indicators and their impact on organisms and their ecosystems.
- Activity 2.2.3: Analysis of recent coastal changes and their environmental consequences. Diagnosis of the origin of problems through the modelling of "type basins". Assessing the impact of climate change on the coastline analysed and proposal of measures to mitigate its adverse effects.

O.E.3: Raising awareness among the population and socio-economic actors in the MAC Region of the risks associated with climate change, through a training programme, exchanging experiences and implementing a climate change adaptation plan.
- Activity 2.3.1: PLANCLIMAC awareness-raising, dissemination and experience-sharing programme.
- Activity 2.3.2: Technical training on climate change adaptation in Macaronesia.

VolRiskMac

Strengthening R&D&I capacities for volcanic activity monitoring in Macaronesia



FACT SHEET
- Acronym: VOLRISKMAC
- Partners: Instituto Volcanológico de Canarias (INVOLCAN), Instituto Tecnológico y de Energías Renovables (ITER), Agencia Insular de Energía de Tenerife (AIET), Centro de Vulcanologia e Avaliação de Riscos Geológicos da Universidade dos Açores (CVARG), CIVISA - Centro de Informação e Vigilância Sismovulcânica dos Açores, Insitituto das Florestas e Conservação da Natureza (IPRAM).
- Duration: 2016-2019 (4 years)
- Budget: 1,590,032.51€.
- Funding: Interreg Madeira-Azores-Canary Islands Territorial Cooperation Programme (MAC) 2014-2020. Axis 3 - Promoting adaptation to climate change and risk prevention and management.

PROJECT SUMMARY

The main objective of the VOLRISKMAC project is to strengthen capacities for monitoring volcanic activity in order to improve the early warning system for volcanic eruptions and seismic volcanic crises, as well as the management of volcanic crises in Macaronesia.

Volcanic risk in Macaronesia is higher now than it was 50 years ago due to increased population and socio-economic development in the region exposed to volcanic hazards. As this development will continue over the coming years, the volcanic risk in the region will be higher in 2050 than it is today. Therefore, it is very important to strengthen all capacities to contribute to the reduction of volcanic risk in the region, especially when this is the region's natural risk that differentiates it from the rest of mainland Spain and Portugal.

In the framework of this project, the recommendations for volcanic risk reduction established by the international scientific and political community through IAVCEI and UNESCO, respectively, will be implemented. Volcanic monitoring and emergency management are the most useful actions to contribute to volcanic risk reduction in densely populated areas such as Macaronesia.

The geographical scope of this project will be the archipelagos of Macaronesia: Azores, Madeira, Canary Islands and Cape Verde. In the Canary archipelago, the activities will be carried out in Tenerife, La Palma, Lanzarote and El Hierro. In Cape Verde, these activities will focus on the island of Fogo. In the Azores, they will take place on the island of Sao Miguel.

SPECIFIC OBJECTIVES:
- Specific Objective 1: Strengthen permanent instrumental networks (continuous recording) to improve volcanic monitoring programmes in Macaronesia.
- Specific Objective 2: Strengthen geophysical, geochemical and geodetic non-continuous recording programmes to

improve volcanic monitoring programmes in Macaronesia.
- Specific Objective 3: Strengthen crisis management and response capacity to volcanic natural disasters and associated hazards in Macaronesia.

ACTIVITIES:
SO 1: Strengthen permanent instrumental networks (continuous recording) to improve volcanic monitoring programmes in Macaronesia.
- Activity 2.1.1 - Strengthening the permanent instrumental geophysical network.
- Activity 2.1.2 - Strengthening the permanent instrumental geochemical network.
- Activity 2.1.3 - Strengthening the permanent instrumental geodetic network.
- SO 2: Strengthen non-continuous geophysical, geochemical and geodetic recording programmes to improve volcanic monitoring programmes in Macaronesia.
- Activity 2.2.1 - Strengthening the non-continuous recording geophysical programme.
- Activity 2.2.2 - Strengthening the non-continuous geochemical recording programme.
- Activity 2.2.3 - Strengthening the geodetic non-continuous recording programme.
- SO 3: Strengthen crisis management and response capacity to volcanic natural disasters and associated hazards in Macaronesia.
- Activity 2.3.1 - Developing early warning systems through the implementation of ICTs.
- Activity 2.3.2 - Simulation and creation of eruptive scenarios.
- Activity 2.3.3 - Workshops for the dissemination of the results and simulations of potential eruptive scenarios.

Volriskmac II

Strengthening R&D&I capacities for building resilience to volcanic emergencies in Macaronesia

FACT SHEET
- Acronym: VOLRISKMAC II
- Ref. No.: MAC2/3.5b/328
- Partners: Instituto Volcanológico de Canarias, Instituto Tecnológico y de Energías Renovables, Agencia Insular de la Energía de Tenerife, Centro de Informação e Vigilância Sismovulcânica dos Açores, Universidade dos Açores, Fundação Gaspar Frutuoso, Instituto das Florestas e Conservação da Natureza, Universidade de Cabo Verde and Laboratorio de Engenharia Civil de Cabo Verde.
- Duration: 2019-2022 (36 months)
- Budget: 1,609,594.76 €.
- Co-funders: Interreg Madeira-Azores-Canary Islands Territorial Cooperation Programme (MAC) 2014-2020. 2nd Call. Axis 3 - Climate change and risk management.

PROJECT SUMMARY
VOLRISKMAC II, a project funded by the Territorial Cooperation Programme INTERREG V A Spain-Portugal MAC 2014-2020, is a continuation of the VOLRISKMAC project.

The overall objective of VOLRISKMAC II is to strengthen R&D&I capacities to develop resilience to future volcanic emergencies in Macaronesia.

This project aims to reinforce the volcanic early warning system in Macaronesia through the improvement of instrumental networks and developing and implementing innovative methodologies to strengthen the resilience of volcanic monitoring systems in Macaronesia. It also seeks to create a collaboration network of the participating partners and national and/or international R&D institutions of recognised experience in order to strengthen the scientific response to volcanic emergencies in Macaronesia.

General objective: strengthening R&D&I capacities to develop resilience to future volcanic emergencies in Macaronesia.

SPECIFIC OBJECTIVES:
- Specific Objective 1: Strengthening the volcanic early warning system in Macaronesia through the improvement of instrumental networks and developing and implementing innovative methodologies.
- SO 2: Strengthening the resilience of volcano monitoring systems in Macaronesia.
- S.O. 3: Creating a collaboration network of the participating partners and national and/or international R&D institutions of recognised experience in order to strengthen the scientific response to volcanic emergencies in Macaronesia.

ACTIVITIES:
SO 1: Strengthening the volcanic early warning system in Maca-

ronesia through the improvement of instrumental networks and developing and implementing innovative methodologies.

- Activity 2.1.1. Designing and implementing geophysical and geochemical instrumental networks to strengthen volcanic emergency response.
- Activity 2.1.2. Designing and implementing an instrumental network of remote optical sensors to strengthen the response to volcanic emergencies.
- Activity 2.1.3. Implementing a petrological methodology to establish the time scales of the precursors of volcanic eruptions in Macaronesia.

SO 2: Strengthening the resilience of volcano monitoring systems in Macaronesia.

- Activity 2.2.1 - Improving data acquisition and transmission systems to ensure effective operation of volcano monitoring systems during emergencies.
- Activity 2.2.2 – Developing and improving the system for processing and storage of information generated by instrumental volcano monitoring networks.
- Activity 2.2.3 - Creating, reinforcing and maintaining technological infrastructure, technological equipment and ad-hoc technical staff to develop monitoring centres for the scientific management of volcanic emergencies.

S.O. 3: Creating a collaboration network of the participating partners and national and/or international R&D institutions of recognised expertise to strengthen the scientific response to volcanic emergencies in the Macaronesia.

- Activity 2.3.1 - Volcanic emergency drills in Macaronesia to strengthen the response of participating partners during the pre-eruptive and eruptive phases.
- Activity 2.3.2 - Generating human capital specialised in volcanic risk and resilience to volcanic emergencies, through the transfer of knowledge, tools and technologies to and from society.
- Activity 2.3.3 – Organising three workshops to disseminate the results.

volcanCALLE

Volcanoes take to the streets

FACT SHEET

- Budget: 11,514.67 €.
- Funding: Fundación CajaCanarias (4,000.00 €) & Instituto Volcanológico de Canarias, INVOLCAN (7,514.67 €)
- Ref. No: ED66
- Acronym: volcanCALLE
- Duration: 2015-2016
- Principal Investigator: Dr. Nemesio M. Pérez

PROJECT SUMMARY

Volcanoes take to the streets is a travelling exhibition open to the general public and free of charge organised by the INVOLCAN that aims to bring volcanic phenomena and volcanic risk management closer to society.

This initiative obtained the support of the CajaCanarias Foundation through its 2015 Call for Grants for Educational Projects and its aim is to inform and teach society about volcanic phenomena and volcanic risk management in the Canary Islands in order to contribute to developing a community that is less vulnerable to volcanic risk.

The travelling exhibition, which is intended to remain for a week in each of the municipalities it visits, consists of a series of informative and educational panels related to (a) historical volcanism in the Canary Islands, (b) the different dangers associated with volcanic phenomena, and (c) volcanic risk management in the Canary Islands. In addition to these 15 informative and educational panels, this travelling exhibition will also include a showcase of volcanic rocks from the Canary Islands.

Visitors will have access to educational material such as crossword puzzles and wordsearch puzzles, which are intended to improve their knowledge of volcanic phenomena amusingly. Several documentaries on volcanology and volcanic eruptions will also be played, including "Teneguía, el volcán amable", co-produced by Centrífuga Producciones, RTVE and INVOLCAN. This initiative will also conduct specific projects with schools, with the aim providing a better understanding of the perception that the residents of the municipality have of volcanic risk in the Canary Islands.

TELEPLANETA

FACT SHEET

- Budget: 149,920.00 €.
- Funding: Agencia Española de Cooperación Internacional para el Desarrollo, AECID (59.920,00 €) & ITER (90.000,00 €)
- Reference: 2014/ACDE/004551
- Acronym: geochemTAAL
- Duration: 18 months
- Principal Investigators: Dr. Pedro A. Hernández / Dr. Gladys Melián

PROJECT SUMMARY

TELEPLANETA is a popular science project that has been running since 2009 and is produced jointly with Televisión Española in the Canary Islands. It is a 20-minute television programme that deals with various scientific topics, including natural hazards, science and technology, and is broadcast on TVE's 24-hour Channel, as well as on the International Channel, and regionally on TVE's La1. This project brings first-hand news and scientific and technological discoveries through a mass broadcasting platform such as TVE, enabling viewers to increase their scientific and innovative culture.

TELEPLANETA, hosted by geologist David Calvo, is entirely produced in the Canary Islands for the world and its main objective is to assert itself as RTVE programme that provides a "public service" helping to raise awareness in society of the relationship between Humanity and Planet Earth. The commission of the twelfth "Science in Action" for the categories of Short Science Films, Teaching Materials and Outreach Work unanimously agreed to award the prize in the category of Short Science Films to the programme TELEPLANETA for the importance and relevance of its weekly programmes informing about the risks of natural disasters and the measures to mitigate them. "Science in Action" is an initiative of the Spanish National Research Council (CSIC), Ciencia Viva, the Royal Spanish Physical Society (RSEF), the Spanish Geological Society (SGE) and the National University of Distance Education (UNED).

geochemTAAL

Strengthening the volcanic early warning system in the Philippines through innovative geochemical methodologies

DATOS

- Budget: 149,920.00 €.
- Funding: Agencia Española de Cooperación Internacional para el Desarrollo, AECID (59.920,00 €) & ITER (90.000,00 €)
- Reference: 2014/ACDE/004551
- Acronym: geochemTAAL
- Duration: 18 months
- Principal Investigators: Dr. Pedro A. Hernández / Dr. Gladys Melián

PROJECT SUMMARY

The main objective of this scientific collaboration project between ITER and the National Institute of Geological Sciences of the University of the Philippines in Diliman is to contribute to improve and optimise the early warning system of the Taal volcano by implementing a geochemical programme that involves the continuous monitoring and measurement of the diffuse flux of CO2 and H2S. It is a project co-funded by the AECID [Spanish Agency for International Development Cooperation] and came about following a request made by the Philippine Institute of

Volcanology and Seismology (PHIVOLCS) to AECID and ITER in 2011 after the good results obtained by the geochemical monitoring programme on the diffuse emission of carbon dioxide (CO_2) in the crater lake of Taal volcano, conducted by the ITER-PHIVOLCS scientific team on a quarterly basis (non-continuous mode). This geochemical monitoring programme in non-continuous mode was very useful in raising the volcanic alert level at Taal in 2011 when a very significant increase in diffuse carbon dioxide (CO_2) emission of approximately 500 to 4,700 tonnes per day was recorded in its crater lake (Arpa M. C. et al., 2013).

Taal volcano is located about 50 kilometres from Manila, the capital of the Philippines, and has erupted violently several times causing loss of life. Because of its proximity to populated areas and its eruptive history, Taal was designated by the United Nations and the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) as one of the Volcanoes of the Decade in order to promote studies aimed at preventing future natural disasters related to volcanic phenomena.

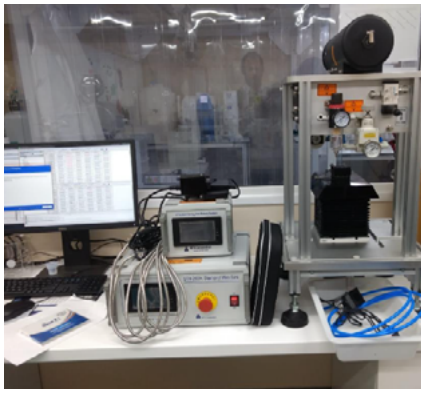
Infrastructure

Geochemistry Laboratory

The INVOLCAN Geochemistry Laboratory is a scientific facility that has been operational since 1997 whose main objective is the study of the chemical composition of volcanic gases, soils and water. The work carried out is related to the main lines of research conducted at INVOLCAN, which focus on Volcanology, Geothermics, Hydrogeochemistry and Environmental Quality. All this work is performed by highly qualified personnel who are constantly undergoing training by attending courses, conferences, etc.

The Geochemistry Laboratory has 2 workspaces: the Wet Chemistry Laboratory and the Instrumental Chemistry Laboratory.

Petrology Laboratory



The overall objective of the petrology laboratory is to measure the chemical composition and physical properties of rocks and minerals in order to learn more about the physical processes operating in the Earth's interior, such as groundwater flows and the processes of volcanic rock and mineral formation. The latter are particularly important as they provide information on the timing and rate of magmatic processes leading to volcanic eruptions. The objective for 2018-2020 was to improve INVOLCAN's capacity to prepare samples for specialised analyses and to maximise the efficiency of external analyses.

Isotopic Geochemistry Laboratory

In the isotope geochemistry laboratory, stable isotope ratios are analysed using magnetic sector mass spectrometers. Analyses can be performed on various matrices (gases, water, soil, minerals, fossils, foodstuffs, rocks, etc.) The laboratory is capable of analysing the ratios^{13} C/^{12} C,18 O/16 O,15 N/14 N and2 H/1 H in solid, liquid and gaseous matrices, the isotopic ratios of all the noble gases (He, Ne, Ar, Kr and Xe) in free gases or dissolved in water and the rest of the stable elements of the periodic table in any liquid or solid matrix. Isotopic composition studies are at the forefront of a wide range of applications: provenance studies of agricultural and anthropological samples, assessment of interactions between different geochemical reservoirs (groundwater, mantle, etc.), geochronology studies to date geological events, constraining the evolution of the cosmochemical system through measurements of isotope ratios in meteorites, etc.

Canary Islands Seismic Network

The Canary Islands Seismic Network is a permanent instrumental network for volcanic monitoring purposes and for the study of the crust and upper mantle of the Canary Islands. It was launched in November 2016 and is currently made up of 51 broadband seismic stations, of which 47 are permanently located (22 in Tenerife, 7 in La Palma, 5 in El Hierro, 4 in Lanzarote, 4 in Gran Canaria, 4 in Fuerteventura and 1 in La Gomera) and 4 are reserve stations. At present, 32 seismic stations are installed and operational (18 in Tenerife, 6 in La Palma, 5 in El Hierro, 2 in Gran Canaria and 1 in Lanzarote) and there are plans to install the remaining 15 seismic stations (4 in Fuerteventura, 2 in Gran Canaria, 1 in La Gomera, 1 in La Palma, 3 in Lanzarote and 4 in Tenerife).

All stations transmit data in real time via GSM connection to ITER. The data are automatically processed in real time by the SeisComp3 Pro software which, in addition to storing and accessing the data, allows the automatic localisation of earthquakes of sufficient magnitude on a local and regional scale. The processing is performed by a dedicated virtual machine on the Teide-HPC supercomputer and equipped with 16 Xeon X5 2670 CPUs, 128GB of RAM, 1TB for O.S. + 25TB of storage and two 10Gbps network cards, one permanently connected to the Internet and the other for shared resources.

The seismic data are reviewed weekly by a team of technicians and researchers to detect and locate small magnitude earthquakes. At present, the Canary Islands Seismic Network can detect and locate less than 1 magnitude earthquakes in Tenerife and its surroundings and less than 2 on the other islands.

Canary Islands Geochemical Network

The Canary Islands Geochemical Network is a permanent instrumental network with continuous monitoring and measurement of parameters of interest for geochemical monitoring for volcanic surveillance purposes. It was set up in April 1999. It currently consists of 18 permanent geochemical stations (9 in Tenerife, 5 in La Palma, 3 in El Hierro and 1 in Lanzarote). At present, 11 geochemical stations are installed and operational (6 in Tenerife, 2 in La Palma and 3 in El Hierro) and there are plans to install 1 in Gran Canaria and reinstall the rest. All stations transmit data in real time via GSM connection to ITER. The data are further processed by ITER staff and stored.

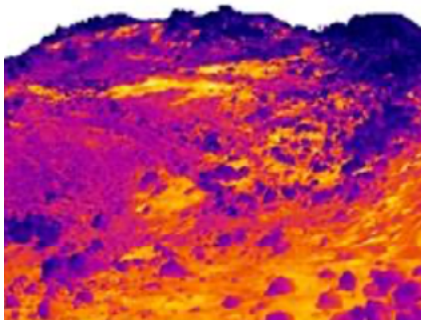
The geochemical data are reviewed weekly by a team of technicians and researchers for reporting. The data consist mainly of time series of diffuse CO2 and H2 S flux, time series of222 Rn and220 Rn activity in both dissolved gas in groundwater and soil atmosphere gas and time series of H2 O/CO2 , CO2 /H2 S, H2 S/SO2 , CO2 /SO2 , He/CO2, CO2 /O2 , N2 /36 Ar,40 Ar/36 Ar, N2 /O2 , of visible emissions (fumaroles).

Canary Islands Geodetic Network

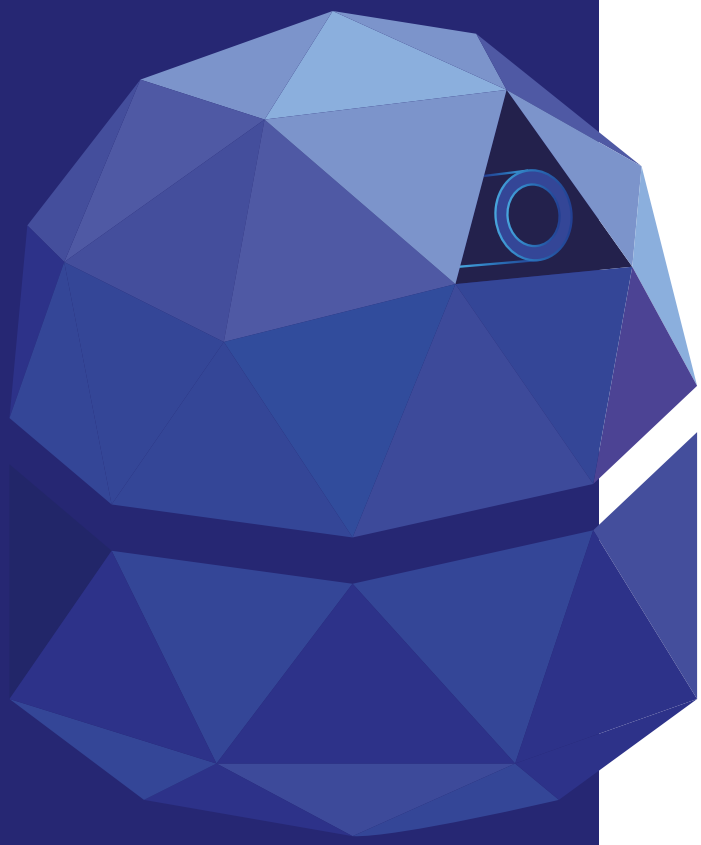
The Canary Islands Geodetic Network is a joint venture of ITER, INVOLCAN, Cartográfica de Canarias (GRAFCAN) [Canaries mapping system] and the University of Nagoya (Japan). At present, this permanent instrumental network has L, 18 of which are INVOLCAN's, 17 are GRAFCAN's and 4 are Nagoya University's (Japan). The main purpose of this network is to monitor ground deformation for volcanic surveillance purposes. It is made up of 43 GPS stations, of which: a) 35 GPS stations of which 12 are permanently located in Tenerife, 5 in La Palma, 6 in El Hierro, 3 in Lanzarote, 4 in Fuerteventura, 4 in Gran Canaria and 1 in La Gomera, and b) the network has another 8 reserve stations to be deployed in case of need or campaign, as well as replacement in case of malfunction of any of the installed stations.

Every day at around 01:00am, all receivers send the data recorded during the 24h of the previous day, to be stored and later processed automatically by the Bernese software in a dedicated virtual machine in the Teide-HPC supercomputer and equipped with 16 Xeon X5 2670 CPUs, 128GB of RAM memory, 1TB for S.O. + 25TB of storage and two 10Gbps network cards, one permanently connected to the Internet and the other for shared resources. Typical displacements detectable by each GPS station correspond to centimetres vertically and millimetres horizontally.

Canary Islands Thermal and Thermographic Network



The Canary Islands Thermal and Thermographic Network is a permanent instrumental network with continuous thermometric monitoring of the temperature at 40 cm depth (heat flow) and thermographic monitoring of the Teide crater for geophysical monitoring for volcanic surveillance purposes. It was set up in April 1999. It currently consists of 9 permanent geochemical stations (5 in Tenerife, 2 in La Palma, 1 in El Hierro and 1 in Lanzarote). At present, 5 thermometric stations are installed and operational (3 in Tenerife, 1 in La Palma and 1 in El Hierro) and there are plans to install 1 in Gran Canaria and to reinstall the rest. All stations transmit data in real time via GSM connection to ITER. The data is then processed by ITER staff and stored. It also has a thermographic camera that continuously monitors the temperature and heat flow of the Teide crater.



Equipment

GEOCHEMISTRY LABORATORY

WET CHEMISTRY LABORATORY

- Production and supply of pure water type II (E-POD) and ultra-pure water type I (Q-POD). Milli Q Integral 3, Millipore.
- Automatic titrators METROHM 716 DMS Titrino with integrated sample processor.
- METROHM 855 automatic titrator.
- Centrifuge Mega Star 1.6, VWR.
- UV/visible spectrophotometer, model UV-3100PC.
- Flores Valles fume extraction hood.
- pH METER PHM 92 Radiometer COPENHAGEN and conductivity meter CDM²10 Radiometer COPENHAGEN.
- Thermostatically controlled bath-agitator VWR
- Precision balances Sartorius BP211D, PRACTUM²24-1S, CP3202S and PRACTUM513 and VWR LP-6501.
- Jouan EB18 and Selecta 2000200 cookers.
- Stirrer/heater VMS-C10-2, VWR.
- Ultrasonic bath/heater
- Glass and plastic consumables (volumetric and Erlenmeyer flasks, pipettes, beakers, burettes, test tubes, etc.), micropipettes.

INSTRUMENTAL CHEMISTRY LABORATORY

- VARIAN 4900 and AGILENT 490 portable dual-channel gas micro-chromatographs with thermal conductivity detector (TCD).
- AGILENT 7890B gas chromatograph with FID and TCD detectors.
- AGILENT GC7890 gas chromatograph coupled to AGILENT mass spectrometer
- MSD5977, equipped with MARKES INTERNATIONAL CIA advantage, Kori-xr and Unity-xr modules.
- DIONEX 500DX liquid chromatograph with conductivity and amperometric detector.
- Liquid chromatograph METROHM 861 Advanced Compac IC with conductivity detector and integrated sample processor.
- Liquid chromatograph THERMO FISHER SCIENTIFIC, Dionex ICS-2100 with conductivity detector with integrated sample processor.
- Inductively coupled plasma atomic emission spectrometer (ICP-OES), PERKIN ELMER Optima 3300DV.
- PFEIFFER Omnistar 422 quadrupole analyser mass spectrometers (QMS).
- HIDEN QGA quadrupole analyser mass spectrometers (QMS).
- HIDEN HPR40 MIMS quadrupole analyser mass spectrometers (QMS).
- Inductively coupled plasma mass spectrometer (ICP-MS), Thermo Fisher Scientific iCAP Q.
- Inductively coupled plasma optical spectrometer (ICP Optical), Perkin-Elmer OPTIMA 3300DV.
- Microwave digestion system MARSX.

OTHER EQUIPMENT IN THE GEOCHEMISTRY LABORATORY

- Vacuum lines for sample extraction and separation.
- Refrigerators for storing samples and standards.

PETROLOGY LABORATORY

- Agate mill, for comminution of particles <10 µm.
- Precision saw STX-202p, PI-KEM.
- Mineral micro sampling device, MicroMill, Elemental Scientific.
- ZEISS V20 Stereomicroscope.

EQUIPMENT TO BE PURCHASED IN THE NEAR FUTURE:

- Sample polisher.
- Carbon / gold sample coater
- Vacuum chamber.
- Pressure chamber.
- Table-top drilling machine for the production of rock cores from 1 to 50 mm diameter.

ISOTOPIC GEOCHEMISTRY LABORATORY

- Isotope ratio mass spectrometer (IRMS), model Thermo Finnigan MAT 253, equipped with the following peripherals: Thermo Finnigan Flash EA 1112 Series elemental analyser, Thermo Finnigan GasBench II, Thermo Finnigan TraceGC ultra gas chromatograph and Thermo Finnigan GC Combustion III sample combustion unit.
- Thermo Fisher Scientific HELIX SFT noble gas mass spectrometer (NGMS).
- Thermo Fisher Scientific TRITON PLUS thermal ionisation mass spectrometer (TIMS), equipped with an RPQ lens for increased sensitivity to isotope abundance, and two 1013 Ω amplifiers for ultra-high precision measurements on small sample quantities and low-abundance isotopes.

OTHER EQUIPMENT:

- Cleanroom: space designed for the preparation of samples for TIMS analysis.
- Production and supply of ultra-pure water type I, Milli-Q Direct 8 + Q-POD Element Millipore.
- Airone X fume hood, variable temperature heaters, Eppendorf micropipettes, Savillex consumables and resins for Mr separation.
- Gas sample purification line for noble gas analysis equipped with two SAES CAPACITORR HV 200 getters and one Ti-Zr getter with CARBOLITE-GERO furnace up to 1200oC.
- Gas sample purification line for noble gas analysis equipped with two SAES NP10 getters and a cold activated carbon finger.
- Filament degassing system for TIMS Thermo Fisher Scientific.

CANARY ISLANDS SEISMIC NETWORK

- Nanometrics Trillium Compact 120 s sensors in surface and Posthole configuration
- Nanometrics Centaur dataloggers
- Guralp 3ESPC 120 s sensors in surface mounting configuration
- Guralp Minimus Dataloggers
- GSM Radiomodem
- SeisComp3 Pro software

CANARY ISLANDS GEOCHEMICAL NETWORK

WESTSYSTEMS geochemical stations for the measurement of diffuse CO flux$_2$ (DRAGUER POLYTRON 2) and H_2 S (TOX-05-H_2 S detector).
WESTSYSTEMS geochemical stations for the measurement of CO diffuse flux$_2$ (LICOR 830) and H S (TOX-05-H S detector).
WESTSYSTEMS geochemical stations for the measurement of CO diffuse flux (LICOR 820) and H S (TOX-05-H S detector).
WESTSYSTEMS geochemical stations for the measurement of diffuse CO flux (LICOR 830).
WESTSYSTEMS geochemical stations for the measurement of diffuse CO flux (LICOR 820).
Quadrupole mass spectrometer - QMS (HYDEN) which records the chemical and isotopic composition of dissolved gases in groundwater.
SARAD RTM-2010-2 electrostatic alpha spectrometers for recording radon (222 Rn) and thoron (220 Rn) gas activity in the soil atmosphere.
SARAD RTM-1688 electrostatic alpha spectrometers for recording radon (222 Rn) and thoron (220 Rn) gas activity in the soil atmosphere.
SARAD RTM-2200 electrostatic alpha spectrometers for gas flow measurement222 Rn and220 Rn and CO .
Microchromatograph VARIAN MicroGC4900 for the monitoring and measurement of CO , H , He, H S, CH , O2 , N2 and Ne contents in the visible emissions (fumaroles) from Teide.
WESTSYSTEMS multisensor equipped with a LICOR 850 for the measurement of CO and H O and electrochemical sensors for the measurement of H S and SO , for the monitoring and measurement of the relationships between the main components of the volcanic gases emitted by the fumaroles of Teide.
Multiparameter probes YSI-EXO2 and EUREKA MANTA 2 and for recording pH, temperature and conductivity of groundwater.

CANARY ISLANDS GEODETIC NETWORK

- Ashtech iCGRS receivers and ASH701945C antennas.
- Ashtech ZXtreme receivers and LEIAX1203+GNSS antennas.
- Leica GMX902 receivers and AX1203+GNSS antennas.
- Leica GM30 receivers and AS10 antennas.
- License for GPS data processing "Bernese GNSS Software".

CANARY ISLANDS THERMAL AND THERMOGRAPHIC NETWORK

- Thermometric stations for measuring soil temperature at a depth of 40 cm.
- FLIR A655sc thermal camera.

PORTABLE GEOPHYSICAL AND GEOCHEMICAL INSTRUMENTATION

PORTABLE GEOPHYSICAL EQUIPMENT:

- FLIR IR thermal camera model P65.
- FLIR IR thermal camera model T660.
- FLIR IR thermal camera model A65.
- FLIR E53 24o IR Thermal Camera.
- Hukseflux LI19 portable digital heat flow meter.
- Wideband portable seismic stations equipped with Nanometrics Trillium Compact 120 s sensors and Nanometrics Centaur datalogger
- Wideband portable seismic stations equipped with Guralp 3ESPC 120s sensors and Guralp Minimus datalogger
- Receiver stations for resistivity and spontaneous potential measurement IRIS V-FullWaver
- Transmitting station for resistivity and spontaneous potential measurement IRIS I-FullWaver
- Electrical generator and signal generator for surface resistivity measurements
- Metronix ADU08e stations for magnetotelluric measurements equipped with MSF-06e magnetometers and respective electrodes.
- MEDA FMV-400 portable magnetometer.

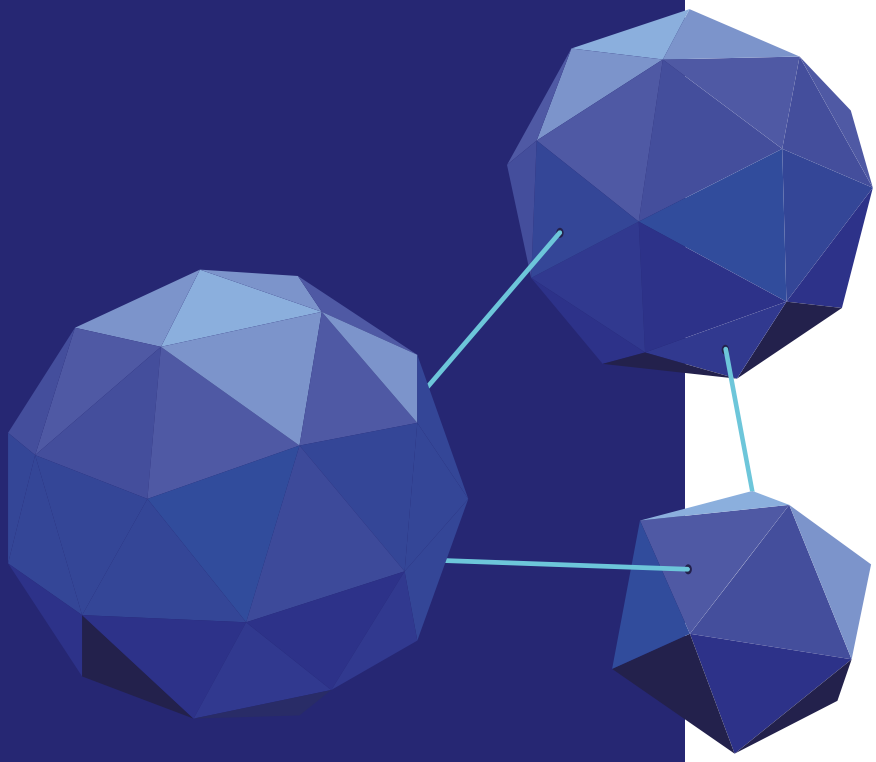
PORTABLE GEOCHEMICAL EQUIPMENT:

- Instrumentation for diffuse flux measurement of CO and H S with LICOR 820 and H S- ALPHASENSE sensor, respectively.
- Instrumentation for diffuse flux measurement of CO and H S with LICOR 830 and H S- ALPHASENSE sensor, respectively.
- Instrumentation for diffuse CO flux measurement2 with DRAGUER POLYTRON 2 sensor.
- WESTSYSTEMS multisensor equipped with a LICOR 840 for

the measurement of CO and H O and electrochemical sensors for the measurement of H S and SO , to monitor and measure the relationships between the main components of volcanic gases.

- WESTSYSTEMS multisensor equipped with a LICOR 850 for the measurement of CO and H O and electrochemical sensors for the measurement of H S and SO , to monitor and measure the relationships between the main components of volcanic gases.
- Mercury vapour analyser model JEROME 431-X.
- Hydrogen sulphide analysers model JEROME 631-X.
- SARAD radon gas electrostatic alpha spectrometers model RTM²010-2.
- SARAD radon gas electrostatic alpha spectrometers model RTM²200.
- SARAD radon gas electrostatic type alpha spectrometers model RTM1688-2.
- Waterproof OAKTON pH/CON 10 Meter multiparameter probes for on-site determination of pH, conductivity and temperature.
- YSI Professional Plus Quatro Cable multiparameter probes for on-site determination of pH, conductivity, redox potential and temperature.
- Portable gas detector Dräger MQG 0100.
- Dimmable diode laser (TDL) gas sensor for CH .

Canalink



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The entity

Canalink is a national operator that was set up in 2004 with the aim of turning the Canary Islands into an international traffic and interconnection platform. We currently have a multiple underwater cable system that enables us to offer top quality high-speed connectivity, linking the Archipelago with Europe.

In addition, we provide access to an extensive land network through our own infrastructure and that of collaborators. This allows us to connect to the main points of presence – PoPs. Thanks to our privileged geographical position and to the different systems we have access to we are a strategic point for Africa-Europe connections. We also have international contracts and agreements that make Canalink a company with great strategic and operational potential for many markets.

- Canary Islands connection with Europe
- Participation in the ACE consortium
- Capacity agreement with WACS

UNDERWATER NETWORK

The submarine network is made up of the links between Tenerife and Cadiz, Tenerife and La Palma and Tenerife and Gran Canaria. These links allow Canalink to sell both capacity and point-to-point circuits between the main islands of the Canary archipelago and the Iberian Peninsula.

In turn, the link with the Iberian Peninsula has a branch line linking Cadiz with Morocco, which is used exclusively to serve the largest operator in Morocco.

All cables are equipped with the latest technology, carrying lambdas or channels up to 100G, allowing Canalink to make the most of the available bandwidth.

Canalink is also an active participant in the WACS and ACE submarine cable consortia, providing connectivity to most countries on the West African coast, Paris, and Lisbon.

TECHNICAL CENTRES AND SUBMARINE CABLE STATIONS

Canalink has points of presence in the Canary Islands through its technical centres and submarine cable stations designed to be able to host third parties in its technical rooms.

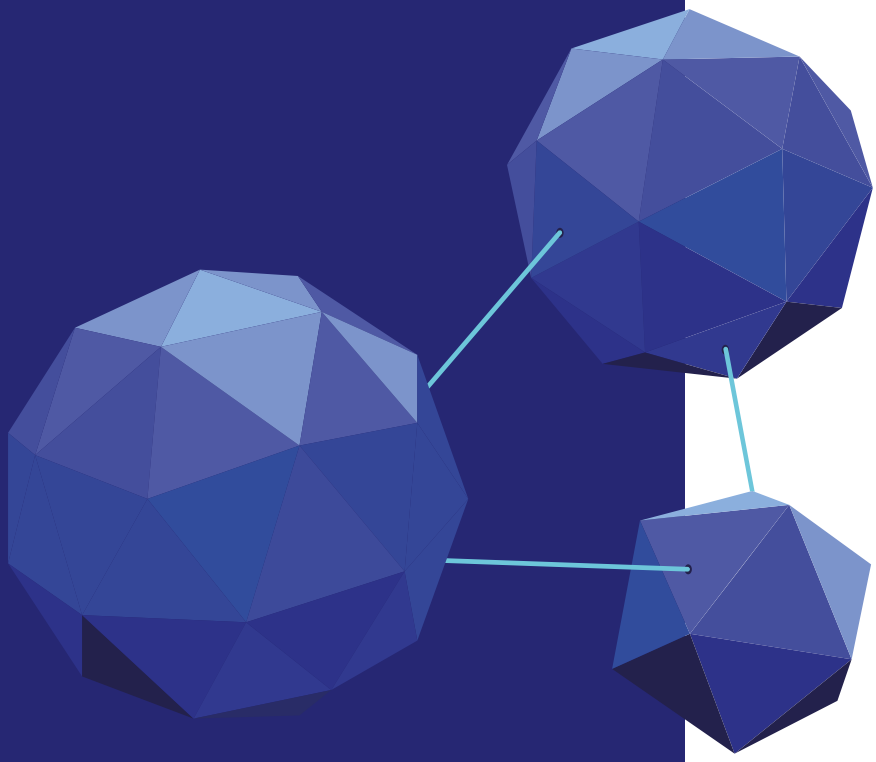
All systems and infrastructures are redundant. Generating sets, rectifiers with battery banks in duplicate (A+B), UPS (A+B), precision air conditioning systems and remote supervision and management systems are available, making Canalink's centres perfect sites for other operators to house their equipment.

On the Spanish mainland, it also has two large cable stations with the same characteristics as its mirror centres in the Canaries and, in addition, through its terrestrial network, the service is extended to several of the most important centres in Seville, such as Telvent's DPC in Seville. Services are also delivered to different DPCs in Madrid.

Internationally, Canalink's main point of presence is Telvent Lisbon, a data centre reached via the WACS and ACE submarine cables.

In 2024 we intend to put into operation a new Canaries-Lisbon link that will allow to increase the capacity and robustness of the connectivity on the islands.

IT³



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La entidad

IT3 is a neutral telecommunications operator created by ITER with the mission of promoting and developing the internal and external connectivity of the island of Tenerife through participating in various local and international projects aimed at expanding and promoting the Information Society on the island and, by extension, in the rest of the Canary Islands.

IT3 is deploying a dark fibre ring: Anillo Insular de Telecomunicaciones de Tenerife (from now on AITT) over the road and rail infrastructure in Tenerife, open to all operators on an equal basis to promote competition.

In its initial phase, this ring will link the metropolitan areas of Santa Cruz de Tenerife and San Cristóbal de La Laguna with the NAP, the anchorage point for numerous submarine telecommunications cables.

In successive phases the ring will be closed around Tenerife and extended inland in order to offer broadband connectivity and access to each and every municipality on the island.

DESCRIPTION OF THE IT3 NETWORK

The electronic communications services network developed and operated by IT3 is a totally passive fibre optic network, intended to be rented as dark fibre optic. IT3's objective is to extend the fibre optic infrastructure throughout all the municipalities of Tenerife with the aim of spreading and promoting the information society.

In addition to the sections shown in the above image, IT3 offers its customers the possibility of building new specific sections that customers need in order to connect to the existing network, under conditions that will be detailed below.

The IT3 network runs underground in both road and rail infrastructures in Tenerife. It is a ring network with a maximum capacity of 504 optical fibres and with all its sections redundant.

The component optical fibres are compatible with the technical requirements for the transmission of signals by third parties according to the following standards:

- General, trunk and access sections: ITU-T G.652d.
- Special sections for submarine cable termination: ITU-T G.655c.

SERVICES

The services offered by IT3 to the wholesale telecommunications infrastructure market consist of making a certain number of fibre pairs along its network available to its customers as dark fibre.

The service can either be rented or an Assignment of Use of the fibre for a determined period of time (IRU) can be purchased. Either way includes the maintenance of the fibre in accordance with Service Level Agreements (SLA) that will be detailed in the corresponding section.

Two different types of service are envisaged, each corresponding to a type of optical fibre and a geographical area:

1. DARK TRANSPORT FIBRE:

This service allows customers to have a physical fibre optic connection between two designated points, by connecting the different fibre optic sections that make up the IT3 network. This physical fibre optic connection is available to the customer so that they can establish the necessary connections and services by connecting the telecommunications equipment they deem appropriate.

This service is offered to electronic communications operators in general. Its geographical scope extends over the entire IT3 network.

2. TERRESTRIAL TERMINATION OF SUBMARINE CABLE:

This service allows operators to establish a fibre optic connection between their Beach Man Holes (BMHs) and their technical centres to control and operate these submarine systems.

This service is aimed at electronic communications operators that moor their submarine cables at BMHs (Beach Man Holes) under the coverage of the IT3 network. Its geographical scope is therefore limited to the routes necessary to connect each BMH to its corresponding technical centre.

Dark Fibre Transport Service

The dark fibre transport service is the constitution of a fibre optic transmission medium between two interconnection points. This transmission medium shall be constituted by the physical connection (fusion) of optical fibre spans along the IT3 network.

The delivery of the dark fibre transport service includes all activities necessary to constitute the physical connection by means of fibre optic cable between the agreed interconnection points.

The customer may make use of this transmission medium during the period hired by connecting the necessary telecommunications equipment to it. It is not permitted, however, to sublet or transfer to third parties all or part of the transmission medium or the different channels or wavelengths into which it may be broken down.

SUBMARINE CABLE TERRESTRIAL EXTENSION SERVICE

The terrestrial submarine cable extension service is defined as the fibre optic connection between the mooring box of a submarine cable and the technical centre from which the submarine cable is operated and monitored.

The delivery of the terrestrial submarine cable extension service includes all activities necessary to constitute the physical connection by means of fibre optic cable between the technical centre and the mooring box.

The customer may make use of this transmission medium during the period hired by connecting the necessary telecommunications equipment to it. It is not permitted, however, to sublet or transfer to third parties all or part of the transmission

medium or the different channels or wavelengths into which it may be broken down.

SERVICE LEVEL COMMITMENT

Objectives

The IT3 quality objectives for the provision of Dark Fibre Transport and Submarine Cable Extension services on point-to-point links, redundant or not, are determined by a commitment to the following parameters:

- The quality, stability and safety of the different elements that make up the infrastructure.
- The delivery time of the links in the existing infrastructure.
- Breakdown repair time.
- The carrying out of programmed work.
- The availability of links.

IT3 manages the entire execution of the installation. IT3 therefore acts diligently in the execution of the same, procuring its supply, execution, and proper completion under the terms and conditions described, providing said services directly or through subcontracting. If applicable, the subcontractors selected by IT3 shall be duly authorised and qualified for the provision of said functions, and under no circumstances shall the Client be held liable for said choice, lack of execution or negligent execution of the obligations assumed by IT3 and the subcontractors chosen by the latter.

RESPONSE TIMES FOR INITIAL SERVICE ESTABLISHMENT

For the services offered, and in relation to studying, offering, and establishing new services, IT3 undertakes to comply with the following times:

- **Feasibility Study:** Time from receipt of the operator's request until the feasibility of the requested sections is answered. Project execution times are not included: ten (10) working days.
- **Service Registration:** Time from the moment the registration request is received from the operator until the service is installed and activated. Project execution times are not included: twenty-two (22) working days.
- **Service Availability:** Total time that the operator is guaranteed to have the service available with correct operation: 99.73% (8,616h).

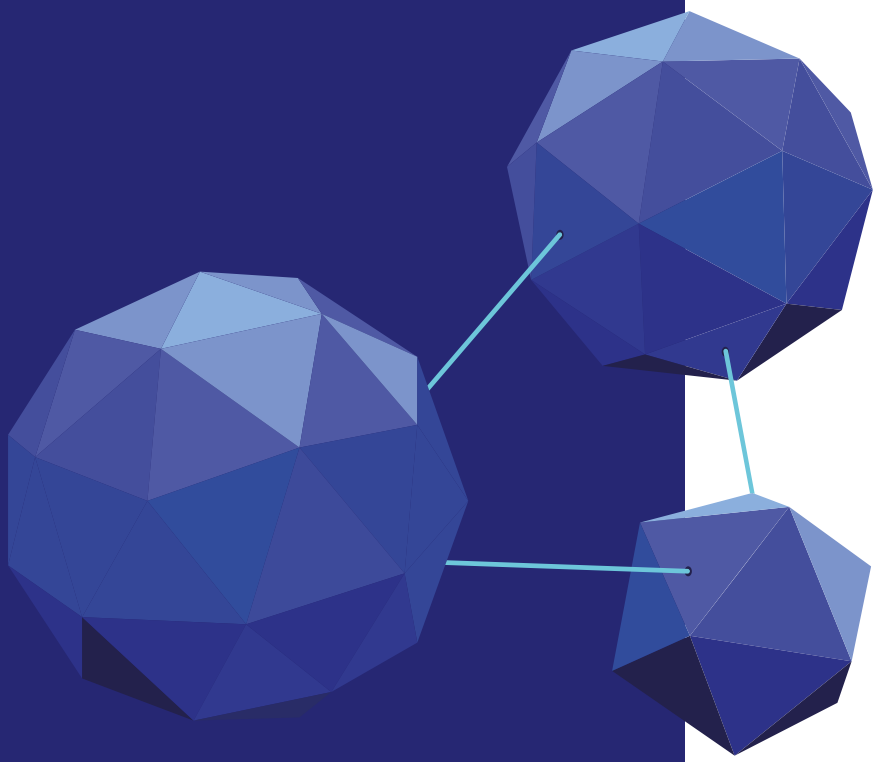
NETWORK MAINTENANCE

IT3 develops throughout its Network and up to the end of its responsibilities, either the distribution boxes where the service is delivered or the optical dispensers in the customer's rooms, Corrective Maintenance and Preventive Maintenance services.

With regard to Corrective Maintenance, the SLA's (Service Level Agreements) that must be taken into account to carry out repairs are determined as well as the procedure for reporting incidents and their processing.

- **Corrective Maintenance**: All those activities related to the resolution, either definitive or palliative, of an incident detected by IT3 or by its clients. If IT3 first detects it and reacts accordingly before the customer detects it, the Corrective Maintenance applied will be "Proactive". In case it is the customer who detects the failure and informs IT3 for resolution, the Corrective Maintenance applied will be "Reactive". In general, all activities in this group may be proactive or reactive, depending on the actor identifying the incident.
- **Preventive Maintenance:** All those activities that are applied to prevent incidents. In other words, activities that are focused on preventing a network incident. With the idea that customers are always warned of any Preventive Maintenance activity that IT3 may carry out, whenever there is a risk of incidents that may affect the service, before any operations are done a notification will be sent, in the form of Scheduled Work, in which the affected customer or customers will specify the most suitable moment to carry these operations out.

Instituto de Astrofísica de Canarias



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Telescopes
Electronics
Optics
Mechanics
Software
Cryogenics
Sky Law
Industry
Innovation
Computing
Medical technology
Quantum communication
Observatories
Astrophysics and Astronomy
Technology and innovation

The entity

Instituto de Astrofísica de Canarias (IAC)

The Instituto de Astrofísica de Canarias (IAC) [Institute of Astrophysics of the Canary Islands], certified by the Spanish Government as a "Severo Ochoa Centre of Excellence", is a Spanish public research organisation that manages two of the best international observatories in the world. Administratively, it is a Public Consortium, made up of the General Administration of the Spanish State, the Public Administration of the Autonomous Community of the Canary Islands, the University of La Laguna (ULL) and the Spanish National Research Council (CSIC).

The Instituto de Astrofísica de Canarias provides the following technological support services abroad, not only in relation to the development of astrophysical instrumentation for earth and space, but also within the framework of other scientific, technological and industrial disciplines such as medicine, telecommunications, environment, security, and any others that may benefit from the capabilities and means of the IAC.

MISSION

To carry out and promote any type of astrophysical or related research, as well as to develop and transfer its technology; to disseminate astronomical knowledge, to collaborate in the specialised university teaching of astronomy and astrophysics and to educate and train scientific and technical personnel in all fields related to astrophysics; to administer the existing astronomical centres, observatories and facilities and those that may be created or incorporated into its administration in the future, as well as the outbuildings at its service; and to foster relationships with the national and international scientific community.

VISION

International leadership in astrophysics, achieving excellent scientific and technological results, boosting the Canary Islands Observatories as an "astronomical reserve", attracting top-level research infrastructures, becoming a leading centre in Europe for the training of research and technical personnel and transferring knowledge among scientific communities.

Areas and departments

Instrumentation (Technological development)

The IAC's Instrumentation Area provides technological support to the centre by preparing and executing research and technological development projects, in order to fulfil its objectives. It brings together an important team of engineering and technical staff, and suitable facilities, which enable the IAC to undertake scientific instrumentation development projects and compete internationally with the best in the sector. Its experience and capabilities are focused on optomechanical design and integration, cryogenics and vacuum, precision mechanics, adaptive optics, fibre optics, optical systems design, digital electronics, detector characterisation, software development and control systems. All this allows the IAC to be a key player in large instrumentation and data analysis projects for observational astrophysics from the ground, such as GTC, E-ELT, EST, NRT, CTA, or from space, such as Planck, Solar Orbiter, PLATO, Euclid, OSIRIS-Rex, etc.

The IAC develops many of the cutting-edge instruments required for its astrophysics research activities. So, it has acquired over time an outstanding level in the most relevant technologies and areas of knowledge in the development of scientific instrumentation. These technical capabilities, in an interdisciplinary environment, are coordinated and optimised through project management.

In addition to a Secretariat and a Coordinator, the Instrumentation Department has human and material resources structured in two groups: Engineering and Production. The engineering group is divided into five departments: Electronics, Mechanics, Software, Optics and Projects.

Services

Design, development and verification of optical systems

IAC engineering has the capacity for the complete development of optical systems and components in all their stages: design, manufacturing, monitoring, integration and final verification.

Design, development and manufacture of electronic systems

Within its capacity for the construction of scientific instrumentation, the IAC has extensive experience in the design and development of electronic systems in general and especially for astronomical instruments and devices.

Design and development of control systems and computer applications

The progress and complexity of instrumentation control systems and their integration with the telescopes or infrastructures where they are to be installed requires the development of tailor-made software applications that offer the required functionality to users and communicate with the rest of the systems.

Design, development and manufacture of mechanical and opto-mechanical systems and precision mechanics

The IAC's mechanical engineering team has the experience and know-how to undertake the design, manufacture and assembly of high-precision opto-mechanical structures, mechanisms and systems.

Design, development and verification of optical fibres

Within the optical instrumentation development capabilities, the IAC has extensive knowledge and experience in the design, manufacture and verification of optical fibres and their applications.

Design and development of laser optical communications systems

Since its initial participation in the European Space Agency's Optical Ground Station project, the IAC has been a benchmark in the study and characterisation of optical communications from Earth with artificial satellites.

Detector characterisation

Detectors, despite their widespread and simple use in a multitude of everyday applications, require very precise knowledge for their use in advanced scientific instrumentation.

Design, development and manufacture of cryogenic and vacuum systems

Astronomical observation in the infrared range of the spectrum requires the use of cryogenic systems where high vacuum and very low temperature technologies are combined.

Management of R&D&I projects

The development of large and complex scientific instruments has led the IAC to specialise in project management techniques, a discipline for coordinating the human and economic effort to obtain results within the desired timeframe.

Technical Office for the Protection of the Quality of the Sky (OTPC)

It offers advice on the precepts of the Sky Law (Law 31/1988) and the Regulations that govern it (R.D. 243/1992 of 13 March 1992, modified by R.D. 580/2017 of 12 June) that preserve the astronomical quality of the observatories of the Canary Islands, and issues technical reports required by law for lighting and radioelectric station projects, as well as lamps and light fixtures certificates.

Computing Services

The purpose of the IAC's IT Services is to attend to the IT needs of all areas of the premises, defining IT standards, developing infrastructure improvement projects, studying advances in Information and Communication Technologies and their application at the IAC, guaranteeing the correct functioning of the installed systems and ensuring privacy and IT security and respect

for the IT Code of Conduct. It is made up of the following groups/units reporting to a Technical Manager: Operations and User Service Centre (CAU), Analysis and Development Group (GAD), Systems and Communication Group (GSC) and Secretariat.

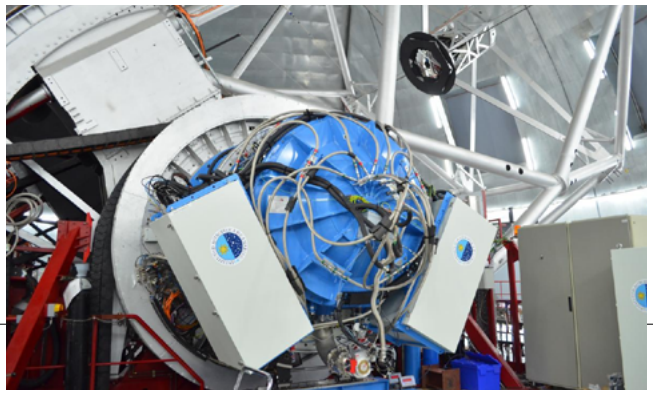
High performance computing

The Canary Islands Digital Innovation Centre, (Centro de Innovación Digital de Canarias) CIDIHUB, is a consortium of organisations and competence centres specialising in business digitisation, providing key infrastructures and resources for the digital transformation of private companies and public entities, operating mainly in the Canary Islands region, although it also collaborates and works with entities from other regions and countries within and outside the European continent. The IAC collaborates in this consortium in the form of high performance computing, providing CIDIHUB with the following facilities: High performance computing infrastructure, the imaging and sensors laboratory, electronics and microelectronics and the High Technology Incubator in Astrophysics and Space, and providing support services for research, testing and validation of products and technology, such as technological advice for technology and digital product development, supply of technological components and integration as part of final digital solutions, demonstration, adaptation and customisation of technologies, access and use of equipment, infrastructures and facilities for research and technological development work, access and use of equipment, infrastructures and facilities for testing and experimentation with digital technologies (software and hardware) and transfer of technological resources for use by other national or European IHLs.

Projects

EMIR

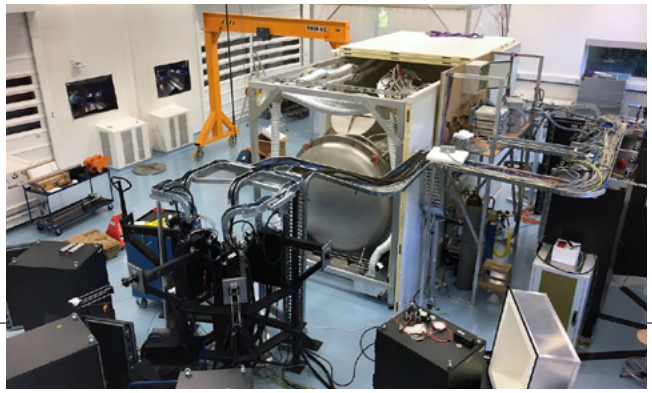
InfraRed Multi-Object Spectrograph



EMIR (Infrared Multi-Object Spectrograph) is a wide-field camera and multi-object spectrograph with intermediate resolution in the near-infrared (NIR) for the GTC telescope, operating at wavelengths between 0.9 and 2.5 um. It is equipped, among others, with three state-of-the-art high-tech subsystems, some of them specially designed for this project: a reconfigurable robotic slit system (CSU) to obtain spectra of around 50 objects simultaneously; scattering elements formed by combining high quality photoresist diffraction gratings and conventional large prisms made of high refractive index material (ZnSe), and the Rockwell HAWAII-2 detector, designed for the near-infrared with a 2048x2048 pixel format, and equipped with a novel control system developed by the project team. EMIR is a second-generation instrument that is installed and operating at the GTC Nasmyth A focus and provides the telescope's user community with new key observing capabilities (imaging, long-slit spectroscopy and multi-object spectroscopy).

EMIR is one of the first multi-object cryogenic spectrographs on a 10 m telescope, so it will be able to observe in the K-band at 2.2 µm. EMIR opens up, for the first time, the study of the nature of galaxies at redshifts beyond z=2 with unprecedented depth and field. For these redshifts, the well-studied visible reference frame of galaxies, in particular the strong Hα line, is shifted into the K-band, enabling key diagnostics of the star formation history of the Universe. EMIR acts as the bridge between the extensive studies at near redshifts carried out in the 1990s on 4m-class telescopes and those above z=6 planned for the near future using the millimetre and far-infrared wavelengths. EMIR also provides a bridge between today's spectroscopic capabilities and those that will become available in the next decade.

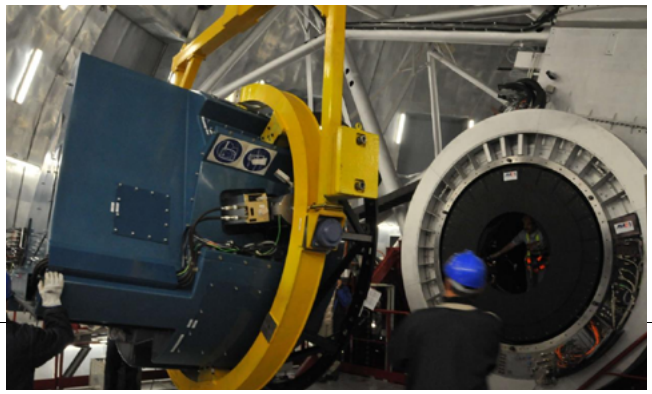
The project is led by the IAC with the participation of the Laboratoire d''Astrophysique - Observatoire Midi-Pyrénées (France), the Universidad Complutense de Madrid and the Laboratoire d''Astrophysique - Observatoire de Marseille (France).



ESPRESSO

InfraRed Multi-Object Spectrograph

At its 67th meeting in October 2007, the ESO STC recommended the development of additional second-generation VLT instruments. Its detailed proposal was endorsed by the ESO Council at its 111th meeting in December 2007. Among the recommended instruments, an ultra-stable high-resolution spectrograph for the combined Coudé focus of the VLT emerged as a cornerstone to complete the current set of second-generation VLT instruments. Once the Phase-A study for such an instrument was completed, the development-design phase began, and the instrument was finally installed and tested at the VLT in autumn and winter 2017. The Echelle Spectrograph for Rocky Exoplanet and Stable Spectroscopic Observation, ESPRESSO, is an ultra-stable, high-resolution, fibre-powered spectrograph, which is located at the VLT's combined Coudé laboratory (LCC) and can be operated with one or up to 4 ESO VLT telescope units (TUs), to be the first instrument capable of using an equivalent 16 m telescope. ESO has defined the main science cases for the ESPRESSO instrument. They are: 1. to measure high-precision radial velocities to search for rocky planets 2. to measure the variation of physical constants 3. to analyse the chemical composition of stars in nearby galaxies. The ESPRESSO instrument has been offered to the scientific community for observations since October 2018.



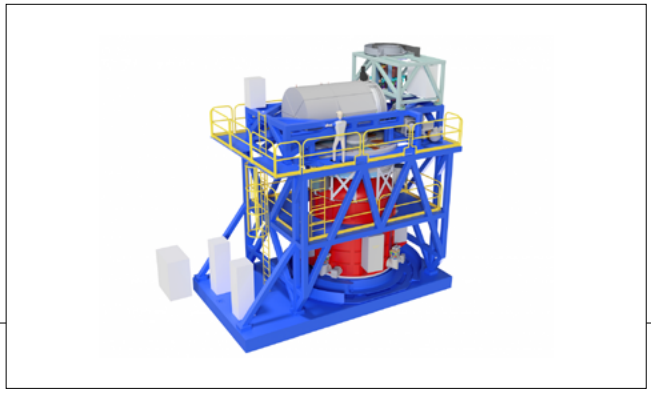
OSIRIS

Optical System for Imaging low Resolution Integrated Spectroscopy

OSIRIS is the Day One visible range instrument for the 10.4 m telescope, Gran Telescopio Canarias (GTC), at the Roque de los Muchachos Observatory (ORM) on the island of La Palma. The project was started at the Instituto de Astrofísica de Canarias (IAC) led by its Principal Investigator Jordi Cepa in response to the need to cover, with the 10.4 m telescope, a fundamental field of astronomical research such as visible range photometry. However, as with day-one instruments on large telescopes, the instrument was designed to be multi-purpose and give access to a broad sector of the Spanish and international astronomical community, whose lines of research are framed in the range of 365 to 1000 nm. Based on this concept, OSIRIS was designed to operate in multiple observing modes including imaging mode, spectroscopic modes in low and intermediate resolution and multi-object, as well as fast photometry and spectroscopy modes. Its most outstanding feature is undoubtedly the use of tunable filters or etalons, a type of interferential filter that allows the wavelength to be selected by modifying the width of the interferential cavity. OSIRIS is one of the first instruments with this capability installed on an 8-10 metre class telescope. Another important point is that the project is the result of an important collaboration between the Instituto de Astrofísica de Canarias (IAC) and the Instituto de Astronomía de la Universidad Nacional Autónoma de México (IA-UNAM).

HARMONI

Integral field spectrograph for the Extremely Large Telescope (ELT)



HARMONI is an integral field spectrograph in the visible and near-infrared (0.45 to 2.45 µm), which provides the core spectroscopic capability of the E-ELT, in a spectral resolution range from R(λ/Δλ) ~ 4000 to R ~ 20000. The instrument simultaneously provides spectra of ~32000 (8000) spatial positions arranged in a rectangular field. HARMONI has four spatial scales, allowing the user to optimally configure the instrument for a wide range of scientific programmes (ultra-sensitive, diffraction-limit physical, chemical or kinematic studies of various astrophysical sources). The coarser scale is suitable for viewing limited observations and the finer scale is the Nyquist sampling of the ELT diffraction limit at near-infrared wavelengths. With its range of scales, HARMONI can be easily adapted to different adaptive optics (AO) systems; in fact, it is designed to work with GLAO, LTAO and SCAO, or even without AO at all! HARMONI is conceived as a workhorse instrument, addressing many of the key ELT science cases. It will exploit the scientific niche of the ELT in its early years, from first light. At near-diffraction limited scales, it will capitalise on the D4 sensitivity gain of the E-ELT, providing unprecedented improvements in sensitivity and spatial resolution and transforming the landscape in observational astronomy in the visible and near-infrared. Even observing in limited conditions (or when the AO cannot be used to provide high Strehl ratios), HARMONI will provide impressive gains over the current generation of instruments on the VLT, for example, a gain of ~ 25 in velocity relative to MUSE on the ESO-VLT. HARMONI will have a high complementarity and synergy with ALMA and JWST, with an angular resolution similar to the former and a sensitivity comparable to the latter. HARMONI is an instrument concept already selected for first light and will therefore be available as soon as the ELT becomes operational. The IAC has been actively involved during its conceptual design phases (i.e. Phase-A and delta-A) as part of an International Consortium led by the University of Oxford (PI), and also formed by UKATC-Edinburgh, CRAL-Lyon, ONERA and Centro de Astrobiología (CAB-CSIC). IAC's contribution is approximately 15% of HARMONI's development, mainly focused on its pre-optics and the electronic control of the whole instrument. HARMONI represents a unique scientific opportunity for the Spanish astronomical community, allowing access to the ELT as soon as it becomes operational through guaranteed time. It also allows Spanish technology centres and industry to participate in the development of this advanced instrument.

MIRADAS

Mid-resolution InfRAreD Astronomical Spectrograph

MIRADAS is a multi-object spectrograph with the capacity to observe up to 12 objects thanks to 12 articulated arms equipped with a mirror, like a probe, which patrol a sector within a 5 arcminute circle in the focal plane of the GTC. In addition to the scientific aspects, the IAC's contribution focuses on the development of the instrument's control system, in which other institutions are also involved. MIRADAS follows the GTC standards so that full integration with the telescope is guaranteed. The control system is based on a distributed architecture, according to the GTC component model, developed in C++ and running on different computers using the CORBA middleware. The project consortium is led by the University of Florida (USA) and includes University of Barcelona (UB), Universidad Complutense de Madrid (UCM), Instituto de Astrofísica de Canarias (IAC), Institut de Física d'Altes Energies (IFAE) and Institut d'Estudis Espacials de Catalunya (IEEC, giving technical support to UB). In addition, there are individual researchers from the Universidad Nacional Autónoma de México (UNAM).

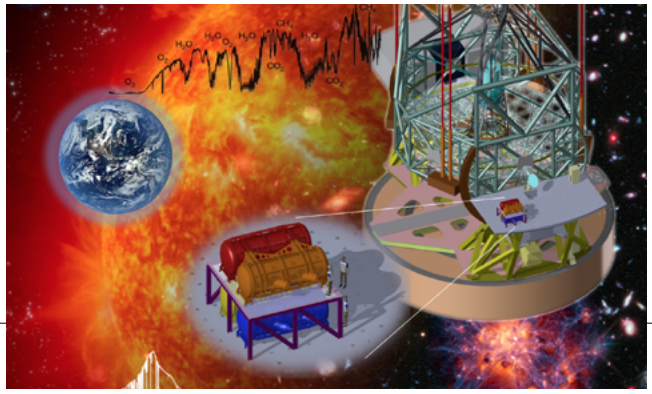
HORuS

High Optical Resolution Spectrograph

HORuS is a high-resolution spectrograph in operation at the 10m Gran Telescopio Canarias (GTC) using components of the UES spectrograph and developed entirely at the IAC. HORuS is a high-resolution Echelle spectrograph with cross-dispersion for observing in the 380-800 nm range with a spectral resolution of approximately 25,000.

HIRES

The High-Resolution Spectrograph



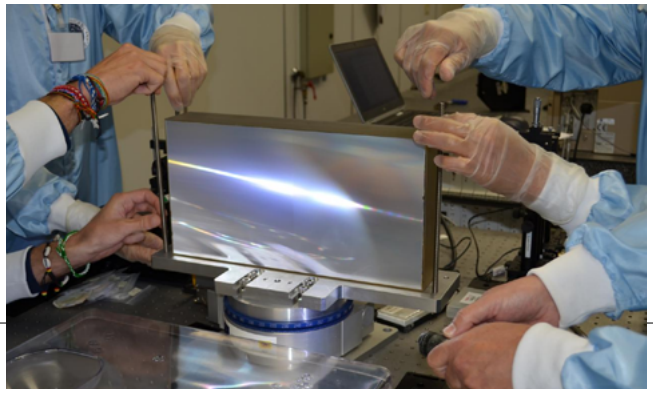
The contract to start the HIRES design studies was signed on 22 March 2016 by ESO. The HIRES consortium is led by the Italian National Institute of Astrophysics (INAF) and is made up of more than 30 institutions. HIRES is currently completing the initial phase of the project known as Phase A.
The proposed HIRES instrument combines high resolution and a wide spectral range with the massive surface area of the ELT to produce data with very little noise or excessive signal. This will allow HIRES to study very faint astronomical objects that require highly sensitive observations.

Its objectives are:

- The study of exoplanet atmospheres as observed in transmission spectra
- The variation of the fundamental physical constants over the evolution of the universe
- The detection of exoplanets from the light they reflect from their stars and the
- The Sandage test, which consists of directly measuring the expansion of the universe by measuring changes in the redshifts of galaxies over several decades.

GREY

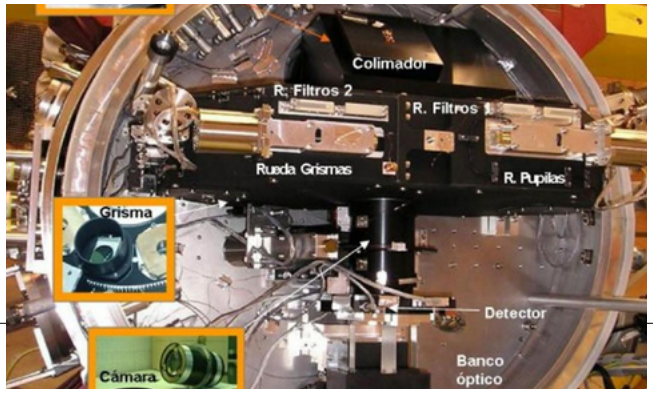
GREGOR Infrared Spectrograph



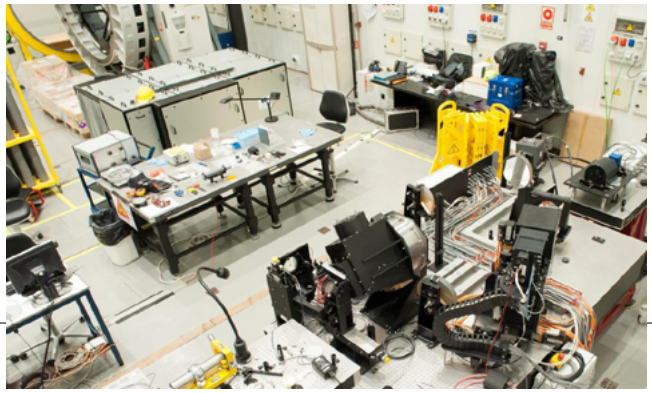
The GRIS spectrograph, installed on the German GREGOR solar telescope at the Teide Observatory, is a key instrument for solar spectropolarimetry on Europe's largest solar telescope. The instrument is under continuous improvement, to extend its scientific capability and to demonstrate technologies for EST.

LIRIS

Long-slit Intermediate Resolution Infrared Spectrograph



LIRIS is a camera and spectrograph for the near-infrared range, which has been built at the Instituto de Astrofísica de Canarias. The modes of operation of LIRIS are: Imaging, spectroscopy, multi-object, coronagraphy and polarimetry. LIRIS has been operating as a common-use instrument at the Cassegrain focus of the William Herschel Telescope (WHT) at the Roque de los Muchachos Observatory since August 2004 and is tackling leading research projects. LIRIS uses a large format detector (Hawaii 1024x1024 pixels) sensitive in the range 0.9 to 2.4 mm, covers the photometric bands J, H and K and provides a field of 4.2'x4.2' (0.25"/pixel). Optical system based on the classical collimator/camera design using grisms as scattering elements to achieve spectral resolutions in the range of 1000 to 3000. The operating conditions of the detector and optics require them to be located inside a tank that guarantees the required cryogenic conditions (e.g. detector temperature 70K). LIRIS is equipped with two cooling systems, a pre-cooling system with liquid nitrogen and a cooling system based on a closed cycle that allows the required temperatures to be lowered. Inside the tank is the slit wheel (60 cm diameter) with 16 positions, which allows slits (0.65", 0.75", 1" and 5" x 4.2'), coronographic masks and multi-slit masks to be placed in the focal plane of the telescope. This wheel is located on the optical bench, the support element of different systems and where the nitrogen tank for pre-cooling is located. On the other side of the optical bench (rear) are located: The collimator which consists of 2 lenses at the entrance, a mirror at 45º and a lens at the exit; the central wheel block made up of 4 wheels: two for filters, which allow a maximum of 22 photometric and line filters to be installed, one for pupils and another with 10 positions for mounting the grisms; and the imaging camera is located on a wheel which allows a reimaging camera for coronography to be fitted in addition to the imaging camera.



GTCAO LGS

Adaptive optics and Laser Guide Star for GTC

GTCAO (GTC Adaptive Optics system) is a post-focus system located on the Nasmyth B platform of the telescope, which corrects the effect of atmospheric turbulence on the light coming from the telescope and feeding the scientific instrument placed below, thus enabling high spatial resolution science to be carried out. GTCAO follows the classical design of an AO (Adaptive Optics) system with the use of two identical off-axis parabolas, maintaining the effective focal length of the telescope. On Day 1, the system will have a single deformable mirror, conjugated to the telescope pupil, and will use natural stars (NGS) for wavefront sensing.

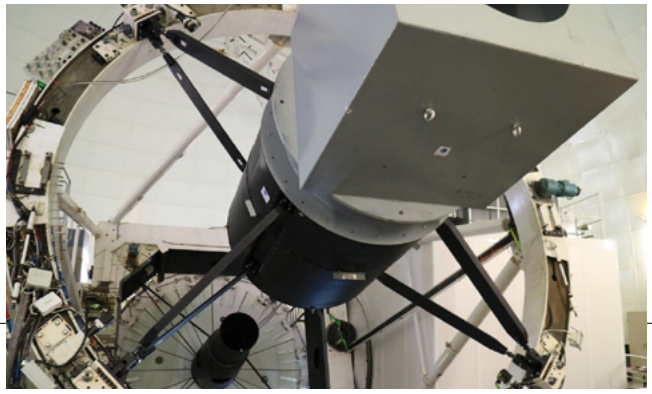
GTCAO will provide a corrected beam that will allow a Strehl ratio of 0.65 in the K-band for bright stars. The size of the transmitted field is 1.5 arcminutes in diameter and the optical design of the system is prepared to include in the future, as an option, an atmospheric dispersion corrector (ADC) that would not degrade the performance of the system down to zenith angles of 60°.

GTCAO uses a Shack-Hartmann wavefront sensor with 20x20 sub-apertures and a deformable mirror with 21x21 actuators. For tip-tilt correction it uses the secondary mirror of the GTC telescope.

The system was conceived from the outset to be upgraded with a laser guide star system to increase sky coverage, and with a multi-guided adaptive optics system to increase the size of the corrected field of view. The upgrade to laser guide star (LGS) is currently under development. The upgrade to multi-conjugate would consist of introducing a second deformable mirror into the optical path of the system, which would be conjugated at an altitude of approximately 10 km.

The first scientific instrument to be used by GTCAO will be FRIDA (inFRared Imager and Dissector for Adaptive optics), an integral-field infrared spectrograph with imaging capabilities.

Note: This project has been co-financed by the European Regional Development Fund (ERDF) within the framework of the Canary Islands Operational Programme 2007-2013, Axis 1, Priority Theme 2, under Resolution no. 364 of 25 November 2014 of the Canary Islands Agency for Research, Innovation and the Information Society (ACIISI), and within the framework of the Canary Islands Operational Programme 2014-2020, "Canarias objetivo de progreso".



WEAVE

WHT Enhanced Area Velocity Explorer

This instrument combines a large field of view of 2 degrees diameter with a large spectral capacity, capable of providing up to 1000 spectra of astronomical objects in a single exposure. It will also have integral field units (IFU) that will be useful for integral field spectroscopy of galaxies. The instrument will offer a resolution of R=5000 between 370 and 950 nanometres wavelength, and a high resolution of R=20000 in two ranges between 410-460 nm and 600-678 nm. This instrument will be crucial for the future of the WHT telescope because it will not only renew the existing instrumentation but also place it at the top of the class of 4-metre diameter telescopes carrying out multi-object spectroscopy inventories. The spectrographs

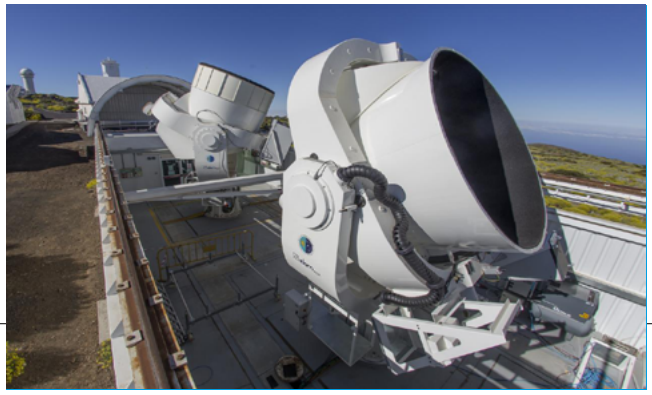
are planned to be located at the Nasmyth focus (GRHIL Laboratory), while the fibre optics will be located at the primary focus of the telescope.

Over a period of five years, WEAVE will produce about 15 million spectra of various astronomical objects. It will provide unique, cutting-edge science in fundamental fields such as the study of the Milky Way, galaxy evolution and cosmology. These data will complement other key European projects such as GAIA and LOFAR.

This instrument is being designed and built by an international consortium involving institutions from Britain, the Netherlands, France, Italy, Mexico and Spain.

QUIJOTE

Q U I JOint Tenerife



The QUIJOTE experiment (Q U I JOint TEnerife) aims to characterise the polarisation of the Cosmic Microwave Background (CMB) and other Galactic and extra-galactic emission processes in the frequency range 10-42 GHz, and on large angular scales (1 degree resolution). The QUIJOTE measurements complement at low frequencies those obtained by the Planck satellite (ESA) and allow us to accurately characterise the polarisation of synchrotron and anomalous microwave emission from our Galaxy.

The experiment consists of two telescopes (QT-1 and QT-2) and three instruments (MFI, TGI and FGI) covering 6 frequency bands. The MFI (Multi-Frequency Instrument) observes in 4 bands (11, 13, 17 and 19GHz), and has been in operation on QT-1 since November 2012. The TGI (Thirty GHz Instrument) and FGI (Forty GHz Instrument) instruments each have 31 receivers, at 30GHz and 42GHz respectively. TGI had its first light with 27 polarimeters in December 2016, and the first FGI detectors had first light in 2018. Currently, both TGI and FGI instruments have been integrated into a single cryostat at the QT-2 focus, in a mixed configuration of 14 30GHz and 15 42GHz receivers.

The TGI and FGI instruments have been designed to achieve the sensitivity necessary to detect a primordial gravitational wave component if it had a tensor-to-scalar ratio of r=0.05. Such a component leaves its imprint on the power spectrum of the FCM polarisation in the form of so-called "B-modes". The detection of such B-modes would open an extraordinary way to elucidate the physics of inflation. To achieve the scientific goals, the QUIJOTE maps for cosmological studies will cover an area of about 3,000 square degrees, and will reach a sensitivity level of 3-4 microK per beam at 11-19GHz, and 1 microK per beam at both 30GHz and 42 GHz. In addition, the experiment provides half-sky maps (20,000 deg2) which are used to model the emission of radio pollutants (synchrotron, free-free and anomalous emission), in the context of the RADIOFOREGROUNDS project: http://www.radioforegrounds.eu.

In parallel, two new instruments are being developed, mostly financed by funds from the scientific-technical infrastructure and equipment plan: a new Multi-Frequency (MFI2), which will replace the current MFI with improved performance; and the TMS (Tenerife Microwave Spectrometer), a microwave spectrograph also in the 10-20 GHz range, complementary to QUIJOTE.

The QUIJOTE project, led by the IAC, has as partners the Instituto de Física de Cantabria (IFCA), the Department of Communications Engineering (DICOM), and the Universities of Manchester and Cambridge in the United Kingdom.

Web: http://www.iac.es/project/cmb/quijote

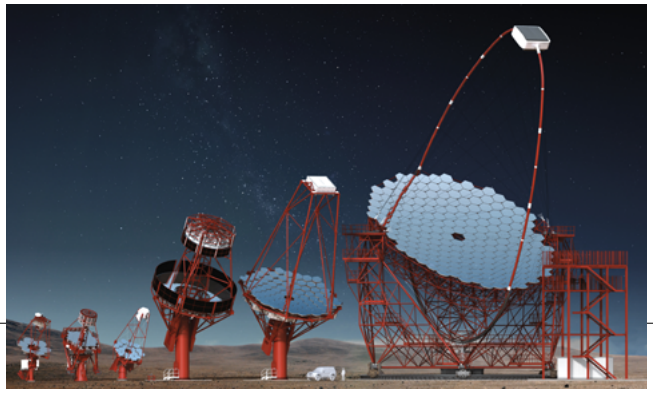
EST

European Solar Telescope

The European Solar Telescope (EST) (http://www.est-east.eu) will be the largest solar telescope ever built in Europe. With a 4.2-metre primary mirror and state-of-the-art technology, it will provide astronomers with a unique tool to understand the Sun and how it shapes space weather. A flagship of European solar physics since 2016 following its inclusion in the ESFRI roadmap, EST is a project led by the Instituto de Astrofísica de Canarias (IAC) and promoted by the European Association of Solar Telescopes (EAST). EAST brings together a community of more than 600 solar physicists from 24 institutions in 18 European countries, with the aim of providing solar astronomers with access to the best high-resolution ground-based observing infrastructures in the world. With a construction cost of approximately 200 million euros, this new telescope represents a major technological challenge in critical areas such as thermal control, adaptive optics and instrumentation. Its construction offers a unique opportunity in terms of technological development, as well as the possibility to create industrial contracts to improve European competence in the design and manufacture of mechanical structures, large format optical elements, high-speed detectors, precision scientific instrumentation or data management systems. There is unanimous agreement on the desired location for the EST: the Canary Islands Observatories. The European projects EST Design Study, SOLARNET, GREST and PRE-EST led by the IAC, together with the recent creation of the EST office, are helping to make this telescope a reality.

CTA

Cherenkov Telescope Array



CTA is a large-scale global project to build a new generation of Cherenkov telescopes dedicated to the study of the very high-energy gamma-ray universe. It will be the largest, most sensitive and advanced instrument ever built for gamma-ray astronomy and the first ground-based observatory of its kind open to the world astronomical and particle physics communities.

The observatory has two sites, each in one hemisphere. In the northern hemisphere, CTA is located at the Roque de los Muchachos Observatory of the Instituto de Astrofísica de Canarias (IAC) on the island of La Palma (Spain). In the southern hemisphere, CTA is located at the Paranal Observatory of the European Southern Observatory (ESO) in the Atacama Desert (Chile).

CTA will host three types of telescopes: Large-Sized Telescopes (LSTs), Medium-Sized Telescopes (MSTs) and Small-Sized Telescopes (SSTs) to cover a wide range of gamma radiation from 20 GeV to 300 teraelectronvolts (TeV). The plan for the northern site includes 4 LSTs and 15 MSTs, while the southern site will have all three types of telescopes: 4 LSTs, 25 MSTs and 70 SSTs. Overall, CTA will have unprecedented accuracy and will be 10 times more sensitive than existing instruments.

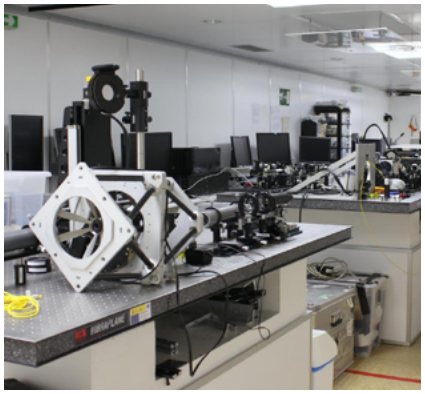
The planning of the construction of the Observatory is managed by CTAO gGmbH, which is governed by the CTA Council consisting of shareholders and associate members from a growing number of countries. CTAO gGmbH works closely with the CTA Consortium, which includes more than 1,400 scientists and engineers from 31 countries involved in the scientific and technical development of CTA. An intergovernmental agreement is being prepared for the construction and subsequent commissioning of the observatory, for which a European Research Infrastructure Consortium (ERIC) is planned.

The construction of CTA will cost a total of more than 200 million euros, of which it is estimated that 90 million euros will be dedicated to the telescopes being installed on La Palma. The CTA-North network, which is expected to be operational in 2024, will have an estimated investment, both in the purchase of goods and services and in the hiring of personnel, of more than 2 million euros per year.

The IAC's actions in the CTA project are funded by the project "The four Large Size Telescopes (LST) of the CTA-North in the ORM" reference ESFRI-2017-IAC-12 of the Ministry of Science, Innovation and Universities, 85% co-financed with European Regional Development Funds (ERDF) of the Operational Programme for Smart Growth 2014-2020, co-funded by the Canary Islands Development Funds (FDCAN), from the Cabildo de La Palma (2016-2018), and funding from the Canary Islands Government, through the Canary Islands Agency for Research, Innovation and the Information Society (ACIISI).

Infrastructure

Optics laboratory

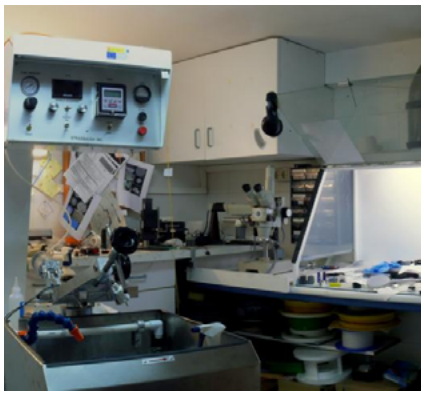


The Optics Laboratory is a class 8, 160 m² cleanroom, in which both temperature and humidity are controlled. These conditions are necessary to guarantee the activities carried out and to enable the perfect conservation of the components and instruments. The laboratory is equipped with specific instrumentation and a wide variety of general-purpose components such as lenses, optical systems, lasers, optical and infrared detectors, filters, light sources, etc. Its main equipment includes the alignment telescope, interferometers, spectroradiometer, spectrophotometer and wavefront sensors. The laboratory is divided into 4 rooms plus an entrance hall: Room A has four optical panels on the same 10-metre-long vibration-isolated bench. This is where the subsystem verification assemblies are carried out. Room B is a class 6 room with a class 5 bench inside. It is the cleanest room in the entire laboratory and is reserved for the assembly of space instrumentation and detectors. Room C is mainly dedicated to fibre optic bundle verification setups. It also houses the spectrophotometer. Room D houses the equipment and set-ups for spectroradiometric and interferometric measurements. The Optics laboratory equipment has been partially financed by ERDF funds.

Optical Coatings Laboratory

The Optical Coatings Laboratory is part of the Department of Optics and is dedicated to the production of thin film deposits on optical surfaces with multiple uses: mirrors, anti-reflective films, interferential filters, etc. The equipment consists mainly of a Balzers BAK 600 evaporator with a built-in electron gun that allows working with high melting temperature materials. It is also equipped with a system of multiple quartz crystals for monitoring the thickness of the deposition. The room occupied by the evaporator within the laboratory is a class 7 cleanroom. In addition, the laboratory has a fume cupboard to prevent inhalation of fumes during cleaning processes.

Fibre optics laboratory



The main objective of the IAC Fibre Optics Laboratory is the preparation, assembly and polishing of optical fibre bundles for application to astronomical instrumentation. Its surface area is about 12 m². The assembly of the bundles is carefully carried out by hand in order to preserve the perfect functionality and characteristics of the fibres. Tools are usually designed to facilitate the assembly, as it is common to work with very thin fibres with cores up to 50 microns in diameter. Bundle assembly consists of joining the fibres at their mechanical interfaces. These interfaces are used for integration into the astronomical instrument or as a tool for further polishing. For this purpose, resin-like adhesives with very slow curing times are used, which are necessary to minimise the stresses on the fibres. To ensure transparency and the preservation of the characteristics of the light entering the fibre, an optical quality polishing of the fibre ends is carried out. To perform this polishing, two polishing machines are available, one metallographic and the other designed for polishing optical elements. The polishing process can vary considerably depending on requirements. Normally and generically, in the initial phase, a fine-grit sandpaper (1,200) is used as an abrasive to eliminate the main defects on the surface to be polished. This is followed by a mechanical polishing process using diamond paste abrasives with different grain sizes up to a size of 0.1 microns. During this process, the flatness and the quality of the optical finish of the fibre faces are frequently checked until the required results are achieved. Finally, the quality of the manufactured bundles is checked in the Optics Laboratory. Their behaviour is checked in terms of optical efficiency, focal ratio degradation and scrambling, both in the near and far field. Part of the equipment of this laboratory has been financed with ERDF funds.

Electronic Design Laboratory

The Electronic Design Laboratory is an 80 m² enclosure conditioned for working with electronic devices and equipment, equipped with a variety of general-purpose measurement and test equipment, and with the usual services in a technological research and development laboratory. In this regard, it has a set of conventional infrastructures, such as floors and tables designed to minimise the accumulation of static electricity, air conditioning, multiple connections to the local computer network, conventional and uninterrupted electricity, access control system by means of a numerical code, etc. At the same time, it is equipped with a set of specific electronic measuring and testing instruments, such as logic analysers, oscilloscopes, signal generators, power supplies, counters, spectral analysers, multimeters, etc. The laboratory is managed by the Electronics Department.

Electromagnetic Compatibility Laboratory

The purpose of the Electromagnetic Compatibility Laboratory is twofold: On the one hand, it allows tests, measurements and experiments to be carried out in total isolation from electromagnetic interference from the outside and, on the other hand, it is able to carry out electromagnetic pre-compliance tests, which consist of the preliminary measurements made on an instrument that must subsequently undergo verification in an official laboratory in order to obtain certification of its electromagnetic compatibility. The laboratory is a prefabricated room with a surface area of 4x4m² and a height of 2.75 metres, with a wide double door and a total width of 1.5 metres. It is lined inside and out with steel sheeting and grounded so that, when the door is closed, electromagnetic radiation inside is attenuated by more than 100 dB compared to its level outside, which means that in practice it does not penetrate. Its design is also known as a "Faraday cage". The laboratory has electromagnetic interference receiving equipment together with a large set of antennas and probes to determine the electromagnetic compatibility characteristics of a given electronic device. It is also equipped with air conditioning, telephone, conventional and uninterruptible power supply, lighting, compressed air and nitrogen gas inlets, antistatic flooring and a panel with electronic connectors to allow connection between devices located inside and outside the room. All these accesses are carefully designed and have the necessary filters to maintain isolation conditions. There is an adjacent 20 m² area equipped with specific workbenches for electronics, where external equipment can be placed to connect with the equipment located inside the room by means of panels with connectors. The laboratory is managed by the Electronics Department. The equipment of this laboratory has been partially financed by ERDF funds.

Electronics Workshop

The aim of the Electronics Workshop is to manufacture and assemble the electronic equipment and systems required for the scientific projects in which the IAC participates. It also provides services to companies and other organisations by developing specific electronic equipment and applications that are not commercially available. For the design of electronic boards and components, the technicians have workstations with specific computer applications for the creation of detailed electronic diagrams, the design of printed circuit boards (PCB) and the preparation of technical documentation. For assembly work, there are four fully equipped workstations with soldering irons, power supplies, multimeters, fume filtration stations, as well as the necessary tools and instrumentation for the construction, assembly, wiring, component assembly and verification of electronic modules. As auxiliary infrastructure, there is a small machining workshop for drilling, cutting, sanding, etc. in the modules and boxes that house the electronic components. Work is also carried out with microcontrollers, automaton programming, circuit inspection, repair and assembly with surface mount technology (SMD).

Astronomy Imaging and Sensors Laboratory

LISA (Laboratory of Imaging-Sensors for Astronomy) is a laboratory of approximately 55 m² dedicated to the characterisation of astronomical detectors under controlled conditions. It has facilities for compressed air, air conditioning, external cooling for high-flow heat exchangers, single and three-phase power, UPS and general-purpose equipment such as microscopes, digital oscilloscopes, control PCs, etc. The laboratory has two work areas, one dedicated to visible wavelength characterisation and the other to infrared, both equipped with all the necessary technical equipment: tables and specific optical components, radiometer, black body, light sources, cryostats, sensors, etc. together with the electronic equipment and software for the control and acquisition of data from the sensors and detectors under study, and the subsequent processing and analysis of the data. The equipment of this laboratory has been partially financed by ERDF funds.

Mechanical Integration and Verification Laboratory

The Mechanical Integration and Verification Laboratory, managed by the Department of Mechanics, provides the basic and specific infrastructures necessary for the assembly, integration and verification of the medium-sized mechanical systems developed in the Instrumentation Area. This laboratory is a 42 m² enclosure conditioned for working with mechanical devices and equipment, equipped with a variety of general-purpose measurement and test equipment, and with the usual services in a research and technological development laboratory. It has air conditioning and compressed air installations, local computer network, three-phase, single-phase and uninterruptible power supply, telephone network, access control system, security systems, etc. It has a set of specific elements for mechanical integration, measurement and verification, such as gauges, cryostats, vacuum pumps, temperature and pressure data acquisition systems, torque meters, sub-micrometric measurement equipment, vibration measurement and analysis equipment, etc. And as auxiliary infrastructure it has multiple mechanical tools, workbenches, shelving, storage trolleys and handling elements.

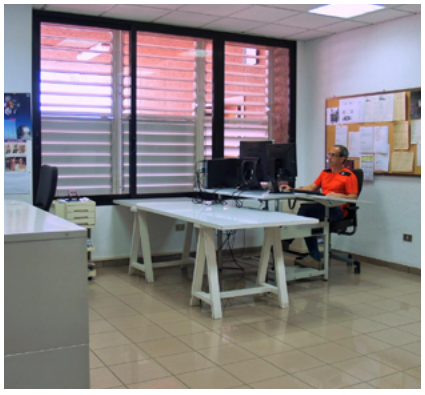
Dimensional Metrology Laboratory

The main purpose of the Dimensional Metrology Laboratory is to check that the manufactured parts meet the required specifications. These checks are normally made on dimension, shape and surface quality. In addition, the laboratory is also used on occasions during the assembly process of optomechanical components where, thanks to the measuring means available in the laboratory, the required assembly accuracy can be guaranteed. The main equipment of the laboratory consists of several highly accurate three-coordinate measuring machines, both contact and non-contact. The laboratory also has a tool presetting machine, roughness meter, standard shims, height gauges, micrometers, centring devices, comparators, callipers, etc., all in an environment where temperature and humidity are controlled and recorded.

CAD/CAE room

This room mainly houses the CAD/CAE systems for design, analysis and calculation of the Department of Mechanics, which due to their peculiar characteristics require specific hardware and software. The equipment consists of workstations on which AutoCAD, Creo Elements/Pro, ANSYS, MathCad and Matlab programmes can be run, and it is air-conditioned and equipped with specific furniture and lighting for the type of work to be carried out. The CAD room is managed by the Department of Mechanics. The equipment of this laboratory has been partially financed by ERDF funds.

Technical Drawing Workshop



The main objectives of the Technical Drawing Workshop are the preparation of technical drawings according to UNE standards, as well as the measurement of parts, sketches, exploded views, assembly drawings, dimensioning, generation of 3D solids and instrument design. The workshop has an area of 87 m² distributed in three areas. The first and most relevant is occupied by the technical staff, where there are three workstations equipped with CAD (mechanical design software) stations and a space for measuring equipment, parts and instruments. A second area is used for plotting, photocopying, cutting and folding plans, as well as printing large-format, high-quality monochrome or colour images. Finally, there is an additional area for archiving and storage.

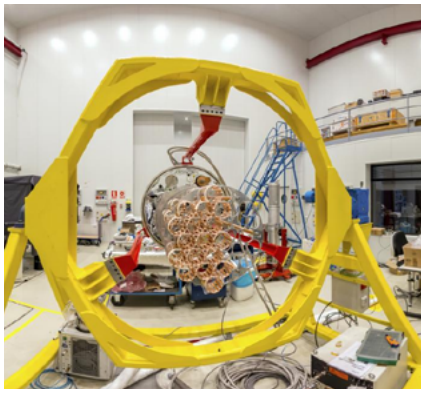
Instrument Maintenance Workshop

The main objective of the Instrument Maintenance Workshop is the maintenance and repair of the IAC's telescopes and scientific instrumentation. To this end, it is equipped with various measuring and testing equipment such as oscilloscopes, spectrum analysers, vacuum pumps, leak detectors, etc. The workshop also has an aluminising facility with the capacity to aluminise mirrors up to 2.5 m in diameter. The complexity of its activities requires highly qualified personnel including technicians with electronics, computer and mechanical training. This capacity is obtained by combining self-training, given by experience and the exchange of information between technicians, with external training that allows constant updating of knowledge in line with the technological advances of the instruments and telescopes.

Mechanics Workshop

The Mechanics Workshop manufactures, verifies and assembles the mechanical parts and components required for the IAC's various instrumental development projects. The staff of the Mechanics Workshop also provides manufacturing and mechanical adjustment support for the telescopes at the Teide Observatory in Tenerife and the Roque de los Muchachos telescope on the island of La Palma. In addition, the workshop can provide services to public and private companies in works related to R+D+i or in those tasks or aspects not easily carried out by companies in the sector. The Mechanical Workshop is prepared for the manufacture of units or medium/short series of parts that normally require high precision. Manufacturing can be carried out in metallic materials, steel, stainless steel, aluminium alloys, bronze... and in a wide variety of plastics depending on the needs. In order to verify that the manufactured parts comply with the specifications, they are measured in the Dimensional Metrology Laboratory, which is equipped with machines and tools with high measuring precision. The workshop has a surface area of 668 m² divided into several areas: machine tool area, where we find machining centres and numerical control lathes, milling machines and conventional lathes; auxiliary machine area, where there is a bending machine, bending machine, endless saw, drills, etc.; painting area, which has a cabin-oven; welding area consisting of TIG, MIG, plasma and oxyacetylene welding machines (with personnel approved for welding steel, stainless steel and aluminium); heat treatment area and shot blasting machine; anodising area and, lastly, an area for storing materials and mechanical components. The equipment of the Mechanics Workshop has been partially financed by ERDF funds.

Large Instrument Assembly, Integration and Verification Room



The Large Instrument Assembly, Integration and Verification Room (AIV) is an infrastructure for common use at the IAC for the assembly and testing of instruments which, due to their size, require large spaces and clean conditions. Internally, this room is divided into three areas: storage, rotators and laboratory, all with a height of 10m. The laboratory area has a surface area of 125 m² and, within it, there is a bench independent from the rest of the building, to avoid external vibrations, which has dimensions of 10x1.2 m² with a rectangle of 2.5x2.3 m² in the centre, and where highly stable optical assemblies can be carried out. The cleanliness level of the room is class 8 and it is temperature and humidity controlled. The rotator area has a surface area of 220.5 m² and has two independent benches of 8x7 m² isolated from the rest of the building. In one of them is installed a simulator of the rotator of the Nasmyth focus of the Gran Telescopio Canarias (GTC). This infrastructure is used to check the correct attachment of the instruments prior to their transfer to the GTC and, above all, to verify that they behave correctly with respect to the rotation that will occur at the telescope during the observation. In other words, there is no undesired bending or misalignment that could affect the quality of the final image obtained. This area, like the laboratory, has a class 8 cleanliness level and its temperature and humidity are controlled. The warehouse area has a surface area of 154.5 m² and in addition to serving as a general-purpose warehouse, it also houses the aluminising plant. All areas are 10m high and are equipped with an 8 tonne overhead crane which allows loads to be moved from one room to another. The floor of the laboratory and rotator areas has a network of interconnected manholes which are also connected to the electrical panels, compressed air intakes, the cooling circuit, telephony and data, so that all these services can be taken to any part of these areas under the floor. There is a three-phase, single-phase and UPS power supply throughout the room, and there is a generator that guarantees the power supply in the event of faults or maintenance outages. The AIV room and part of its equipment has been financed by ERDF funds.

Aluminising plant

The purpose of the aluminising plant is to deposit a thin layer of reflective aluminium on an astronomical mirror. To do this, once the deteriorated layer has been removed, the mirror, without its reflective layer, is introduced into the aluminising chamber where an aluminium evaporation process is carried out under vacuum. The IAC's aluminising plant has the capacity to coat mirrors up to 2.5 m in diameter. The vacuum level required before evaporation is 1x10-5 mbar and for this purpose two mechanical pumps and a diffuser are available, as well as the necessary sensors, valves and other devices. The plant has a PLC-based control system. The mirrors are aluminised once every year or year and a half and the aluminising process, including the initial cleaning of the mirror, takes 2 to 3 days, without taking into account the transfer time to the observatory.

LaPalma Supercomputer

The LaPalma supercomputer is one of the twelve nodes of the Spanish Supercomputing Network (RES) and is part of a system of supercomputers distributed throughout Spain, connected with high-speed networks and designed to offer greater computing capacity to the Spanish scientific community.

The La Palma node is located at the Centro de Astrofísica en La Palma (CALP) in Breña Baja.

Its installation on La Palma is a strategic commitment to support observational activity at the Roque de Los Muchachos Observatory - especially after the incorporation of the Gran Telescopio CANARIAS (GTC) - and also to strengthen the development of telecommunications on the island.

This network is funded by the Ministry of Science, Innovation and Universities and is coordinated from the Barcelona Supercomputing Center-National Supercomputing Centre (BSC- CSN), where the MareNostrum, one of the most powerful computers in Europe, is installed. In fact, the La Palma node is part of the old MareNostrum equipment.

The other nodes of this network are located at the BSC-CNS, the Fundación Pública Galega Centro Tecnológico de Supercomputación de Galicia, the Centro de Supercomputación de Castilla y León, the Consorci de Serveis Universitari de Catalunya, Cénits-COMPUTAEX, and the universities of Cantabria, Málaga, Valencia, Zaragoza and Universidad Autónoma de Madrid. Each of these supercomputers can exchange large amounts of information, distribute tasks and optimise resources at high speed.

TECHNICAL SPECIFICATIONS

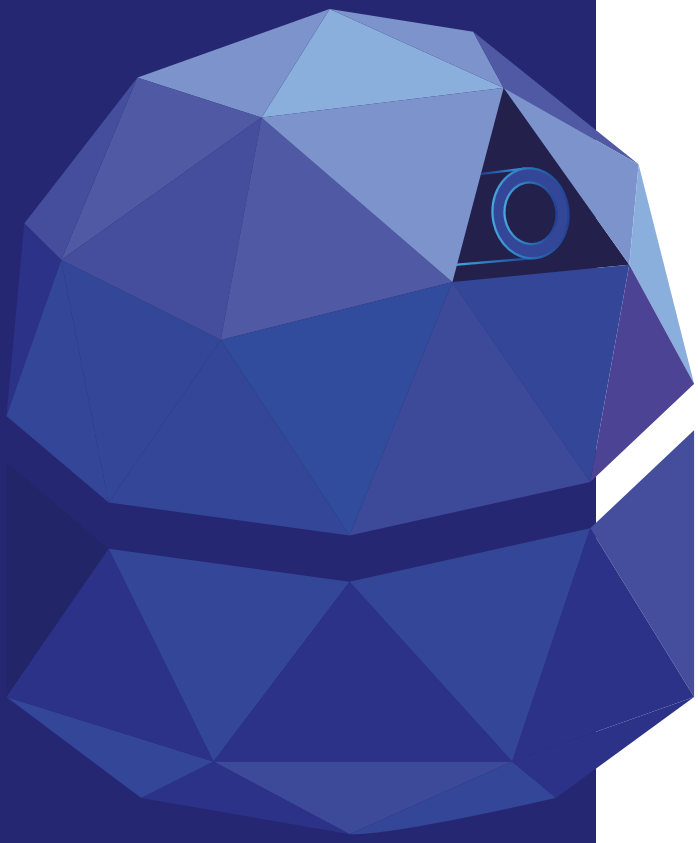
LaPalma has the following characteristics:

- It consists of 252 computing servers
- Each server has 2 x 8-core Intel Xeon SandyBridge 2.6 Ghz processors.
- A total of 4032 cores are available
- Peak performance is 83.85 TFlops
- The total amount of main memory is 8 TB
- A 346 TB parallel file system stores scientific data.

In addition, the supercomputer is connected to the IAC headquarters in Tenerife by submarine cable with a bandwidth of 10 Gigabit/s (Gbps), of which at least 1 Gbps is guaranteed. With La Palma, communications are speeded up and the dense information traffic between the Canary Islands and the mainland is compensated for.

LaPalma's energy consumption is low: it requires only 84 kW of power.

The room housing the supercomputer has a raised floor capable of withstanding a weight of 2,000 kg per square metre. It also has alternative systems to guarantee the power and cooling supply, as well as advanced climate control, security, monitoring and fire protection functions. LaPalma is kept in the room at a temperature of 24 degrees Celsius.



Equipment

Indicative list of equipment to provide outside services

- Logic analyser for FPGAs
- Microwave network analyser
- Special performance oscilloscopes
- Spectrum analysers
- Frequency response analyser
- Control systems analyser
- Logic analysers
- Electromagnetic compatibility (EMC) measurement equipment
- Shielded room
- Climatic chamber
- Precision reference source
- Precision digital multimeters
- FLUKE 5520A and 5320A Calibrators (Calibration Standards)
- Power quality analyser
- Soldering Station and Precision Kit
- IR welding furnace
- HP 3458A, 34401A and 971A Multimeters (Calibration Standards)
- HIBOK 58 Clamp Ammeter (Calibration Standard)
- FLUKE 5500A Coil (Calibration Standard)
- Charging for power supplies
- Several boxes of decades of resistors (Calibration standards)
- Kilovoltmeter HIPOTRONICS KVM-20B
- Optical tables with brackets
- Alignment telescope and accessories
- Optical supports and positioners
- Optical trolleys and rotators
- Wavefront sensor
- Class 100 Bank
- Fibre optic polishing machines
- Spectrometer and accessories
- Fizeau ZIGO interferometer
- Differential interferometer
- VARIAN Spectrophotometer
- Optical table and simulation accessories for adaptive optics
- Rotary and dry primary vacuum pumps (Scroll) up to 30 m3/h
- Turbomolecular pumping systems up to 510 l/s
- 8-channel temperature monitors
- Pirani, Penning and full range pressure sensors (1000 mbar-5x10-9 mbar)
- 1, 2 - Wide range of gauges and 6-channel vacuum sensors and readout units
- ISO-K and ISO-KF vacuum hardware
- Quadrupole mass spectrometer, up to mass 200
- He leak detector, with Sniffer mode
- Open-cycle, closed-cycle and hybrid multi-purpose test cryostats
- Liquid nitrogen tanks up to 500 litres
- Manoregulators for pure gases, N2 and He
- Liquid nitrogen level sensor
- Oxygen level detection sensors
- 127.5 l vacuum degassing furnace
- Thermographic camera
- Wide range of screwdrivers and torque spanners
- Torque meter 0.35Nm
- 1 and 2 column handling tools
- Foldable crane with a load capacity of 1 T
- Numerical control lathe MAZAK QT15
- Numerical control vertical machining centre
- Horizontal Numerical Control Centre MAZAK- H400
- Horizontal Numerical Control Centre MAZAK VTC-300C MKII
- High speed spindle (60.000 rpm) IBAG HFK90S40
- ROGEN US- 417 rotary machining stand
- Tool checking machine
- Autogenous welding machine
- TIG welding machine
- Welding turntable
- Paint booth
- Shot blast cabin
- 3-coordinate measuring machine MITUTOYO F.J.805
- Laser Tracker 3D measurement system
- FARO ORO DIAM²40 6-axis portable measuring machine
- Lighthouse Rail 3 metres long
- Analogue 5-channel sub-micrometric measurement system
- Vibration measuring equipment with 8-channel signal conditioner, with 0.5 to 3 kHz and 1 to 10 kHz accelerometers and impact hammer
- Wide range of internal micrometers
- Wide range of outdoor micrometers
- Photometer
- Durometer
- Roughness meter
- Wide range of calibres
- Wide range of pattern shims
- Wide range of pattern rings
- Wide range of magnetic bases for gauges
- Wide range of dial indicators

Directory

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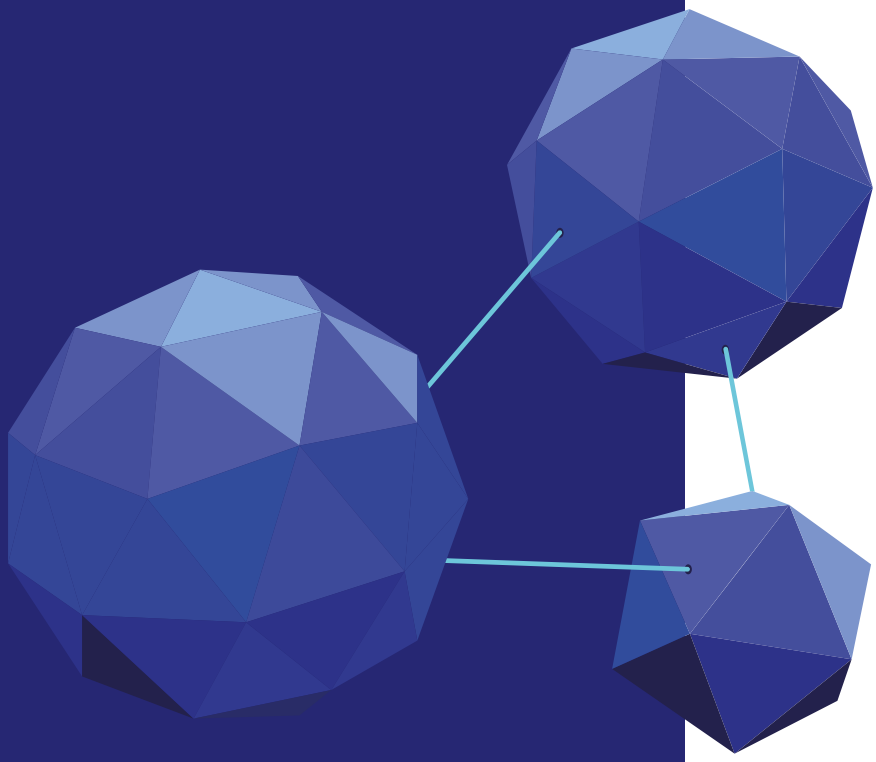
Centro Atlántico del Medicamento

CEAMED



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Key words:

Drug development
Cancer
Bioassays

The entity

Atlantic Medicines Centre - CEAMED

CEAMED is a company founded in 2006 by a group of lecturers from the universities of La Laguna and Las Palmas de Gran Canaria, together with the Fundación del Instituto Canario de Investigación del Cáncer (FICIC). CEAMED S.A. structures its activity in two divisions: CEAMED SERVICIOS and CEAMED NUEVOS FÁRMACOS. The CEAMED SERVICIOS division has two main missions, on the one hand to provide added value to the Canarian biotechnology industry by certifying Aloe vera products, and on the other hand, to act as a CRO for companies in the Canary Islands and the rest of the world. The CEAMED NEW DRUGS division is focused on the identification and development of new anti-tumour drugs for tumours that have no treatment or tumours that are resistant to current treatments.

Areas

Chemistry Area
Anti-tumour drug development (New Drugs Division) and chemical synthesis services (Services Division).

Biology area
In vitro and in vivo biological activity assays (New Drugs Division and Services Division).

Management/administration area
Administration/Quality Management

Services

Aloe vera analysis and certification

Aloe analysis and certification of the composition established by the EU for the quality of products derived from this compound.

Physicochemical and microbial analysis of Aloe Vera with an ISO9001 certificate.

Synthesis of compounds

Multi-step organic synthesis. Isolation and derivatization of natural organic compounds. Design and synthesis of compound libraries. The molecules produced are analysed and characterised in depth by NMR, HPLC-UV and MS, providing the basis to generate Certificate of Analysis.

Modification of chemical compounds

Description and labels: Evaluation and modification of chemical compounds to improve solubility, permeability, high clearance, CYP (P450) enzyme inhibition and hERG inhibition.

Viability and in vitro growth studies

Description and labels: screening of compounds in 40 tumour and non-tumour cell lines. Single point screening, dose/response curves, synergy studies, time-dependent studies and structure/activity studies are analysed.

Acute toxicity studies in vivo and in vitro

Description and labelling of in vitro toxicity studies of compounds in non-tumour cell lines such as Vero cells and human lung fibroblasts and/or primary cultures in human blood-derived white blood cells (PMBC). Likewise, in vivo studies of the action of the compounds are carried out by administering the drug by the usual routes (IP, VO, SC, or IV (in the case of rats) and performing acute single dose studies, multiple dose studies and the delay test.

Mechanism of action studies

Description and labelling essential studies of mechanisms of action in cell culture: Apoptosis.

Cell cycle analysis. ROS (Reactive Oxygen Species) formation and/or specific studies of mechanisms of action by analysing cell signalling pathways using PCR and Western Blot.

Consultancy

Description and labelling full scientific consultancy service for drug development through the analysis of the literature concerning the problem, including scientific information; study of published patents; study of the potential market for a given drug or therapeutic target. Assistance in the preparation of patents. Preparation of plans for pre-clinical studies. Advise on potential business partners. Advise on the most appropriate CROs. Preparing and managing projects for official calls for proposals.

Projects

Fused Quinonic compounds

This is CEAMED's most important patent to date, carried out in collaboration with the universities of La Laguna and Las Palmas de Gran Canaria.

Describes the design, synthesis, and preclinical development of a family of inhibitors of the JAK2/STAT5 pathway in chronic myeloid leukaemia. The lead compound CM-363 has been studied in depth and published in Oncotarget. Download article

CM-363 and other compounds in that family such as CM-652 and CM-670 have been studied in collaboration with the National Institute of Health for applications in other tumour types.

New Amonafide salts

ES 2128193

1-(di-n-propylacetylaminomethyl) cyclohexylacetic acid

ES 2326355

STEMINIB/Project

Research and development of novel transcription factor STAT5 inhibitor compounds for myeloid leukaemia.

STATINIB/Project

Research and development of novel STAT3 transcription factor inhibitor compounds for triple negative breast cancer (TNBC).

IMPACT consortium/ H2020-MSCA- RISE-2014

Pre-clinical development of innovative compounds and new formulations for some cancers (including prostate cancer) and against pathogenic bacteria (e.g. S. aureus).

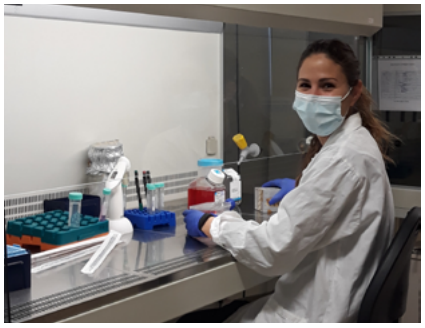
Infrastructure

Chemistry laboratory

Laboratory specialised in the preparation of small molecules. LQUI.

Chemistry laboratory, with two fume hoods, cooker (Memmert), 2 recirculators, Scotsman ice maker, vacuum controller, vacuum pumps, thermal baths, rotary evaporator, chemical synthesis and purification equipment. Also, a freeze dryer, a microwave reactor and a sonicator.

Analytical chemistry equipment



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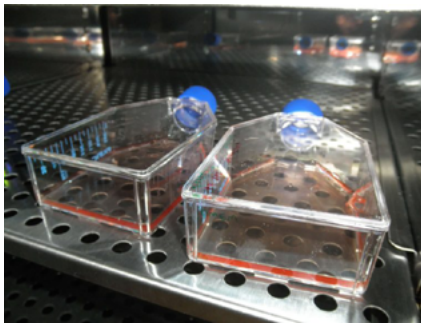
The biology laboratory in section A has an autoclave, Testar laminar flow hood, incubator with orbital shaker, spedry96 biotage, pH meter and equipment for working with microorganisms, refrigerator, -20oC freezer and -80oC freezer. Section B has a Mili-Q (Milipore) water distiller, Ovan bath, equipment for working with DNA and protein gels, orbital shakers, hotplate, two microcentrifuges, DNA-speed/Vac system, Thermo scientific Multiskan GO spectrophotometer.

Culture laboratory



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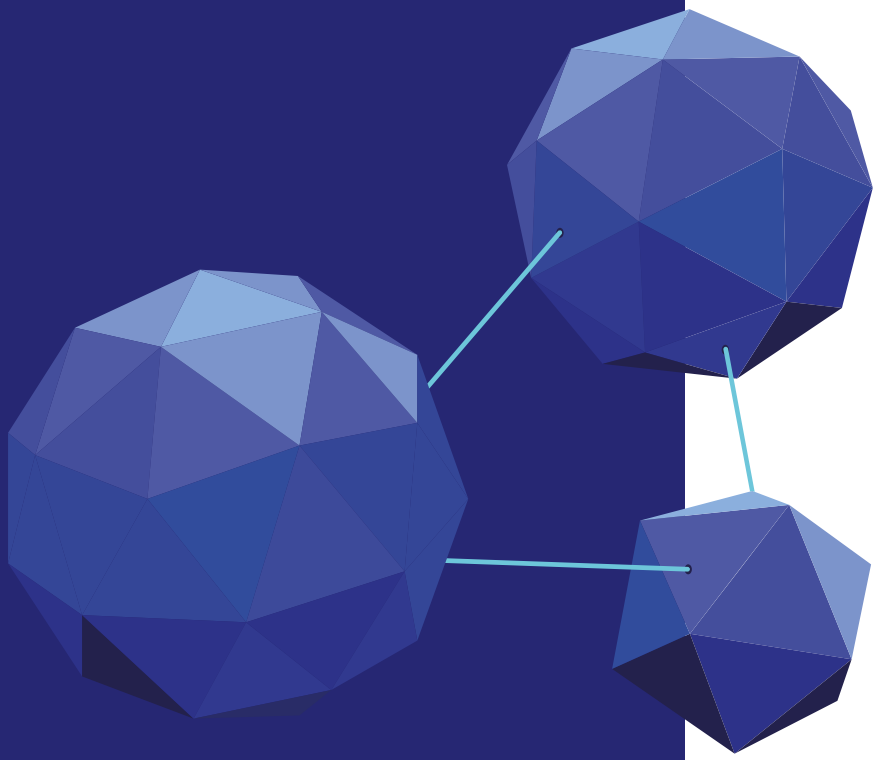
Fundación Canaria del Instituto Canario de Investigación del Cáncer



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Palabras clave

Desarrollo de fármacos
Cáncer
Bioensayos

The entity

Fundación Canaria del Instituto Canario de Investigación del Cáncer - FICIC

The FICIC was established in 2001 first as an Association and then as a Foundation (2004) to provide scientific answers to the specific problems of the Canary Islands regarding the prevention, diagnosis and treatment of cancer. To this end, the following objectives were set:

- To strengthen cancer research throughout the Canary Islands, making the most of and improving the human and material resources available to groups currently researching cancer, and to provide attractive conditions for new groups to join cancer research.
- To unite the forces of basic, clinical, translational and population-based research in a continuous effort to enable the best diagnosis and the highest quality innovative therapies for cancer in the Canary Islands.
- To produce educational resources to improve the level of understanding of the origins, evolution and treatment prospects of cancer in order to conduct effective cancer prevention campaigns in the Canary Islands.
- To develop new sources of wealth in the Canary Islands based on knowledge, with the support for the industry generated by the Canary Islands Foundation (FICIC) for the development of new anti-tumour drugs and for applied genomics.

FICIC has more than 400 member scientists who are organised in several research groups under different disciplines such as:

- New cancer drugs
- Natural products and cancer
- Cancer biology
- Radiobiology
- Tumour pathology
- Cancer epidemiology
- Diagnostic imaging

Areas and departments

R&D&I
Bioassay platform for the search for biological activity (anticancer, antibiotic, antifungal) and labels.

Dissemination
Dissemination as a tool for the prevention of illnesses, both cancer and other common illnesses. So, from the start the Canary Islands against Cancer campaign has been conducted along with other projects with the aim of promoting healthy habits among the population, both teenagers and adults.

Training
Training has occupied a large part of our activities, with different courses being held on a regular basis, including a university master's degree in molecular oncology, a university expert course in molecular oncology, training programmes for researchers and technicians, doctoral courses, a course on the general principles of cancer, as well as conferences for young cancer scientists in the Canary Islands and international conferences. It also organises congresses for young cancer scientists in the Canary Islands and international congresses.

Congresses
Organisation of scientific congresses, congresses of young cancer scientists in the Canary Islands and international congresses.

Services

Evaluation of samples
Evaluation of samples to determine biological activities (anticancer, antibiotic, antifungal) and labels.

Organisation of informative talks
Giving informative talks on healthy habits for disease prevention.

Organisation of training courses

Organisation of congresses

Projects

Biopolis Project

- Objective 1: Establishing stable and specific Macaronesian Cooperation Networks in the field of Biomedicine and Biotechnology.
- Objective 2: Promoting the use of Knowledge in Biomedicine and Biotechnology in Macaronesia.
- Objective 3: Developing the scientific and technological capacity of Macaronesia in terms of research into the therapeutic potential of its biodiversity.

Project Biopharmac

The aim of the BIOPHARMAC project (a follow-up to the successful BIOPOLIS project), was to develop transregional and transnational cooperation networks in the field of Biotechnology and Pharmacology, which promote and facilitate the technological and scientific transfer from research centres and institutes, universities and other R+D+I centres to companies. Thus, it strengthens the research, technology and innovation system of the regions involved, both at regional and international level and contributes to improve the competitiveness of the biotechnology and pharmaceutical industries, in the Macaronesian area.

Algabiomac Project

The transnational research project Algabiomac has discovered the therapeutic potential of micro and macro algae present in the marine habitat of the archipelagos of the Canary Islands, Madeira and Cape Verde as possible new anti-tumour agents, according to the results of field and laboratory activities.

Macbioblue Project

The aim is to develop demonstrative actions that help companies to develop and implement technologies, products and processes in the field of blue biotechnology (algae), with great potential in the region, being common priority areas of the RIS3 and the H2020 programme.

Infrastructure

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Laboratory specialised in the preparation of small molecules. LQUI.

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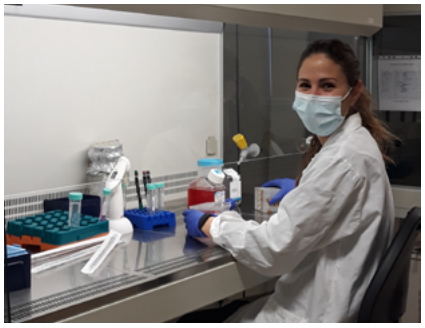

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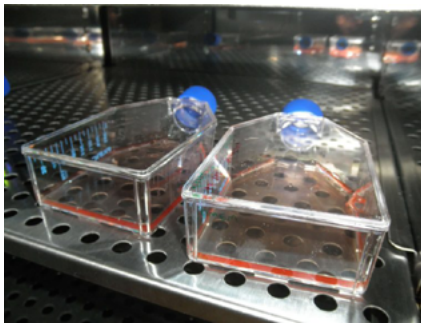

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Directorio

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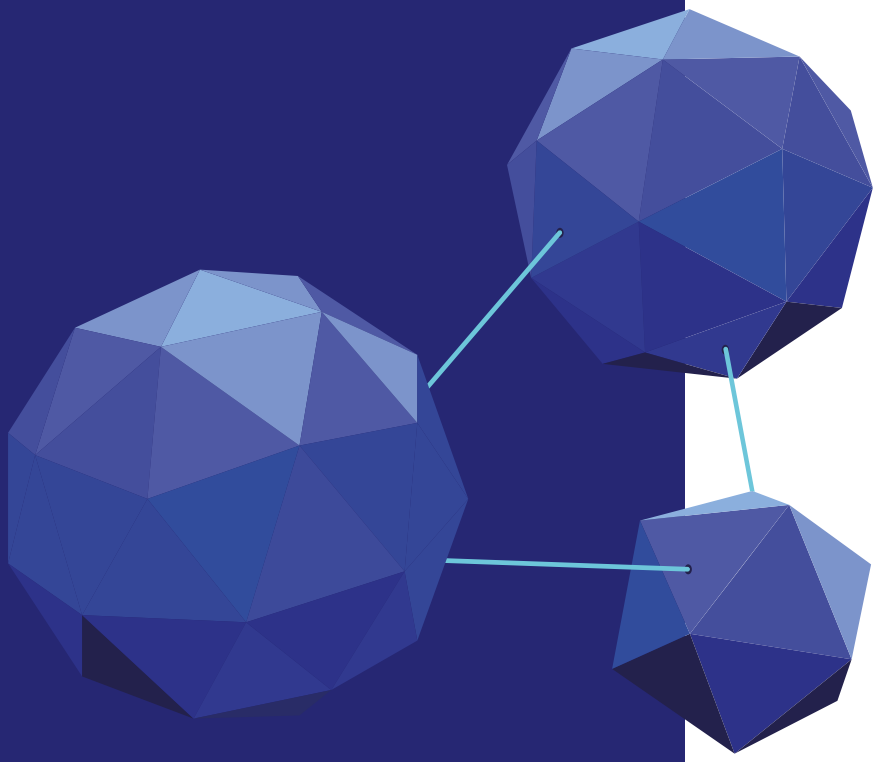
Universidad de La Laguna

Universidad de La Laguna



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www.ull.es

The entity

The University of La Laguna (ULL) is the oldest centre of higher education in the Canary Islands, with more than two hundred years of history. The decree for its foundation dates back to 11 March 1792 and it was signed by King Charles IV. Since that date, it has gone through several names and stages, until it was given its current name in 1913.

Two hundred and twenty-five years after its foundation, the University of La Laguna continues to be a benchmark in the Canary Islands community which, with the Atlantic serving as a bridge, reaches out to the world. Today, this public institution is made up of more than 20,000 people, including students, teaching staff and administration and services personnel. 19,627 students in official undergraduate and postgraduate courses, 1,586 lecturers and 839 members of the Administration and Services Staff.

Its catalogue of degrees includes 45 Bachelor's Degrees, 34 Official Master's Degrees, 18 Doctorate programmes and 16 ULL-specific degrees (2 at undergraduate level and 14 at postgraduate level).

The ULL is undergoing a process of internal renovation in which new information technologies and telematic education, centralised in its Virtual Teaching Unit, will be promoted.

The strategic tri-continental position of the Canary Islands calls on its universities to take on a leadership role in their Atlantic region.

CENTRAL CAMPUS

The Central Campus is located in the modern area of the city centre of San Cristóbal de la Laguna. It is home to the most emblematic building of the ULL, the so-called "Edificio Central", designed in the 1940s by the architect José Enrique Marrero Regalado and completed by Domingo Pisaca y Burgada in 1953. It houses the Paraninfo, the institution's main hall.

For many years, this building housed the faculties of Law, Science and Philosophy and Arts, but the increase in the number of students and the creation of new campuses gradually emptied it of academic activity and, at present, it houses administrative services and some vice-rectorates. This campus is home to:

- Central Building.
- Headquarters of the ULL General Foundation.
- ULL Central Sports Centre.
- San Fernando and Santa María halls of residence.
- Section of Technical Architecture of the Higher Polytechnic School of Engineering.
- Faculty of Education.
- School of Doctoral and Postgraduate Studies.

ANCHIETA CAMPUS

The Anchieta Campus is very well connected, as it is located next to one of the roundabouts at the entrance to the city of San Cristóbal de La Laguna, which also connects the municipalities in the north of the island with the capital, Santa Cruz de Tenerife.

This space brings together the headquarters of the specialities of Sciences and Engineering, as well as some specialities of Health Sciences. Specifically. It houses:

- All sections of the Faculty of Science: Biology, Physics, Mathematics and Chemistry.
- The Faculty of Pharmacy
- The Agricultural Engineering Section of the Higher Polytechnic School of Engineering.
- The School of Engineering and Technology.
- The headquarters of the General Research Support Service (SEGAI).
- la Caixa"- CajaCanarias" Student Services Building

GUAJARA CAMPUS

The Guajara Campus is the largest in extension of the entire ULL, completed in the mid-1980s although it has buildings that were inaugurated in 2014 and still has unbuilt plots of land to house future buildings. It is located near the town centre of San Cristóbal de La Laguna, flanking the TF-5 northern motorway and well connected by buses and trams.

This space houses all the Humanities and Social Sciences studies, as well as one of the most important areas of the institution, the central headquarters of the Library Service, whose extremely valuable antique collection holds specimens dating back to the 16th century. On the campus you can find:

Todas las secciones de Facultad de Humanidades: Bellas Artes, Filología, Filosofía y Geografía e Historia.

- All sections of the Faculty of Humanities: Fine Arts, Philology, Philosophy and Geography and History.
- All sections of the Faculty of Political, Social and Communication Sciences: Political and Social Sciences and Information Sciences.
- Section of Psychology and Speech Therapy of the Faculty of Health Sciences.
- Faculty of Law.
- Faculty of Economics, Business and Tourism.
- Lecture room building
- General and Humanities Library.
- la Caixa"-CajaCanarias" Student Services Building
- Parque de las Islas Residence Hall

OFRA CAMPUS

This campus is located in the vicinity of the Hospital Universitario de Canarias (HUC), where most higher studies related to Health Sciences are located, with the exception of Psychology and Speech Therapy. The relationship with the hospital campus is very fluid since, although the facility is not under the ULL (it

is under the Canary Islands Health Service), it is vital for teaching and research in degrees such as Medicine or Nursing. This campus houses:

- Medical, Nursing and Physiotherapy Sections of the Faculty of Health Sciences.
- Nuestra Señora de Candelaria School of Nursing.

SANTA CRUZ CAMPUS

It is not a campus as such, as it is not structured in several university departments in one single site. However, this name can be used to bring together the different institutional buildings located in the capital of Tenerife. Namely:

- Nautical, Machinery and Naval Radio electronics Section of the Higher Polytechnic School of Engineering.
- Tenerife School of Tourism (affiliated centre).
- Headquarters of the ULL Social Council.

SOUTHERN CAMPUS

Located in Adeje, it is physically situated in an extension of the municipal cultural centre that, for many years, has housed the different Adeje Summer University courses and some specific courses. As a result of this educational relationship, the possibility arose of increasing ULL's educational offer in this southern town with the establishment of a permanent campus, which finally became a reality in 2012.

At the moment, this campus only hosts the bachelor's degree in Tourism taught by the Faculty of Economics, Business and Tourism, but including more disciplines, either at undergraduate or postgraduate level, is under study.

INSTITUTES

- Institute of Medieval and Renaissance Studies
- Andrés Bello Institute of Linguistics
- Institute of Materials and Nanotechnology
- Institute of Biomedical Technologies
- Bioorganic Institute (Instituto Universitario de Bio-Orgánica Antonio González)
- Institute of Tropical Diseases and Healthcare of the Canary Islands
- University Institute of Advanced Studies in Atomic, Molecular and Photonic Physics
- University Institute of Women's Studies
- University Institute for Social Research and Tourism
- Business Institute
- University Institute of Neuroscience

Undergraduate degrees

ARTS AND HUMANITIES

- Philosophy
- History
- History of Art
- Fine Arts
- Conservation and Restoration of Cultural Heritage
- Design
- Spanish: Language and Literature
- Classical Studies
- Applied Francophone Studies
- English Studies

SOCIAL AND LEGAL SCIENCES

- Accounting and Finance
- Law
- Economics
- Geography and Territorial Planning
- Early Childhood Education
- Primary Education
- Pedagogy
- Business Administration and Management
- Journalism
- Labour Relations
- Sociology
- Social Work
- Tourism
- Social and Cultural Anthropology

SCIENCE DEGREES

- Pharmacy
- Nursing
- Physiotherapy
- Speech Therapy
- Medicine
- Psychology
- Human Nutrition and Dietetics

HEALTH SCIENCES DEGREES

- Pharmacy
- Nursing
- Physiotherapy
- Speech Therapy
- Medicine
- Psychology
- Human Nutrition and Dietetics

ENGINEERING AND ARCHITECTURE DEGREES

- Agricultural and Rural Engineering
- Civil Engineering
- Technical Architecture
- Industrial Electronics and Automation Engineering
- Computer Engineering
- Mechanical Engineering
- Industrial Chemical Engineering
- Naval Radio-electronics Engineering
- Nautical and Maritime Transport
- Marine Technologies

Official Masters

ARTS AND HUMANITIES:

- Content-Integrated Learning in Foreign Languages (English)

- Religious Studies: History and Society
- Gender Studies and Equality Policies
- Innovation in Design for the Tourism Sector
- Research in Philosophy
- Theory and History of Art and Cultural Management
- Cultural Heritage Use and Management

SCIENCE:

- Astrophysics
- Terrestrial Biodiversity and Island Conservation
- Marine Biology: Biodiversity and Conservation
- Mathematical Modelling and Research. Statistics and Computation
- Nanoscience and Molecular Nanotechnology
- Chemistry

HEALTH SCIENCES:

- Bioethics and Bio-law
- Biomedicine
- Research and Diagnosis of Tropical Diseases
- Research, Management and Quality in Health Care
- Food Safety and Quality

SOCIAL AND LEGAL SCIENCES:

- Regional Development
- Human Resources Development and Management
- Human Resources Management
- Tourism Management and Planning
- Education and Information and Communication Technologies
- Advanced Pedagogical Studies
- Communicative Innovation in Organisations
- Psycho-pedagogical Intervention in Formal and Non-Formal Educational Contexts
- Family, Social and Community Intervention and Mediation

ENGINEERING AND ARCHITECTURE:

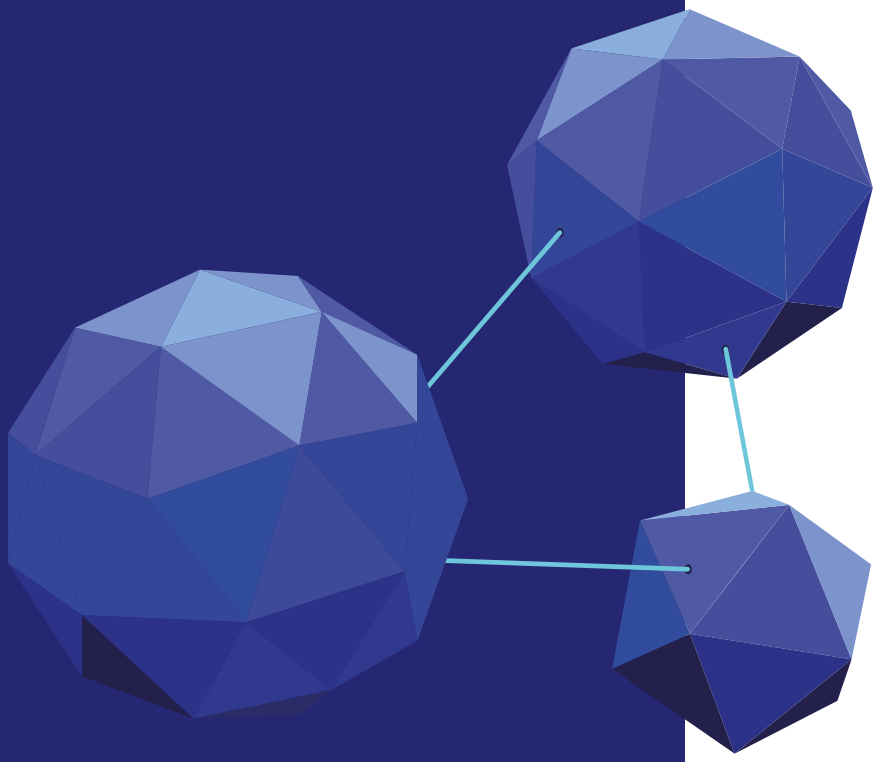
- Cybersecurity and Data Intelligence
- Videogame Development
- Renewable Energies
- Construction Management and Technological Innovation
- Computer Engineering

QUALIFYING COURSES TO PERFORM PROFESSIONAL ACTIVITIES:

- Master in Law
- Master in Teacher Training for Secondary Education, Vocational Training and Language Teaching
- Master in Industrial Engineering
- Master in General Health Psychology

Instituto Universitario de Neurociencia

Instituto Universitario de Neurociencia
Universidad de La Laguna



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Key words:

Neuroscience
Laboratory
Research
Innovation

The entity

The University Institute of Neuroscience (IUNE) emerged from the NEUROCOG project funded in 2010 by the Canary Islands Agency for Research, Innovation and the Information Society (ACIISI), the European Union, and the ULL Campus of Excellence, through a competitive call aimed at identifying and developing major lines of scientific research in the Canary Islands. NEUROCOG involved the launch of competitive R&D projects on cognitive neuroscience and applications to education and health. Also, scientific collaborations between research groups of excellence and the "Neurocog Colloquiums" which programmed regular conferences and seminars by leading local and foreign researchers as a multidisciplinary meeting point. This momentum provided fertile ground to establish a multidisciplinary group of excellent researchers from Psychology, Education, Health, Physiology, and Engineering with the common goal of becoming a leading institute in Cognitive Neuroscience and having a translational impact in the clinical, educational, and technological fields to improve the welfare of society.

+70 PER YEAR
Publications in high-impact magazines

41%
Co/Authoring and international collaborations in publications

73
Researchers

+34
Competitive research projects

85
Graduates

Mission

To promote and carry out top-level cognitive, social, clinical and educational research, offering scientific infrastructures to foster cutting-edge advances in neuroscience, conducting translational research of excellence and internationalisation.

Vision

To be internationally recognised as a leading centre for scientific and technological research and innovation in the field of neurosciences, promoting quality, cutting-edge, multidisciplinary scientific activity.

Environment

Strengthen synergies between basic and applied research to promote cutting-edge research in cognitive neuroscience by designing new avenues of intervention in the fields of health, education and social improvement.

Objetive

To contribute to the welfare of society through the application of knowledge and technology derived from the research developed.

Areas and departments

Research at the IUNE is divided in four areas, each of which includes several research groups. Our projects aim to advance our knowledge of neuroscience in order to improve people's lives. The four areas are complementary and their research groups have fruitful interactions.

Area of cognitive, affective and socio-behavioural neuroscience

It provides functional models of processes (i.e. memory, language, emotion) some of which are implemented in neuroimaging studies under technical supervision in the Area of Neuroimaging and Mental Health.

- Cognitive neuroscience and psycholinguistics
- Cognition, language and inhibition processes
- Memory and cognition
- Reasoning and decision-making
- Social cognition and group and interpersonal relations
- Language: comprehension and production
- Motivation and the brain
- The neural basis of health locus of control
- Emotions and facial expressions

Area of neuroimaging and mental health

The study of cognitive and emotional processes is relevant to the analysis of mental health problems and the study of ageing, brain-damaged patients and neurodegeneration.

- Brain imaging laboratory
- Electrical engineering and bioengineering
- Neurochemistry and neuroimaging
- Basic neuroanatomy
- Virtual environments for psychological treatment
- Health risk factors in the Canary Islands

Area of neuropsychology and developmental neuroscience

The area of neuroimaging and mental health provides synergistic outlets for this area, specifically the analysis of functional and structural connectivity in healthy brains serves as a template for exploring neuropathological conditions.

- Neural, epigenetic and psychological factors in development and parenting
- Cell signalling and neurodegenerative diseases
- Applied neuropsychology

Area of education, diversity and learning difficulties

It is intensively influenced by cognitive, affective and socio-behavioural neuroscience (functional models of memory, language or emotion).

- Learning difficulties
- Language difficulties
- Education for diversity and inclusive education
- Gender and decision-making in school contexts

Services

Positioning studies

Studies that allow marketing and communication managers to know how their brand or product is positioned in the consumer's mind compared to the competition.

This service allows companies to know how a brand is perceived, how competitors' brands are perceived and which of these values are most important for the potential consumer. With this information, marketing managers design the strategic communication plan.

- **Sector of application:** Marketing and communication
- **Technique used:** Priming or implicit association.

Advertisement pre-testing

These are studies that provide insight into the effectiveness of an advertising piece.

This service helps advertising agencies or marketing managers to optimise advertising communication during the design process by analysing variables such as visual attention, emotion and recall. It is applicable to advertising agencies and, in general, to any company that carries out advertising campaigns.

- **Sector of application:** Marketing and communication
- **Technique used:** Eye movement recording

Identification of key data

Data collection procedure for research projects, advertising campaigns, monitoring of social networks (trending topics, hashtags, etc.), others.

Data collection can be very diverse, but this service includes the following functions: selecting the appropriate sample, contacting study participants, applying assessment instruments (questionnaires, behavioural tasks...), acquisition of neuroimaging records, and delivery of tabulated data in a database.

- **Sector of application:** Education, advertising, research, communications and health.
- **Technique used:** Depending on the needs of the project, different data acquisition techniques can be used.

Identifying the target / target niche

Designing experiments and simulations to determine target/target niches for a given sector. Programming experiments in free software (Psychopy and Pyton).

This service supports brand and operating system independence; research and validation of hypotheses in controlled environments.

- **Sector of application:** Education, advertising, research, communications, health.
- **Technique used:** Response times, visual or auditory stimuli, EEG, monitoring, brain computer interface (BCI).

Designing and conducting laboratory studies with eye tracking equipment

It offers researchers from different areas with no experience using eye tracking equipment, the chance to carry out experimental studies with this methodology.

It allows teachers/researchers who do not have this type of equipment or do not know how it works to carry out rigorous studies using eye tracking methodology.

- **Sector(s) of application:** Aimed at all teachers or researchers (from different universities) interested in carrying out studies using eye tracking methodology.
- **Technique used:** Eye movement recording.

Data analysis, processing and integration

From raw data, the aim is to obtain relevant information from which to draw conclusions, validate hypotheses or activate processes.

This service assists in the identification of patterns or underlying observables in raw, unprocessed data. Applicable to all domains of measurable knowledge.

- **Techniques used:** Statistics, Machine Learning, Deep Learning, Tensorflow, Convolutional Networks, Long Short-Term Memory.

Transcranial magnetic stimulation treatment

Treatment with transcranial magnetic stimulation to neuro stimulate brain circuits that are malfunctioning.

Brain activity can remain in homeostasis or, as it happens in neuropsychiatric disorders, in an imbalance in functional activity showing hyperactivations or hypoactivations that substantially modify the functional connectivity network associated with a specific clinical symptomatology. With TMS we manage to solve this functional imbalance and restore the homeostatic connectivity of a healthy brain.

- **Sector of application:** Health
- **Technique used:** Transcranial magnetic stimulation.

Treatment with electrical stimulation

Treatment with low-intensity electrical stimulation to neuromodulate abnormal brain circuits.

Brain activity can remain in homeostasis or, as it happens in neuropsychiatric disorders, in an imbalance in functional activity showing hyperactivations or hypoactivations that substantially modify the functional connectivity network associated with a specific clinical symptomatology. With TMS we manage to solve this functional imbalance and restore the homeostatic connectivity of a healthy brain.

- **Sector of application:** Health
- **Technique used:** Direct current electrical stimulation

EMT diagnostics

Diagnosis of neuropsychiatric disorders through a study of the corticospinal pathway.

It studies the pathophysiology of neuropsychiatric disorders, exploring peripheral and central motor pathways, especially in neuromotor diseases. In addition, it can measure the outcome or evolution of treatment, the mechanism of drugs action. It can also perform the functional study of brain connections in normal human neurophysiology to inspect the damage caused to particular muscles after a stroke, multiple sclerosis, motor neuron disease and other injuries or disorders. In addition, it can locate tumours and other lesions to generate preoperative motor maps.

- **Sector of application:** Health
- **Technique used:** Transcranial magnetic stimulation and electromyography, to take measurements of motor threshold, silent period, central motor conduction time.

Magnetic resonance diagnostics

It allows us to assess the anatomical structure of the brain and the functional activity underlying the processing of different cognitive tasks.

Functional and anatomical magnetic resonance image processing.

- **Sector of application:** Health
- **Technique used:** Magnetic resonance imaging

Electroencephalography diagnosis

An electroencephalogram (EEG) is a test that detects electrical activity in the brain using small metal discs (electrodes) attached to the scalp.

An EEG is able to determine changes in brain activity that can be useful for diagnosis and early detection of brain disorders, behavioural problems, personality disorders, neurodegenerative diseases, deafness.

- **Sector of application:** Health
- **Technique used:** Encephalography

Personalised consultancy

This is a personalised advisory and consultancy service in neuroscientific research and clinical intervention.

It provides research or clinical intervention professionals with a personalised advice service specialised in solving the methodological or theoretical problems of other professionals.

- **Sector of application:** Health
- **Technique used:** Personalised consultancy, scientific advice.

Specialised training in neuroscience

Theoretical neuroscience education and practical training in the use of equipment for diagnosis, treatment and research in neuroscience.

The need for training or technical-practical training of health professionals (neurologists, psychologists, psychiatrists...) interested in understanding brain activity associated with neurological or psychiatric disorders, for the development of more precise and effective neurorehabilitation techniques.

- **Sector of application:** Health
- **Technique used:** Neuroscientific teaching

Projects

Improving road safety on the island of Tenerife

Eye tracking and visual saliency

FACT SHEET

- Funding: Ministry of Science and Innovation and Fundación Empresa Universidad de La Laguna.
- Implementation period: 2012-2015

PROJECT SUMMARY

According to the latest report of the Address General de Tráfico (DGT) [Traffic Authority], Santa Cruz de Tenerife is the fourth Spanish province with the highest number of black spots on the road (53), all of which are on the island of Tenerife. An important factor that has a negative influence on the high accident rate on these stretches of road is the poor visibility of the signposting. The main objective of this project is to carry out a detailed study of the visibility of traffic signs in the so-called "black spots", using state-of-the-art technology such as Eye tracking systems and the Neuromorphic Vision Toolkit C++ software. This technology has been used in the latest research on road safety as it allows us to record where the driver is looking at all times and to carry out a physical analysis of the traffic signs and their surroundings. This way, we can find out, on the one hand, whether drivers pay attention to traffic signs when driving on stretches classified as dangerous by the DGT and, on the other hand, whether the signs meet the necessary physical conditions to attract the driver's attention to their surroundings. With this valuable information, the aim is to detect which are the main signalling problems and what modifications to the signs or their surroundings would improve their visibility in order to reduce the accident rate on these stretches of road.

Furthermore, this project aims to be the first step in the creation of a Technology Based Company (TBC) that will apply this modern research equipment, not only to road safety studies on other islands, but also in other fields where they would be clearly useful such as marketing and advertising, web design and usability, ergonomics, etc. In fact, this research group of the University of La Laguna has just signed two collaboration agreements with marketing companies.

Medusa Project

Master in Diversity and Social Inclusion Education

FACT SHEET

- Entities involved: Universitatea Lucian Blaga - Universita Telematica Internazionaleuninettuno Uniwersytet Lodzki - EVM Project
- Implementation period: 2019-2022

PROJECT SUMMARY

This Strategic Partnership (SP) proposes the creation of a flexible learning pathway in line with the needs of students and social organisations to meet diversity and social inclusion. It will provide a joint programme of Higher Education and vocational training modules to prepare young people, providing higher education institutions with innovation, expertise and added value.

Boosting the recruitment of highly skilled staff requires initiatives that address training to make the education sector attractive and capable of transforming both academic knowledge and the high-level core and cross-sector competences needed to be useful and applicable. This is why this Strategic Partnership proposes creating a flexible learning pathway in line with the needs of learners and social organisations to meet diversity and social inclusion issues and solutions for EU citizens. It will provide a joint programme of study modules in Higher Education and Vocational Education. Training that will capitalise the Education sector with skilled young people, providing Higher Education Institutions with innovation, expertise and added value. MEDUSA arises from a Strategic Partnership comprised by four entities from three countries (Spain, Italy and Romania) that are very concerned about social inclusion and diversity issues: three universities and one SME.

The aim is to offer an International Master in Education in Diversity and Social Inclusion, which will offer a curriculum tailored to equip the young generation with the specific, core and transversal competences currently required in the Education sector. This international Master will provide students with opportunities to acquire additional skills through online study and training.

Brain Solutions

Applied Neuroscience Transfer Unit

FACT SHEET

- Funded by the Programme for the Promotion of Knowledge and Technology Transfer 2016-2020. Agustín de Betancourt Programme
- Implementation period: 2016-2020

PROJECT SUMMARY

Brain Solutions aims to offer a non-invasive therapeutic alternative to treat patients with drug-resistant major depression, through an advanced diagnosis based on clinical neuroimaging evidence and personalising the NIBS treatment by adjusting the dose and the brain area intervened for each patient. To evaluate the reduction of clinical symptoms in patients after using non-invasive brain stimulation and a follow-up 3 months later.

It is a therapeutic alternative based on Neuroimaging diagnostic techniques and treatment with non-invasive stimulation that can provide a real and scientifically proven option for patients who do not find relief in conventional methods. Brain stimulation is a non-invasive treatment alternative. It is painless, has no medicine side effects, does not require hospitalisation, does not create dependence, has minimal and temporary side effects, enabling the rehabilitation or reduction of symptoms of various neurological disorders (stroke, Alzheimer's, Parkinson's, Multiple Sclerosis, Fibromyalgia) and psychiatric disorders (Depression, Anxiety, Addictions).

Functional neuromarkers and neuromodulation in autistic spectrum disorder

FACT SHEET

- Acronym: NEFUNTEA
- Funding Entity: Fundación Caja Canarias
- Duration: 3 years

PROJECT SUMMARY

The research was conducted with young adults with autism spectrum disorder (ASD) and used non-invasive brain stimulation techniques (TMS and tDCS) and EEG. The project addresses the neurological study associated with empathy and theory of mind deficits in young adults with ASD, comparing them with a control group of neurotypical participants. The extent to which electrical brain stimulation (tDCS) can influence brain plasticity in ASD and ultimately improve their behaviour in tasks involving empathy and theory of mind has also been tested.

Regarding the first objective, brain electrophysiology techniques (EEG) and non-invasive brain stimulation (NIBS) have been used to obtain neuromarkers of psychosocial and emotional deficits in autism. Two neuromarkers have been assessed using EEG: 1) functional connectivity between anterior and posterior structures; the hypothesis is that autistics have a connectivity deficit that should be assessed from functional connectivity analyses performed at resting state EEG; 2) spectral analysis of EEG to assess the extent to which mu-wave suppression -a marker of mirror neuron activity- is altered in autistics, during the observation of action videos. The third neuromarker was obtained through the combined use of TMS and electromyographic recording. Specifically, it has been assessed how cortico-spinal excitability (recorded as changes in amplitude of the evoked motor potential) is altered when observing painful events. All three of the above neuromarkers could lead to standardised diagnostic tests that could be easily used in clinical contexts. The second aim of the project is to apply neuromodulation on the temporo-parietal junction, a region closely related to theory of mind, which is presumably malfunctioning in autistic individuals. Specifically, transcranial electrical stimulation (tDCS) has been used for 5 20-minute sessions with the anodic electrode on the area of interest. It will be tested whether it improves perspective-taking capacity and functional connectivity.

Hippocampal Substructures in Ageing and Pathology:
A high-resolution magnetic resonance imaging study

FACT SHEET
- Funding Entity: Ministry of Science and Innovation
- Implementation period: 2018-2022

PROJECT SUMMARY
The increase in the proportion of people in the later stages of life can be expected to lead to a corresponding increase in the demand for health systems. For example, it is estimated that by 2050, 30% of the Spanish population will be over 65 years old and there will be 4 million people who are over 80. These shocking figures imply that there will be an increase in the proportion of people with cerebrovascular disorders and in the proportion of people with neurodegenerative disorders such as Parkinson's and Alzheimer's disease. To reduce the potential economic impact of these diseases on healthcare, we need basic neuroscience research, which can improve our understanding of these diseases and the options for treatment and care. The focus of this project is the hippocampus, a brain structure that is considered critical in age-related changes and is also strongly involved in Alzheimer's disease. Our proposal aims to study hippocampal formation with high-resolution MRI techniques in relation to ageing and prodromal Alzheimer's disease. Our hypothesis is that ageing and disease affect only some but not all the substructures of the hippocampal formation. We expect these studies to achieve a high scientific impact in the field of neurodegenerative diseases as well as in the field of basic neuroscience. Given that the various substructures of the hippocampal formation contain different molecular compositions, our results may guide future molecular biology studies, targeting those molecules that are present only in specific areas of the hippocampal formation, and thus contribute to the development of new treatments.

Intervention in Reading Comprehension in Students at Risk
Language Delay (LDR) and Specific Language Disorder (SLD)

FACT SHEET
- Funding: Ministry of Economy and Competitiveness of the Government of Spain.
- Implementation period: 2018-2021

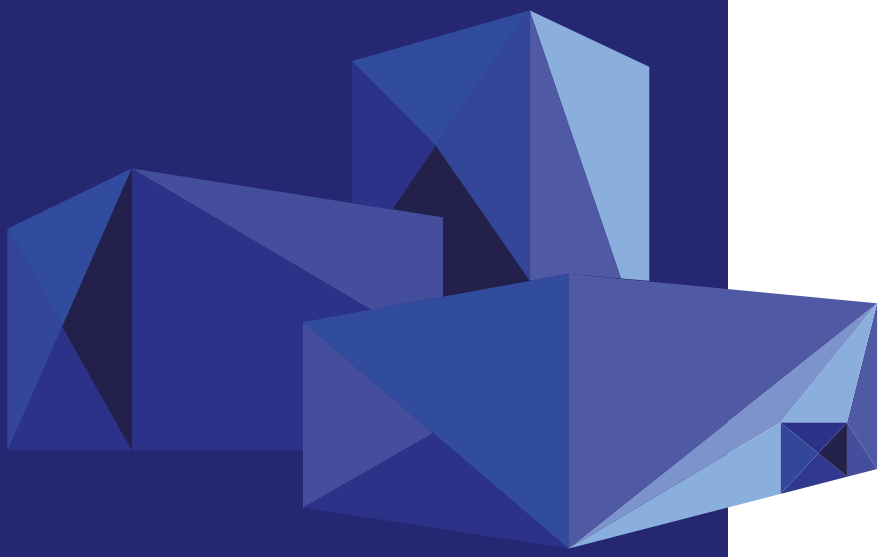
PROJECT SUMMARY
El objetivo del proyecto es doble. En primer lugar, detectar y evaluar un grupo de alumnado escolarizado en el último año de la Educación Infantil, que afronta el aprendizaje de la lectura en evidentes condiciones de riesgo, y que recientemente ha sido etiquetado como Trastorno del Desarrollo del Lenguaje. En segundo lugar, diseñar, desarrollar y evaluar la eficacia de un programa de intervención para mejorar la comprensión lectora. Se parte de la idea de que un niño progresa en el aprendizaje de la lectura, cuando a partir de la automatización de los procesos de decodificación, la comprensión oral se convierte en uno de los focos principales para la comprensión lectora. Los contenidos del programa se sustentan en una adaptación del Modelo de la Cuerda (Scarborough, 2010). Concretamente, se combina el trabajo en el aprendizaje y la automatización de las habilidades de decodificación con la estimulación del lenguaje oral (profundidad léxica, lenguaje figurado, morfosintaxis, habilidades narrativas), funciones ejecutivas, inferencias y memoria de trabajo.

Development of a high-quality scientific and technological advanced prototype for biomedical applications based on near infrared image reconstruction

FACT SHEET
- Acronym: DOTNIR
- Funding: Cabildo de Tenerife
- Entities involved: University of La Laguna and Informática y Equipamiento Médico de Canarias S.A. (Informédica SA).
- Implementation period: 2016-2020

PROJECT SUMMARY
The objective of the DOTNIR project has been to develop a prototype tomograph for in vivo biomedical imaging, based on non-invasive techniques that use near-infrared light to detect specific physiological or pathological characteristics in tissues. This project has been carried out within the framework of the Programa de Transferencia Agustín de Betancourt 2016-2020. The DOTNIR project has had the support and active participation of a multidisciplinary research group within the Neuroimaging Laboratory of the Faculty of Medicine of the University of La Laguna. During the project, research has been conducted on diffuse optical near-infrared spectroscopy techniques; software for image reconstruction has been designed and developed along with the design of parts for testing components and experiments. Project dissemination activities have also been carried out. As a result, programmable modules for monitoring changes in blood oxygenation in living tissue through diffuse

optical channels have been implemented. By structuring several of these modules in an array, the number of optical acquisition channels can be multiplied, making it possible to have spatially localised changes within the scanned tissue and to reconstruct spatially and time-resolved images of tissue function. With the support of the Informédica company, a platform has been implemented to consult and store biomedical images, as well as to monitor products that compete with our development in the market.



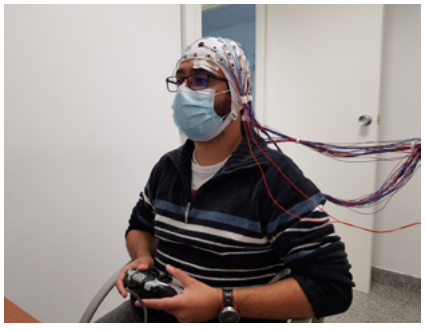
Infrastructure

Laboratory Transcranial Magnetic Stimulation (TMS)

Transcranial magnetic stimulation (TMS) is a non-invasive technique that uses electromagnetic fields to alter brain activity. Initially developed as a diagnostic technique for measuring the excitability and connectivity of nerve tissue, and for mapping brain function, TMS, thanks to its ability to modulate the excitability of brain tissue, appears to have an important role in the treatment of various neuropsychiatric conditions. In recent years, TMS has been proposed as a possible treatment option in those patients with psychiatric and neurological disorders in which the cerebral cortex is clearly involved.

Our ECNI Laboratory is equipped with a Magstim Rapid 2 device with a 70 mm butterfly coil capable of precise stimulation of cortical areas and a Brainsight neuronavigation device.

Electroencephalography Laboratory (EEG)



Electroencephalography (EEG) recording allows measurement of cortical electrical activity associated with the electrochemical processes that characterise communication between neurons. When a group of neurons arranged in the same direction fire together, they generate an electrical current that travels through the brain, skull and scalp to the outside world. When we talk about EEG, we are referring to the graphical representation of voltage changes generated by electrical currents from the surface of the head.

Our EEG lab has two fully functional machines with Neuroscan Synamps2 amplifiers, each installed in a different room. Both machines use elastic Quick-Caps with 70 sensor channels. We use stimulus presentation programs that collect behavioural data; E-prime, Presentation and PsychoPy software. Scan Acquire software is used for EEG recording setup. The data is pre-processed and analysed using toolboxes such as Cartool, Fieldtrip, Brainstorm and scripts made in our premises.

Among the different measures with physiological significance that can be extracted from an EEG recording, Event Related Potentials (ERP) is possibly the best known in cognitive neuroscience. The waveform that results from the average of several stimulus presentations that share some property (i.e. belong to the same experimental condition) presents several visually identifiable features (positive and negative peaks or deflections) that have been associated with more or less specific cognitive processes.

Eye Movement Laboratory (Eye Tracking)

Eye tracking is a device that measures the position and movement of the eyes. It is used in visual system research, psychology, cognitive linguistics and product design.

Eye-tracking data is collected using a remote or head-mounted "eye tracker" connected to a computer. Non-intrusive eye trackers generally include two common components: a light source and a camera. The light source (usually infrared) is directed towards the eye. The camera tracks the reflection of the light source along with visible eye features, such as the pupil.

This data is used to extrapolate eye rotation and gaze direction. The eye tracker also detects additional information, such as blink frequency and changes in pupil diameter.

The IUNE Eye Tracking Laboratory is currently equipped with four SMI systems.

SEGAI - University of La Laguna's General Service for Research Support

The Research Magnetic Resonance Service comprises a wide range of techniques for the magnetic resonance study of the human and animal organism. Functional magnetic resonance neuroimaging techniques, in vitro and in vivo magnetic resonance spectroscopy, transcranial magnetic stimulation and cortical bioelectrical activity are available.

- Functional Magnetic Resonance Imaging (fMRI)
- RIS
- MR Spectroscopy
- MRI
- Dor Navigation

Instituto de Tecnologías Biomédicas

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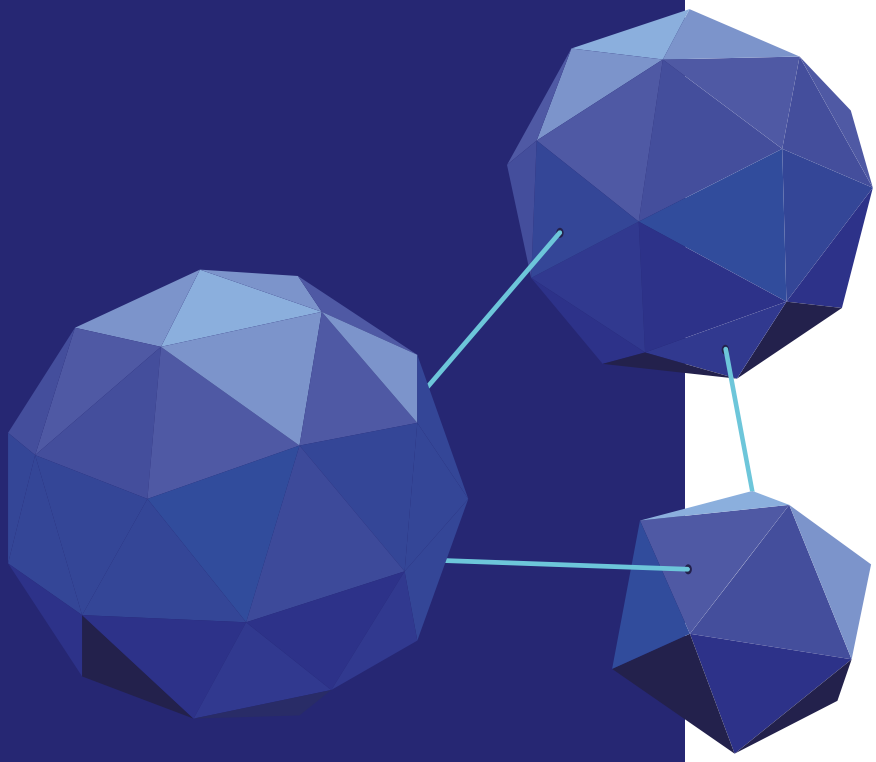
Universidad de La Laguna



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Key words:

Neuroscience
Laboratory
Research
Innovation

The entity

The Institute of Biomedical Technologies ITB aims to develop and promote biomedical research of excellence, with a translational orientation and in relation to the bio-health needs of its social environment. The ITB's mission can be summarised as the combination of interdisciplinary approaches to basic biomedicine, medicinal chemistry and clinical research, aimed at discovering new approaches that enable knowledge and bio-health technology to be conveyed to patients and industry.

From the outset, one of the ITB's structural objectives has been to establish synergies between the different regional institutions involved in bio-health research, with the purpose of consolidating a space for competitive, sustainable biomedical research that aims at excellence in the Canary Islands. To this end, among other initiatives, it has promoted the drawing up of multi-annual strategic plans and the participation, together with other regional research institutes and centres, in national and European public calls to fund joint research projects and acquire large scientific equipment.

Specific objectives

Based on the overall objective of conducting biomedical research of excellence, translationally oriented and focused on regional bio-health needs, ITB's specific objectives are as follows:

- Designing and conducting research projects following the institute's scientific lines by implementing a management system and a research agenda aimed at generating results.
- Taking part in organising and running interdisciplinary master's and doctoral programmes, staff training, courses, seminars, congresses and any other training-related activity.
- Establishing effective procedures to attract high-quality research, technical and management staff, maintaining and improving human resources.
- Establishing cooperative interactions with other research centres.
- Collaborating with the production sector to develop biotechnological applications to specific problems, promoting innovation and the transfer of knowledge and technology.
- Implementing healthcare innovation, based on the results of clinical and epidemiological research. Disseminating the concepts and advances in biomedicine, contributing to build a culture that favours its development.

Areas and departments

Genetic and rare diseases

This programme is defined by the characteristics of the Canary Islands on account of their history and geographical location. The current genome of the Canarian population comes from the North African aboriginal heritage, which together with the European heritage from the 15th century onwards, make up a genome that is unique in the world. In addition, many diseases have a genetic component influenced by the island concept, due to the founder effect and the lack of infrastructures that favoured inbreeding in the past. The research groups participating in this programme are focused on the study of the molecular basis of cancer and rare metabolic diseases. In the case of cancer, the objectives of these groups are to advance prevention, diagnosis, identification of biological causes and development of effective treatments, with the aim of making this serious health issue a chronic disease rather than a fatal disorder. Moreover, although rare diseases affect only a limited population (less than 2,000 individuals in Europe), the number of different diseases is very large (more than 5,000), so that the total number of affected patients could reach more than 30 million in the European Union. In the medium and long term, this programme is aimed at developing personalised medicine and strengthening partnerships with the industry. This area is made up of 7 research groups.

Chronic diseases related to ageing

This programme is devoted to research on the biological basis of major human diseases and the search for new therapies to tackle them. Considering that most of these diseases become dramatically more serious with age and the increase of the ageing population in the European Union, the economic consequences of these diseases are enormous. In addition, most age-related disorders have a complex development and affect different body systems, thus requiring a preventive approach, a global therapeutic approach, and a strict regulation of lifestyle. This area is made up of 5 research groups.

Drug development and identification of therapeutic targets

This programme is aimed at promoting the development of projects focused on the search for new compounds with therapeutic potential, new drug delivery systems and the identification of molecular targets with pharmacological utility. The programme brings together three research teams with complementary approaches and numerous collaborations with groups from the Institute's other three programmes. This area is made up of 3 research groups.

Neurobiology and disorders of the nervous system

This programme includes the research groups that study the biology and pathology of the nervous system, with particular emphasis on neurodegenerative diseases, the molecular and cellular bases of neuronal vulnerability, the development of animal models for the study of the genetic bases of neurodegeneration, and the analysis of global brain function and the biological bases of cognition. At cellular and molecular level, the role of specific membrane proteins (ion channels and transporters) and signalling molecules in different types of excitable cells is studied using electrophysiological, molecular and morphological approaches. An emerging platform in this programme is dedicated to develop new animal models of neurodegenerative diseases. Several lines of research focus on the analysis of the human brain as a whole, using electrophysiological and neuroimaging techniques. Together, this approach guarantees a holistic view of the human nervous system which, once the appropriate scale is reached, will be useful in the search for new therapies for neurodegenerative diseases. This area is made up of 9 research groups.

Products and services

Advanced Imaging and Microscopy Service (SIMA)

The Advanced Imaging and Microscopy Service (SIMA) is part of the services, technological platforms and equipment of the ITB, a multidisciplinary centre dedicated to basic and translational research in Biomedicine and Biotechnology, which includes the activity of teaching and research staff from different areas of knowledge, Departments, University Hospitals and associated units of the University of La Laguna (ULL) and the Canary Islands Health Service.

This service is available to all ITB and ULL researchers, as well as to other institutions, both public and private. For this purpose, before using any equipment, it must be registered in the Service's database. This database is maintained in the Google Scholar environment, according to ULL guidelines.

OBJECTIVE OF THE SERVICE.

The SIMA is managed and staffed by qualified specialist personnel. It also boasts specialised scientific equipment whose objective is to provide, in addition to infrastructure, advice and technical support to users in the use, configuration and performance of experiments on the different microscopes.

The Service provides advanced optical microscopy systems, sample preparation and maintenance service and resources for post-processing of images and data.

SERVICES PROVIDED

Among the applications developed at SIMA we highlight:

- Multi-channel confocal and transmitted light imaging of live cells or fixed samples.
- Conventional fluorescence microscopy.
- Super-resolution microscopy (STED and dSTORM).
- Detecting immunocytochemical labelling by fluorochrome-labelled antibodies in both cell cultures and histological sections.
- Fluorescent in situ hybridisation (FISH).
- Obtaining micro-samples from histological sections by laser microdissection.
- In vivo and real-time analysis of cells using fluorescent markers and/or fusion proteins and derivatives, under controlled temperature and atmospheric conditions.
- Colocalization, internalisation and intracellular trafficking studies.
- Physiological analysis of Ca2+ response.
- Study of protein-protein interactions using the Fluorescence Resonance Energy Transfer (FRET) technique.
- Study of protein transport using the FRAP (Fluorescence Recovery After Photobleaching) technique.
- Determination of fluorescence spectra (Lambda Scan)
- Image processing and quantification with specialised software: LAS x, ImageJ, Fiji.
-

SERVICE FUNCTIONS

- Coordinating the use of the different microscopes of the Service.
- Maintaining the Microscopy Service equipment in good working order, solving technical or procedural problems immediately.
- Advising in and providing technical support in the use of microscopes and image processing software for users.
- Providing mandatory training for self-employed users.
- Carrying out experimental procedures.
- Preparing samples.
- Implementing the necessary service improvements, through continuous training by means of specific courses and gathering information on the latest developments in the field of confocal and super-resolution microscopy.
- Being in permanent communication with equipment suppliers (revision, queries, and repairs).

Advanced Cellular Studies Unit

A confocal or laser scanning microscope scans a specimen sequentially, point-by-point, line-by-line, or multiple points at once, and assembles the pixel information into a single image. This results in optical plane images of the specimen with high contrast and high resolution in the X, Y, and Z axes. Confocal microscopes are suitable adjuncts in highly specialised biomedical research, offering high precision three-dimensional imaging and accurate examination of subcellular structures and dynamic processes. High-speed imaging provides the necessary data for a wide range of integrated analytical techniques. The most common applications of confocal microscopes are immunofluorescence and probe detection, colocalization analysis, 3D reconstructions, time series, photobleaching techniques such as Fluorescence Recovery After Photobleaching (FRAP) or Fluorescence Loss in Photobleaching (FLIP), Fluorescence Resonance Energy Transfer (FRET) techniques or determination of fluorescence spectra (Lambda Scan). The confocal microscope supports applications requiring sensitivity in life sciences, such as surface topographical tasks on material surfaces.

OBJECTIVE OF THE UNIT

The Advanced Optical Microscopy Unit at CIBICAN aims to provide researchers with the necessary equipment and technical support to perform advanced microscopy experiments (epifluorescence, confocal, phase contrast and Normarski, FRAT, FRET,

etc.), both on fixed samples and on living cells. In addition, it also seeks to facilitate the analysis and quantification of microscopy images generated by users.

ADVANCED OPTICAL MICROSCOPY

Equipment and software available:

- Olympus FV1000 Confocal Microscope: (i) Olympus IX81 inverted microscope, with motorised XY stage; (ii) 3 PMTs (photomultiplier detectors); (iii) 1 transmitted light detector; (iv) mercury lamp for fluorescence; (v) incubation chamber with temperature and C02 control for live cell; (vi) Objectives: 10X/0.3 NA, 20X/0.75 NA, 40X/1.30 NA and 60 X/1.35 NA; (vii) fluorescence filters for DAPI, FITC and TRITC; (viii) laser lines: 405 nm laser diode, 458/488/514 nm multiline Argon laser, 543 nm green Helium Neon laser, and 633 nm red Helium Neon laser; (ix) 4096x4096 scanning system; and (x) 4fps scanning speed at 512x512. Acquired through infrastructure project, MCyT 2003, co-financed by the Cabildo de Tenerife.
- Super-resolution stimulated emission depletion (STED) microscopy system coupled to the TCS SP8 microscope: (i) 2 high power (>1.5 W) STED lasers of wavelength 592 nm and 660 nm, for depletion; (ii) optical coupling by ultra-precise optical fibre with "Votex phase filter" and optical polarisation for resolution enhancement, zero PSF optimisation; (iii) rack integrating STED laser, electronic control and optical modulation (AOTF); (iv) integration in the LAS X confocal software; (v) implementation of deconvolution software with algorithms specially dedicated to STED imaging; (vi) deconvolution, visualisation and analysis software package for STED and confocal imaging; (vi) optimised objective for STED applications, PLAN APO 100x/1.40 oil STED White; (vii) 3D STED module; (viii) active anti-vibration table; (ix) active optical table. Purchased under the infrastructure project UNLL15-BE-3217 of the MCyT, co-financed by the Cabildo de Tenerife.
- Leica DM 4000B direct epifluorescence microscope: (i) 5X/0.15 NA, 10X/0.30 NA, 20X/0.5 NA, 40X/0.75 NA and 100X/1.30 NA objectives for oil immersion; (ii) Q-Win and Q-fluoro image analysis software. Acquired by infrastructure project, MCyT 2003, co-financed by the Cabildo de Tenerife.

ELECTRON MICROSCOPY

Consisting of an electron microscope and ultramicrotome, it has been implemented through competitive calls from the MCT and CE-FP7, with co-funding from the Cabildo de Tenerife. Implementation period: 2003-2013. Approximate investment: 293,889 €. Researcher in charge: Eduardo Salido.

ELECTROPHYSIOLOGY AND BIOPHYSICS

Made up of different basic systems for intracellular and extracellular recordings, it has been implemented through competitive calls from the MEC, MCT and MCINN, with co-funding from the Cabildo de Tenerife. Implementation period: 2001-2008. Approximate investment: 506,328 €. Researcher in charge: Teresa Giráldez.

FLOW CYTOMETRY

Formed by 2 flow clithometers MAC SQUANT Analyzer (Miltenic Biotec) and Accuri (Becton Dickson), it has been implemented through competitive calls of the CE-FP7 and Campus de Excelencia (ULL). Implementation period: 2003-2008. Approximate investment: 128,275 €. Researcher in charge: Veronique Smits.

EQUIPMENT AND SOFTWARE AVAILABLE

- Olympus FV1000 Confocal Microscope: (i) Olympus IX81 in-dump microscope, with motorized XY stage; (ii) 3 PMTs (photomultiplier detectors); (iii) 1 transmitted light detector; (iv) mercury lamp for fluorescence; (v) incubation chamber with temperature control and C02 for live cell; (vi) Objectives: 10X/0.3 NA, 20X/0.75 NA, 40X/1.30 NA and 60 X/1.35 NA; (vii) fluorescence filters for DAPI, FITC and TRITC; (viii) laser lines: 405 nm laser diode, 458/488/514 nm multiline Argon laser, 543 nm green Helium Neon laser, and 633 nm red Helium Neon laser; (ix) 4096x4096 scanning system; and (x) 4fps scanning speed at 512x512. Acquired through infrastructure project, MCyT 2003, co-financed by the Cabildo de Tenerife.
- Leica TCS SP8 Confocal Microscope: (i) Inver- (ii) Confocal microscopy
- (ii) 4 detectors: 2 PMT photomultipliers and 2 HyD hybrids (PMT+GaAsP); (iii) 1 transmitted light detector; (iv) metal halide lamp for fluorescence; (v) incubation chamber with temperature control and C02 for live cell; (vi) objectives: 10X/0.40 NA, 20X/0.70 NA, 40X/0.85 NA, 40X/1.30 NA, and 63X/1.40 NA; (vii) fluorescence filters for DAPI, FITC and TRITC; (viii) laser lines: 405 nm laser diode, 458/488/514 nm multiline Argon laser, 561 nm laser diode, and 633 nm red Helium Neon laser; (ix) 8192x8192 high resolution scanning system; (x) 4fps scanning speed at 512x512; and (xi) LAS AF software with modules for FRET and FRAP colocalization, which allows marking sample positions, large image formation from single images, time-lapse experiments, 3D projection and separation with superimposed emission. Purchased under the EU structuring project FP7-REGPOT (IMBRAIN) programme, awarded to ITB in 2012.
- Super-resolution stimulated emission depletion (STED) microscopy system coupled to the TCS SP8 microscope: (i) 2 high power (>1.5 W) STED lasers of wavelength 592 nm and 660 nm, for depletion; (ii) optical coupling by ultra-precise optical fibre with "Votex phase filter" and optical polarisation for resolution enhancement, zero PSF optimisation; (iii) rack integrating STED laser, electronic control and optical modulation (AOTF); (iv) integration in the LAS X confocal software; (v) implementation of deconvolution software with algorithms specially dedicated to STED imaging; (vi) deconvolution, visualisation and analysis software package for STED and confocal imaging; (vi) optimised objective for STED applications, PLAN APO 100x/1.40 oil STED White; (vii) 3D STED module; (viii) active anti-vibration table; (ix) active optical table. Purchased under the infrastructure project UNLL15-BE-3217 of the MCyT, co-financed by the Cabildo de Tenerife.
- Leica DM 4000B direct epifluorescence microscope: (i)

5X/0.15 NA, 10X/0.30 NA, 20X/0.5 NA, 40X/0.75 NA and 100X/1.30 NA objectives for oil immersion; (ii) Q-Win and Q-fluoro image analysis software. Acquired by infrastructure project, MCyT 2003, co-financed by the Cabildo de Tenerife.

Instrumentation and sample preparation service

This service is equipped with centrifuges, ultracentrifuges, gradient forming station, cell and particle counter, microplate readers, microsample spectrophotometer and equipment for the analysis and quantification of proteins and DNA in different preparations.

With the advice and training by the researchers in charge, these resources allow to:

- Perform common procedures in the preparation of samples in any field of Basic and Clinical Biomedical Research: Obtaining, isolating and quality analysis of nucleic acids, lipids and proteins from human, experimental animal, and cell culture samples.
- Separate cells according to their physical characteristics and subcellular localisation of proteins.
- Study protein expression, phosphorylation, interactions and activity using colorimetric, fluorescence and chemiluminescence techniques.
- Cytotoxicity and pharmacological efficacy studies of compounds in pre-clinical phases of research.

Proteomics Service

Proteomics and other mass quantitation omics analyses are fundamental to life research and have reached unprecedented levels of complexity. In order to simplify the reading of complex results, the omics data analysis service has been created within the ITB Proteomics Service. The analyses are carried out on freely available platforms that contain all the necessary tools for statistical analysis, exporting data to other free tools on the internet and even representing the data ready for publication. The basic analyses we can perform include:

- Studies of differential expression and its representation in the form of a volcano.
- Correlation/reproducibility studies, principal component analysis and hierarchical categorisation.
- Category enrichment studies (Gene Ontology) including metabolic pathways; cell signalling; cellular localisation, etc.
- Identification and quantification of post-translational modifications, including studies of phosphorylation motifs and prediction of kinase activation.
- Complex studies including temporal dynamics and identification of expression patterns or population assays using artificial intelligence (learning machine analysis).

SERVICES PROVIDED

- Initial phase: ideally, we prefer to contribute to the experimental design and discuss the methodology of sample processing and instrumental analysis that best suits each case.
- Development phase: we conduct an initial analysis and the data are discussed with the researchers. We define objectives and analysis to be carried out.
- Execution phase: we carry out the in-depth analysis, generate graphs of the results and draw conclusions. There is continuous communication between the researcher(s) and the data analyst throughout the whole process.

Projects

Construction and development of a biomedical research centre in Tenerife

FACT SHEET

- Reference: ADE-210/00046
- Partners: Universidad de La Laguna (ULL), Cabildo de Tenerife, Hospital Universitario de Canarias (HUC), Hospital Universitario Nª Sª de Candelaria (HUNSC), Servicio Canario de la Salud (SCS), with the collaboration of the Fundación Canaria para el Avance de la Biomedicina y la Biotecnologías (Fundación Bioavance, Cabildo de Tenerife).
- Duration: 01/01/2011 - 31/12/2014 and extended until 31/12/2018
- Budget: €8,030,000
- Funding entity and programme: Instituto de Salud Carlos III (ISCIII), Ministry of Science and Innovation – Sub-programme for actions to boost the SNS (National Health System) research and technology: support to develop health research institutes

PROJECT SUMMARY AND OBJECTIVES

The action was aimed at boosting the development of a biomedical research centre in Tenerife, which has now been established as the Institute of Biomedical Technologies (ITB), with the participation of the University of La Laguna (ULL) and the associated University Hospitals. The funding requested was earmarked to finalise the strategic plan, commissioning the project to build the ITB headquarters and building the first phase of the approximately 3,000 m² premises to house the general services, large equipment, and animal facilities. As this is a subsidy in the form of a low-interest repayable loan, its cost is reimbursed by means of a Cabildo de Tenerife grant, in accordance with the agreement signed between the ULL and the Cabildo.

RESULTS

The execution of the project allowed the ITB to consolidate itself as a central structure for research and innovation in biomedicine and health sciences in Tenerife. It is decidedly translational-oriented and capable of integrating excellence research groups from the ULL and its University Hospitals. The specific objective that involved the fundamental investment of the funding obtained resulted in the delivery of the first phase of the building of the Institute. The ULL and the ITB management are currently working with the Cabildo de Tenerife on the design of the second phase of the building and searching for funding for its construction, which will add space for the laboratories of individual groups, attract internationally trained talent and help to advance in its qualitative and quantitative growth in capacities and human resources.

Improving Biomedical Research and Innovation in the Canary Islands

FACT SHEET

- Acronym: IMBRAIN
- Reference: FP7-REGPOT-2012-CT2012-316137
- Partners: Instituto Universitario de Tecnologías Biomédicas (ITB)-Universidad de La Laguna (ULL), Instituto Universitario de Bio-Orgánica (IUBO, ULL), Hospital Universitario de Canarias (HUC, SCS), Hospital Universitario Nª Sª de Candelaria (HUNSC, SCS), Servicio de Evaluación del Servicio Canario de Salud (SCS), Fundación Bioavance (Cabildo de Tenerife).
- Duration: 01/12/2012 - 31/05/2016
- Budget: 4,158,874 €.
- Funding entity and programme: European Commission, Directorate-General for Research and Innovation - 7th Research Framework Programme (FP7) - RTD-REGIONS-REGPOT-GA

PROJECT SUMMARY AND OBJECTIVES

The European Union's Seventh Framework Programme (FP7) for Research and Development launched the Research Potential programme with the aim of strengthening R&D&I capacity in those institutions with potential for excellence located in the EU's convergent and outermost regions, thus promoting their full integration into the European Research Area. In 2012, the University of La Laguna (ULL) developed an ambitious project around the ITB, with the collaboration of the Instituto Universitario de Bio-Orgánica (IUBO) [University Institute of Bio-Organics] and clinical research groups of Tenerife's university hospitals and the support of the Cabildo de Tenerife's Fundación Canaria para el avance de la biomedicine y la biotecnología (BIOAVANCE) [Canary Islands Foundation for the Advancement of Biomedicine and Biotechnology]. It had the following objectives: (i) Exchange of knowledge and experience with European centres of excellence; (ii) Recruitment of researchers with international experience, facilitating the return of regional talent; (iii) Improvement of scientific infrastructures by updating and acquiring advanced equipment; iv) Development of a Strategic Plan for Innovation and Intellectual Property Management, the creation of an effective knowledge and technology transfer capacity, and the extension of the innovation culture in the local and regional environment; v) Dissemination of research activities to society; vi) Independent international evaluation of their research and innovation capacities and quality, and of the impact of the European programme. In this context, the ULL proposed, as an essential mission, to combine its potential in basic biomedicine, medicinal chemistry and clinical research, in order to reinforce the transfer of bio-health knowledge to society and industry. This project obtained the maximum qualification (15/15) and received the full amount requested. It was executed over four years with the results summarised below.

RESULTS

- Exchange of knowledge and experience with European centres: scientific exchanges were established with 17 European centres, increasing collaborative publications and the presentation of joint competitive projects.
- Recruitment of researchers and technicians: 26 people were recruited over 3 years: 12 researchers, 6 technicians, 5 managers and 4 PhD students. To date, almost all of them are employed (8 in the ULL and the rest in other regional, national or foreign institutions or companies).
- Equipment upgrading: various pieces of equipment were upgraded or purchased for a total of approximately €1m, completing several advanced scientific-technical platforms, which are now part of the ITB's scientific infrastructure.
- Development of a strategic plan for innovation and Intellectual Property (IP) management, creating an effective capacity for transfer and extension of the innovation culture (specific guidelines for biomedical researchers).
- Dissemination of research activities and results: In addition to the usual communication in the scientific media through publications and conferences, an active presence was maintained in the written press, radio and television. In particular, thanks to project funds, in 2013 the production of a radio programme (Doble Hélice) was initiated through an agreement between the ULL and Radio Nacional de España in the Canary Islands, dedicated to disseminating the scientific findings of the participating groups, which won two national awards, launched a television version and is currently still active. In addition, around 20 monographic meetings were organised, focused directly on the exchange of results with the scientific community, or the dissemination of activities in the community.
- An independent commission appointed by the European Commission (EC) prepared an evaluation report, which was presented on 17 May 2016 to the project's Steering Committee and formally submitted to the EU.

Biomedical Innovation Platform

NUTRAHLIPIDS GROUP. PHYSIOLOGY OF LIPIDS AND THEIR DERIVATIVES FROM ANIMAL AND HUMAN NUTRITION

To contribute to the development of technology for farming marine and terrestrial species in a sustainable way, through in-depth knowledge of their lipid metabolism and various physiological functions related to nutrition and health. Likewise, the knowledge and analytical technology developed in lipidomics is applied, in collaboration with various members of the ITB, in the field of nutrition and human health..

TITLE OF THE PROJECT:

Demonstration and technology transfer project to help companies develop new products and processes in the field of blue biotechnology in Macaronesia.

FACT SHEET

- PI: Covadonga Rodríguez González
- Acronym: Macbioblue
- Reference: MAC/1.1.b/086
- Partners/participating entities: Instituto Tecnológico de Canarias (ITC); Instituto Canario de Investigaciones Agrarias (ICIA); Fundación Canaria del Instituto Canario de Investigación del Cáncer (FICIC); Universidad de La Laguna (ULL); Universidad de Las Palmas de Gran Canaria (ULPGC); Universidade da Madeira- Fundação Gaspar Frutuoso (UMA-FGC); Universidade dos Açores (UAc); Univ. de Cabo Verde (Departamento de Engenharias e Ciências do Mar) (UNICV); Universidade de Nouakchot (Mauritania) (USTM); Laboratoire d'Electrochimie et des Procédés Membranaires (LAE) Universite Cheikh Anta DIOP (Senegal) (UCAD)
- Implementation period: 01/01/2017 - 30/11/2021 (5 years)
- Budget: ULL subproject 137,234.69 €; total project amount 1,499,699.96 €.
- Funding body: European Regional Development Fund, ERDF

PROJECT SUMMARY

MACBIOBLUE (https://macbioblue.com/) is a cooperation project led by the Canary Islands Technological Institute (ITC) that promotes technology transfer to companies in order to develop and implement novel technologies, products and processes in the field of blue biotechnology based on native species of macro and microalgae. It has great potential in the region, due to its applications in aquaculture, agriculture, pharmacology, cosmetics and human and animal nutrition, common priority areas of the RIS3 and the H2020 programme.

University of La Laguna's NUTRAHLIPIDS Group (https://portalciencia.ull.es/grupos/6273/detalle) is carrying out trials by including upwelling algae that reach the coasts of the Canaries in fish feed. It is studying which products produced by the ITC from native microalgae have potential in the formulation of diets for the larval rearing of marine species for aquaculture.

OBJETIVOS

- Demonstrative action of an algae processing plant to extract bioactive compounds (fucoxanthin), assess the biomass for use as ecological fertiliser and its potential for fish nutrition and other applications (itc; icia; uma).
- Demonstrative action of the production of navicula salinicola to extract fucoxanthin and other applications (ITC; ULPGC).
- Demonstrative action of the technical feasibility of dunaliella salina cultivation on Macaronesian islands and its association with traditional salina. Transfer of native strains of dunaliella sp. to Cape Verde for biotechnological use (itc).
- Bioactivity studies of seaweed extracts (anticancer, antibiotic, antifungal, nematicide, insecticide, anti-aging, antioxidant), their commercial application, isolation and identification of bioactive compounds studied in seaweeds from the Canary Islands, Madeira, Azores, and African countries (FICIC; UMA-FGF; UAC).
- Biocatalysis (digestion of proteins and polysaccharides), characterisation of bioactive peptides from macroalgae biomass and their industrial interest (UAC).
- Demonstrative action to develop new products for feeding aquatic organisms. Evaluation of the antioxidant, bio-stimulant and nutritional capacity of upwelling micro and macroalgae to enrich live prey and the culture of bearded mullet, carp, sole and sea bream (ULL-Nutrahlipids).
- Demonstrative action to develop aquaculture feed products from upwelling microalgae and macroalgae. Effect of fucoxanthin, protein, fatty acids, polysaccharides on the feeding and culture of tilapia and fast-growing species (ULPGC-GIA).
- Demonstrative action to develop new diets in humans and test new and effective nutritional sources from microalgae (ULPGC).

HEALTH TECHNOLOGY ASSESSMENT UNIT (SCS)

- Evaluation of telemedicine-based health services, economic evaluation of health technologies and economic impact of diseases.
- Health technology assessment and study of the effectiveness and efficiency of health technologies, through systematic reviews and cost-effectiveness analyses.
- Shared decision making through the development, evaluation and implementation of shared decision support tools and techniques.

FUNDED PROJECTS

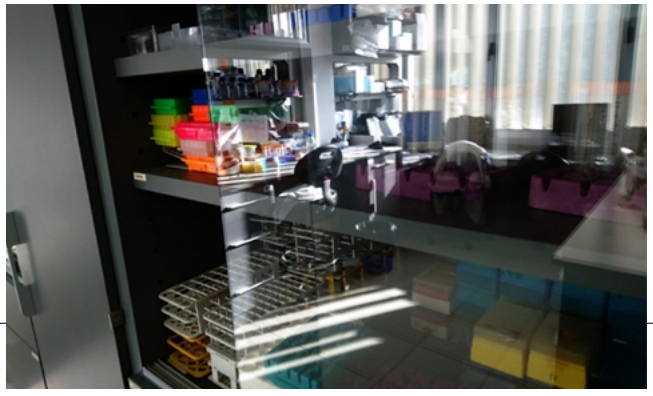
- Effectiveness and cost-effectiveness of complex 5-year ICT-based knowledge transfer interventions to improve health in patients with DM² (INDICA-DOS, PI16/00769). PI: Pedro Serrano. Instituto de Salud Carlos III (2017-2019, €50,215).
- EUnetHTA Joint Action 3. PI: Pedro Serrano. EU Executive Agency for Health and Consumers (2016-2020, €88,000).
- Research Network on Health Services in Chronic Diseases (REDISSEC). PI: Pedro Serrano. Instituto de Salud Carlos III 2017-2020, €240,000).

CANARY FOUNDATION FOR THE ADVANCEMENT OF BIOMEDICINE AND BIOTECHNOLOGY (FUNDACIÓN BIOAVANCE)

The ITB is a specialised organisation of the University of La Laguna focused on translational biomedical research. Given its great potential in innovation and transfer, the Cabildo de Tenerife created the Bioavance Foundation with the mission of assisting the ULL to develop this potential and diversify its activity. The main objectives of the Bioavance Foundation are:

- To promote, encourage and develop research and innovation in biomedicine and biotechnology, as well as their applications, especially with regard to advances in the prevention, diagnosis and treatment of diseases, and from a translational, global and integrative perspective.
- To give support in the management of the projects of the ULL's Institute of Biomedical Technologies (ITB), promoting innovation and transfer, collaborating in the search for funding, and boosting the development of the centre.
- To encourage the interaction of research agents with economic agents to promote the industrial activities of high social value and high added value in the field of Biomedicine.
- To give support for the dissemination of biomedical research.

Post-translational modifications in the control of genomic stability and their role in cancer and other diseases



FACT SHEET

- Acronym: POSTONC
- Reference: PID2019-109222RB-I00
- Funding Entity: Ministry of Science and Innovation
- Organisation: Fundación Canaria Instituto de Investigación Sanitaria de Canarias (FIISC), Hospital Universitario de Canarias, La Laguna, Tenerife
- Principal Investigators: Raimundo Freire and Veronique A.J. Smits
- Duration: June 2020 - May 2023 (3 years)
- Budget: 278,300.00 €.

PROJECT SUMMARY AND OBJECTIVES

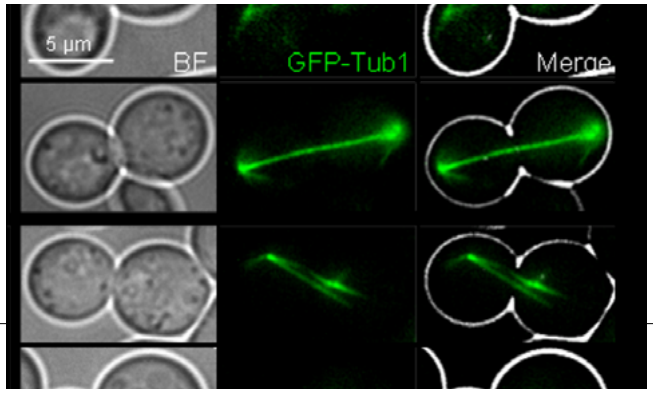
Despite all the efforts in cancer research, the number of new cancer cases in Spain (and worldwide) keeps increasing every year (in Spain more than 270,000 new cases are predicted in 2019, 12% more than in 2015). Moreover, cancer is one of the leading causes of mortality in Spain. In this project, we are

joining forces with two research groups with the aim of improving our knowledge of cancer development and, ultimately, helping to find new cancer treatments. Preliminary data from our two groups demonstrate the role of different enzymes in controlling genome stability by regulating post-translational modifications. Since defects in genome stability maintenance mechanisms have previously been shown to cause carcinogenesis, understanding these genome mechanisms will lead to a better understanding of tumorigenesis and cancer treatment. In particular, our indications suggest that the ubiquitin hydrolase USP29 controls the stability of the methyl transferase Setd8, the histone de-methylase PHF2 is involved in controlling the repair of DNA double-strand breaks (DSBs), the ubiquitin hydrolase ATXN3 is involved in controlling DNA replication and both Cullins and USP7 antagonise each other to regulate ubiquitination and Cyclin F degradation. In addition, there are mutations in ATXN3 and Cyclin F that are pathogenic and lead to neurological syndromes.

Our main goal is therefore to identify new enzymes involved in maintaining genome integrity and to use this knowledge to improve the treatment of cancer and neurodegenerative disorders.

SPECIFIC OBJECTIVES

- To study the regulation of the stability of the Setd8 methyl transferase protein involved in DNA repair and replication by USP29-mediated deubiquitinating.
- To investigate how PHF2 controls DSB repair and R-loop formation, characterising its interactors.
- To examine the role of the ATXN3 wild-type and pathogenic form in the control of DNA replication.
- To define how Cyclin F is controlled by USP7 and Cullin(s) and its implications in amyotrophic lateral sclerosis (ALS) and frontotemporal dementia (FTD).
- To analyse the involvement of RNA helicases in DSB repair, DNA replication and R-loop-induced DNA damage.



Characterisation of DNA break signalling and repair at telophase and anaphase bridges.

FACT SHEET

- Acronym: ADNROTOTHELOPHASE
- PI: Félix M. Machín Concepción
- Reference: BFU2017-83954-R
- Partners: Fundación Canaria Instituto de Investigación Sanitaria de Canarias (FIISC) and the University of La Laguna (ULL).
- Duration: 01/01/2018 - 31/12/2021
- Budget: 170,610.00 €
- Funding: Individual Challenges 2017. State R&D&I programme oriented towards the challenges of society.

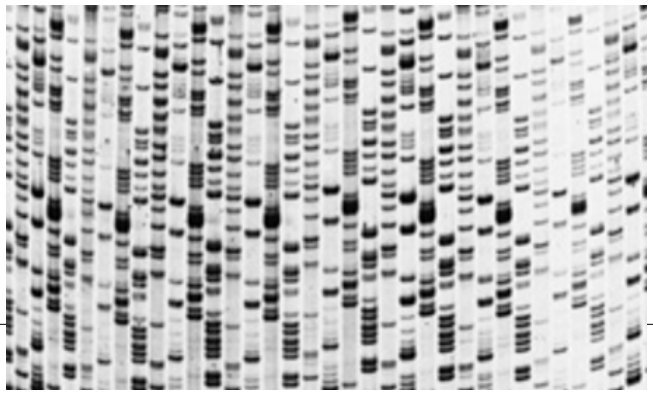
PROJECT SUMMARY

DNA double-strand breaks (DSB) are one of the major genotoxic damages to cells and, paradoxically, play an essential role in both carcinogenesis and anti-tumour therapy. If DSB occurs in G1, when chromosomes have not yet replicated, the preferred repair mechanism is non-homologous end joining (NHEJ). In case the chromosomes have already replicated (S, G2 and M phases of the cell cycle), homologous recombination (HR) with the sister chromatid is the favoured mechanism. The control of the NHEJ vs HR choice is highly dependent on cyclin-dependent kinase (CDK): low CDK activity in G1 favours NHEJ, while high CDK activity in the rest of the cycle favours HR. For HR to succeed, it is also essential that the intact sister chromatid, which serves as a template for the broken chromatid, is close and aligned; this is made possible by the cohesin complex. While this model of DSB repair control is adequate to explain what happens in G1, S, G2, prophase and metaphase, anaphase and telophase are cell cycle stages where a great paradox occurs: on the one hand, CDK activity remains high, which would favour HR, while, on the other hand, the sister chromatids are no longer aligned or close and the cohesin complex has been dismantled. In addition, there are genetic and environmental conditions that favour the non-complete resolution of sister chromatids in anaphase; for example, the loss of activity of the anti-tumour target Topoisomerase II (Top2). In these exceptional circumstances, these chromatids remain close together and connect the daughter nuclei via "anaphase bridges". A DSB generated at these bridges, and the subsequent segregation of the ends to each of the daughter nuclei, results in a type of mutagenic repair by both HR and NHEJ.

In this project we address how cells respond to DSBs generated in: (i) telophase on perfectly resolved and segregated chromatids, and (ii) areas close to chromosomal regions present in anaphase bridges due to Top2 deficiency. For this purpose, we

use genetic models based on Saccharomyces cerevisiae that favour the two conditions mentioned above, and we complement them with studies in cell lines of tumour origin (HeLa). For the generation of DSBs we use either the radiomimetic substance phleomycin (non-specific DSBs) or endonucleolytic systems such as HO, CRISPR/Cas9 and chimeras with endonucleases (sequence- or site-directed DSBs). Our objectives include: (1) to demonstrate whether and what type of cellular response is generated by DSBs in anaphase/ telophase; (2) to elucidate the components of this response (e.g. components of the checkpoint); (3) to determine cell survival and genetic variation in survivors of these DSBs; (4) to elucidate the molecular steps in the repair of these DSBs and the respective roles of NHEJ and HR; and (5) to identify new molecules that generate DSBs and anaphase bridges.

To fulfil these objectives, we make use of a wide range of advanced molecular and cellular biology techniques, including fluorescence and confocal live cell microscopy, pulsed-field and two-dimensional electrophoresis, Southern and Western blots, etc.



Development of a genomic diagnostic unit

FACT SHEET

- Acronym: UDIGEN
- PI: Carlos Flores Infante
- Reference: RTC-2017-6471-1
- Partners: ITER, Universidad de La Laguna (ULL), Fundación Canaria Instituto de Investigación Sanitaria de Canarias (FIISC).
- Duration: 01/09/2018- 31/12/2021 (40 months)
- Budget: 904,828.99 €.
- Co-funding: Challenges Collaboration 2017. State Programme for R&D&I Oriented towards the Challenges of Society.

RESUMEN DEL PROYECTO

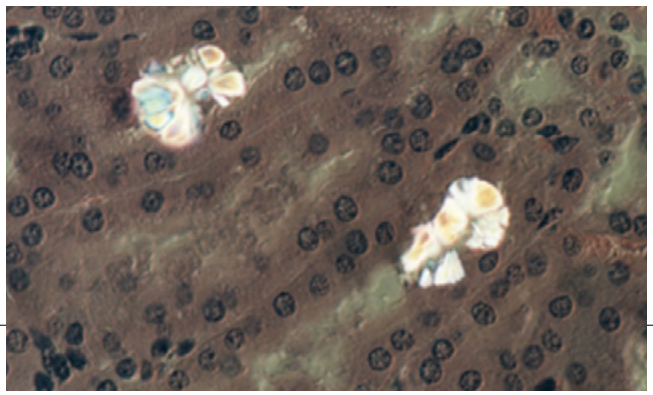
The overall objective of the UDIGEN project is to develop an integrated genomic analysis platform, from sequence to interpretation, to facilitate genetic counselling in order to reduce the time between the suspicion of genetic disease and a definitive diagnosis. This objective allows the advancement of technological development, innovation and quality research, as specified in the thematic objective of the operational programme of the project call.

UDIGEN will carry out its activities on the basis of the experience acquired in three sub-studies:

- An orthogonal validation study.
- A population-based study in reference samples.
- A study of patients with evidence of genetic disease.

As a result, the experience is expected to introduce the routine use of exome sequencing as a first-line test to support the diagnosis of genetic disorders and the consequent reduction of time and costs until a definitive diagnosis is obtained. In addition, bioinformatics tools will be developed to manage, question and interpret genetic variation and its connection with diseases through efficient Big Data analysis procedures.

OxaluriaSRT. Treatment of primary hyperoxalurias



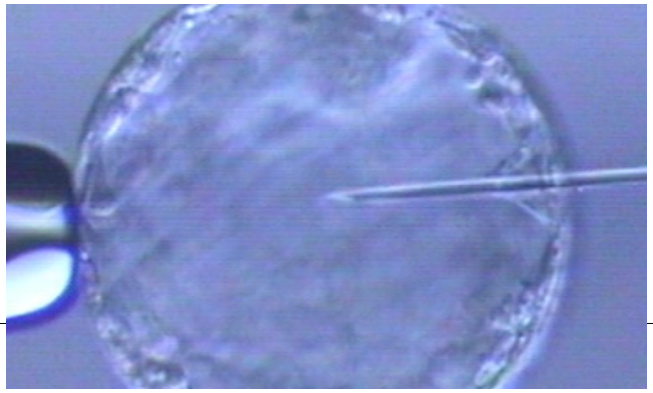
FACT SHEET

- Acronym: OxaluriaSRT
- PI: Eduardo Salido Ruiz
- Reference: SAF2015-69796-C2-1-R Ministry of Economy and Competitiveness
- Partners: Hospital Universitario de Canarias-Universidad de La Laguna
- Duration: 2016-2020
- Budget: 157,300.00 €

PROJECT SUMMARY

Primary hyperoxaluria (PH) is an autosomal recessive disease usually caused by mutations in the AGXT gene (PH1), and more rarely by mutations in other genes (GRHPR -PH2-, HOGA1 -PH3-). We have generated murine models of hyperoxaluria to study the basic mechanisms of the disease and to test new therapeutic strategies. In this project we address the following objectives: 1) inhibition of glycolate oxidase (GO) and/or lactate dehydrogenase (LDHA) enzymes of glyoxylate metabolism, as an efficient therapeutic strategy (Substrate Reduction Therapy) in primary hyperoxalurias. To achieve "proof of concept" and identify lead compounds that help to better define future investments aimed at curing or alleviating the disease with drugs. In a previous project we have shown that some aspects of this hypothesis are fulfilled; we are developing a medicinal chemistry plan aimed at finding and improving glycolate oxidase inhibitors; 2) study the molecular mechanisms of the frequent mutations that lead to mitochondrial mistargeting, analysing compounds that can facilitate the correct subcellular localisation of the AGT enzyme (Chemical Chaperone and Proteostasis Regulator Therapy); and 3) to deepen the understanding of the basic mechanisms of renal damage by oxalate deposits and to better define, in observational clinical studies, the natural history of the disease, leading to a cohort of patients who will be candidates for future therapeutic interventions

Development of a method for the selection of human embryos with better embryo quality in Assisted Reproduction Techniques



FACT SHEET

- Acronym: DESART-19
- PI: Julio T. Ávila Marrero and Pablo Martín Vasallo
- Reference: ProID2020010073 and ULL.ADB.19.08.
- Partners: Universidad de La Laguna (ULL), Instituto Universitario de Tecnologías Biomédicas (ITB) and the Canary Islands Human Reproduction Assistance Centre.
- Duration: 2020-2022.
- Budget: 56,800 €.
- Co-funding: Canary Islands Research Agency (Canary Islands Government), FEDER CANARIAS 2014-2020 and Agustín de Betancourt Programme of the University of La Laguna, funded by Cabildo de Tenerife, TF Innova, FDCAN, MEDI.

PROJECT SUMMARY

Fertility problems, which are becoming more and more frequent, are not only a physical and psychological damage, but also an economic problem that affects society. The number of people resorting to assisted reproduction techniques has in-

creased greatly in recent years due, in part, to delayed childbearing for socioeconomic reasons, placing Spain as the first European country in terms of assisted reproduction treatments.

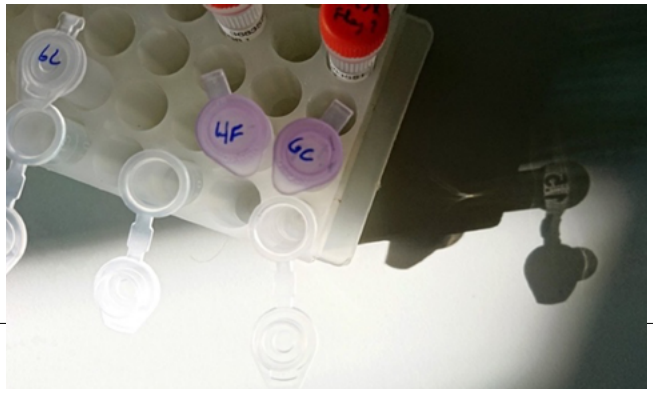
The main problem with these techniques lies in the frequent need for repeated reproductive cycles to obtain a pregnancy and the increased likelihood of multiple pregnancies. These aspects pose a health risk, in addition to increasing the cost of the process. The selection of the best quality embryo to be implanted, among those obtained during the process, is the main factor that determines the success of the technique. This is why developing a more precise method to select the best quality embryo would not only increase the pregnancy rate, but also minimise the risk factors mentioned above.

Therefore, the final objective of this project is to implement an embryo selection method based on the combination of morphological data and the expression pattern of genes related to embryo quality, which will improve the success rate of fertility treatments. This could improve the assisted reproduction techniques currently used and would therefore be an important advance in a booming health field, boosting its productivity.

The project is structured in three main phases which include:

- Optimising the protocol to quantify genes related to embryo quality from blastocele fluid. This fluid, located in the embryonic cavity, contains RNAs from the communication between the cells of the embryo, which are important for its correct development. Moreover, its extraction does not affect the viability of the embryo.
- Identifying RNAs that can be used as markers of embryo quality in the above-mentioned liquid. So, the RNAs that are important for the correct development of the embryo will be determined in order to analyse them individually in each embryo.
- Multifactorial analysis of the RNA expression results obtained and their correlation with morphological and clinical parameters, in order to design a combined optimal scoring table to select embryos with a high probability of pregnancy rate.

If our multifactorial screening method is validated, it could be implemented in public or private centres, as it would mean a major advance to reduce costs and risks in a health field that is clearly growing.



Regulation of the cellular response to DNA damage and replicative stress: molecular mechanisms and implications for tumorigenesis

FACT SHEET

- Acronym: TUNDRA
- Reference: SAF2016-80626-R
- Funding Entity: Ministry of Economy and Competitiveness
- Organisation: Fundación Canaria de Investigación Sanitaria (FUNCANIS), Hospital Universitario de Canarias, La Laguna, Tenerife
- Principal Investigators: Veronique A.J. Smits and Raimundo Freire
- Duration: January 2017 - October 2020 (3 years)
- Budget: 229,900.00 €

PROJECT SUMMARY

Proper control of DNA replication and DNA damage response (DDR) are key cellular mechanisms for maintaining genome integrity and preventing oncogenic transformation. In addition, anti-tumour therapies rely on defective DNA repair mechanisms in cancer cells, which increases their sensitivity to therapeutic agents. A precise and programmed cellular response to DNA damage and replication problems requires a tight regulation of all actors involved. Recent data (including from our groups) show that post-translational modifications, such as phosphorylation, acetylation and modification by SUMO or ubiquitin, are important in the coordination of these pathways. However, information on how these pathways are regulated by these modifications is still limited. We intend to research into the mechanistic details of DDR and DNA replication (stress) by identifying novel modifiers of these processes and studying how they control various aspects of DDR and replication. In addition, we will apply our expertise in the field of genomic stability by studying these responses in cancer cells obtained from patients. Research at the molecular and cellular level into the mechanisms that maintain genomic stability is of great importance, both for understanding the development of cancer and for its treatment.

SPECIFIC OBJECTIVES

- To study new regulators of post-translational modifications (Ub and SUMO) in DNA replication and DDR.

- To investigate the mechanism by which Claspin and Chk1, proteins mediating DNA replication and DDR, control the cellular response to misfolded proteins (UPR).
- To characterise novel mediators of DDR among chromatin-modifying enzymes.
- To apply our basic research to characterise the responsiveness of tumour cells to therapeutic agents.

Systems pharmacology approach to difficult-to-treat paediatric asthma (AC1500015)

FACT SHEET
- PI: María del Mar del Pino Yanes
- Acronym: SysPharmPediA
- Partners/participating entities: Hospital Universitario Nuestra Señora de Candelaria, University of La Laguna, University of the Basque Country, University Children's Hospital Regensburg, University of Maribor, Utrecht University and Academic Medical Center University of Amsterdam.
- Implementation period: 01/05/2016 - 30/11/2019
- Budget: 91,113.00 €
- Funding entity: Instituto de Salud Carlos III, Ministry of Science and Innovation and ERA-Net ERACoSysMed under the H2020 programme.

PROJECT SUMMARY

The study of interactions between physiological biomarkers, environmental and genomic factors may significantly accelerate the discovery of new therapeutic targets for complex diseases. Childhood asthma is a multifactorial disease composed of different clinical phenotypes, characterised by different symptom expression, type of inflammation or underlying pathological features. Therefore, a systems medicine approach is needed to unravel the complexity of the disease and identify phenotypes to predict therapeutic response.

Inhaled corticosteroids are the most effective and commonly used medication to control asthma symptoms. However, a large variability in response to this treatment has been observed between individuals and populations. It has been suggested that these differences are the result of the interaction of several factors, with the genetic make-up of the individual being an important aspect to consider. Despite this, the genetic markers of response to inhaled corticosteroids identified so far do not allow prediction of responsiveness to this medication. This project aimed to identify genetic variants involved in the response to asthma treatment with inhaled corticosteroids. To this end, samples and genomic data from the Pharmacogenomics in Childhood Asthma consortium (PiCA), which includes the main asthma cohorts in children and young adults worldwide, were analysed. They compared whether there were differences at the genomic level between those individuals who had asthma exacerbations despite being treated with inhaled corticosteroids (poor responders) and those who did not (good responders). Gene expression changes in pulmonary smooth muscle cells following corticosteroid treatment were also analysed and integrated with genomic data from patients in the PiCA consortium.

Our results showed the existence of genetic variants involved in the response to inhaled corticosteroids shared among different populations, but also some that were specific to certain population groups. We also identified an enrichment in genetic variants located in genes whose gene expression is regulated by trichostatin A, an antifungal compound that represents a potential drug for the treatment of asthma that could be evaluated in future research.

Colorectal cancer screening in intermediate risk population: Multicentre study comparing immunological faecal occult blood test and colonoscopy

FACT SHEET
- PI: Enrique Quintero Carrión
- Acronym: COLONPREV
- Reference: PI08/90717
- Participating partners/entities: Asociación Española de Gastroenterología [Spanish Association of Gastroenterology], Hospital Universitario de Canarias (Tenerife), Hospital Clínico Lozano Blesa (Zaragoza), Hospital Clínic (Barcelona), Hospital del Mar (Barcelona), Hospital Provincial de Castelló, Hospital la Fe (Valencia), Hospital Meixoeiro (Vigo), Hospital Cristal Piñor de Ourense, Hospital 12 de Octubre (Madrid), Hospital de la Princesa (Madrid), Hospital Puerta de Hierro (Madrid), Hospital de Alcorcón, Hospital Clínico San Carlos (Madrid), Hospital Universitario Virgen de la Arrixaca (Murcia) and Hospital de Donosti (San Sebastián).
- Implementation period: 2009-2012
- Budget: 347,000.00 €
- Funded by: Instituto de Salud Carlos III

PROJECT SUMMARY

Objectives: 1) To compare the diagnosis rate of the immunological method for detecting occult blood in faeces (SOHi) with colonoscopy for detecting colorectal cancer (CRC) and advanced adenoma in the first round of screening; 2) To evaluate the participation rate and complications associated with each strategy. Methodology: multicentre, randomised, controlled study in 8 Autonomous Regions (Aragon, Canary Islands, Catalonia, Basque Country, Galicia, Madrid, Murcia and Valencia), coordinated by the Health Administration, primary care and specialised care in each Autonomous Region. Inclusion criteria: asymptomatic population between 50 and 69 years old. Exclusion criteria: 1) previous performance of a CRC screening test in the recommended periods; 2) belonging to high-risk groups (family or personal history of CRC or polyposis); and 3) symptoms suggestive of colorectal disease, severe coagulopathy or carriers of a total colectomy. First, information on CRC screening and a letter of invitation to participate in the study were mailed by post. Subsequently, eligible patients were randomised (1:1 ratio) to the two study groups using computer-generated lists. Participants were grouped by domicile and stratified by age (5-year groups) and sex. Study groups: Group I: two SOHi (latex agglutination) samples and colonoscopy in positives; Group II: colonoscopy. Sample calculation: Accepting an alpha risk of 0.05 and a beta risk of 0.20 in a bilateral contrast, 7,329 subjects in each study group were required to detect an absolute difference equal to or greater than 0.02 in the diagnosis of advanced neoplasia between the two groups, assuming a ratio of 0.05 in one of them and a participation rate of 0.3.

Obesity, metabolic syndrome, and kidney disease

Description of renal disease in patients with obesity and metabolic syndrome

FACT SHEET

- PI: Manuel Hernández Guerra de Aguilar
- Duration: 02/01/2019 - present
- Budget: €45,000
- Funding: Instituto de Salud Carlos III (ISCIII) - Proyectos FIS 2019

PROJECT SUMMARY

Obesity is a risk factor for chronic kidney disease. However, the pathogenesis of kidney disease in obese patients is uncertain. Some studies have suggested that patients with metabolic syndrome are most at risk for kidney disease. Therefore, in this project we intend to study cases with more severe metabolic syndrome - those with fatty liver and hepatic fibrosis associated with steatosis - and to look at the evolution of renal function in these patients. In this exploratory study, a group of patients with mild and severe fatty liver disease (NASH + fibrosis) will be followed over time. Renal function will be measured with a reference standard, the plasma clearance of iohexol. In addition, at the same time we will perform a study in obese mice (obesity induced by atherogenic diet) in which we will study the evolution of renal function and analyse lipid deposition in renal and hepatic tissue.

Interaction between mineralocorticoid and glucocorticoid receptors: implications for energy homeostasis

FACT SHEET

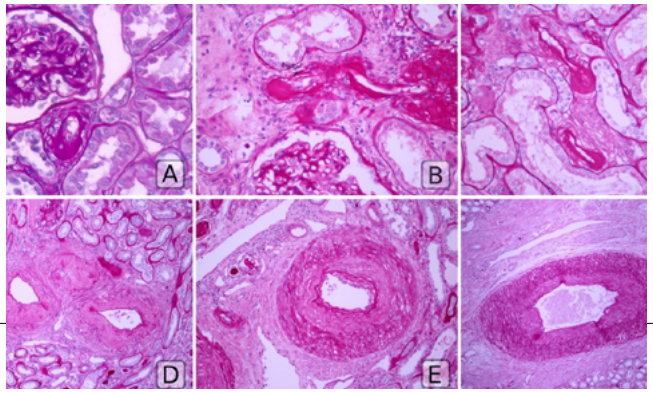
- PI: Diego Álvarez de la Rosa Rodríguez
- Acronym: OLIGOMIR
- Reference: PID2019-105339RB-I00
- Partners: Universidad de La Laguna, INSERM (Institut national de la santé et de la recherche médicale, France, Dr. F. Jaisser group), NIH (National Institutes of Health, USA; Dr. Gordon L. Hager group).
- Duration: 1/6/202020-1/6/2023
- Budget: 188,100.00 €
- Funding: Research Challenges 2019. State R+D+I Program Oriented to the Challenges of Society. Ministry of Science and Innovation.

PROJECT SUMMARY

Signalling by corticosteroid hormones produced in the adrenal gland allows us to adapt to changes in the environment and stress resulting from these changes. Defective regulation of the-

se signalling pathways underlies common public health problems, including hypertension and metabolic syndrome. Mineralocorticoid and glucocorticoid receptors (MR and GR, respectively) mediate the actions of these hormones, cooperating or sometimes antagonising each other, depending on the cell type and tissue in which they are located. While the gene targets and mechanisms of action of GR have been studied in detail, little is known about the role of MR in non-epithelial tissues, particularly with regard to its modulation and its interaction with GR when both receptors are expressed in the same cell. Currently, this field of research is limited by the lack of information on mechanisms of MR regulation and by the lack of adequate models to study the action of this receptor in the presence of GR. In particular, there is no information on RM target genes in key organs for metabolic health such as the liver. In addition, we have limited information on the nuclear dynamics of MR, including its oligomerisation, chromatin interactions and association with GR. In order to study the role of MR-mediated signalling in liver and its importance in energy homeostasis and blood pressure maintenance, we will use new transgenic mouse models or knockouts recently developed in our laboratory, with special emphasis on the role of MR in the regulation of liver metabolism and its interactions with the protein kinase SGK1 and GR. We will also study the nuclear dynamics and oligomerisation of MR using advanced microscopy techniques in a cell line model that allows the analysis of receptor-DNA interaction in real time. This technical approach will enable us to study the molecular determinants of MR oligomerisation and its interaction with GR. In addition, it will allow us to explore the role of the quaternary organisation of RM in the modulation of receptor activity by cellular factors such as SGK1 and the influence that various RM antagonists currently used as drugs in humans have on this parameter.

ENBiBA (European Nephrectomy Biobank). Understanding kidney damage in type 2 diabetes, obesity and metabolic syndrome: a continuum in kidney disease



FACT SHEET

- Acronym: ENBiBA
- Partners: University Clinical Centre, Hospital Universitario Fundación Alcorcón, Hospital de Bellvitge, Hospital Sant Joan Despí Moisès Broggi, Rigshospitalet, IIS-Fundación Jiménez Díaz-UAM, Galilee Medical Center, Hospital Universitario de Canarias, Hospital de Santa Cruz, Centro Hospitalar Lisboa Norte, Centro Hospitalar São João, Ospedale San Raffaele, Hospital 12 de Octubre
- Duration: 1/6/2017 - present
- Budget: 100,000.00 €
- Funding: ISCIII - FIS Projects 2019. European Renal Association (ERA)

PROJECT SUMMARY

Histological lesions at renal level, i.e. the morphological change in different renal structures (glomeruli, vessels, tubulo-interstitium) in diabetes, obesity and metabolic syndrome, are not fully established. In addition, the correlation between clinical and histological lesions is not well known. In particular, we have very little information on the nephropathy of obesity and metabolic syndrome. The main reason for this lack of knowledge is that patients with diabetes, obesity and renal disease do not routinely undergo renal biopsy in the vast majority of cases due to the low prevalence of proteinuria. To overcome this obstacle, we have devised the ENBiBA project through which we collect the healthy part of nephrectomy specimens in general for renal cancer in order to have enough material to analyse renal tissue.

To date we have almost 500 samples and have published a study in KIR diabetes patients.

EX PRED PROJECT (Exercise and prediabetes after transplantation) Prevention of post-transplant diabetes in patients with pre-diabetes through exercise

FACT SHEET
- Acronym: EX PRED
- PI: Armando Torres Ramírez
- Duration: 02/01/2019 - present
- Budget: 65,000.00 €
- Funding: ISCIII - FIS Projects 2019. FIISC 2020 Project

RESUMEN DEL PROYECTO

Post-transplant diabetes (PTDM) is a common and severe complication after kidney transplantation. It can affect approximately 20-30% of patients who were not diabetic before transplantation. Our group has described that the evolution of TMPD is bi-modal: the majority of cases (80%) appear during the first months after transplantation and have been termed early TMPD, while 20% of cases appear later than 12-24 months after transplantation - late TMPD. To date, no strategies to prevent late PTMD have been suggested. In this project we set out to study the feasibility of therapeutic exercise to prevent the onset of PTMD in patients with pre-diabetes after transplantation. The protocol foresees 12 months of treatment and controls with quarterly oral glucose intakes to see the reversibility of prediabetes. The study has yielded excellent results: 60% full reversibility, so it will be stopped early for efficacy.

FGF23/KLOTHO system as a predictor of cardiovascular morbidity and mortality.

FACT SHEET
- PI: Juan F. Navarro González
- Partners/participating entities: Canary Islands Health Service and Institut de Recerca Biomèdica de Lleida (IRBLleida).
- Implementation period: 2017-2021
- Budget: 50,215.00 €.
- Funding Entity: Instituto de Salud Carlos III

PROJECT SUMMARY

Cardiovascular disease is the leading cause of mortality in the population. Atherosclerosis is the substrate responsible for the development and progression of vascular damage that underlies the vast majority of cardiovascular events. Previous work by our group has demonstrated the biological plausibility of the involvement of the fibroblast growth factor (FGF) 23/Klotho biological system in the pathogenesis and pathophysiology of atherosclerotic vascular disease. Specifically, we have demonstrated the expression of elements of this system in the human vascular wall and have observed that patients with atherosclerotic vascular disease (coronary, carotid and peripheral) have lower serum concentrations of Klotho and higher levels of FGF23 than patients without such disease, as well as a lower vascular expression of Klotho. We have found that this association is independent of other cardiovascular risk factors. The main goal of the present project is to evaluate whether the FGF23/Klotho system is useful as a prognostic biomarker of cardiovascular morbidity and mortality, for which we will study the evolution of two cohorts. The primary cohort is under project PI07/0870, made up of 1033 patients, 774 of whom have had their FGF23 and Klotho levels determined under PI13/01726. The second cohort, the replication cohort, comprising 1257 individuals, includes subjects with normal renal function and patients with renal disease, and derives from the NEFRONA project (observational, prospective, multicentre study of cardiovascular morbidity and mortality in patients with different stages of renal disease).

Regulation of fat inflammation in human obesity. Role of the chemokine system and alpha2-adrenergic receptors in macrophage accumulation in adipose tissue

FACT SHEET
- Principal Investigator: José Federico González Díaz
- Reference: PI21/00406
- Centre: Hospital Universitario de Canarias (HUC)
- Duration: 2021 - 2023 (36 months)
- Budget: 125,000.00 €
- Funding Entity: Instituto de Salud Carlos III (ISCIII)

PROJECT SUMMARY

One of the major health concerns worldwide is obesity, a process linked to low-grade inflammation in which macrophages play a key role. It is well established that the majority of resident macrophages in lean individuals belong to the anti-inflammatory M² type, whereas in the adipose tissue of obese individuals the number of macrophages, preferentially of the inflammatory M² phenotype, is significantly increased. The driving force respon-

sible for macrophage recruitment in adipose tissue in human obesity has not yet been fully elucidated. Several studies have established an association between α2-adrenergic receptors, human obesity and inflammation. Data from our laboratory have shown that α2-adrenergic receptors produce an anti-inflammatory effect both in vivo and in vitro by reducing the migratory capacity of leukocytes, including monocytes. The aim of this project is to understand the mechanisms that regulate macrophage accumulation in adipose tissue of obese individuals, specifically the chemokine system and the role of α2-adrenergic receptors in the control of macrophage recruitment, and survival in adipose tissue in a mouse model of obesity. We believe that this proposal could shed light on the relationship between obesity and inflammation and characterise possible therapeutic targets that, by modulating the number of macrophages in adipose tissue, could improve the health status of people with obesity.

Regulation of macrophage extravasation by α2-adrenergic agonists in COVID-19-associated CTS

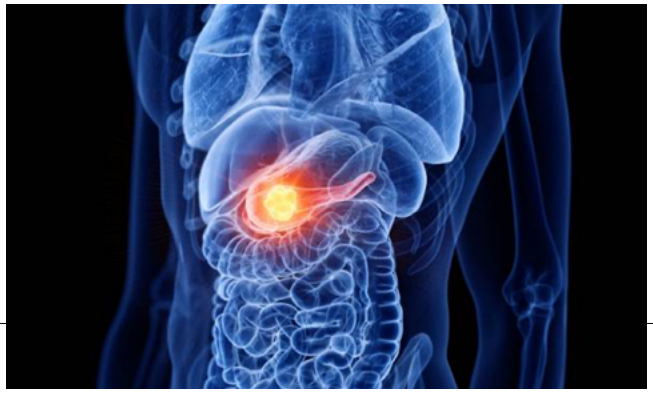
FACT SHEET

- Principal Investigator: José Federico González Díaz
- Reference: COV20/00932
- Centre: Hospital Universitario de Canarias (HUC)
- Duration: 2020 - 2021 (12 months)
- Budget: 49,000.00 €
- Funding Entity: Instituto de Salud Carlos III (ISCIII)

PROJECT SUMMARY

Patients with severe COVID-19 develop a cytokine storm syndrome (CTS) that severely worsens their prognosis. CTS is characterised by an excessive accumulation of activated macrophages causing a massive release of pro-inflammatory cytokines. Macrophage depletion in the development of CTS has been reported to decrease lethality in several animal models. Data from our laboratory demonstrate that α2-adrenergic receptor agonists prevent neutrophil accumulation in the inflammatory focus and preliminary results have shown a similar anti-inflammatory effect on circulating monocytes. This project aims to generate mechanistic rationale to support α2-adrenergic agonists as modulators of monocyte migration to the inflammatory focus in order to prevent/treat COVID-19 patients developing CTS.

New therapeutic strategies for pancreatic cancer treatment



FACT SHEET

- PI: José Manuel Padrón Carrillo
- Acronym: TheraPanc
- Reference: ProID2020010101
- Period of implementation: 01/01/2020 - 30/09/2022
- Budget: 70,000.00 €
- Funded by: Agencia Canaria de Investigación, Innovación y Sociedad de la Información (ACIISI) [Canary Islands Agency for Research, Innovation, and Information Society]

PROJECT SUMMARY

Pancreatic ductal adenocarcinoma of the pancreas (PDAC) is a relatively rare tumour (2% of all cancer cases) but is the fifth leading cause of cancer deaths worldwide. The median survival time after a diagnosis of PDAC is less than 1 year and the average lifetime risk of developing PDAC is 1/78. Some of the factors that make PDAC such an aggressive cancer are the following: late diagnosis (due to the absence of symptoms and biomarkers for early diagnosis), the difficult anatomical location of the pancreas, metastatic spread when the primary tumour is too small to be detected, the dynamic interaction of the tumour with stromal cells (which create a dense fibrous layer around the tumour) and the limited efficacy of existing therapies. The overall goal of the TheraPanc project is to demonstrate, in a preclinical setting, that inhibiting glutamine metabolism with small molecules blocks PDAC growth. In TheraPanc we will focus on pro-

posing predictive biomarkers and developing a new therapy that targets the way PDAC cells obtain the energy needed for proliferation. The TheraPanc project is developing a new, more effective and better tolerated therapy to treat pancreatic cancer, with the ultimate goal of improving survival and quality of life for patients suffering from this malignant disease.

Oligonucleotides in hybrid nanosystems for local and systemic targeted therapies

FACT SHEET

- Acronym: OligoNanoTarg
- PI: Araceli Delgado Hernández, Carmen M. Évora García
- Reference: RTI2018-097324-B-I00
- Implementation period: 01/01/2019 - 30/09/2022
- Budget: 181,500.00 €
- Funded by: Ministry of Science and Innovation (MEC. RETOS.18)

PROJECT SUMMARY

One of the main challenges in therapeutics today is the development of drug delivery systems that reach the target organ, exert their therapeutic effect and are eliminated without interfering with the rest of the organs and tissues of our organism. To achieve this goal, intensive work is being carried out to develop nanosystems designed by applying physiologically based technological resources that give them the specificity required to reach their site of action.

So, the "drug delivery systems" research group is working along these lines. The versatility of nanosystems makes them potentially useful nanopatterns for targeting therapeutic agents to virtually any cell or tissue in the body: our current research project focuses on the development of nanoparticles to treat two diseases: osteoporosis (OP) and uterine leiomyoma (LU).

The challenge here is to design, elaborate and characterise (in vitro-in vivo) lipid-polymeric hybrid nanoparticles (NPs) for systemic and local administration as specific oligonucleotide transporters (gapmers). With these two disease models we will test the NPs by two routes of administration: IV for osteoporosis, which is a systemic disease affecting bone tissue quality; and local for gynaecological tumour destruction. The NPs, with the gapmer selected according to the disease to be treated, after intravenous (IV) injection, should be targeted by transporting the oligonucleotide to mesenchymal stem cells (MSC) to increase bone formation and by local administration to somatic stem cells (SSC) involved in the generation of the uterine tumour. The microfluidic technique is proposed as an alternative to conventional double emulsion methods for the preparation of NPs. In order to achieve selective transport and to avoid destruction by the liver, the purifying organ par excellence, the surface of the NPs is decorated with ligands to prevent opsonisation and to direct the gapmer to its site of action. Therefore, the ligands are selected, the binding procedure is optimised and the desorption kinetics are determined. The NPs are characterised in terms of size, polydispersity, Z-potential, individual layer and surface composition, integrity, gapmer encapsulation efficiency and freeze-drying conditions.

The gapmers are selected according to the efficacy shown in mouse MSC (rMSC) and UB-derived cell cultures, respectively. The in vitro efficacy and cytotoxicity of the gapmer-NPs as well as their intracellular biodistribution are tested. The osteogenic effect of transfected mMSCs and the cytotoxicity of OP NPs are tested in rMSC cultures. The anti-tumour effect on UL is evaluated in ex-vivo cultures of patient tumour sections. The evaluation of gapmer-NPs functionalised with a bone-specific aptamer is carried out in osteoporotic female mice. The osteogenic effect of the NPs is assessed in live osteoporotic mice by densitometry before and during the treatment period and by histological analysis at the end of the experiment after the animal has been put down.

Simultaneously, the effect of gapmer-NPs developed for UL alone or in combination with NPs encapsulating drugs with potential applications in leymomas by local route are evaluated in a xenograft model developed in mice.

Subsequently, to evaluate the efficacy of the nanosystem, mice will be injected intratumorally and the size of the tumour will be monitored by ultrasound. In addition, once the animal has been put down, histopathological analyses of the tumour and major organs will be performed as a measure of efficacy and toxicity.

The in vivo results allow the establishment of a rational, safe and effective dosing regimen for both IV and intratumoral NPs.

Finally, as our intention is to make our work transferable to industry or clinics, we have to study the possibility of patenting and licensing the patent of the developed nanosystem.

Proof-of-concept for a non-invasive technology for early diagnosis of Sporadic Alzheimer's Disease based on circulating exosomes

FACT SHEET

- PI: Néstor V. Torres Darias
- Acronym: ADEXOSOM
- Partners/participating entities: INTECH-Cabildo Tenerife
- Implementation period: 30/01/2019 - 30/02/2021
- Budget: 118,128.00 €
- Funded by: INTECH-Cabildo Tenerife/Universidad de La Laguna

PROJECT SUMMARY

There are no reliable methods for the early diagnosis of sporadic Alzheimer's disease (AD). In this project we aim to test whether circulating exosomes can serve as a basis for early, non-invasive diagnosis of AD. We build on two previous studies. In the first one we identified more than 500 differentially transcribed mRNAs in early AD that encode exosome-exportable products in the hippocampus. Moreover, we observed dysregulation of exosome components consistent with alterations in blood-brain barrier permeability during normal ageing. Since exosome transit between brain and blood is enhanced by inflammation, the working hypothesis is that peripheral circulating exosomes include a plethora of early AD biomarkers. The combination of analytical, clinical and computational studies will serve to determine a set of biomarkers sensitive and specific enough to differentiate between AD states. The information from the exosome analysis will also allow the reconstruction of different types of networks that may be operating in the source cells of the brain. We expect to obtain a new diagnostic method and a better understanding of AD pathogenesis.

ERC NANOPDICS: studying ion channels from a multidisciplinary perspective

FACT SHEET

- Acronym: ERC NANOPDICS.
- PI: Teresa Giráldez Hernández
- Referencia: ERC-2014-CoG-648936-NANOPDICS.
- Title: Optoelectrical dynamics of ion channels activation and calcium nanodomains
- Duration: 01/09/2015 - 31/08/2021.
- Budget: 1,999,742.00 €
- Funded by: European Research Council.

PROJECT SUMMARY

Many types of cells in living systems use electrical signalling to perform their physiological functions. Cells store and deploy electrical energy to, among other things, communicate, release hormones or neurotransmitters, grow and divide. Ion channels are intriguing, localised proteins that allow the controlled flow of specific ions (potassium, sodium, calcium, magnesium, chloride...) across cell membranes. The amazing thing about ion channels is that their function can be studied in real time, using techniques such as patch-clamp and fluorescence. It is not surprising that the malfunctioning of these proteins is a common cause of many diseases, such as epilepsy, migraine, muscular dystrophy, hypertension, etc. Because of their unquestionable pathophysiological relevance, ion channels are nowadays one of the main pharmaceutical targets.

In neurons, Ca2+ influx sites and Ca2+ sensors are located within 20-50 nm, in "Ca2+ nanodomains". This tight coupling is crucial for the functional properties of synapses and neuronal excitability. Two key players act in the nanodomains, coupling the Ca2+ signal to the membrane potential: voltage-dependent Ca2+ channels (VDCC) and voltage-dependent high-conductance Ca2+ and K+ channels (BK). BK channels are characterised by synergistic activation by C2+ and membrane depolarisation, but the complex molecular mechanism underlying channel function is poorly understood. Information on the pore region, voltage-sensing domain or isolated intracellular domains has been obtained separately using electrophysiology, biochemistry and crystallography. However, the specialised behaviour of this channel must be studied across the entire protein complex in the membrane to determine the full range of structures and movements critical for its function in vivo. Using a combination of genetics, electrophysiology and spectroscopy, our group has for the first time measured the structural rearrangements that accompany activation of the entire BK channel in the membrane.

From this unique position, our first goal is to fully determine the real-time structural dynamics underlying the molecular

coupling of Ca2+, voltage and activation of BK channels in the membrane environment, their regulation by accessory subunits and channel effectors. The subcellular localisation of BKs and their role in Ca2+ nanodomains make these channels perfect candidates to report local changes in [Ca2+] restricted to specific nanodomains close to the neuronal membrane. In our lab, we have created fluorescent variants of the channel that report BK activity induced by Ca2+ binding or by Ca2+ and voltage binding. Our second goal is to optimise and deploy these new ones to study physiologically relevant Ca2+-induced processes in both cellular and animal models.

ERC NANOPDICS: studying ion channels from a multidisciplinary perspectivear

FACT SHEET

- Acronym: NeuroGluNBK.
- PI: Teresa Giráldez Fernández
- Reference: RTI2018-098768-B-C21.
- Title: Pathophysiological roles of NMDAR-BK complexes in the brain (NeuroGluNBK).
- Duration: 01/01/2019 - 30/09/2022.
- Budget: 190,000.00 €
- Funded by: State R&D&I Programme Oriented to the Challenges of Society. MINECO. Call for proposals 2018.

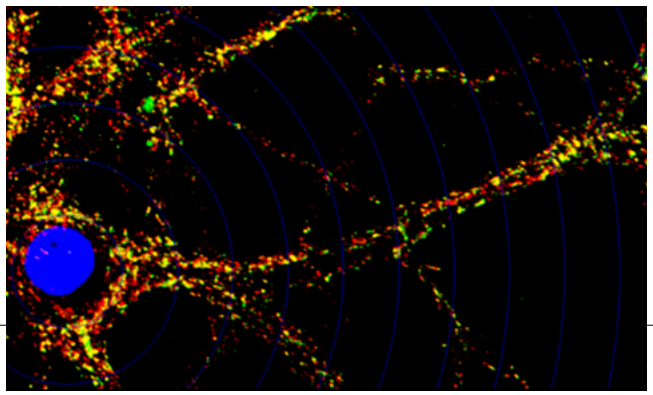
PROJECT SUMMARY

Epilepsy is a serious problem with a major impact on the Spanish socio-health system, as well as one of the major challenges society is facing at present (Challenges of Spain's Science and Technology Strategy: Health, Demographic Change and Wellbeing). It is one of the most common neurological diseases, affecting 55 million people in the world, 400,000 in Spain. The clinical efficacy of antiepileptic drugs is mainly aimed at symptomatic treatment to minimise the appearance of seizures but it fails to prevent the disease from progressing. About 30% of epileptic patients are resistant to current treatments. The search for new mechanisms to improve therapeutic efficacy is therefore essential. Potassium channels form the largest and most diverse family of ion channels and are fundamental regulators of neuronal excitability. Increasing evidence supports the idea that K+ channels and their associated proteins are important drug targets to treat neurological diseases such as epilepsy. Voltage- and Ca2+-regulated K+ channels (BK) are widely expressed in the nervous system and contribute to a variety of neuronal functions. BK channels are activated by depolarisation of the cell membrane in combination with relatively high intracellular Ca2+ concentrations, restricted to Ca2+ sources in close proximity to the channel. At the postsynapse, it has been suggested that such a source could be N-methyl-D-aspartate receptors (NMDARs). NMDAR-dependent activation of BK would be an inhibitory mechanism regulating synaptic integration of afferent inputs, with BK being a brake on neuronal excitability. BK and NMDAR genetic alterations have been linked to several neurological diseases, including epilepsy. Since 2001 it has been known that these channels are associated in vivo, but their physiological role in neurons is unknown. Recent results from our laboratory show that in the somatosensory cortex these complexes are functional and are involved in the control of neuronal plasticity. The hypothesis of this project is that NMDARs act as a neuronal Ca2+ source for the activation of NMDAR-associated BK channels, constituting important regulators of postsynaptic integration of afferent inputs in the brain. Using a technical combination of electrophysiology, imaging, molecular biology and genetics, our aim is to clarify the pathophysiological role of NMDAR-BK complexes in the brain, with special emphasis on epileptogenic areas. The experience and tools available in our laboratory allow us to approach this general objective from a molecular approach to a more integrated physiological perspective.

SPECIFICALLY, WE PROPOSE:

- 1) to molecularly characterise NMDAR-BK complexes, determining their role in the synaptic integration of afferent stimuli, and 2) to study the relevance of NMDAR-BK complexes in epilepsy. We hope to have a major impact on the field of ion channel research and neuroscience by identifying the role of NMDAR-BK in neuronal pathophysiology. The knowledge produced by this project will lead to the identification of new and more specific pharmacological targets for the treatment of imbalances in neuronal excitability.

Synaptic restoration: a new therapeutic strategy against neurodegeneration



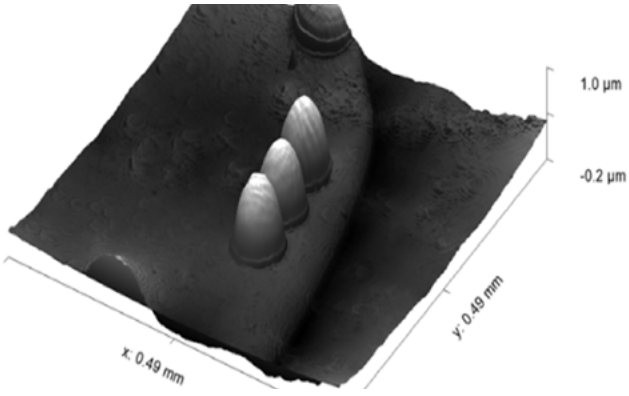
FACT SHEET

- PI: Ángel Acebes Vindel
- Reference: PID2019-106509RB-I00
- Implementation period: 01/06/2020 - 31/05/2023
- State R+D+I Program Oriented to the Challenges of Society. Agencia Estatal de Investigación (AEI) [State Research Agency]. 2019 Call for proposals.
- Budget: 72,600.00 €

PROJECT SUMMARY

Loss of synapses and the presence of olfactory deficits are early causes of neuronal death, memory loss and cognitive impairment found in Alzheimer's disease (AD) patients. In this pre-symptomatic phase of the disease, which is impossible to diagnose due to the absence of identifiable clinical markers, we aim to characterise synapse loss and olfactory defects in AD animal models. Our project aims to determine whether an in vivo increase in the number of synapses at early stages can reverse synaptic loss, restore olfactory function and, in the longer term, protect against neuronal death. In AD transgenic murine models, our strategy will consist of pharmacological activation of phosphoinositide-3 kinase (PI3K) by in vivo administration to mice of a transduction peptide called PTD4-PI3KAc. We will then be able to characterise the effects on synapse formation, olfactory discrimination, neuronal physiology and neuroprotection. Finally, given that anosmia is a key element in the early stages of AD, identifying an early olfactory biomarker represents one of the main objectives of our project.

Synaptic restoration: a new therapeutic strategy against neurodegeneration



FACT SHEET

- PI: Carlos Cairós (IP-ULL: Ángel Acebes Vindel)
- Acronym: MICROFAVAR
- Sub-programme 1.2.4 "Knowledge transfer and development of R&D&I projects of the TF INNOVA Programme 2016-2021" (2020-2024). Agustín de Betancourt Programme (2019). Cabildo de Tenerife.
- Financing: 160,000.00 €

PROJECT SUMMARY

Historically, progress in the study of living organisms has been closely linked to the development of microscopy, both at cellular level, in the identification of neurons and glial cells in nervous systems, and in the study of biological processes relevant to medicine and other branches of science, including neurophysiology. In recent decades, taking advantage of advances in digital image processing and computing power, different digital microscopy techniques have been developed that overcome the classical resolution limits. These include fluorescence microscopy, STED, PALM and TIRF, which have managed to break the diffraction limit and reach resolutions of a few nanometres, but which use invasive markers that can modify the sample. Quantitative phase imaging microscopy arises from the need to study biological processes without external modification and without using markers that can alter the sample. It is a digital evolution of classical phase contrast microscopy that allows three-dimensional information to be obtained from transparent samples, through optical path maps taken from the wavefront phase information.

We are developing an innovative module, compatible with most commonly used laboratory microscopes, which allows its conversion into a quantitative phase imaging microscope, with nanometric precision in the vertical axis (providing 3D information of the sample) to be potentially applied in biomedicine and medical diagnosis. To this end, a collaboration agreement has been signed with Wooptix S.L., a technology company based in the Tenerife Technology Park, specialising in the development and application of image processing algorithms. This microscope will make it possible to visualise transparent samples in non-invasive applications without using markers, contrast agents or phototoxic agents, such as lasers or other types of aggressive radiation, which could modify the sample. The instrument will be validated in the most demanding environments, such as real-time visualisation of dynamic changes in synapses and dendritic spines in normal and pathological conditions; in in vivo study of cellular processes associated with axonal guidance, differentiation of axonal and dendritic arbours and processes of neurite elongation and retraction, among many other applications.

Regulation of fat inflammation in human obesity. Role of the chemokine system and alpha2-adrenergic receptors in macrophage accumulation in adipose tissue.

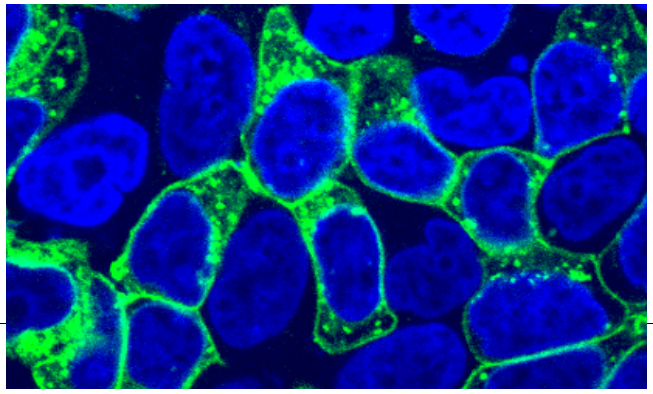
FACT SHEET

- PI: Abraham Acevedo Arozena
- Reference: PI20/00422
- Implementation period: 2020-2023
- Health Research Projects. Instituto de Salud Carlos III [Carlos III Health Institute]
- Budget: 123,420.00 €

PROJECT SUMMARY

The reasons why the vast majority of patients develop amyotrophic lateral sclerosis (ALS) remain a mystery, and more research is clearly needed to understand the causes of this disease and other neurodegenerative diseases. TDP-43 is the key protein in ALS disease as it is the main component of the inclusions that characterise ALS and other proteinopathies that are defined by TDP-43 disease, collectively referred to as TDP-43 proteinopathies, including, but not limited to, frontotemporal dementia (FTD). In addition, mutations in TARDBP, the gene encoding TDP-43, cause ALS and/or FTD. In this project we continue with our laboratory's main goal, which is to study the central role of TDP-43 in the pathogenesis of ALS and other TDP-43 proteinopathies. To this end, our study focuses on the early stages of the disease, particularly on how mutations lead to toxicity affecting TDP43 functions as well as identifying new functional interactors that could represent new therapeutic targets. To this end, we are working with patient cell models as well as innovative mouse models developed in our laboratory, such as a new humanised mouse that represents, at the biochemical level, the closest possible model to the human disease. In addition, we continue with the first genetic study of patients with ALS and familial dementias in the Canary Islands, in order to identify new mutations that will help us to understand the cause of these diseases.

Dopaminergic D3 receptor (D3R)-induced autophagy and neuroprotection: Impact of D2R co-expression and differences between healthy and proteostatic-stressed cells



FACT SHEET

- PI: Tomás González Hernández
- Acronym: D3Rautoph
- Reference: PID2019-105795RB-I00
- Partners: Universidad de La Laguna (ITB)
- Duration: 01/06/2020-30/05/2023 (36 months)
- Co-funded by: State R+D+I Program Oriented to the Challenges of Society.
- Budget: 227,601.00 €

PROJECT SUMMARY

Neurodegenerative diseases are characterised by the pro-

gressive loss of different neuronal groups and the deterioration of neurological functions associated with these neurons. In most of them, the cause is unknown and there is currently no cure. We know that autophagy disruption (a process aimed at eliminating and recycling abnormal proteins) plays a fundamental role in the pathogenesis of these diseases, so that interventions aimed at activating autophagy can halt degeneration. However, autophagy shares signalling pathways with apoptosis (a form of cell death) and currently available autophagy inducers act non-selectively on neurons and other cell types, and do not distinguish between healthy cells and cells affected by the degenerative process. It would therefore be interesting to find inducers that act selectively on degenerating neurons. A common feature in two neurodegenerative diseases, Parkinson's disease and Huntington's disease, is that the neurons that are the main targets of degeneration, mesencephalic dopaminergic neurons and striatal medium spiny neurons, respectively, express the dopaminergic receptors D2 (D2R) and D3 (D3R). Recent results from our group indicate that D3R activation induces the clearance of mutant huntingtin in a genetic model of Huntington's disease and that this effect is due to the activation of autophagy by mTORC1 inhibition. A striking aspect of these results is that, unlike classical mTORC1 inhibitors, inhibition via D3R does not affect mTORC1 target molecules in protein transduction and synthesis. Furthermore, preliminary data suggest that the temporal pattern of autophagy activation by this mechanism depends on the proteostatic state of the cells. In healthy cells, activation is transient, whereas in cells undergoing proteostatic stress (degeneration) activation is prolonged. It would therefore be possible to induce autophagy in specific neuronal populations and for autophagy to be prolonged in degenerating cells without affecting healthy cells.

Based on these results, the aims of this project are to study: 1. Why some G protein-associated receptors (D3R type), but not others (D2R type), can activate mTORC1-dependent autophagy. 2. What intracellular signalling pathways link D3R with mTORC1 inhibition and autophagy without affecting protein synthesis. 3. How D2R co-expression, present in most mesencephalic dopaminergic neurons, affects D3R-induced autophagy, and 4. How proteostatic status (healthy vs. altered) affects the temporal pattern of autophagy induction.

These studies are being carried out in cell and animal models using biochemical, molecular and morphological techniques at the Institute of Biomedical Technologies (ITB) and University of La Laguna's General Research Support Service.

To design more selective and safer autophagy inducers with neuroprotective effects in Huntington's disease and Parkinson's disease. 2. To know the signalling pattern that must be activated through other receptors linked to G proteins to induce autophagy in other neurodegenerative and psychiatric diseases.

Hippocampal substructures in ageing and disease: a high-resolution magnetic resonance imaging study

FACT SHEET

- Acronym: HIRESHIPPO
- PI: Niels Janssen
- Reference: PSI2017-84933-P
- Partners/entities involved: ITB, IUNE, Universidad de La Laguna (ULL).
- Implementation period: 01-01-2018 - 30-09-2022
- Budget: 96,800€.
- Funded by: Ministry of Science and Innovation

PROJECT SUMMARY

The increasing number of people in the later stages of life can be expected to lead to a corresponding rise in the demand of health systems. For example, it is estimated that by 2050, 30% of the Spanish population will be over 65 years old and there will be 4 million people over 80. These shocking figures imply an increase in the number of people suffering from cerebrovascular disorders and in the number of people with neurodegenerative disorders such as Parkinson's and Alzheimer's disease. To reduce the potential economic impact of these diseases on healthcare, we need basic neuroscience research to improve our understanding of these diseases and the options for treatment and care. This project focuses on the hippocampus, a brain structure that is considered critical in age-related changes and is also strongly involved in Alzheimer's disease. Our proposal aims to study hippocampal formation with high-resolution MRI techniques in relation to ageing and prodromal Alzheimer's disease. Our hypothesis is that ageing and disease affect only some but not all the substructures of the hippocampal formation. We expect these studies to achieve a high scientific impact in the field of neurodegenerative diseases as well as in the field of basic neuroscience. Given that the various substructures of the hippocampal formation contain different molecular compositions, our results may guide future molecular biology studies, targeting those molecules that are present only in specific areas of the hippocampal formation, and thus contribute to develop new treatments.

Functional magnetic resonance imaging of active neural tracts

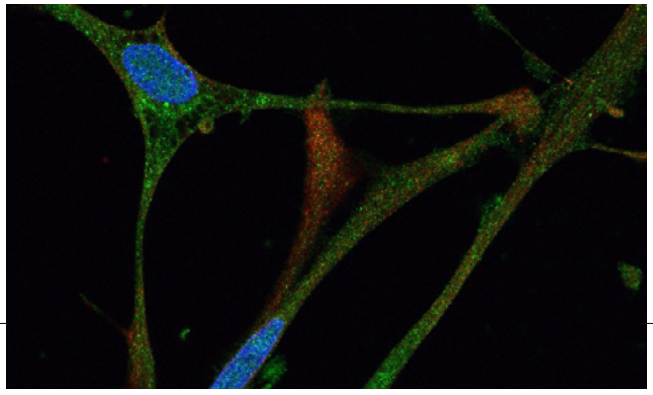
FACT SHEET

- Acronym: AXON_MRI
- PI: José L. González Mora (IP-ULL)
- Reference: SAF2017-91824-EXP, Proyecto Explora Ciencia
- Intervening partners/entities: Consejo Superior de Investigaciones Científicas (CSIC), University of La Laguna, (ULL) and Departments of Psychiatry and Neurology at Massachusetts General Hospital and Harvard Medical School. Harvard University
- Implementation period: 2017-2020
- Budget: 18,150.00 € + 120,000.00 €.
- Funded by: Ministry of Science, Innovation and Universities

PROJECT SUMMARY

The ability to non-invasively detect and measure the propagation of electrical activity in a neural tract in real time and with a spatial resolution that allows its anatomical identification in the active human brain is the most relevant, ambitious and, for now, unsolved problem in neuroscience. Techniques such as electroencephalography, magnetoencephalography or functional magnetic resonance imaging have not yet achieved this. The main objective of the project is to demonstrate that a new technique can be developed based on anatomical, physiological and physicochemical principles and diffusion imaging theory, which would lead to a direct in vivo measurement of the electrical activity of brain connections (neural tracts). Based on the previous results obtained, the intention is to achieve a reliable and ideally routine technique, which can be used by both researchers and doctors. Most importantly, to understand the mechanisms involved in the generation of the functional image of active axonal tracts. Functional magnetic resonance imaging (fMRI) allows us to map the distribution of activated neural centres using specific paradigms. Measuring the molecular diffusion of water in neural tracts using diffusion magnetic resonance imaging provides a static map of the neural connections between centres in the brain but does not capture the electrical activity of the axons that make up those tracts. We have observed an increase in AF during activation, which allows us to record the activations of active tracts, which was the main goal of the project. However, we still do not understand which axonal mechanisms explain these good results. Therefore, in the current project, we intend to perform the necessary experiments to find a consistent explanation for this increase in AF and, in addition, to consolidate a complex technique using software tools that facilitate its use, as well as to improve the sampling rate within our possibilities.

As the developed method studies the transverse movement of water molecules during the propagation of action potentials in axons, and/or their interaction with periaxonal elements, we propose that the measurement of water molecule diffusion based on this dynamic property of axonal tracts is called dynamic diffusion imaging (dDI). This technique, dDI, directly measures the electrical activity of connections between distant cortical and subcortical active centres in the brain.



Prognostic role of androgens in glioblastoma: ANDROGLIO project

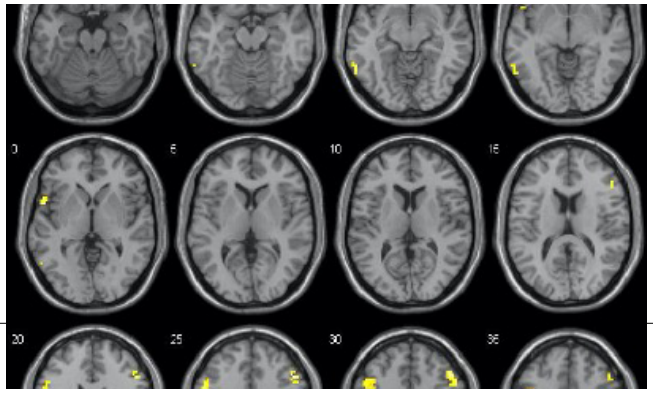
FACT SHEET

- Acronym: ANDROGLIO
- Reference: PIFIISC19/31
- Partners/entities involved: Hospital Universitario de Canarias (HUC)
- Implementation period: 26/01/2020 - 25/01/2022
- Budget: 19,625.00 €
- Funded by: FUNDACIÓN CANARIA DE INVESTIGACIÓN Y SALUD [CANARY ISLANDS FOUNDATION FOR RESEARCH AND HEALTH]

PROJECT SUMMARY

Glioblastoma (GB) is one of the most common tumours of the central nervous system (CNS) and is associated with a very poor prognosis despite treatment. In the last 20 years, most of the studies that have tried to identify new therapeutic alternatives have either failed or the benefit obtained is of little clinical relevance. It is therefore necessary to identify and characterise new therapeutic targets for the treatment of WBC.
In this regard, our project has a novel approach that aims to

determine the effect of androgens and their receptor in patients diagnosed with WBC. Androgens play an essential role in the development of plasticity mechanisms in the CNS, but, at the same time, there is some evidence to suggest that they could play an important role in the development of WBC. This evidence comes mainly from in vitro studies and needs to be confirmed in properly designed clinical studies. The results of this study would allow us to determine the suitability of the androgen receptor and androgen levels as possible therapeutic targets for WBC.



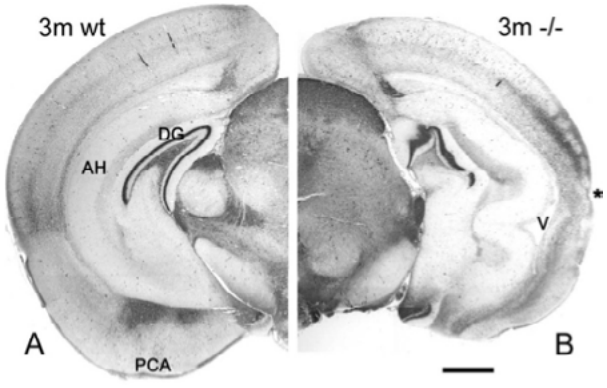
Identification of biomarkers related to cognitive impairment associated with androgen deprivation therapy in prostate cancer patients

FACT SHEET

- Acronym: COGCAP
- Reference: OA19/082
- Partners/entities involved: Hospital Universitario de Canarias
- Implementation period: 30/12/2019 - 31/12/2021
- Budget: 15,125 € + 20,000 €.
- Funded by: Fundación DISA + Fundación MAPFRE

PROJECT SUMMARY

Prostate cancer (PC) is one of the most epidemiologically important diseases in the world. One of the treatments used in this disease is androgen deprivation therapy (ADT), which aims to reduce testosterone production to prevent tumour recurrence or progression. Testosterone is fundamental in the maintenance of brain homeostasis, being involved in brain plasticity phenomena. In this regard, the use of TDA is associated with the development of cognitive alterations, with a greater risk of developing Alzheimer's disease and other types of dementia. The main objective of our project is to identify biomarker predictors that allow us to classify patients with CP who are at greater risk of developing cognitive alterations associated with ADD. To this end, we propose a prospective and comparative observational study (patients with CP+ADT; patients with CP without ADD; individuals without CP) in which functional and structural neuroimaging studies will be performed, as well as biochemical blood tests, before the onset of ADD and on two further occasions over the course of a year. Identifying biomarkers to predict cognitive impairment associated with ADD would represent a definitive step towards personalised medicine in PC.



The role of P73 as a reelin regulator in cognitive function during ageing and Alzheimer-type disease. Involvement of lipid raft microdomains.

FACT SHEET

- PIs: Raquel Marín Cruzado and Miriam González Gómez
- Acronym: BrainLifactors
- Reference: SAF2017-84454-R
- Partners/participating entities: Universidad de La Laguna
- Period of implementation: 01/01/2018 to 31/06/2021 (36 months + 6 months extension)
- Budget: 193,600.00 €.
- Funded by: Ministry of Science and Innovation

PROJECT SUMMARY

This project addresses the hugely important biomedical aspect of the influence of p73 on cognitive function during ageing and Alzheimer's disease (AD). The proposal is framed within the fundamental social challenge of healthy brain ageing. Therefore, the results of this project may help to clarify the molecular mechanisms involved in this process and thus to develop new preventive or palliative therapies that contribute to improving the quality of life in the elderly.

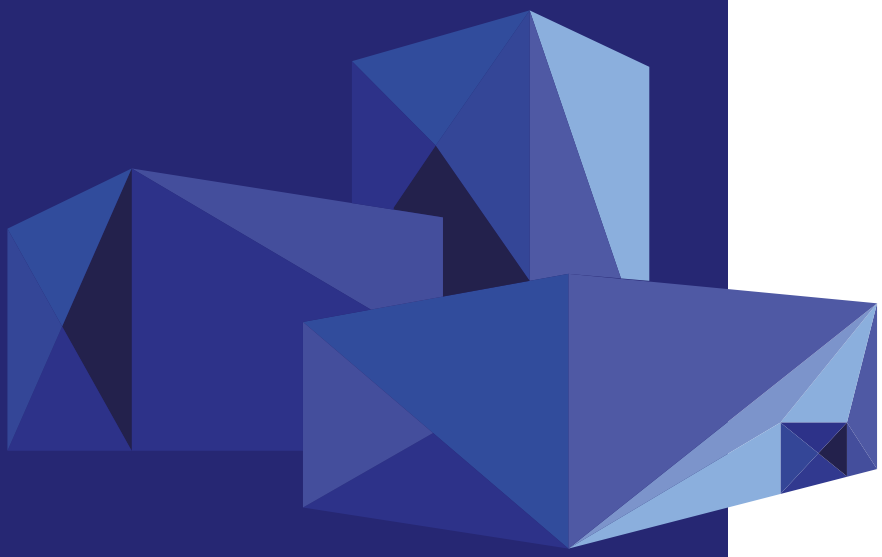
So far, p73 is known to play an important role in the central nervous system, regulating neuronal death and survival. Multiple isoforms of the p73 protein with different functions are known. The truncated form of p73, ΔNp73, has been shown to be a potent survival factor for neurons, while the transactivation form TAp73 is crucial for the long-term maintenance of neural stem cells required for adult neurogenesis. This form is also important for neuronal ageing, and TAp73-null mice develop premature ageing phenotypes with decreased ROS. Our preliminary observations show that in the absence of p73, not only do irreversible brain lesions occur but, these animals, once past weaning, have extremely long lives. These findings suggest "a paradoxical duality of p73", in which the absence of p73 leads to a degeneration of brain tissue in parallel with a slowing of ageing in the rest of the organism, a phenomenon that will be investigated in this project.

One of the most remarkable aspects of mice deficient for all p73 isoforms (P73 knockout) is the absence of Cajal-Retzius cells, which represent the most important source of reelin, a secreted glycoprotein that controls radial migration in the cortex. The extracellular protein reelin plays an important role in synaptic plasticity, cognitive functions and neuronal survival during cortical development and in the adult brain. This protein also has a neuroprotective action against the formation of β-amyloid plaques and their toxicity.

The main objectives of the project are to study the potential modulation of p73 in the expression of reelin and to characterise the role of p73 in the molecular mechanisms of neuronal survival associated with brain ageing, as well as its potential involvement in neurodegenerative processes such as Alzheimer's disease. In particular, we will determine the behavioural patterns according to gender and in different age ranges. We will investigate the potential degree of Alzheimer-type anatomopathological degeneration (senile plaques and neurofibrillary tangles), as well as potential modifications in the expression of cell survival factors in different brain areas of these animals.

We will use human brain samples, KOp73 mouse model and Alzheimer-type disease, neuronal cultures and cerebrospinal fluid samples from AD patients at different stages.

The proposed approaches will allow us to characterise relevant aspects of brain ageing and related neuro-diseases and will provide innovative tools for early diagnosis. In addition, the results are expected to help understand the molecular and cellular changes in nerve cells associated with ageing.



Infrastructure

The construction of the first phase of the ITB headquarters building has recently been completed, and the furniture is currently being purchased and installed, the voice, data and telephone connection system is being finalised, and the large pieces of equipment that were located in the laboratories of different departments are scheduled to be moved. The new three-storey building, located on the Health Sciences Campus and in the vicinity of the Complejo Hospitalario Universitario de Canarias, has a total surface area of 4,000 m²: (1st) an advanced animal facility for rodents and other small animals, specially designed to generate and keep genetically mutated animals; (2nd) a spaces for transfer activities through the Bioavance Foundation, laboratories for the institute's large common equipment, and a large space for experimental laboratories for researchers; and (3rd) a technical floor, located between the two previous ones, to control the maintenance of the building's general facilities.

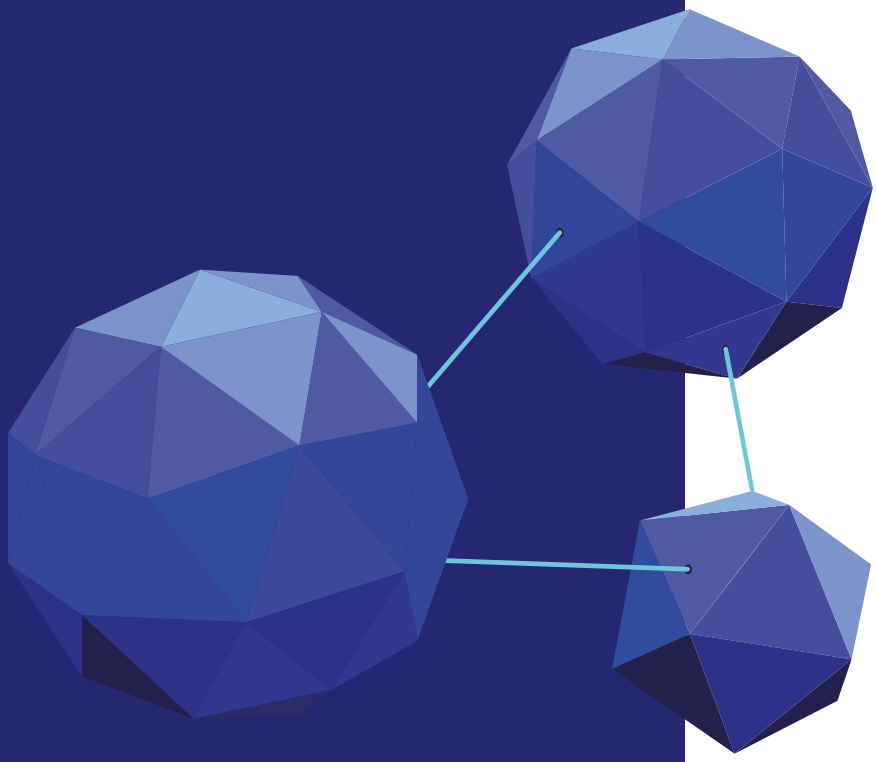
While it was being set up, the ITB's research groups have participated in a coordinated manner in national and European competitive infrastructure calls, which has allowed them to progressively acquire the necessary equipment and renew it at the appropriate pace. At present, the common infrastructure of the institute is made up of the following units, platforms and services:

- Advanced cellular studies unit, including: (i) Advanced Imaging and Microscopy Service (SIMA); (ii) system for microdissection and optical sections at cellular level; (iii) flow cytometry; (iv) electrophysiology for cellular and subcellular studies.
- Instrumentation and sample preparation services, including: (i) spectrometry, spectrofluorometer and microplate readers; (ii) benchtop centrifuges and ultracentrifuges; (iii) advanced systems for quantification of proteins and DNA in different preparations; (iv) cell and particle counters.
- Tissue and cell culture rooms, including P2-type facilities
- Brain and Tissue Bank
- Omics Unit (genomics, lipidomics, metabolomics, proteomics)
- Phenotyping, genotyping and behavioural studies of rodents (in the animal facility)
- Cognitive neuroscience

In addition, the institute's groups have access to the ULL's General Research Support Services (SEGAI), on the Anchieta Campus, which include common equipment and scientific and technical instrumental support, both for internal and external groups. In the case of the specific infrastructure for biomedical and biotechnological experimentation, this service includes a general animal facility, microscopy, genomics, magnetic nuclear resonance for chemical analysis and structural biology, and magnetic nuclear resonance for the study of brain function. Moreover, the institute's groups involved in translational research have access to and collaborate regularly with the Clinical Trials Unit of the Complejo Hospitalario Universitario de Canarias, which is part of the Spanish Clinical Trials Centre (CAIBER) and the Biobank service, certified by the Instituto de Salud Carlos III, and through the collaboration between the ITB and ITER.

Inst. Univ. de Enfermedades Tropicales y Salud Pública de Canarias

Instituto Universitario de Enfermedades Tropicales y Salud Pública de Canarias
Universidad de La Laguna



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Key words:

Tropical diseases
Diagnosis
Therapy
PCR
Drugs
Water and air quality

The entity

The Instituto Universitario de Enfermedades Tropicales y de Salud Pública de Canarias [Canary Islands Institute of Tropical Diseases and Public Health] is a multidisciplinary institution, under the University of La Laguna, made up of lecturers, researchers and professionals related to the field of Public Health and Biotechnology. Its main function is research, development and innovation in these fields. By decree 59/2013, of 16 May, the Institute was awarded the Gold Medal of the Canary Islands.

It was established in 2001 with the aim of providing a useful tool to control, prevent, diagnose and investigate a significant number of tropical diseases whose incidence was increasing in the Canary Islands for various reasons, applying microscopy, immunology and molecular biology techniques.

Areas and departments

Biostatistics and Bioinformatics Unit

The objective of the unit is to provide a statistical and computer support service to the different research groups of the Institute in order to improve the quality of the results and conclusions obtained. The fields of research and work of this unit are:

- Research design: sampling, sample sizes, types of designs...
- Optimal designs of experiments for linear and non-linear models
- Biostatistical analysis of univariate and multivariate data
- Spatial statistics
- Support in scientific computing resources for data analysis

Island Ecology and Biogeography Unit

The Ecology area is made up of the following research groups:
- Biogeography.
- Community, island and terrestrial ecology.

Molecular Genetics Unit

Human Molecular Genetics: this group addresses three different areas. The first one has to do with determining the role of tachykinins present in immune cells in the development of asthma, studying their expression, regulation and signalling mechanisms. The second goal is the molecular analysis of candidate genes that could be involved in the development and progression of uterine tumours. The third area focuses on the neuroprotective effect of estradiol, DHA and ethanol against Alzheimer's disease, studying at the genetic level the mobilisation of the cell's antioxidant defence system, lipid metabolism pathways and certain intracellular signalling pathways.

Biodiversity and Molecular Evolution: this group is interested in the study and quantification of genetic variability in natural populations by using neutral molecular markers, analysing relationships between individuals, identifying divergence patterns between populations and establishing species boundaries.

Parasitology Unit

The Parasitology group are pioneers in the study of tropical diseases in the Canary Islands. Public and private centres have been and continue to be advised by members of the IUETSPC on cases of doubtful origin, providing answers and solutions.

The Parasitology unit is made up of the following research groups:
- Immunology and molecular biology of parasites.
- Faunistic and parasitic zoonoses.
- Antiparasitic therapy.
- Free-living amoebae.
- Entomology.
- Biomarkers of disease

Virology and Bacteriology Unit

- Water and air quality
- Aerobiology: Airborne Germs
- Biological analysis of supply and wastewater
- HIV
- SARS-Cov2/COVID19 Diagnosis
- Biological Alerts

New Therapies and Drug Development Unit

This unit consists of the research group - Galenic Drug Development - which works on the following lines of research:
- Developing, optimising and evaluating controlled release dosage forms of drugs
- Optimising and controlling medicines for paediatric use
- Evaluation and quality control of medicinal products
- Characterisation and stability of macromolecules

Bioanalytical and Environmental Unit

- Presence of contaminants in water, cosmetics
- Removal of pollutants from water and soil
- Microplastics
- Analytical chemistry

Services

Parasitic protozoan therapy trials

Evaluation of the antiparasitic activity of products of natural and synthetic origin. Available models: Free-living amoebae, Trypanosoma cruzi, Leishmania spp.

Free-Living Amoebae Diagnosis

Diagnosis of free-living amoebae in clinical and environmental samples.

Air and water analysis

Bacteriological and parasitological analysis of water of any origin and air.

Emerging/tropical pathogens diagnosis

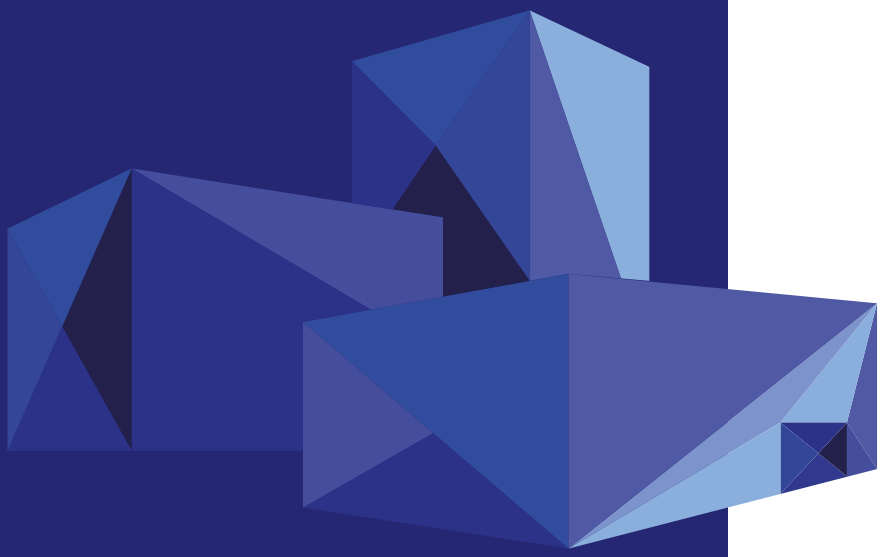
- Detection of SARS-Cov2 (COVID19) by RT-PCR in biological and environmental samples
- Detection of Ebola in biological samples
- Diagnosis of emerging pathogens and biohazardous agents: Ebola, anthrax, haemorrhagic fevers.

Medical Entomology

Characterisation and identification of vectors (mosquitoes, flies, ticks)

Analysis of chemical pollutants in water / microplastics analysis

Analytical Chemistry/Microplastics



Infrastructure

Level 3 Biosafety Laboratory (P-3)

BSL-3 Laboratory
Level 3 laboratory P3 pathogen culture and testing

Laboratory deworming therapy

Parasitic protozoa culture room for the study of the antiparasitic activity of extracts and pure products of natural and synthetic origin.

EQUIPMENT:

- Vertical laminar flow hoods
- Incubator
- Centrifuges
- Cell counters
- Autoclave
- Badge reader
- Inverted and fluorescence microscopy
- Ultrafreezer

Water and Environment Laboratory

- Filter ramp
- Air filtering systems
- Thermal cyclers
- Incubators

Biological Alerts Laboratory / Biomarkers Laboratory

- Pathogen culture
- Detection of more than 20 pathogens simultaneously
- Gene expression
- RT-PCR
- SARS-Cov2
- FilmArray
- Disease biomarkers
- Quantum Studio
- Laminar flow hoods

Directory

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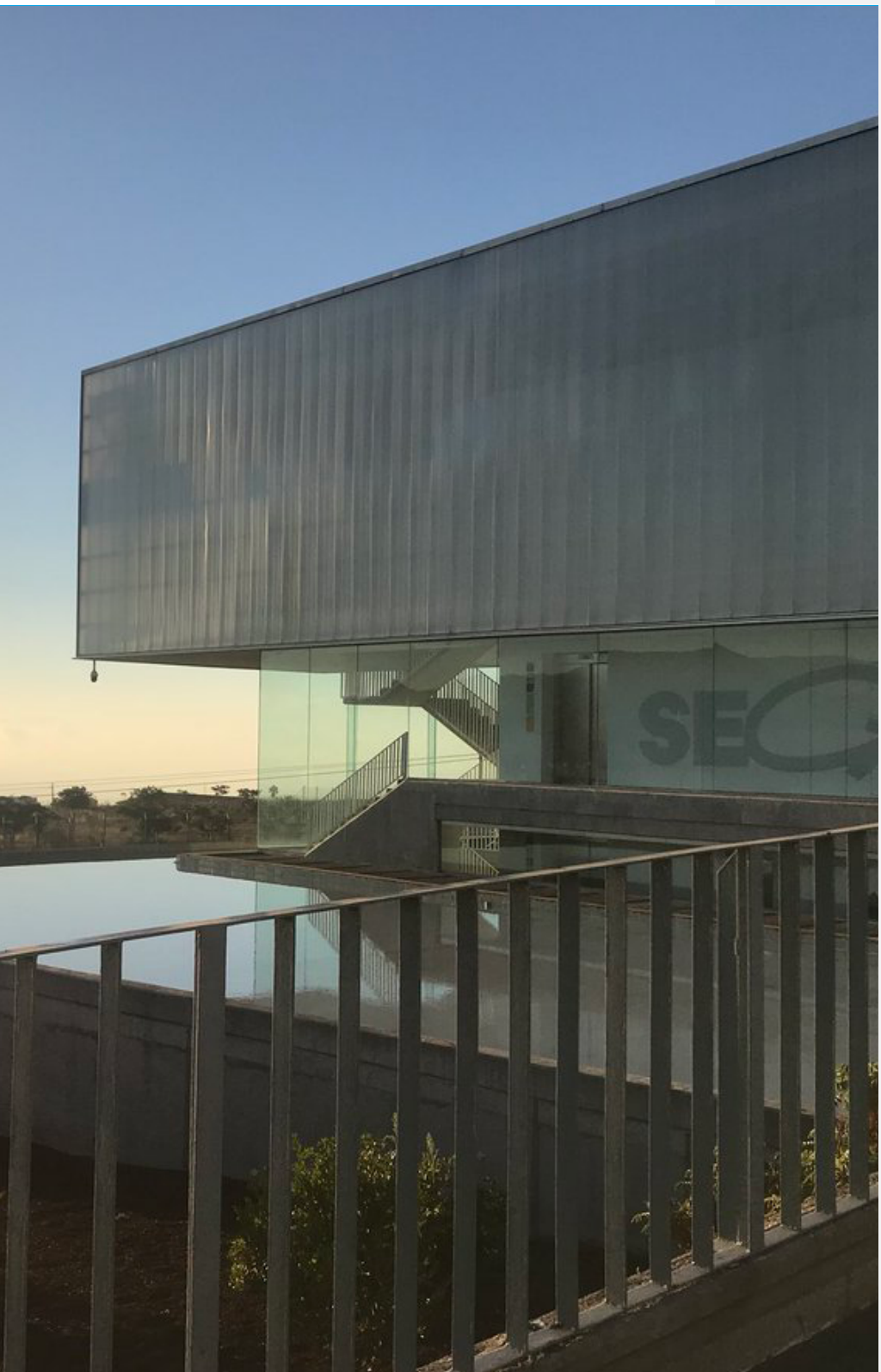
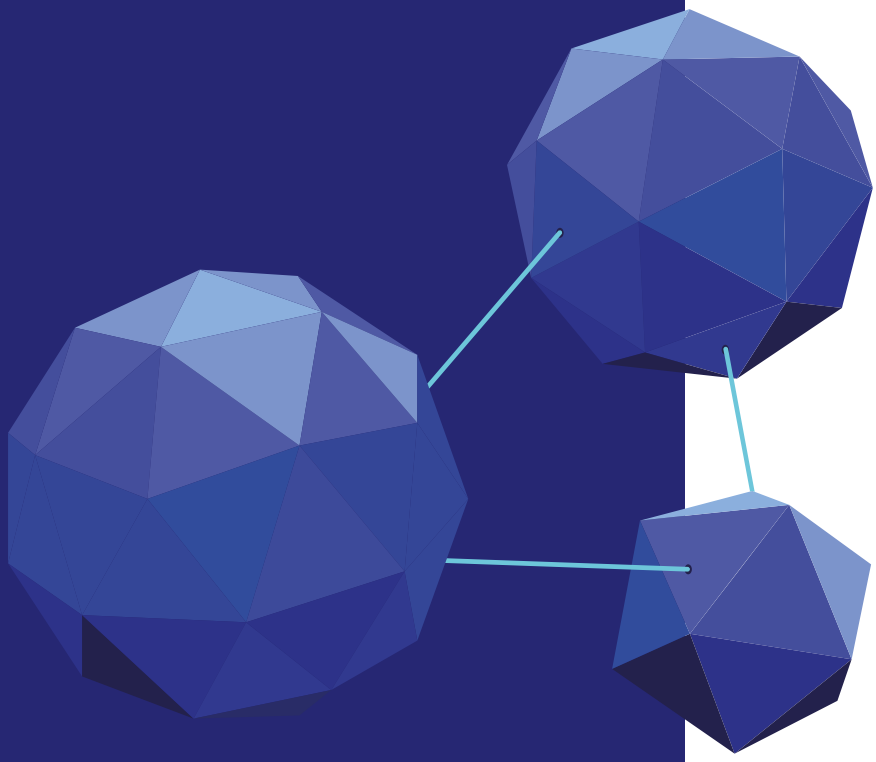
SEGAI

Servicio General de
Apoyo a la Investigación
Universidad de La Laguna





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The entity

The Servicio General de Apoyo a la Investigación (SEGAI) [General Research Support Service] is an innovative university unit which aims to provide scientific-technical support to ULL research groups, as well as to other public research organisations and companies in our region.

Servicios

The SEGAI guarantees the efficient management and use of the ULL's scientific and technological infrastructures, so that they are accessible to all its researchers. The services that can be requested are the performance of tests, technological support for teaching and research, and advice on the development of research projects. It also provides solutions to the needs of external institutions.

SEGAI aspires to become a benchmark in the R+D+i developed at the ULL and in the business and scientific sectors of the Canary Islands, acting as a driving force for technology and knowledge transfer, and thus collaborating to make the ULL more competitive, and closer and more accessible to society.

SEGAI's main goal, in accordance with its Quality Policy, is to meet the needs of its users, which is possible thanks to the high-performance infrastructure available, and above all, to a highly qualified and professional human team, made up of University lecturers as scientific heads of each Service and technicians. SEGAI is currently made up of a total of 26 Services or Laboratories grouped into four sections or divisions:

1. ELEMENTAL AND MOLECULAR ANALYSIS
2. MATERIALS AND SURFACES CHARACTERISATION
3. BIOMEDICAL TECHNOLOGIESS
4. SCIENTIFIC AND TECHNICAL SUPPORT

The Elemental and Molecular Analysis division is made up of a set of techniques that, based on the interaction of electromagnetic radiation with the sample under study, allow information to be obtained on the elements and molecules they are made of, making it possible to determine their composition and concentration and explain their molecular structure.

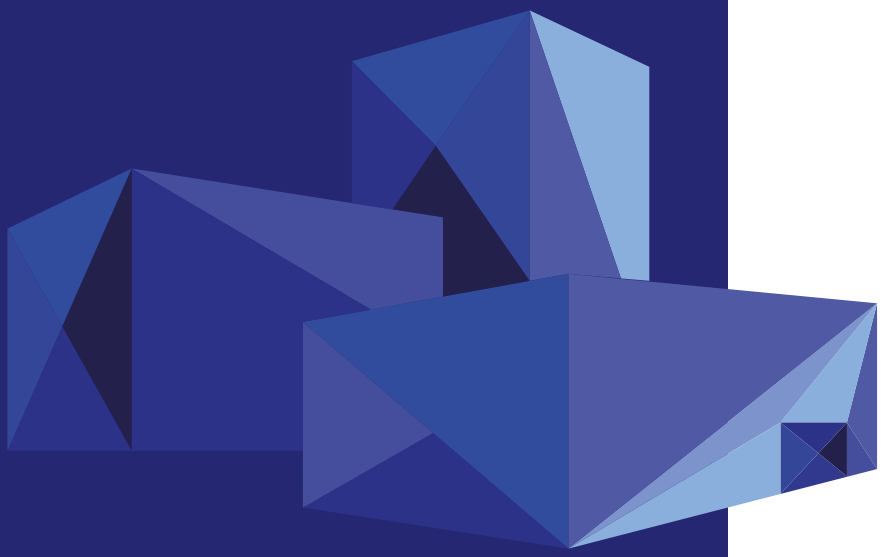
The Materials and Surface Characterisation division, carries out studies of physical properties and the determination of the composition of samples of solid materials and surfaces. The available techniques provide information on different properties of solids, such as density, viscosity, microhardness, particle size, porosity, magnetic properties, crystalline structure and constituent phases, temperature behaviour, surface topography and elemental composition, among others.

A third division provides the services related to Biomedical Technologies. It includes the Animal Facility, the Medical Physics and Environmental Radioactivity Laboratory, the Genomics and Magnetic Resonance Services for Biomedical Research, as well as the Herbarium and the Radioactive Facility of the Anchieta Campus.

Finally, there is the Scientific-Technical Support division, which comprises services to enable studies in the field of conservation and restoration of cultural assets, in the field of linguistics or forensics, as well as services that offer major technological support to develop prototypes and repairs or maintenance of scientific infrastructure.

These services have state-of-the-art technology and together offer companies more than 120 industrial applications, as well as high-level technical advice and reports.

In order to establish the unit as an R&D leading and model organisation, both within the University and in the business sector, SEGAI has equipped itself with a quality management system based on the international standard ISO 9001:2015, certified in 11 of its services and partially implemented in the rest, and on the European EFQM model of Excellence and Quality in Business Management, of which it has the +400 Seal.



Infrastructure

Elemental and molecular analysis

ATOMIC ABSORPTION SPECTROSCOPY SERVICE

Atomic absorption spectroscopy makes it possible to determine the presence of more than 70 different elements in dissolved or solid samples with very sensitive detection limits, at the ppm or ppb level (10-3 and 10-6 g/L or kg of sample). It is an important technique for determining the existence of trace metals in food, water and beverage samples, as well as in environmental studies to determine atmospheric pollution (metal content in aerosols), in forensics, in archaeology, and in the conservation and restoration of cultural assets (identification of pigments). Other sectors in which this technique is applied to determine metal content are the metal industry, the pharmaceutical industry, and the cosmetics and perfumery industry.

Techniques available

- Atomic absorption spectroscopy with a graphite furnace.
- Atomic absorption spectroscopy with flame atomisation.
- Inductively coupled plasma mass spectrometry (ICP-MS).
- Treatment of samples by wet digestion using microwaves.

Equipment

- Atomic Absorption Spectrophotometer with Graphite Chamber and background corrector Zeeman Varian 220Z Equipped with GTA 110Z Power Supply and UltraAA.
- Atomic Absorption Spectrophotometer with air/acetylene flame atomisation and nitrogen protoxide/acetylene Varian 220 FS.
- Inductively coupled plasma mass spectrometer with orthogonal detection system (ODS), Agilent 7900 ICP-MS.

INFRARED SPECTROSCOPY SERVICE

This spectroscopic technique allows information to be obtained on how the atoms that make up a molecule of unknown structure are joined together, based on the frequency at which they vibrate after interaction with infrared radiation. It is widely used in research and industry because sample preparation is not complex, and it is a fast and accurate technique, being used for monitoring chemical reactions and in quality control. Some of the most important applications include characterisation and identification of materials (polymers, plastics, minerals, catalysts, composite materials, etc.), analysis of pharmaceutical and synthetic products, analysis of contaminants, forensic identification, pigment analysis, etc.

Service certified according to ISO 9001:2015.

Techniques available

- Infrared spectroscopy technique to study samples of different nature (solids, liquids and gases) under ambient and high temperature conditions.
- Attenuated total reflection technique (ATR).
- NIR technique for agri-food samples.
- In-situ electrochemical interface studies.

Equipment

- Bruker IFS 66/S spectrometer equipped with a DLaTGS detector for routine measurements at room temperature and a liquid nitrogen cooled MCT detector for high sensitivity and fast measurement.
- Specac's Golden Gate ATR accessory with diamond prism.
- Bruker MPA (Multi-Purpose Analyzer) spectrometer.

- Jasco FT/IR-6800 spectrometer with ATR PRO ONE accessory.
- Jasco IRT-7200 microscope coupled to Jasco FT/IR-4700LE spectrometer

MASS SPECTROMETRY AND ELEMENTAL ANALYSIS SERVICE

Mass spectrometry is an analytical technique to accurately determine molecule distribution in a substance on the basis its mass. It is used to identify the different chemical elements in a compound, or to determine the isotopic content of different elements in the same compound.

In the facility carbon, nitrogen, hydrogen, and sulphur content of solid or liquid samples can also be obtained using the elemental analysis technique. Its main application is to confirm the structure of a compound, as well as being a purity criterion.

ISO 9001:2015 certified service..

Techniques available

- Accelerated electron impact (EI) mass spectrometry.
- Fast atom bombardment mass spectrometry (FAB).
- Chemical ionisation (CI) mass spectrometry.
- Gas chromatography coupled to high resolution mass spectrometry, GC-HRMS.
- Elemental composition analysis (C, N, H and S).

Equipment

- Micromass AutoSpec magnetic trisector mass spectrometer with EBE geometry.
- Elemental Analyser CNHS FLASH EA 1112.

NUCLEAR MAGNETIC RESONANCE SERVICE

The technique of nuclear magnetic resonance spectroscopy exploits the interaction of a magnetic field with the nuclei of the constituent atoms of the sample to obtain information on the molecular structure of both organic and inorganic compounds.

Techniques available

- Nuclear magnetic resonance spectroscopy of H, C-13, P-31, N-15 and F-19.
- Kinetics and molecular dynamics studies.

Equipment

- Bruker Avance 500 high-resolution liquid-phase spectrometer with an automatic BACS changer for 60 samples. Equipped with the following accessories: 5 mm BBO three-channel reverse sensing probe (1 H,13 C, broadband), HRMAS three-channel reverse sensing probe (1 H,13 C,31 P) and a Bruker BCU Xtreme cooling unit for experiments at low temperatures.
- Bruker Avance III 600 high resolution liquid phase spectrometer equipped with 5 mm TCI cryoprobe with inverse detection (1 H,13 C,15 N) and 5 mm TXI probe with inverse detection (1 H,13 C,15 N).

AGRI-FOOD TECHNIQUES SERVICE

The state-of-the-art scientific infrastructure in this unit, together with its experienced qualified staff, guarantee the determination of pesticides and other essential analyses for local products and foodstuffs. Currently, different lines of work have been developed, focusing on specific demands and the needs of producers. This laboratory aspires to become a regional reference for the determination of contaminants and nutrients in agri-food samples.

Techniques available

- Qualitative and quantitative analysis of contaminants and nutrients in agri-food samples (pesticides).

Equipment

- Acquity UPLC I-Class liquid chromatograph coupled to a Waters Xevo G2-XS QT of time-of-flight analyser quadrupole mass spectrometer.
- Acquity UPLC H-Class liquid chromatograph coupled to a Waters Xevo TQD triple quadrupole mass spectrometer.

- Infinity 1290 liquid chromatograph coupled to an Agilent Technologies 6230 TOF LC/MS time-of-flight analyser mass spectrometer.
- 7890B gas chromatograph coupled to a 7000 C triple quadrupole mass spectrometer and Agilent Technologies CombiPAL robotic automatic sample injector.
- Scion 436-GC gas chromatograph coupled to a Bruker TQ triple quadrupole mass spectrometer and CP-8400 autosampler.
- Scion 436-GC gas chromatograph with flame ionisation detector (FID) and Bruker CP-8400 autosampler.

LIPID ANALYSIS SERVICE

Lipids are a group of very heterogeneous macromolecules that are mainly made up of C, H, O and P. Their main function is to provide energy, and it is important to study them as they provide around 30% of the calories in daily intake. This service includes analytical methodologies for their determination in biological samples.

There are basically three types of lipids in food: oils and fats, phospholipids and fatty acids. Analysing these parameters is relevant from the point of view of food quality and safety, since it is precisely from some of the physico-chemical properties of these compounds that their properties derive.

Techniques available

- Lipid analysis: types of fats and acids present.

Equipment

- Gas chromatograph Scion436-GC with flame ionisation detector (FID) and Bruker CP-8400 autosampler.
- Lipid class development systems using high performance thin layer chromatography (HPTLC).
- BioRad's Model 5000 VersaDoc integrated image analysis system.
- BioRad Densitometer GS 800.

Characterisation of materials and surfaces

PARTICLE AND MICROSURFACE CHARACTERISATION LABORATORY

In this laboratory, the physical characterisation of surfaces and powdery solids is carried out, determining particle size, microhardness, viscosity, porosity, specific surface area and absolute density, among other parameters.

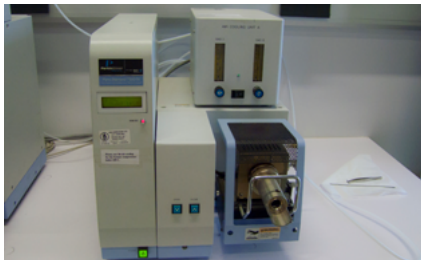
The fields of application are very varied. For example, the hardness of a material, as well as its elastic, plastic and deformation properties are related to its quality, durability, strength, efficiency, ageing and physical or chemical alteration, and are characteristics that determine the use of the material in construction, as coatings (paints or lacquers), as electronic components, or as rubbers or polymeric materials with industrial or biomedical applications. Knowing the density, specific surface area and porosity of a material is important in the manufacture of resins, pigments, adsorbents, filters, ceramics, paper, pharmaceutical drugs and excipients, catalysts, etc.

Techniques available

- Photon correlation spectroscopy and laser light scattering.
- Static Light Scattering (SLS).
- Helium pycnometry.
- Mercury intrusion porosimetry.
- Gas physisorption.
- Rheometry.

Equipment

- Particle size and Z-potential analyser, Zetasizer Nano ZS, from Malvern Instruments.
- Wet and dry particle size analyser, Mastersizer 2000, from Malvern Instruments.
- Micromeritics Accupyc 1330 gas pycnometer.
- Micromeritics Autopore IV mercury porosimeter.
- Micromeritics Gemini V physisorption analysers.
- Micromeritics ASAP 2020 physisorption analysers.
- Bohlin CVO 100 rheometer, from Malvern Instruments.



THERMAL ANALYSIS SERVICE

This service makes it possible to determine the changes in mass and energy variations in a material produced through temperature, as well as to identify, by means of mass spectrometry, the decomposition or reaction gases generated.

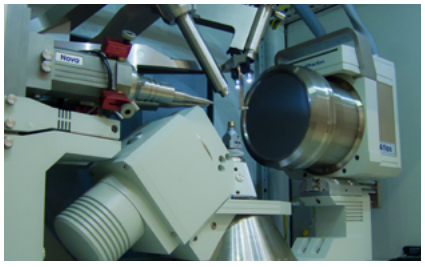
The material's density changes can also be studied through temperature as well as its coefficient of thermal expansion, among other parameters. So, polymers, rocks, minerals, construction materials, fossil fuels, pharmaceuticals, etc. can be characterised.

Techniques available

- Thermogravimetric analysis.
- Differential thermal analysis.
- Thermal characterisation of processes using differential scanning calorimetry.

Equipment

- TA Instruments Discovery DSC 025 Differential Scanning Calorimeter.
- TA Instruments Discovery SDT 650 Simultaneous Thermal Analyser (TG/DSC).
- Perkin Elmer Pyris Diamond TG/DTA thermogravimetric analyser.



X-RAY DIFFRACTION SERVICE

The Integrated X-ray Diffraction Service (SIDIX) has state-of-the-art infrastructure, essential for basic and applied research in different areas of knowledge, such as Anthropology, Archaeology, Materials Science, Pharmacy, Physics, Geology, Palaeontology, and Chemistry, as well as in the fields of Construction, Civil Engineering, Forensic Forensics, etc.

This technique allows the physical characterisation of solids, so the crystalline structure of a compound can be determined, imperfections of materials can be studied, or crystalline phases present in a sample can be identified.

Service ISO 9001:2015 certified

Techniques available

- X-ray diffraction on polycrystalline samples.
- X-ray diffraction of single crystals.
- X-ray diffraction as a function of temperature and pressure.
- Energy dispersive X-ray fluorescence (EDXRF).

Equipment

- PANalytical X'Pert PRO Diffractometer.
- PANalytical Empyrean diffractometer.
- Oxford Diffraction Supernova Diffractometer.
- Rigaku Oxford Diffraction Supernova diffractometer.
- Bruker S2 Puma energy dispersive X-ray fluorescence spectrometer.

MULTI-TECHNIQUE SURFACE ANALYSIS SYSTEM SERVICE

Thanks to the available equipment different spectroscopic techniques can be combined to characterise solid surfaces in their original or degraded conditions. It is possible to identify the elements present in the sample, quantify them and determine how they are combined. In addition, stripping and in-depth analysis can also be carried out.

It can be applied to study of a large number of materials: metals, polymers, semiconductors, ceramics, fibres, catalysts, biomaterials, minerals, etc.

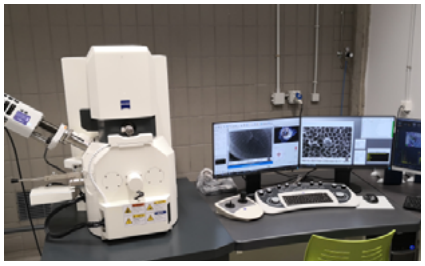
Techniques available

- X-ray photoelectron spectroscopy (XPS).
- Ultraviolet photoelectron spectroscopy (UPS).
- Auger electron spectroscopy (AES).
- Ion Scattering Spectroscopy (ISS).
- Auger electron microscopy (SAM).
- Secondary electron microscopy (SEM).

Equipment

- Escalab Thermo Fisher 250.

ELECTRON MICROSCOPY SERVICE



The existing infrastructure of this facility is a window into the micro- and nanometric world. It enables the observation of the surface topography of samples by scanning electron microscopy, and their internal structure by transmission electron microscopy. It is also possible to perform qualitative and semi-quantitative microanalysis of the elements present and to obtain a map of their distribution.

Electron microscopy can be used in different areas, e.g. Cell Biology, Botany, Genetics, Zoology, Parasitology, Anatomy, Histology, Disease, Forensic Medicine, Chemistry, Physics, Materials Science, Engineering, etc.

ISO 9001:2015 certified service

Techniques available

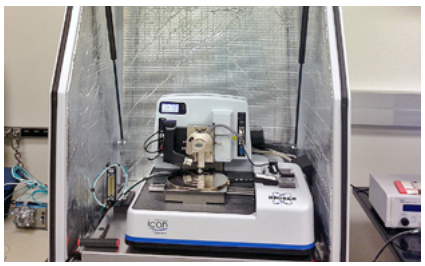
- Scanning electron microscopy (SEM).
- Transmission electron microscopy (TEM).
- Energy dispersive X-ray spectroscopy (EDXS).

Equipment

- JEOL JEM 1010 transmission electron microscope (TEM) with a resolution of 0.4 nm.
- ZEISS EVO 15 scanning electron microscope (SEM) with 2 nm resolution and Oxford X-MAX 50 mm energy dispersive X-ray (EDX) microanalyzer (50 mm)2.
- JEOL JEM 2100 transmission electron microscope (TEM) with 0.24 nm resolution and Oxford XMAX 80 mm energy dispersive X-ray microanalyzer (EDX)2 coupled.
- Ultramicrotome Leica Ultracut UTC 7062. Equipment for biological sample preparation.
- QUORUM Q150R ES PLUS sputtering equipment.
- Non-biological sample preparation equipment: ultrasonic disc cutter, concave grinder and precision ionic polishing system.

ATOMIC FORCE MICROSCOPY SERVICE

Atomic force microscopy, AFM, is a technique for the surface characterisation of materials with a resolution of less than 100 nanometres. For particularly flat samples, the resolution can be sub-nanometre. The AFM technique together with tunneling microscopy, STM, are part of the so-called nanoscopies. This is a whole group of techniques, instruments and procedures aimed at characterising matter at the nanometre scale.



Techniques available

- Atomic force microscopy (AFM) in magnetic, conductive, lateral forces, electrical forces, surface potential (work function), nanomechanical properties (Young's modulus), adhesion and deformation.
- Tunnelling microscopy (STM).

Equipment

- Atomic force microscope Nanoscope V Multimode DIGITAL INSTRUMENT.
- Dimension Icon Bruker atomic force microscope.

Biomedical technologies

ANIMAL FACILITY

This service deals with more than 1200 requests per year related to the sale of animals for research (rats, mice, rabbits and frogs), their accommodation in the facility and assistance in procedures in which they are used. It also has fully equipped operating theatres where research projects requiring animal experimentation can be carried out.

This is a unique facility with a pathogen-free zone for housing immuno-compromised or genetically modified animal species.

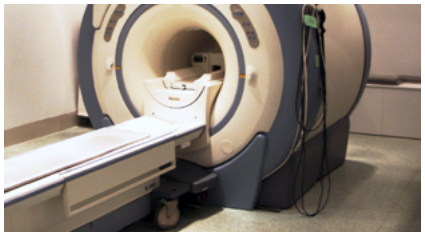
ISO 9001:2015 certified service

Techniques available

- Specific pathogen-free zone.
- Two operating theatres, one of which is located in the pathogen-free zone.
- Laboratory.
- 12 rooms for breeding and keeping rodents and lagomorphs in a controlled environment.
- Sterilisation area.
- Material, feed and swarf stores.
- Incinerator.
- Insectarium.

Equipment

- Rattus Norvergicus: Rat.
- Sprague-dawley, designation OFA/SD (IOOS Caw).
- Mus musculus: Mouse.
- Swiss CD1.
- C57BL/6.
- 129S2/SvPasIco.
- BALB/c.
- FVB.



MAGNETIC RESONANCE IMAGING SERVICE FOR BIOMEDICAL RESEARCH

A range of techniques are available to study brain response under both physiological and pathological conditions, including functional magnetic resonance neuroimaging techniques, in vitro and in vivo magnetic resonance spectroscopy, transcranial magnetic stimulation and cortical bioelectrical activity.

ISO 9001:2015 certified service

Equipment

- MRI 3.0 T Excite HD SIGNA EXCITE 3.0T 511496-4.
- Multinuclear spectroscopy kit, currently with 13C and 1H.
- Sensory stimulation systems compatible with the MRI environment.
- Systems for recording physiological and behavioural responses compatible with MRI.
- Equipment for the study of cortical biopotentials compatible with the MRI environment.
- MRI-guided transcranial magnetic stimulation system.
- Complete laboratory for the study of the basic principles of neurovascular response, biophotonics, cellular electrophysiology, molecular transfer, etc.

MEDICAL PHYSICS AND ENVIRONMENTAL RADIOACTIVITY LABORATORY

This is a technical, research and consultancy laboratory that carries out radiological measurements and studies. It is part of a national network of laboratories for radiological monitoring of risk levels for the population and the environment, which supplies data to the Nuclear Safety Council. It has equipment and personnel with accredited technical qualifications to carry out tests to determine environmental radioactivity in water, food, soil and aerosols, in compliance with the ISO 17025 standard.

Techniques available

- Measurement of environmental radioactivity due to natural radionuclides and possible contributions of artificial radionuclides in different matrices.
- Measurements of electromagnetic fields generated by high-voltage power lines.
- Training for staff working in the use of radiation and for the general public.
- Radon measurements in dwellings, public and private buildings, caves and galleries.
- Measurement of electromagnetic radiation emitted in the vicinity of telephone base stations (and the transmitting equipment itself).

Equipment

- Alpha spectrometers Canberra Industries Inc 7401VR (camera); A-450-18-AM (detector).
- ZnS solid scintillation detectors Canberra Industries Inc. 2007P.
- Gamma spectrometer: P-type Ge-HP detector GR2520 Canberra Industries Inc.
- Gamma spectrometer: Ge-XTRA detector. Type No. Inc.GX4019 Canberra Industries Inc.
- High-flow aerosol sampling station with two flow measurement units (PTI). Physik-Technik-Innovation (PTI) ASS-500 1/00.
- LaBr3 solid scintillation detector. UNISPEC-L LABR-1,5×1,5 Canberra Industries.
- Air Suction Pumps AVS-28th RADeCO Science Applications Inc.
- HI-Q VS-23 Air Suction Pump HI-Q Environmental Products Company.
- Electromagnetic field meters. Narda Safety Test Solutions GmbH EFA 300 B 2245/30 (meter) 2245/90.31 (E-sensor), 2245/90.10 (I-sensor).
- Electromagnetic field meter. Narda Safety Test Solutions GmbH EMR 300 2241/31 (meter) 2244/9073 (sensor).
- Environmental radiation monitor with compensated Geiger Müler detector. Environmentalmeter type 6-80 no. 002232 MINI-INSTRUMENTS.
- Thermoluminescent dosimeter reader, TLD System 4000 Harshaw Nuclear Sytems.
- Sarad RadonScout Plus Radon Meter Serial No. RSCP-0144.

GENOMICS SERVICE

This service provides university researchers and other public bodies, as well as companies in our area, with cutting-edge instrumentation in the field of DNA analysis, making it a leading centre at regional level.

DNA analysis has multiple applications in different areas: basic research in Genetics and Ecology; it is an important tool in Biomedicine, as it enables the characterisation of genes with clinical relevance, the detection of genetic susceptibility to certain types of

cancer, the design of drugs, and the diagnosis of hereditary diseases; in Forensic Medicine to identify individuals and paternity tests; in Microbiology for the characterisation of viruses and bacteria; in Veterinary Medicine, to obtain pedigrees and identify genes of interest in species improvement programmes; in Agri-food, to identify species, their traceability and detect fraud.

ISO 9001:2015 certified service

Techniques available

- Automatic sequencing by capillary electrophoresis.
- Genotyping or fragment size analysis of PCR-generated fragments.

Equipment

- Analytical balance MFD BY A 8DCO.LTD Balance ACCULAB VI-400.
- Beckman Coulter Microfuge Beckman Coulter Microfuge 18.
- Eppendorf Microcentrifuge Eppendorf Centrifuge 5804.
- Becton Dickinson LSRII flow cytometer.
- BioRad PowerPac 300 power supply for electrophoresis.
- Automatic DNA sequencer Applied 3500 Lifetechnologies 3500 Applied BioSystem.
- BIO-RAD iCycler real-time thermocycler for relative quantification of RNA or DNA.
- Thermal Cycler PTC200 MJ Research PTC200.
- UV Transilluminator UVP TFM-20.

ANCHIETA CAMPUS RADIOACTIVE FACILITY

This service allows the user to acquire, store and safely use radioactive material for teaching and research purposes, in quantities greater than those exempted. The resulting radioactive waste is also managed. The available infrastructure includes a liquid scintillation counter for the detection of beta particles and 2 solid scintillation counters (one probe and one well type) to detect gamma particles. The facility has an area equipped for working with radioactive material with appropriate safety measures, a laminar flow hood, protective shields and a series of radiation detectors that allow environmental radiological monitoring and control of contamination of equipment and work surfaces.

The facility has permits for the handling of a wide range of radionuclides, so research groups from different areas can use it.

Techniques available

- Measurements of radiation emitted by beta particles in liquids.
- Measurements of radiation emitted by gamma particles in solids.
- Measurement of radiation emitted by high-energy radionuclides in animals.
- Testing of a wide range of radionuclides.
- Semi-quantitative measurement of impressed radiation on radioactively sensitive plates.

Equipment

- Liquid scintillation counter for beta radiation (TRICARB 4810 LSC, PERKIN-ELMER).
- Solid scintillation well counter for gamma radiation (COBRA II, PACKARD).
- Solid scintillation probe counter (CAPTUS™-500, CAPINTEC).
- Laser emission scanner (MOLECULAR IMAGER FX, BIO-RAD).
- Laminar flow hood (CAPTAIR®, CRUMA).
- Protective shields (56-610, VICTOREEN).
- Radiation monitor (900 Probe: MC-10 type R, MINI INSTRUMENTS).
- Radiation monitor (T-401, TRACERCO).
- Centrifuge (Super T21, SORVALL).

TFC HERBARIUM

The University of La Laguna's Herbarium is internationally registered with the acron-

ym TFC and is a member of the Asociación de herbarios Ibero-macaronésicos (AHIM) [Ibero-Macaronesian Herbarium Association]

This facility has sample collections exceeding 130,000 specimens (53,000 of vascular plants), 24,000 of fungi, 16,000 of lichens, 15,000 of algae and 22,000 of bryophytes). It is undoubtedly one of the most important representative collections of Canarian flora in general, compared to that of any other herbarium located in the Canary Islands or outside. It also has collections from the other Macaronesian archipelagos, the Iberian Peninsula and European countries, as well as from North Africa, Venezuela, Mexico, Cuba and other parts of the world through exchanges with international herbaria. Reference collections of many ULL works are also deposited in this herbarium. In addition, several collections of the Herbarium are included in the Data Portal of GBIF.ES- Spanish Node of the Global Biodiversity Information Infrastructure.

Offer

- Plant/species identification.
- Preparation of plant/species identification reports.
- Processing of fresh research material and inclusion in the herbarium/species.

Scientific and technical support

DIGITAL DESIGN AND MANUFACTURING LABORATORY

The laboratory makes use of advanced graphic technologies to offer a comprehensive service in the field of digital fabrication in the fields of artistic production, product design, architecture and scientific dissemination.

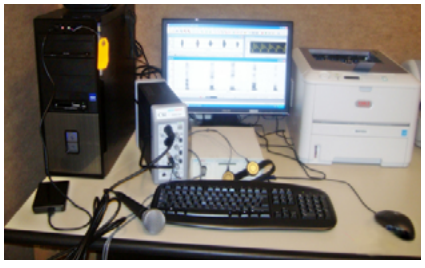
The design and production of virtual and physical objects is carried out using 3D software and computer-controlled manufacturing machines.

Techniques available

- 3D printing of models.
- Cutting of parts for models and prototypes.
- Milling of relatively soft materials.
- Engraving of materials.
- 3D infographics and models for scientific dissemination.
- 3D scanning of small and medium sized objects.

Equipment

- 3D printer type (FDM) Solidready Printing of three-dimensional prototypes type (FDM).
- 3D printers type (FDM) Witbox Three-dimensional prototype printer type (FDM).
- HAASE three-axis CNC milling machine work area (80 x 120 x 14 cm).
- Paper and vinyl cutting plotter SECABO work area (60 cm).
- ARTEC EVA 3D scanner Focal distance between 40 and 100 cm.



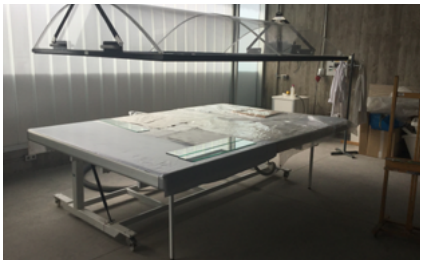
PHONETICS LABORATORY

This facility has the necessary equipment to analyse and identify the human voice, normal or with diseases, or any type of sound wave, both from an articulatory and an acoustic or physical perspective.

The fields of application include research in linguistics (sounds, phonemes, prosody, etc.); the logopaedic or medical field, to address the analytical and therapeutic problems posed by the production or perception of the human voice; the forensic field, where a series of objective analyses allow certain voices to be recognised and identified and which can be used as evidence in legal proceedings; and the psychological field, when dealing with problems involving language processing.

Techniques available

- Acoustic analysis of sound waves, characterising them by means of fundamental physical parameters (frequency, intensity, duration).
- Articulatory analysis of the voice in speech sequences.
- Various devices for recording, playback and exposure of voice samples.



WORKS OF ART ANALYSIS AND DOCUMENTATION SERVICE

The equipment in this service can be used in works of art conservation-restoration projects. Thus, for example, images obtained in the ultraviolet spectral range are used to determine the state of the surface of the pictorial work, the varnish, the repainting and the recognition of some pigments. Infrared images can detect the existence of covered forms and inscriptions, transformations in the compositions and the underlying drawing.

Techniques available

- Multispectral documentation and analysis: acquisition of technical images in the visible and invisible spectrum (360-1000 nm) to highlight and interpret certain physical characteristics of the object under examination.
- 3D scanning enables the creation of a replica of an object of any size, colour and texture in digital format so that it can be archived, reproduced, modified or prepared for prototyping. For this purpose, we use short-range recording devices with outstanding geometric accuracy.
- Low-pressure hot table: provides an environment of controlled heat, humidity and vacuum that facilitates consolidation, coating and deformation removal treatments of organic materials (easel painting, graphic works, textiles, etc.).

Equipment

- ARTIST Multispectral System: multispectral equipment designed for the analysis of movable heritage with advanced documentation and processing capabilities. It has a spectral sensitivity of 380 to 1,100 nm and a CCD sensor with a resolution of 2 MP.
- FujiFilm XT1-IR camera: a mirrorless, portable camera designed for scientific documentation with a spectral sensitivity of 380 to 1,000 nm and a 16.3 MP APS-C sensor.
- Artec Eva scanner: portable structured light scanner, with an optimal capture range between 15 and 200
- cm, a scanning resolution of 0.2 mm and a texture resolution of 1.3 MP.

FORENSIC SUPPORT SERVICE

This service is made up of a platform of SEGAI's member services which, working cooperatively from different areas of knowledge, offer a wide variety of analytical methods and techniques to meet the numerous approaches and needs demanded by the development of expert activities at a local, national and international level. It should be pointed out that activities carried out include consultancy services for public and private organisations, as well as for individual users within the legal framework.

ISO 9001:2015 certified service.

Techniques available

- Document analysis
- Mineralogical identification.
- Determination of corrosion in metals.
- Detection of contaminants.
- Food and cosmetic fraud.
- Speech expertise to identify subjects.
- Comparative analysis of scratches and forcings, presence of plastics and paints.

Equipment

- Niton XL3 T950 Helium Energy Dispersive X-Ray Fluorescence Analyser

ELECTRONICS SERVICE

It is an instrumental maintenance laboratory set up to repair equipment, design and develop electronic prototypes. They also develop software for the visualisation and control of scientific equipment, in addition to offering advice on electronic issues.

ISO 9001:2015 certified service.

Techniques available

- Repair of electronic equipment (excluding computer equipment).
- Development of visualisation and control software for electronic equipment.
- Design and development of electronic prototypes.

Equipment

- LPKF Protomat S62 mechanical milling PCB fabrication equipment with 0.25 microns resolution and automatic tool change. It achieves high precision even on RF and microwave circuits.
- Mega Rota Spray RS1210 chemical etching printed circuit board manufacturing equipment.
- LPKF ProtoPlaceS semi-automatic positioning and dispensing system for SMD (Surface Mount Device) components with vision camera, carousel dispenser and air intake for vacuum pump.
- Soldering/soldering system for SMD components including BGA (Ball Grid Array) components Ersa PL550A.
- Sony equipment for conferences where simultaneous translation is required, consisting of a central console SX1310A and interpreter unit SX6600.
- LPKF MiniContactRS through-hole plating system for PCBs with diameters from 0.3mm and above with Reverse Pulse Plating technology that guarantees a homogeneous plating over the entire surface of the hole.
- Simultaneous translation system based on infrared transmission HT-6700.

MECHANICS SERVICE

This workshop develops, manufactures, repairs, modifies and conducts geometric verification of mechanical prototypes. It has three-dimensional metrology machinery, a machining lathe with position control, a machining-milling centre, and a circular, rectangular and square profile cutting machine.

Techniques available

- Design and repair of mechanical prototypes.
- Measurement, geometric verification and digitisation of parts up to a maximum size of 300 x 500 x 300 mm.
- Profiles or bars cross-linking with a maximum cross-section of 10 x 10 cm.
- Modification or repair of parts and prototypes.

Equipment

- 4-axis CNC machining centre MICROCUT MCV-2412 with FAGOR 8055M control.
- MICROCUT TC-1440 parallel lathe with FAGOR NV-300T digital dimension display.
- Band saw MG CY-210.
- LINCOLN POWERTEC 271C MIG/MAG wire welding equipment.
- 3D printer type FDM BQ HEPHESTOS 2.
- MITUTOYO QM-M353 three-dimensional measuring machine.

LIQUID NITROGEN SERVICE

The ULL's Liquid Nitrogen Service provides users with high purity liquid nitrogen, at a temperature of -196ºC, both for teaching and research.

It is used to freeze food, preserve blood samples and other biological products and as a general cryogenic agent. It is also used to pressurise cans and bottles of non-carbonated beverages by adding nitrogen droplets before sealing the container and is also used as a refrigerant for sophisticated scientific equipment.

COMPUTER SUPPORT SERVICE FOR RESEARCH

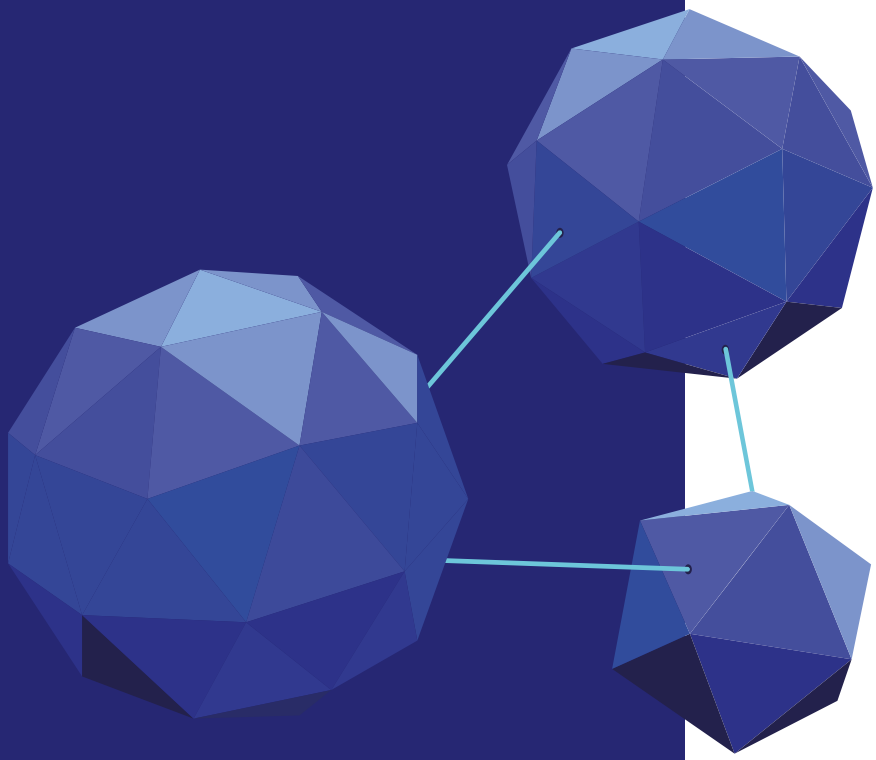
It provides support and access to scientific computing resources to the University of La Laguna's research community. The high-performance computing equipment available has been financed with European Regional Development Funds (ERDF).

Equipment

- Tajinaste IBM AMD Opteron 64 supercomputer.
- Drago Bull's Coherence Switch Bullx Linux supercomputer.

Instituto Universitario de Bio-orgánica Antonio González

Instituto Universitario de Bio-Orgánica Antonio González
Universidad de La Laguna



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The entity

The Instituto Universitario de Bio-orgánica Antonio González (IUBO-AG) [Antonio Gonzalez Institute of Bio-organics] was founded in 1964 with the aim of studying the secondary metabolites produced by marine and terrestrial organisms of the Canarian biodiversity, in order to provide a new source of unique compounds. Over the years, the Institute has evolved into a multidisciplinary centre oriented towards research in fields such as Bio-Organic Chemistry, Biomedicine, Biotechnology, Organic Geochemistry and Smart Materials. The Institute is a benchmark for advanced training, specialising both ULL students and staff from other national and international centres. Since its beginnings, the Institute has interacted with other research centres, especially regional ones, to generate joint research areas. It has also shown its capacity as an incubator to create technology-based companies, collaborating with the production sector and favouring technology transfer.

The Institute organises its scientific activity in research groups that are ultimately responsible for the development of research projects, training staff and students, organising courses, seminars, congresses, and any other training activity related to the Institute's activities. In addition, the Institute's research staff offers advice to public and private institutions.

Areas and departments

Biodiversity Platform

The platform aims to generate a bank of extracts from the pharmacognostic study of terrestrial and marine plant and animal species native and non-native to the Canary Islands, in order to learn more about the pharmacological potential of the species that grow in the Canary Islands, their lipid characterisation, and their deuterium isotopic register (particularly important in these studies because it is a biomarker of adaptability and climate change). The biobank addresses at regional level a global problem, that is, the need to contribute to the conservation and sustainable use of biodiversity, natural resources and ecosystem services in the Canary Islands and, therefore, in the Macaronesian region.

The IUBO-AG groups participating in this platform are AMBILAB, BIOLAB, PROMAR, QUIBIONAT, QUIMIOPLAN

Platform for Chemical Libraries of Therapeutic Interest

The platform aims to design, synthesise and characterise libraries of compounds based on natural privileged structures related to the biodiversity of the Canary Islands, and is oriented towards the discovery of new compounds with biological activity. These compound libraries can be used by the IUBO-AG groups as well as offered to outside technological needs.

The IUBO-AG groups participating in this platform are SINTESTER, SYNBIOPROD, QUIBIONAT, QUIMIOPLAN, SINTESTER, SYNBIOPROD and QUIBIONAT.

Materials and Nanomaterials Platform

The platform aims at the preparation, characterisation and application of green clays and nanomaterials in different fields, including smart materials, advanced functional materials, and nanoparticles for small molecule delivery. Among the smart materials, priority will be given to products obtained through "green" processes following a strategy that contributes to an eco-conscious management of resources and raw materials. One of its priority lines of action is to optimise and adapt scientific-technical protocols in the field of optical microscopy that use toxic materials in their production chain. Specifically, the methods for manufacturing thin films for microscopic observation will be optimised, minimising the use of toxic chemical products and their waste.

The IUBO-AG groups participating in this platform are AMBILAB, AFM-NANO, BIOLAB

Services

Unicellular organisms culture service

Culture of marine unicellular organisms, both bacteria and microalgae, especially the group of toxic dinoflagellates. Extraction, purification, isolation, and complete structural characterisation of marine natural products.

Phytochemistry department

Extraction, purification, isolation, and structural elucidation of plant natural products.

Pre-clinical study service

Preclinical study of plant extracts, chemical products, therapeutic or diagnostic agents in cell cultures. Design and interpretation of assays required in the development of new therapeutic or diagnostic agents.

Lipid and isotopic analysis service

Lipid characterisation and deuterium isotopic recording as a biomarker of adaptability and climate change.

Chemolibrary synthesis service

Design and synthesis of compound libraries for therapies.

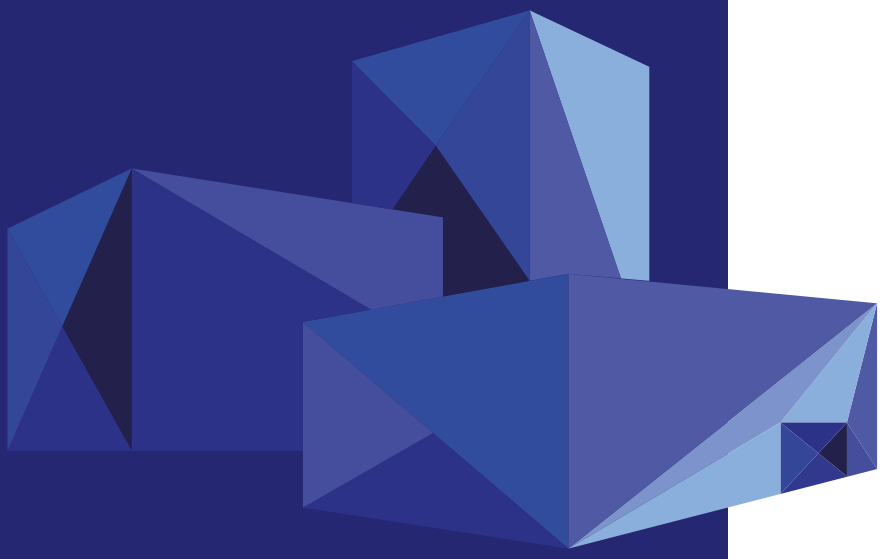
Nanomaterials Service

Preparation, characterisation and application of green clays and nanomaterials in different fields, including smart materials, advanced functional materials, nanoparticles for small molecule delivery.

Thin film service for microscopy

Optimisation and adaptation of scientific-technical protocols in the field of optical microscopy that use toxic materials in their production chain. Specifically, the methods for manufacturing thin films for microscopic observation are optimised, minimising the use of toxic chemical products and their waste.

Petrographic microscopy service



Infrastructure

Distillation

Bulk solvent distillation room

Steam distillation systems for the purification of bulk organic solvents

Screening

Culture room of human tumour and healthy cells for the study of the biological activity of chemical extracts and compounds.

Vertical laminar flow hoods, thermostatised incubator, centrifuges, cell counters, autoclave, spectrophotometer and luminometer, multiwell plate readers, light microscope, deep freezer, etc.

Bio-cultures

Culture room for marine unicellular organisms (bacteria and microalgae).

Thermostatised chamber, horizontal laminar flow hood, optical microscope, autoclave, centrifuges, chromatographs, deep freezer, etc

Phytochemistry

Rooms for extraction, isolation and purification of natural compounds.

Solvent removal equipment (industrial and benchtop rotary evaporators), different sizes of Soxhlets for solvent extraction of plant material, counter current and high-efficiency chromatography equipment.

Climate change biomarkers

Lipid analysis and deuterium isotopic recording laboratory

Gas chromatograph to determine organic compounds, system to measure isotope ratios in specific compounds, system to measure elemental isotope ratios, equipment for obtaining infrared spectra

Chemo library synthesis

Equipment and infrastructure enabling the synthesis and purification of organic chemicals

Stirring and heating plates.

Sheet preparation

Manufacture of thin films for microscopic observation, minimising the use of toxic chemicals and their residues.

Precision polishing machine for metals, rocks and other materials, precision cutting machine for metals, rocks and other materials, radial cutting machine for rocks and other materials, low-temperature furnace

Nanoparticle preparation

Manufacture of nanoparticles for drug delivery

pH-meter, stirring plates, ultrasonic homogeniser

Directory

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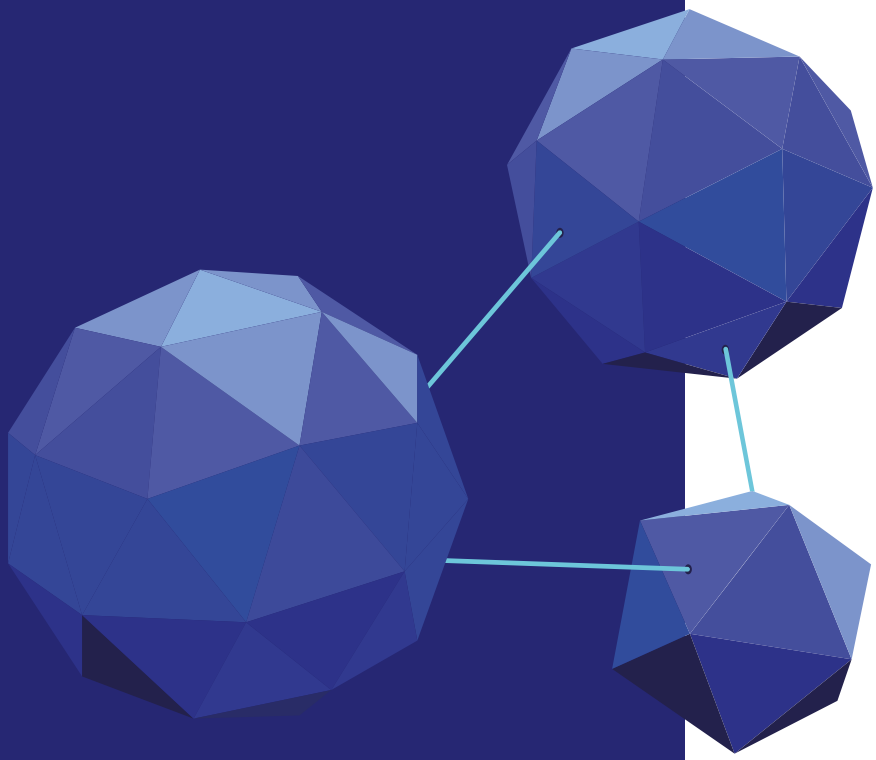
Instituto Universitario de Estudios Avanzados en Física Atómica, Molecular y Fotónica

Instituto Universitario de Estudios Avanzados en Física Atómica, Molecular y Fotónica
Universidad de La Laguna



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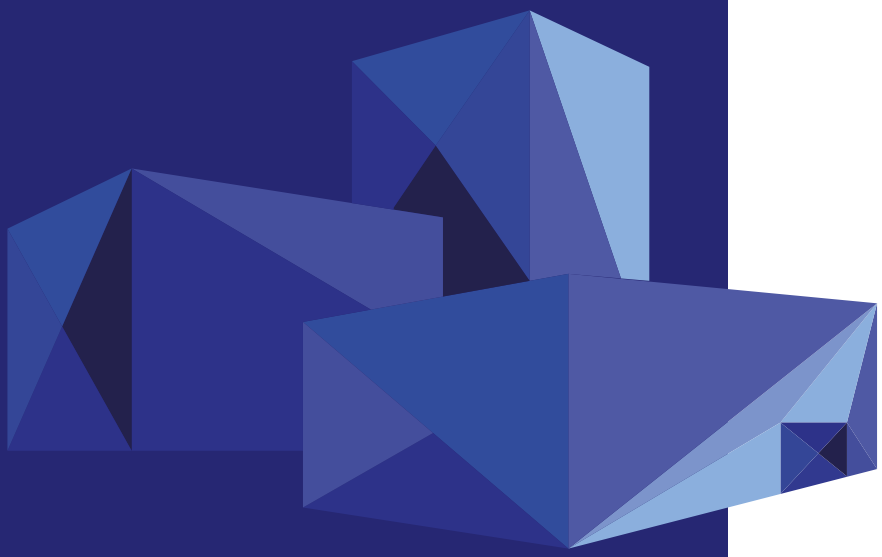
The entity

The Instituto Universitario de Estudios Avanzados en Física Atómica, Molecular y Fotónica (IUDEA) [University Institute for Advanced Studies in Atomic, Molecular and Photonic Physics], created by the Autonomous Region of the Canary Islands and the University of La Laguna, aims to develop research and postgraduate training of excellence.

Services

- Optical and Laser Spectroscopy System under ambient and extreme pressure and/or temperature conditions
- Laser processing of materials
- Raman Spectroscopy System
- Scientific computing



Infrastructure

Ultra-fast 3D laser nanofabrication

The IUDEA facilities include a new system for ultra-fast micro- and nano-processing of materials, shown in Figure 2. The system allows structuring materials both on the surface and in volume, with spatial resolution down to 100 nanometres, which is approximately the size of the SARS-CoV-2 virus. This extreme resolution can be achieved in part thanks to the use of a laser that is unique in the Canary Islands, with pulses of approximately 100 femtoseconds in duration, which in practice allows the equipment to be used as a 3D nanolithography system for photonic circuits. Dr. Airán Ródenas has developed both the fundamental technique and the new experimental system.

This system enables the quick structuring of any type of existing material, from metals to insulators and semiconductors. In the case of non-conductive materials, processing can be carried out in volume, and 3D architectures and nano-architectures can be designed by digitally controlling the positioning of the samples. The system can be used as a 3D laser printer with nanometre resolution.

Microstructured surfaces can be endowed with anti-bacterial, water-repellent or water-attracting properties, which have multiple industrial applications.

Fibre coupling and sensing system

The experimental set-up for fibre coupling and sensing consists of a tunable laser, polarisation controllers, coupling optics and optomechanics, optical amplifier and detectors.
The experiment works in C-Band (the telecommunications standard at 1550 nm for long distance) and is therefore fully compatible with standard fibre optic systems, which makes it extremely versatile.
Coupling to optical resonators allows the study of various types of optical non-linearities (such as micro lasers or phenomena mediated by radiation pressure, among others) or their study as microsensors in various domains (temperature, pressure or pH, among others) with a volume comparable to the size of a cell.
We also have several Fiber Bragg Gratings (FBGs) embedded in fibre, which allow us to make optical measurements of temperature, mechanical stress or curvature in macroscopic physical systems kilometres away.

Development of optofluidic sensors based on microspheres doped with rare earth ions

The aim is to fabricate transparent microspheres from different glassy matrices using a method based on the rapid cooling of glassy microdroplets. In addition, to analyse optical properties, a modified confocal microscopy system has been prepared at the IUDEA that allows excitation and detection in different areas. This has enabled the analysis of the optical properties of transparent microspheres doped with rare earth ions as a function of temperature or for use as microlasers.

Optical properties of materials doped with rare earth ions under extreme pressure and/or temperature conditions. Optical pressure and temperature sensors

Although it is relatively easy to apply high pressure on a material with the help of a sapphire, moissanite or diamond anvil cell [Holzapfel], determining pressure P and temperature T inside the hydrostatic chamber, where the material to be studied is placed, requires other materials with certain properties whose sensitivity to pressure and temperature changes is well known and calibrated. These are the standard pressure and/or temperature sensors used in experiments under extreme conditions [Tröster 2003]. Due to the transparency of anvils in the visible light range, it is quite common to know the pressure and temperature in an experiment through an indirect, in situ measurement of the luminescence of an optically active ion, whose sensitivity to changes in pressure and/or temperature has been previously calibrated and standardised.

The luminescence of an ideal optical pressure sensor must meet a number of general requirements:

- it must consist of a single line of issue and no background,
- its intensity should not increase or decrease significantly,
- it must have a large displacement with pressure $d\lambda/dP$,
- this displacement must depend very little on the temperature $d\lambda/dT$,
- it must have a small line width Γ compared to the line offset,
- i.e. factor Γ -1- $d\lambda/dP$ negligible, and, finally,
- a high stability of the matrix structure under extreme conditions is required.
- pressure and temperature.

The Cr ion luminescence3+ in ruby is the most widely used sensor for pressure in the hydrostatic chamber, mainly due to its intense red emission at ~694 nm associated with the 2E4A2 transition, its large redshift with pressure, and its easy excitation with commercial lasers. However, its drawbacks include its low sensitivity below 1 GPa, in the pressure range of most inte-

rest to biology and astrobiology research, and its large broadening and loss of intensity at high temperatures.

The method to measure the sample exact temperature in the hydrostatic chamber is less standardised. The characterisation of optical temperature sensors is a relatively new field of research with potential applications in different disciplines such as chemistry, biomedicine or electromagnetics, where limitations such as useful working range, slow response or high sensitivity to electromagnetic interference of conventional sensors like thermocouples or pyrometers have to be overcome. Luminescence thermometry is based on temperature-induced changes in the luminescence properties (intensity, energy shift, lifetime or polarisation) of an optically active ion in a given material (glass, glass-ceramic, crystal or nanocrystals). It can overcome these difficulties, with the added advantage that no photon-to-pulse conversion is required. In addition, the structure of the sensor matrix must be highly stable over a wide temperature range and the luminescence of the active ion must be efficient, so it seems logical that the design and development of an optical temperature sensor requires an active medium (matrix + Ln3+ ion) with highly optimised properties. The most commonly used optical method to determine temperature is based on the existence of two emission levels of an optically active ion close enough in energy to be considered thermalised and in thermal, or quasi-thermal, equilibrium. The ratio of luminescence intensities of these two thermalised levels can be calibrated as a temperature function with the aid of the same equipment used for pressure calibration. For temperatures up to 1000 K luminescent materials can be used in situ, although there are problems of matrix blackbody emission and luminescence inhibition, as non-radiative de-excitation probabilities are favoured. However, so far, no clear or systematic strategy has been followed to exploit the predictive capabilities of the theories of Ln3+ ions optical properties in the design of optical sensors. Figure 6 shows the cryostat and oven available at the IUDEA, which allow optical measurements from 12 to 1300 K.

Therefore, it is necessary to look for new P-T sensors to solve these problems. So, special attention has been paid to Ln3+ ions, as they show strong absorption and emission lines in the optical range and high sensitivities to P and T changes.

Optical grey water detection sensors

The goals we aim to achieve in this line of research involve producing scientific and technological knowledge that can be directly applied to monitor the degree of purity or contamination of water. This is an essential natural resource on the planet and particularly scarce on the islands. Therefore, they clearly fall within the fifth priority "Green growth and sustainability" and more specifically the sub-priority "Eco-innovation, agriculture, fisheries and environmental protection".

Achieving these objectives would provide an advantage to monitor contaminants in water over current more conventional methods which require a technician to travel to the site to take a water sample and then on to a specialised laboratory for analysis, see Figure 7. Our sensors would allow remote monitoring that would save costs and analysis time, enabling near real-time monitoring of water.

Nowadays, people are quite aware of sustainability and environmental issues. The active participation of companies and corporations in these issues also reflect their concern. In particular, the hotel industry is especially sensitive to the environmental impact it produces. Specifically, water consumption in the areas with more hotels is enormous. An example of the new sustainable and environmental policies of most hotel chains is the question asked to guests as to whether they want towels, bed linen, etc. to be washed daily. In this regard, the characteristics of the optofluidic sensors that we propose (remote control, real-time monitoring, low cost) make them particularly interesting for the hotel industry's environmental policy, with a view to reusing water and reducing its consumption.

Optical detection of neurodegenerative diseases

At IUDEA's laser laboratory we are developing an optical technique to detect neurodegenerative diseases. This line of research is carried out in close collaboration with researchers from the Faculty of Medicine of the ULL and the Hospital Universitario de Canarias. We are based on a novel technique called Random Laser, whose first experiments on mouse brains and neuron cell cultures have been very satisfactory.

Scientific computing

At the IUDEA we have the numerical computing power provided by a heterogeneous cluster of 12 64-bit nodes installed in a rack. These nodes have 4, 8, 16, 20, 24 and 48 cores with 1 TB of total RAM and 20 TB of hard disk.

The use of this cluster has allowed us to develop different lines of research ranging from the solution of differential equations to study population dynamics, the optimisation of atomic and molecular aggregates, the control and manipulation of atoms, the design and study of quantum engines, the analysis of heat transport in ion systems confined in electromagnetic traps, among others. Figure 9 illustrates various results obtained from these lines of research.

Other private companies

Webidoo Spain

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The entity

We envision a world in which all businesses, large and small, take full advantage of the opportunities of digital innovation.

We are the main ally of SMEs in their journey towards digitalisation, providing solutions tailored to their needs and simplifying technological complexity.

We operate from strategic locations in Tenerife, Spain, and Milan, Italy, valuing above all talent and collaboration to build a digital future that is more inclusive and accessible to all.

In short, Webidoo is the gateway to a digital world where all businesses, regardless of size, can thrive and make the most of technological opportunities.

Cloud Canary Services

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Email:
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The entity

Tailor-made software service for small and medium-sized companies: clocking systems, data management, among others. Educational platforms service.

Paso Alto Biophysics & Biomedical Engineering

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The entity

The study, research, development, discovery of new drugs, provision of consultancy services and technical or business scientific advice in the field of biophysics, biotechnology, pharmacy, medicine and other areas.

LeanMind

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The entity

We promote the professional growth of your team of developers. Our mission is to support organisations by accompanying the people who work in them, building a team, growing side by side personally and professionally. Our vision is to inspire developers to build quality and purposeful software to have an impact.

Blogsterapp Ambassador

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www.blogsterapp.com/es/

The entity

In today's digital environment, social media promotion is critical. This tool not only simplifies the management of your networks, but also automates key tasks, provides real-time analytics and makes it easy to identify trends. In addition, its intuitive interface makes it accessible to everyone from entrepreneurs to marketing experts. In short, this tool is not just a promotional platform, but a strategic ally to take your social media strategy to the next level and deliver impactful results. Discover how this innovative solution can transform your online presence.

GatewayTIC

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www.gatewaytic.com

The entity

Empresa tecnológica que crea soluciones móviles de gran alcance, que van más allá de sus funcionalidades, con gran pasión por el diseño y la programación.

Promar

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www.promar2007.com

The entity

We are a young and dynamic Spanish company based in the Canary Islands, our activity is focused on the marine environment and on carrying out oceanographic and environmental works supported by an oceanographic vessel.

Our services are aimed at both private companies (construction companies, engineering firms, architectural firms...) and the administration (Port Authority, Cabildo, Town Councils, Government of the Canary Islands...).

We are guided by the application of the most up-to-date, rigorous and efficient technologies and management procedures. All the work procedures applied will be inspired by the principles that regulate the new conception of total quality and will be aimed at creating value for the company.

Our mission is to achieve Total Quality in the performance of our services in accordance with environmental and quality legislation.

Producs and services

BATHYMETRY AND GEOPHYSICS

Bathymetry is the science that measures the depths of the sea to determine the topography of the seabed. Currently, measurements are taken by differential GPS for an exact position, and with single or multibeam hydrographic sounders to determine the exact depth, all of which is processed in an on-board computer to produce the bathymetric chart.

We have enough technology to provide measurements of submerged elements with centimetric precision in almost real time. In addition, because we can take over 9000 accurate x,y,z measurements per second, we can provide an accurate three-dimensional view of all submerged features within a short time of data collection.

The latest technology in bathymetric measurements is carried out with multibeam echo sounders. This system is very complex due to the factors that affect its measurements, as it works with sound in a medium in which the transmission of sound is not uniform. This non-uniformity in the measurements due to variations in the speed of sound propagation in the water, linked to temperature and salinity, and to changes in the direction of the beam due to refractions caused by these speed variations, is automatically corrected in real time by the different instruments involved in the multibeam measurement system. In addition, the probe is supported by a ship, a system that moves on the three axes, which means that each measurement has to be accurately corrected from the movements of this mobile platform measured by special motion sensors (gyroscopic).

In terms of GEOPHYSICS, we have the Geopulse system:

This is a seismic system of medium-high resolution and medium penetration, which emits an acoustic pulse of great power and short duration (0.1msec), by means of a Boomer of advanced design. The acoustic signals are received by a group of hydrophones ("streamers") towed parallel to the emitter, and once amplified and filtered, they are printed on a recorder to obtain a profile of the seabed, reaching penetrations between 75 and 100 m and an acceptable resolution (0.5 m approximately).

CARTOGRAPHY AND BENTHIC BIONOMICS

Promar 2007 Investigaciones Marinas has the experience and the necessary infrastructure for the elaboration of a cartographic support and a description from an environmental point of view of the natural components, landscape and heritage elements, accompanied by an assessment of the natural units and an integration of the data obtained in a Geographic Information System. As well as the creation of beach profiles necessary for the regeneration of dune systems.

OCEANOGRAPHIC STUDIES

The service of data collection and physical and chemical oceanographic parameters for the determination of the environment of the areas to be studied, provides information on the different ecosystems with which we are working as well as their degree of conservation and the future regulatory measures that should be imposed.

Data will be analysed, such as:

- Water sampling
- Sediment sampling (surface and full column).
- Phytoplankton and zooplankton sampling.
- Benthic sampling
- Pelagic sampling
- Currents
- Tides
- In situ oceanographic parameters (oxygen, temperature, salinity, conductivity, depth, sound velocity, chlorophyll)
- Laboratory analysis

The analysis of the more specialised parameters will be carried out in specialised laboratories complying with ISO 14000 and

9000 standards and collaborating with the Ministry of Health and Environment.

UNDERWATER PROSPECTING

We carry out underwater video recordings, as well as underwater surveys by means of autonomous diving with qualified personnel with the qualification of professional diver according to the law of underwater activities.

These techniques will be used in studies such as

- Bionomics
- Environmental Impact Studies
- Marine Reserves
- Construction site controls
- Submarine outfalls
- Port inspections
- Conservation and regeneration of ecosystems.
- Cartographies

ENVIRONMENTAL REPORTS

By means of technical assistance, we carry out environmental studies to ensure that the work is carried out properly.

Promar 2007 Investigaciones Marinas, aims to offer a wide range of solutions to different environmental problems by offering studies with all kinds of detail of the ecosystems to be investigated.

Environmental impact studies: The concept of Environmental Impact Assessment can be defined as a set of techniques that seek as a fundamental purpose to manage human affairs in such a way that a system of life in harmony with nature is possible.

With the management of environmental impact Promar 2007 Investigaciones Marinas aims to collaborate in order to minimise intrusions in the various ecosystems and to maximise the chances of survival of all forms of life, however small and insignificant they may be from our point of view, thus contributing to the biological balance.

We adapt each of our studies to the different projects with which we have to work.

ENVIRONMENTAL EDUCATION

Environmental education must be developed through the use of research and experimentation, and with the resources offered by Educational Research, it is possible to produce environmental education processes with rigour, scientificity, quality and effectiveness that manage to solve environmental problems with social participation. We propose moving from a theoretical and contemplative environmental education to a practical and problem-solving education.

The strategy to achieve the effective development of projects, experiences, studies and research requires taking into account and complying with the following:

- Efficiently diagnose the territorial environmental problem.
- Identify the object of study (natural resource or component of the environment and the environmental problem)..
- Define the specific objective of the experience.
- Express possible hypotheses, scientific questions and ideas to defend.
- Formulate the related tasks to be carried out.
- Select methods, techniques, procedures and instruments.
- Implement the approaches, strategies and fundamentally, the activities and actions to solve the ecological problem.
- Determine how the specific and territorial problem will be transformed and solved.
- To value the educational result and the contribution to the environmental culture.
- Determine human participation in the solution of environmental problems.
- Design indicators, variables or parameters to effectively determine the solution of the environmental problem and how environmental education was developed.
- Carry out quantitative and qualitative evaluation, which allows for the evaluation of the process.
- Present, communicate and disseminate the results of the work.
- Conceive and implement follow-up so that the problem manifests itself again.
- Consider feedback on the process, project and experience..

UNDERWATER ARCHAEOLOGY

We support both port works and different groups for archaeological prospecting studies.

One of our objectives is to raise awareness of the values of archaeological and historical heritage, paying special attention to the heritage of the Canary Islands, considering that dissemination and divulgation are fundamental tools for the protection and defence of our heritage legacy.

We have teams and professionals in the field of underwater archaeology, with state-of-the-art technology and extensive experience in this type of work on the coast and seabed.

- Archaeological Excavations
- Archaeological soundings
- Archaeological Prospecting
- Archaeological Reports
- Archaeological Inventories
- Archaeological Emergencies
- Surveillance and monitoring of works
- Proposals for B.I.C. declaration
- Underwater Archaeological Charts
- Archaeological projects
- Environmental reports
- Archaeological impact reports

For sites with metal objects, it is possible to investigate from the surface with detection radars, which allow us to discover the anomalies produced in the magnetic field by the metal. Sites such as wooden wrecks require a fairly close approach by divers in order to be able to draw a detailed plan.

Among the instruments that will be used for the investigation of underwater sites are ROVs (Remote Operated Vehicles), which are robots that in difficult operations can replace divers (as in deep-sea excavations) or AUVs (Autonomous Underwater Vehicles), which are individual submarines; the hoover with a float, retention bag and basket, which sucks up and expels debris and sediment to the surface that hinders the investigation; the segmented frame or metal grating placed on the wreck to divide the site into grids and thus draw a plan of the site on which to locate the objects found.

StartDevs

Address:
Avenida Trinidad 61, Torre Profesor Agustín Arévalo, planta 5, oficina 3, San Cristobal de La Laguna, Santa Cruz de Tenerife

The entity

It is a company specialising in design, marketing and software development. They offer end-to-end solutions for companies looking to stand out in the digital world. With a passionate and talented team, StarDevs transforms ideas into captivating visual realities, implements effective marketing strategies to increase visibility and engagement, and develops innovative software to drive efficiency and innovation. They are the trusted partner that turns your goals into success. With StarDevs, your vision becomes reality.

Mecides Management

Address:
Avenida Trinidad 61, Torre Profesor Agustín Arévalo del Campus Central de la ULL (Planta 6 – Despacho 6)
38204 San Cristóbal de La Laguna (Santa Cruz de Tenerife)

Email:
info@mecides.es

The entity

MECIDES carries out the technical and financial evaluation, as well as monitoring of the entire research project to ensure that it runs smoothly. This is why it selects the R&D&I projects that will participate in the technological patronage after being evaluated by our engineers and scientific doctors.

Wooptix

Address:
Av. Trinidad, 61, 38204 San Cristóbal
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Telephone :
+34 822 900 502
Email:
info@wooptix.com

www.wooptix.com

The entity

Wooptix is an international company, founded in Spain, spin-off of the astrophysics department of the University of La Laguna, Tenerife. It offers a unique solution for capturing and processing the full spectrum of light through Wooptix Light Field and Wavefront Phase Imaging technologies. Its work focuses on advanced image and light field processing to achieve the best results in resolution, volumetric information and reflective item measurements.

Its goal is to offer cutting-edge solutions in the world of imaging with cutting-edge technology that has applications in fields as diverse as medicine, manufacturing, astrophysics, barcode scanners, augmented reality and video cameras.

Areas and departments

VIDEO CAMERA
Single lens Light Field video camera. Real-time volumetric capture at maximum sensor resolution. Applied to video cameras and smartphones.

MEDICINE
New technique for high precision measurements and detection of transparent tissue from the wavefront sensor and the light field, which generates millions of pixels using the entire image sensor. Ophthalmology, Endoscopy, Microscopy.

ADVANCED MANUFACTURING
New technique for measuring reflective and transparent materials, plus real-time data points with sub-nanometre accuracy. Semiconductor metrology, flat panels, etc.

BARCODE SCANNER
Intelligent barcode scanning from smartphones and augmented reality user experience.

Projects

SEBI
SEBI es una cámara light field de alta resolución capaz de obtener información de profundidad y color en tiempo real permitiendo video en vivo.

SELFIE LIGHT FIELD CÁMARA
SEBI is a high resolution light field camera capable of obtaining depth and colour information in real time allowing live video.

T-EYEDE
The Wooptix t-eyede eyepiece system provides a higher lateral resolution by several orders of magnitude. It is a detector with a transparent structure.

PHEMET
New semiconductor metrology technique for measuring wafer geometry, capturing millions of data points in a few milliseconds with sub-nanometer height accuracy and higher spatial resolution than any other technique.

BARCODE SCANNER APP
The Wooptix barcode scanner offers a smart scanner for mobile platforms that allows users, workers and customers to scan effortlessly, enabling any code to be located and decoded in an instant with a new UX based on basic augmented reality tools.

Encamina

Address:
Av. Trinidad, 61, Planta 6 Nº10. 38204
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Cruz de Tenerife

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+34 962 698 064

www.encamina.com

The entity

A different kind of technology consultancy, driven by passion and our Pensar En Colores attitude.

It is the fresh, optimistic and committed attitude that uses ingenuity and creativity to find technology and talent solutions that improve the present of people, business and our society.

Our mission is to empower the best in the people and processes of medium and large organisations around the world, through SaaS applications and relevant projects, leveraging our digital footprint products.Including our excellence in Microsoft technology and our Think In Colours attitude.

Our vision, to be leaders in the Microsoft ecosystem for the national level and an international benchmark in niche solutions and services through the cloud.

And we want to achieve this with intensity, from the place where we most like to live, with a brilliant team, collaborating for excellent clients, and generating wealth for our society, our professionals and our company.

Products and services

APPLICATION MANAGED SERVICES

The AMS service aims to respond to the needs of administration, management and maintenance of applications so that they have an optimal operation throughout their life cycle.

It allows project teams to be absolutely focused on strategic objectives, focusing on the evolution and future of the business, while the AMS service is dedicated to maintaining the current systems, with a specialised team, methodology and tools that optimise the management of incidents and improvement tasks.

GADA-I

Es la plataforma ideal para sistemas de gestión basados en expedientes de todo tipo:

- Securely receives documentation
- Classifies by applying Artificial Intelligence
- Displays an intelligent search service to locate information
- Leaves trace of all accesses (logs)

TEAMSCHAMP

TeamsChamp is a web and Microsoft Teams application that helps you to measure employees' Digital Collaboration and Communication by analysing their use of Office 365 tools such as SharePoint, Teams, OneDrive, Exchange, Skype, etc.

Its main objective is to drive the best use of Office 365 in the organisation, but also to enhance the skills necessary for its digital transformation, through gamification.

PLAYQUIZ

PlayQuiz is a SaaS application that integrates with Microsoft Teams. Each day it challenges users to answer 3 questions from the Microsoft 365 ecosystem to earn digital knowledge points.

Bringing gamification into the enterprise allows users to learn best practices for using Microsoft 365 tools while playing games and challenging their peers.

TEAMSPOWER

This report analyses which M365 tools, how and how much they are used in the organisation. As a result, it provides an analysis of the company's level of Digital Transformation.

It provides the user with a traffic light style view that places the company at one level or another based on configurable thresholds. If the company is above the set threshold, the indicator will be green, if it is in the average, yellow and if it is below, red.

TEAMSPULSE

It is an application (based on Power BI) that shows the virtual presence and activity status of employees, wherever they are working, regardless of the location and device they are using.

TeamsPulse analyses aggregated company presence data, based on the activity statuses employees have in Office 365, to provide a real-time snapshot of employee engagement..

Elpuntasso

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+34 922 71 23 28
Email:
info@elpuntasso.com

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La entidad

Company offer management portal.

2 Coders Studio

Address:
Calle Practicante Ignacio Rodríguez
s/n Edificio Polivalente II, Planta Baja
Oficina 1, 35017, Las Palmas

Telephone:
+34 928 45 95 85
Email:
info@2coders.com

www.2coders.com/

La entidad

Custom software development: videogames, sports, web applications and mobile TV.

Agnos PCB

Address:
PCTT Tenerife
C/ Rectora María Luisa Salguero –
Las Mantecas
38320 Santa Cruz de Tenerife
Spain

Email:
info@agnospcb.com

www.agnospcb.com

The entity

Quality control motherboards devices .

Arquimea Research Center

Address:
Avenida de las Mantecas, s/n, 38320,
San Cristóbal de la Laguna

Email:
hello@arquimearesearchcenter.com

www.arquimea.com

The entity

Arquimea Research Center is a private research centre belonging to the Arquimea group. Arquimea Research Center carries out research projects that are the convergence of exponential technologies and have a potentially high impact on the biggest global markets and challenges of the coming years. The centre's vision is to develop disruptive technology that will become a technological driver of products and solutions with a high social and economic impact..

Konecta BTO

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Av. Trinidad, 61, 38204 San Cristóbal
de La Laguna, Santa Cruz de Tenerife

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+34 922 71 23 28
Email:
info@elpuntasso.com

www.konecta-group.com/es/

The entity

Telemarketing y Outsourcing. prestación de toda clase de servicios de telemarketing, incluyendo televenta, lineas de atención, telecobranza y otros servicios de marketing y mercadotecnia, en especial aquellos que puedan ser articulados en centros de teleatención o en plataformas tecnológicas.

Diario de Avisos

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Avenida Principal Darsena Pesquera
S/n EDIFICIO PLATO. 38180, Santa
Cruz De Tenerife (Santa Cruz De
Tenerife). España

www.diariodeavisos.elespanol.com

The entity

Newspaper and magazine publishing.

PwC España

Address:
Plaza de la Candelaria, 1, 4ª planta
38003 Santa Cruz de Tenerife, España

Telephone:
+34 922 534 710

www.pwc.es

The entity

Committed to offering quality services in auditing, tax and legal advice and consultancy. The firm works for all types of clients, mainly local family companies, multinationals with a presence in the Islands, as well as for the public sector.

REGENERA (Recogida General de Residuos y Aguas

Address:
Calle Rectora María Luisa Tejedor Salguero. Edifico NanoTEC. Parque Urbano Las Mantecas, 38320 San Cristóbal de La Laguna

Telephone:
+34 607 504 447
Email:
info@regenera.es

www.regenera.es

The entity

Collection, transport, treatment, recycling, recycling, reuse, final deposit, or other form of processing or disposal, of all kinds of solid or liquid waste

eSignus

Address
Calle Puerto de los Cristianos N24,
38120, S/C de Tenerife.

Email:
business@esignus.com

www.esignus.com

The entity

They offer recognised and truly secure user experiences for storing and managing digital assets, creating robust hardware and software solutions.

Big Data Company

Address:
C. Rectora María Luisa Tejedor
Salguero 38320 La Laguna, Santa
Cruz de Tenerife

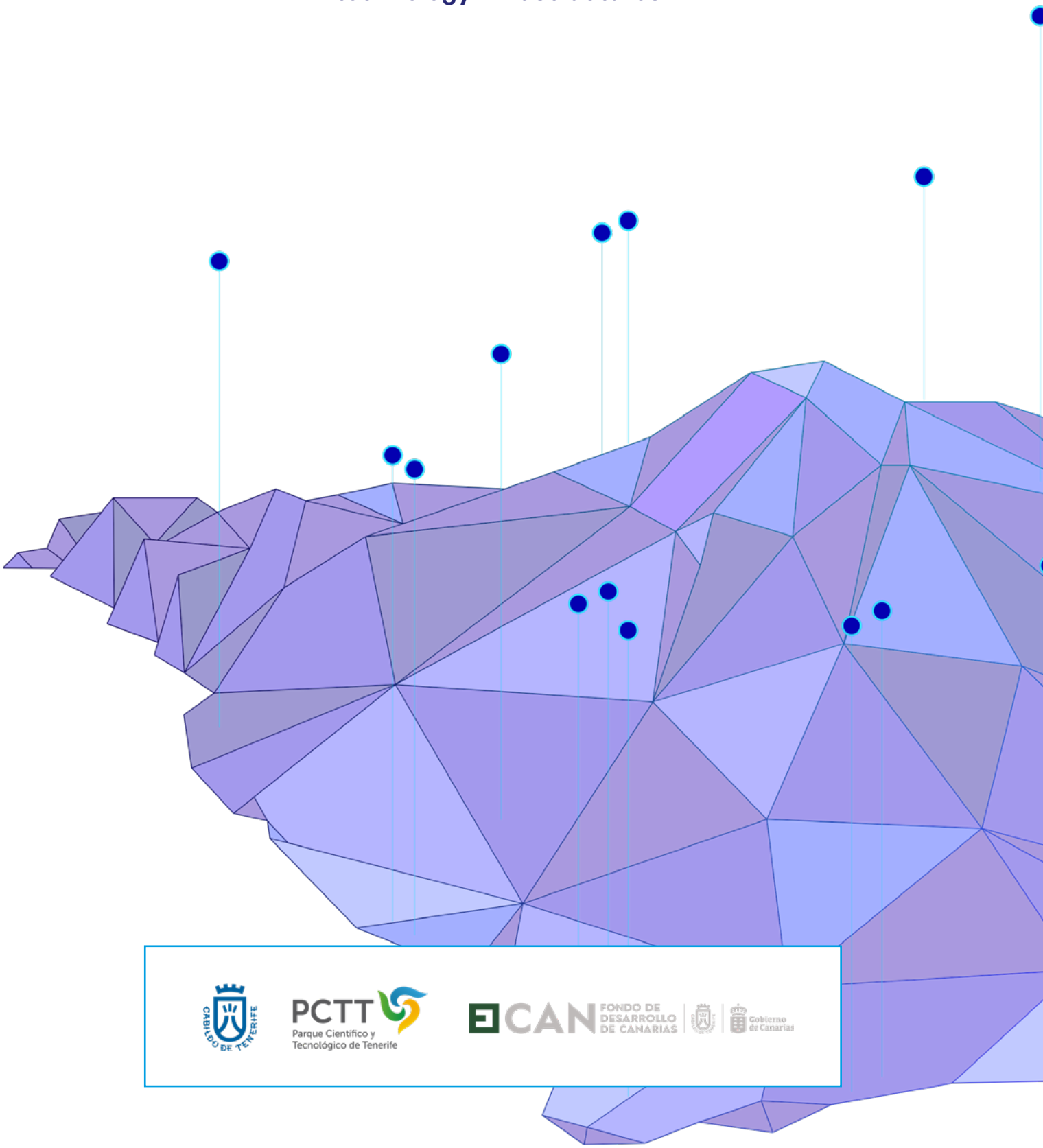
Telephone:
+34 600 28 16 47

www.bigdatacompany.eu

The entity

A company specialising in Big Data and Artificial Intelligence Big Data and Artificial Intelligence solutions, with the mission to help companies boost their business and achieve their digital transformation through the strategic use of data.

Tenerife's innovation and technology infrastructures



PCTT Parque Científico y Tecnológico de Tenerife

CAN FONDO DE DESARROLLO DE CANARIAS | Gobierno de Canarias