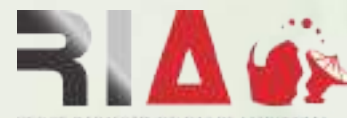


SPANISH CAPACITIES IN TECHNOLOGIES FOR ASTRONOMY



Edited by: Centro para el Desarrollo Tecnológico Industrial (CDTI)
C/ Cid, 4 28001 Madrid (Spain)

Legal deposit: M-7192-2015

March 2015

Index

Foreword	1
CDTI	3
<u>COMPANY PROFILES</u>	
ABENGOA S.A.	6
ASTURFEITO S.A.U.	8
AVS ADDED VALUE INDUSTRIAL ENGINEERING SOLUTIONS S.L.U.	10
CADINOX S.A.	12
COMPAÑÍA ESPAÑOLA DE SISTEMAS AERONÁUTICOS S.A.	14
CRYOVAC SL	16
DEIMOS SPACE	18
DMP S.L.	20
EADS CASA ESPACIO S.L.	22
EMPRESARIOS AGRUPADOS	24
FRACTAL SLNE	26
GMV AEROSPACE AND DEFENCE S.A.U.	28
GTD SISTEMAS DE INFORMACIÓN S.A.U.	30
HILFA	32
IDOM	34
INDRA SISTEMAS S.A.	36
INGEMETAL ENERGÍAS S.A.	38
INTARCON	40
ISDEFE S.A.	42
IXION INDUSTRY & AEROSPACE S.L.	44
JEMA	46
LEADING ENTERPRISES S.L.	48
LIDAX	50
NORTEMECÁNICA S.A.	52
SENER INGENIERÍA Y SISTEMAS, S.A.	54
SEVEN SOLUTIONS S.L.	56
TECNALIA	58
TEMAI INGENIEROS	60
THE VACUUM PROJECTS S.L.	62
TSK ELECTRÓNICA Y ELECTRICIDAD, S.A.	64
TTI	66
<u>OTHER COMPANIES</u>	
AERNNNOVA, ANÁLISIS Y SIMULACIÓN, COMET, ESTEYCO, EXPOGRAFIC, INGECIBER, NATEC, PROCON, SERTEC, SGENIA, SOFTWARE, TECNOBIT	71
<u>ASTRONOMY OBSERVATORIES</u>	
CENTRO ASTRONÓMICO HISPANO-ALEMÁN DE CALAR ALTO (CAHA)	78
GRAN TELESCOPIO CANARIAS	80
OBSERVATORIOS DE CANARIAS	82
OBSERVATORIO ASTROFÍSICO DE JAVALAMBRE	84
OBSERVATORIO RADIOASTRONÓMICO DE PICO VELETA	86
OBSERVATORIO DE YEBES	88
TECHNOLOGY MATRIX	93
ACRONYMS	101



Foreword

The path to scientific discovery is an excellent example of multi-disciplinary work whereby researchers, engineers and decision makers are set to collaborate closely with a constant reassessment of needs and strategies.

For a medium-sized country like Spain, the involvement in facilities at the frontier of knowledge and technology is a driver for promoting international collaboration, demonstrating capacities in the execution of very singular projects, and assessing our R&D policy through the challenges imposed by the technology requirements often demanded by these facilities. In that respect, Astronomy not only represents an area of great interest because of its inspirational dimension to the public and intrinsic quest for scientific knowledge. It also represents a pole around which scientists are trained, highly specialized technology is developed and access to international fora is granted.



The outstanding conditions for the observation of the universe at different frequencies is an invaluable asset for our country, and the large number of facilities that are present across our territory are proof of the connection between Spain and Astronomy research. This connection spreads beyond our borders with the participation at first-class international infrastructures like ESO, where Spanish researchers and companies put their best capacities and creativity to the service of science and innovation, pursuing ground-breaking science at affordable costs.

Spain is proud to have developed, in collaboration with international partners, the largest optical-near infrared telescope GRANTECAN, which is in full exploitation. A great amount of technology expertise acquired through GRANTECAN has enabled the participation in ESO's European Extremely Large telescope, an impressive project joining the efforts of several nations to reach higher and deeper in the universe and in our understanding of it.

Spanish companies and technology centers are willing to continue to be partners in this challenging endeavor by pushing technology forward, increasing the portfolio of references in Astronomy already attained as shown in this catalogue. By doing so, they will contribute to consolidate an active industrial sector in Spain, benefit from the transfer of capacities to other business lines and develop international partnerships.

We are confident that scientists, engineers and procurement officers working at Astronomy facilities worldwide will find this themed guide to **Spanish capacities in technologies for Astronomy** useful and we look forward to fruitful collaborations to be triggered as a result.

Francisco Marín Pérez
Director General of the Spanish Innovation Agency (CDTI)





Activities:	Public agency Funding of industrial R&D projects Participation in international programs and research facilities
Affiliation:	Ministry of Economy and Competitiveness
Contact:	Kauzar Saleh (Spanish Industrial Liaison Officer to ESO) kauzar.saleh@cdti.es Tel: +34 915 810 491
Address:	Cid, 4 - 28001 Madrid
Web page:	www.cdti.es

Main activities

CDTI is a public entity within the Ministry of Economy and Competitiveness. Since 1977, CDTI supports industrial research and innovation amongst Spanish companies, using the following lines for accomplishing this task:

- Funding of industrial R&D projects across most production sectors (IT, energy, transportation, health, etc).
- Support to the creation and consolidation of technology-based companies.
- Participation as representatives or experts at international research programs and facilities (ESFRI infrastructures, EC programs, ESA, other cooperation programs).

CDTI runs these activities from its HQ in Madrid (staff of 320 employees), as well through its international network present in 28 countries worldwide.

Participation at research infrastructures and programs

- Industry Liaison officer to ESO, CERN, F4E, ESS, XFEL, ESRF, ILL
- Delegate body to all ESA boards, and representative at ESA Council together with MINETUR
- Delegate to all EC H2020 boards
- Expert and National Contact Point to several EC H2020 boards and to EUMETSAT
- Delegate to several EU Space committees
- Member of several H2020 Strategic Research Clusters (robotics, electric propulsion)

Specific funding tools related to research infrastructures

- R&D projects for large research infrastructures: CDTI provides funding for R&D projects targeting potential technology needs of research infrastructures. Funding is in the form of partially reimbursable soft loans (10-years to pay back) for up to 85% of the project costs, out of which up to 30% is in the form of direct funding. Projects are led by one or more companies, with the possibility to subcontract public research centers. Proposals are welcome any time throughout the year (open call).
- Support to the participation in tenders for research infrastructures: CDTI provides funding up to 30 k€ in form of loans for the preparation of tenders. Loans are to be reimbursed only in case the company is awarded the contract, or if the offer is technically non-compliant or exceeds in more than 25% the award price. Funding requests are welcome any time throughout the year (open call).
- Large R&D projects: these are large projects (7-20 M€) involving at least three companies, and funding is in the form of soft loans (10-years to pay back) for up to 75% of the project costs, out of which up to 30% is in the form of direct funding.





COMPANY PROFILES



[ABENGOA]ESO and ESA Electronic Testing Equipment, 2014



[ABENGOA] Facilities of Aerospace department, 2014



ABENGOA

Core business:	Electronics Circuit Boards, Functional Modules and Crates Measuring Instruments
Employees:	26,000
Turnover/Year:	7,356 M€ (2013)
Contact:	Ms. Sonia de la Rosa sonia.delarosa@abengoa.es Tel: + 34 911 252 497
Address:	Avenida Madrid, 50 28802 Alcalá de Henares (Madrid)
Web page:	www.abengoa.com

Company activities:

- Abengoa is an international company that applies innovative technology solutions to sustainable development in the energy and industrial sectors
- The Aerospace Department & Manufacturing Division expertise lies in the design, manufacturing and testing of electronic and power equipment for defense and aerospace

Contracts in Astronomy:

- [ESO] Production and verification of bias modules and cartridge power distribution cards for band 5 of ALMA, 2014

Other contracts in Science & Space:

- [ESA/RUAG AB] Design, manufacturing and testing of a full test bench for the ExoMars satellite management Unit, 2012
- [CERN] Design, manufacturing and testing of power supplies for CERN, 2013
- [ESA] Test bench for Meteosat Third Generation (MTG) power distribution unit for Airbus Defence and Space (ADS), 2013
- [ESA] Test bench for Ariane 5 launcher electronics, Airbus Defence and Space (ADS), 2014

R&D projects in Science & Space:

- [ESA] Terrestrial & Space energy technology roadmap, ESA General studies program, 2013
- [ESA] Environmentally friendly hydrogen production, ESA Technology Readiness Program, 2013
- [CDTI] In orbit demonstration of fuel cell and its control electronics (CEPHEUS), 2013-2014



[AURA] LSST telescope 3D model, 2014



[ESO/MT-M] ALMA antennas in the shop, 2014

Core business: Engineering and fabrication of complex/precision equipment for scientific and oil and gas sectors

Employees: 190

Turnover/Year: 41 M€ (2014)

Contact: Mr. Ricardo Rodriguez
rrodriguez@asturfeito.com
Tel: +34 985 514 024

Address: Área Ind. de Tabaza, parcela B-9
33438 Carreño (Asturias)

Web page: www.asturfeito.com

Company activities:

- Mechanical and hydraulic design, fabrication and complete assembly of complex/precision scientific equipment (telescopes, antennas, etc.)
- Specialized on-site installation and commissioning of complete equipment

Contracts in Astronomy:

- [ESO] Supply of the structures for the 25 European antennas of the ALMA project (with MTM): Fabrication engineering and procedures, material purchasing, fabrication, complete assembly (mechanical, electrical hydraulic) & shop commissioning, 2007-2012.
- [AURA] LSST Telescope Mount Assembly supply and site installation in Chile in Joint Venture with GHESA, 2014-2018.
- [NASA] Different projects for Deep Space Network, Including "Group achievement award" by NASA for outstanding project performance, 2011-2014.
- [DESY] Mechanical components for CTA medium antenna prototype, 2012
- [GTC] Lateral extensions of GTC vacuum vessel
- [GTC] Manufacturing for OSIRIS

Other contracts in Science & Space:

- [F4E-IDESA] Tokamak JT-60 Cryostat Base Machining and final assembly
- [F4E-CIEMAT] Tokamak JT-60 Cryostat supply (welding, machining and precision assembly)
- [F4E-R. Group] ITER 750-Tons Reactor Crane supply
- [ESRF] Manufacturing parts for mirror assembly and components for beamline ID 16
- [ILL] Manufacturing support detectors for the High Flux Reactor The Megajoule Laser (LMJ)

R&D projects in Science & Space:

- [CDTI] EUREKA-ALMA Development of steel structure for radiotelescope antennas and development of its manufacturing procedure, 2007-2008



[INTERNAL FUNDING], Design, manufacturing and integration of a 10mm pitch fiber positioner robot, 2012



[IAA] Design, manufacturing and integration of the BOOTES polarimeter, 2013

Core business: Manufacturing of Opto-Mechanical Devices

Employees: 28

Turnover/Year: 3 M€ (2014)

Contact: Mr. Miguel Ángel Carrera
macarrera@a-v-s.es
Tel: +34 943 821 841

Address: Pol. Ind. Sigma Xixilion Kalea 2, Bajo Pab. 10
20870 Elgoibar (Gipuzkoa)

Web page: www.a-v-s.es

Company activities:

- Design, manufacturing and integration of fiber positioners for multi object spectrographs, Pitch sizes: 8mm, 10mm, 20mm, 30mm.
- Optical engineering and opto-mechanical design, manufacturing and integration
- Design, manufacturing and integration of large mechatronic systems
- Design, manufacturing and integration of high vacuum, UHV and cryogenic systems

Contracts in Astronomy:

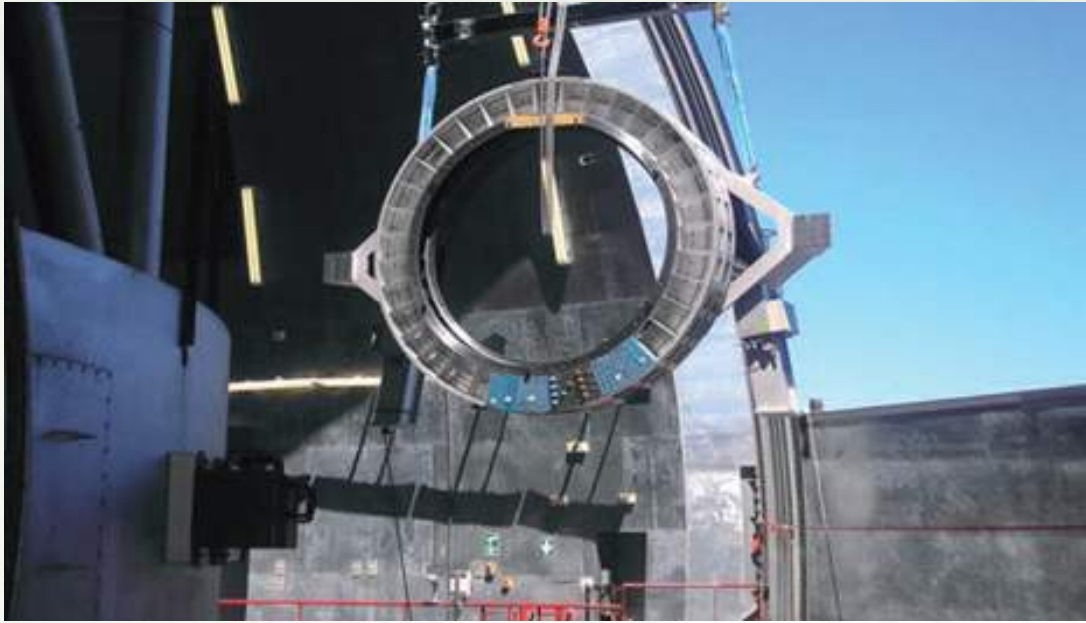
- [UCM] Design, manufacturing and integration of focal plane and spectrograph mechanics of the MEGARA instrument for GTC, 2015
- [IAC] Manufacturing and integration of the wavefront sensor for the adaptive optics of GTC, 2015
- [IAC] Design, manufacturing and integration of fiber link, ESPRESSO, 2014
- [IAA] Design, manufacturing and integration of the BOOTES polarimeter, 2013
- [UFL] Design, manufacturing and integration of a cryogenic probe arm for MIRADAS, 2012

Other contracts in Science & Space:

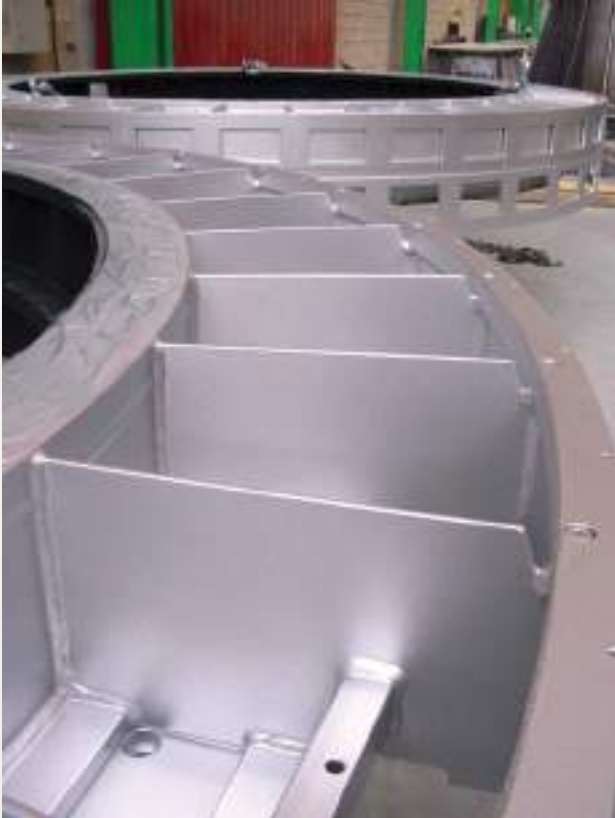
- [ESA] Breadboard of a Sampling Tool Mechanism for Low gravity Bodies, 2012
- [ESA/ADS] Sample acquisition means for the PHOOTPRINT lander, 2014
- [CERN] HIE-ISOLDE short diagnostics boxes
- [ESRF] Small angle X-ray scattering beamline SAXS (33 m long, 2 m wide, x-y-z sample movement)
- [ISIS] Polaris diffractometer and beam defining jaws for PEARL

R&D projects in Science & Space:

- [CDTI], Multi Object Spectrograph fiber positioning system, 2009
- [CDTI], Spherical focal plane studies for massive spectroscopy in large telescopes, 2012
- [INTERNAL FUNDING] Design and development of a 8mm pitch fiber positioner for the DESI instrument, 2014



[GTC] Nasmyth Rotators, 2003



[GTC] Nasmyth Rotators, 2003

Core business: Mechanics | Vacuum and Low Temperature Technology

Employees: 50

Turnover/Year: 11 M€ (2013)

Contact: Mr. Andoni Isasti
a.isasti@cadinox.com
Tel: +34 943 697 306

Address: Okobio, 32
20491 Belauntza (Gipuzkoa)

Web page: www.cadinox.com

Company activities:

- Manufacturing of large mechanically-welded components with very high requirements, both in mechanical tolerances, both in vacuum, cold and radiation environments.
- Processes: cutting, bending/rolling, welding and NDT, machining, surface treatment, inspection and testing.

Contracts in Astronomy:

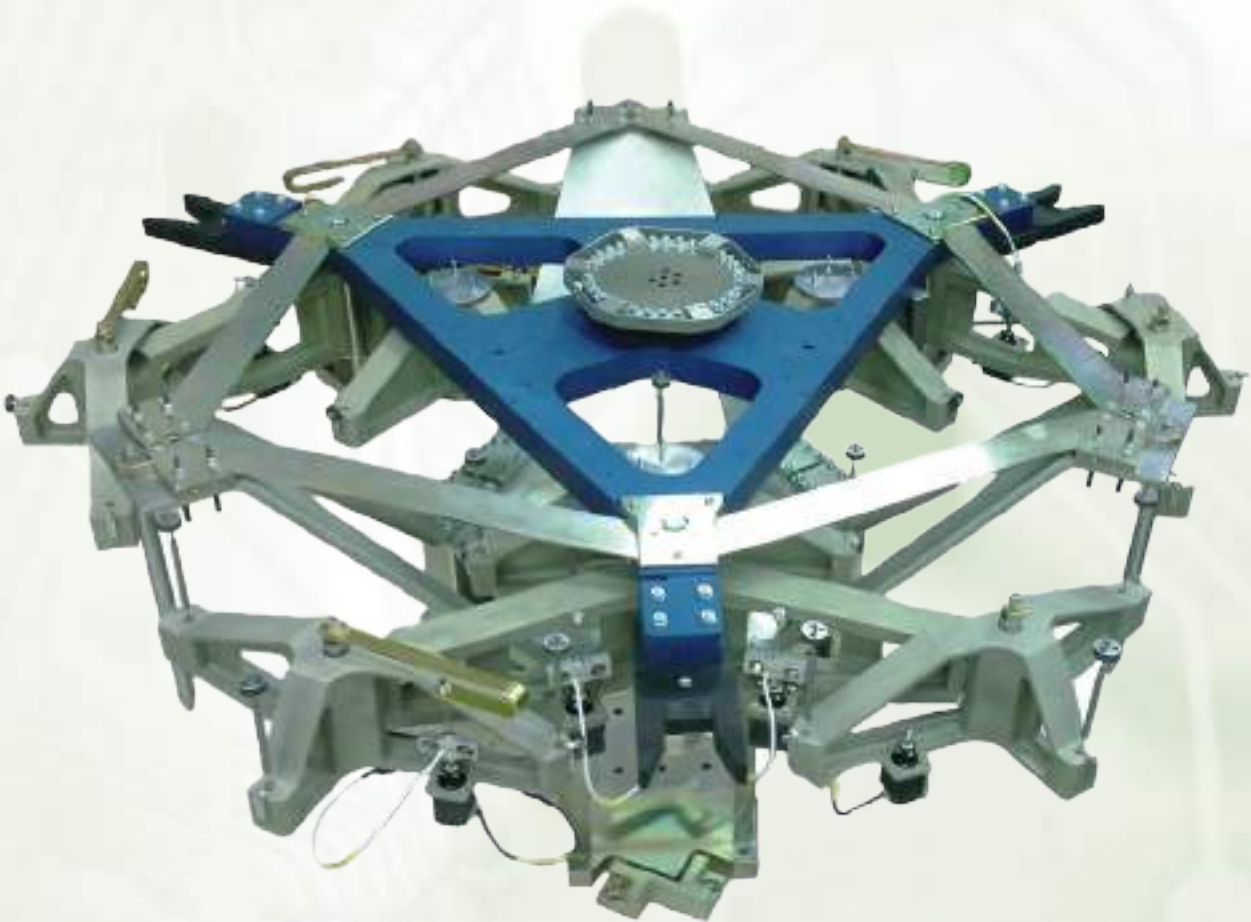
- [GTC] Manufacturing of Nasmyth Rotators, 2003

Other contracts in Science & Space:

- [CERN] NA 62 RICH vessel: 17 meter length and 4 meter diameter formed by 4 vacuum vessels. Complex geometrical tolerances, vacuum-tight weldings and vacuum-exposed surface painting. 2013
- [CERN] HIE-ISOLDE cryomodules: vacuum and He vessel fabrication and testing, high accuracy in geometrical tolerances, vacuum-tight weldings and extreme cleanliness of vacuum and cryo -exposed surfaces. 2013
- [ESRF] Manufacturing of the Small Angle Scattering Beamline SAXS: 33-meter length, 5 vacuum tanks with high accuracy in geometrical mobile tolerances and vacuum-tight weldings. 2012
- [ILL] IN16B vacuum chamber: fabrication and testing of Al vacuum vessel with high accuracy in geometrical mobile tolerances and vacuum-tight weldings. 2011



[ESO] M1 Positioner Actuator, 2010



[ESO] M1 Support System, 2010



Core business: Engineering-consultancies-
studies-research | Mechanics |
Actuation

Employees: 326

Turnover/Year: 72 M€ (2013)

Contact: Mr. Fernando Enrich
fernando.enrich@cesa.aero
Tel: 34 916 240 173

Address: Paseo John Lennon, 4
28906 Getafe (Madrid)

Web page: www.cesa.aero

Company activities:

- Design, manufacturing, qualification and product support of mechanical equipment and aerospace/aeronautical applications
- Design and manufacturing of electromechanical actuation systems
- Maintenance, repair and overhaul of aeronautical equipment

Contracts in Astronomy:

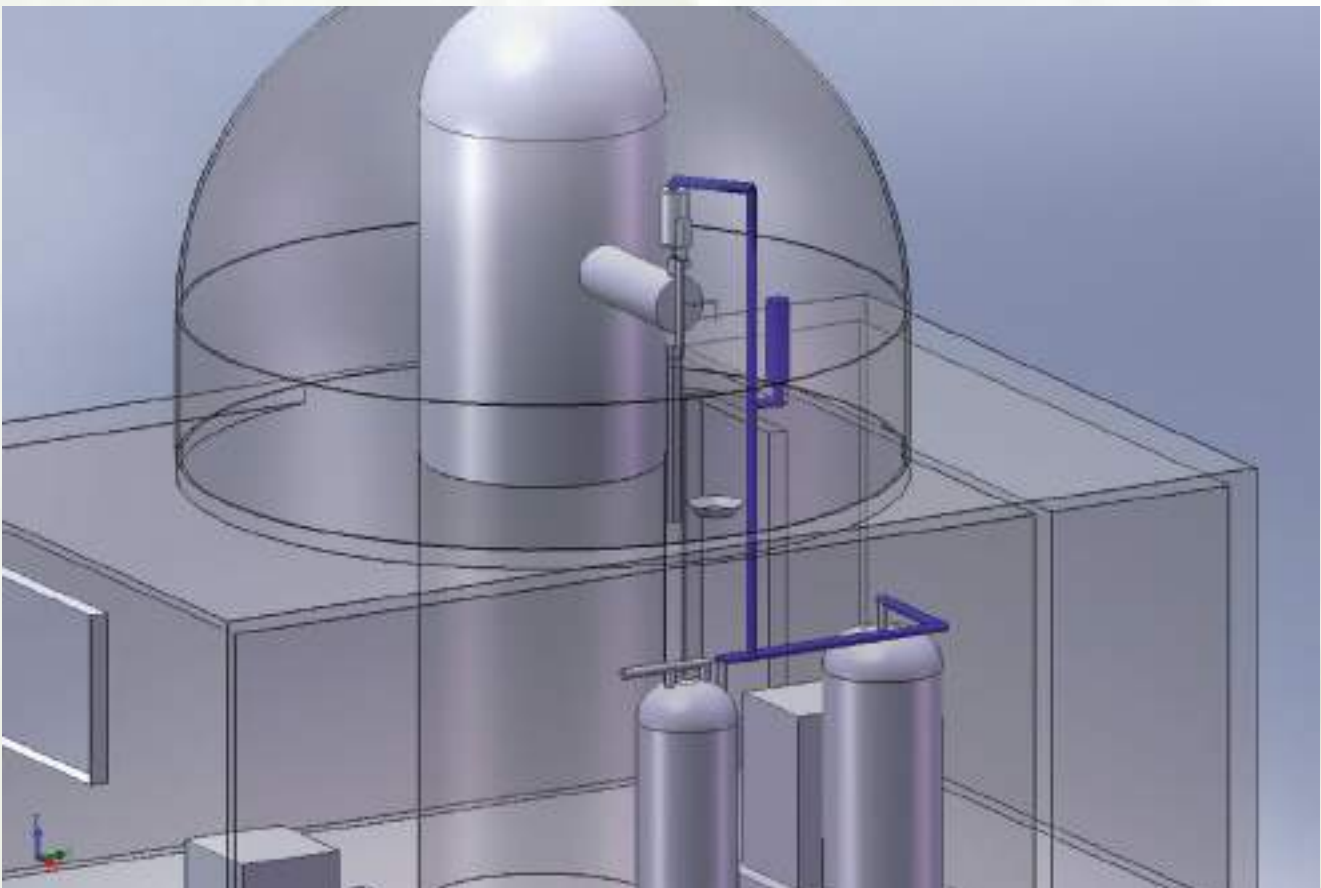
- [ESO] Design, manufacture, verification and delivery of qualification models of the E-ELT M1 segment supports, fixed frame assembly and auxiliary equipment, 2015
- [ESO] Design and fabrication of prototype segment subunits for the primary mirror of the E-ELT, 2009
- [ESO] Manufacturing and delivery of prototype position actuators for the primary mirror of the E-ELT, 2009
- [GTC] Design and fabrication of prototype segment subunits for the primary mirror of GTC, 2000
- [GTC] Manufacturing and delivery of prototype position actuators for the primary mirror of GTC, 2000

R&D projects in Science & Space:

- [CDTI] Innovative concepts for large telescope optomechanics, 2009
- [FP7] Design, development and manufacturing of an EMA with an electronic control unit and test set-up for advanced landing gear system actuation
- [FP7] Reliability and safety enhanced electrical actuation system architectures for aircraft control



[IAA] CARMENES in-vacuum cooling hardware, 2014



[OSN] Automatic refilling system for the BOOTES-IR Camera, 2011



Core business: Cryost.,chambers, custom-made vessels
Employees: 10
Turnover/Year: 947,475€ (2013)
Contact: Mr. Javier Luzarraga
info@cryovac.es
Tel: +34 916 065 463
Address: Arquímedes 40
28946 Fuenlabrada (Madrid)
Web page: www.cryovac.es

Company activities:

- Cryogenics: Finite element calculations, engineering and fabrication of cryogenic transfer lines, vacuum insulated equipment, custom Dewars, helium recovery systems and cryostats.
- Vacuum: Design and manufacturing of vacuum chambers and components, portable vacuum equipment and thin film deposition systems.
- High pressure equipment: Installation of laboratory gas tubing, leak detection and fabrication of gas mixers and high pressure cells.
- Control systems: Automation and development of electronic interfaces for cryogenic, vacuum and high pressure systems.

Contracts in Astronomy:

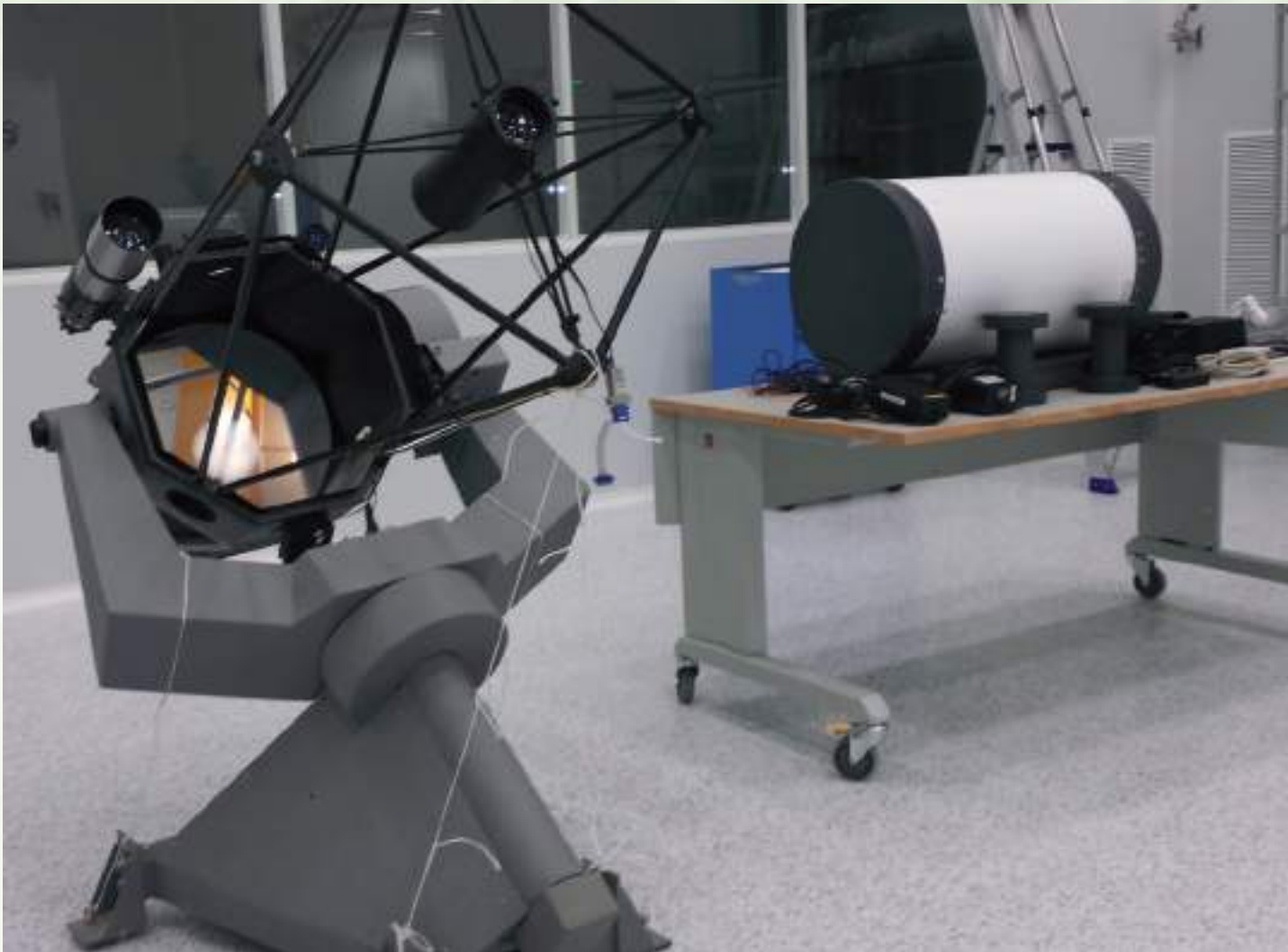
- [IAA] CARMENES in-vacuum cooling hardware (radiation shield, mechanical link and in-vacuum cooling circuits), 2014.
- [IAA] Gas distributors and heat exchangers, 2012.

Other contracts in Science & Space:

- [CERN] DO-28141/TE/HIE-ISOLDE Supports for HIE-ISOLDE transfer line equipment, 2013.
- [IFMIF] Mechanical structure for IFMIF/INDRA, 2014-15.
- [IBERESPACIO] Thermal Vacuum Chamber, 2014-15.

R&D projects in Science & Space:

- [OSN] Development of an automatic refilling system for the BOOTES-IF Camera, 2011
- [CDTI-EEA Grants] Cryogenic Transfer Lines: The Next Generation, 2014-15.
- [CDTI] Instrumentation for Small Diamond Anvil High Pressure Cells, 2013-14.
- [CDTI] Conception of Large Volume High Pressure Cells for Neutron Diffraction, 2010-11.



[Deimos Sky Survey/ESA] Refurbishment of CENTU1 & TRACKER telescopes for Space Surveillance and Tracking at ELEC NOR Deimos integration facilities, 2015



[ELEC NOR-Deimos] Integration of the 10 m TTC Ground Station for Deimos-2 Satellite, 2013



Core business: Engineering-consultancies-
studies-research

Employees: 300

Turnover/Year: 35 M€ (2013)

Contact: Ignacio Tourné
Ignacio.tourne@deimos-space.com
Tel: +34 918 063 450

Address: Ronda de Poniente, 19
28760 Tres Cantos (Madrid)

Web page: www.elecnor-deimos.com

Company activities:

- Space systems engineering
- Data processing systems (Earth observation, science...)
- Implementation and operation of space surveillance & tracking (SST) telescopes
- Satellite and payload systems integration

Contracts in Astronomy:

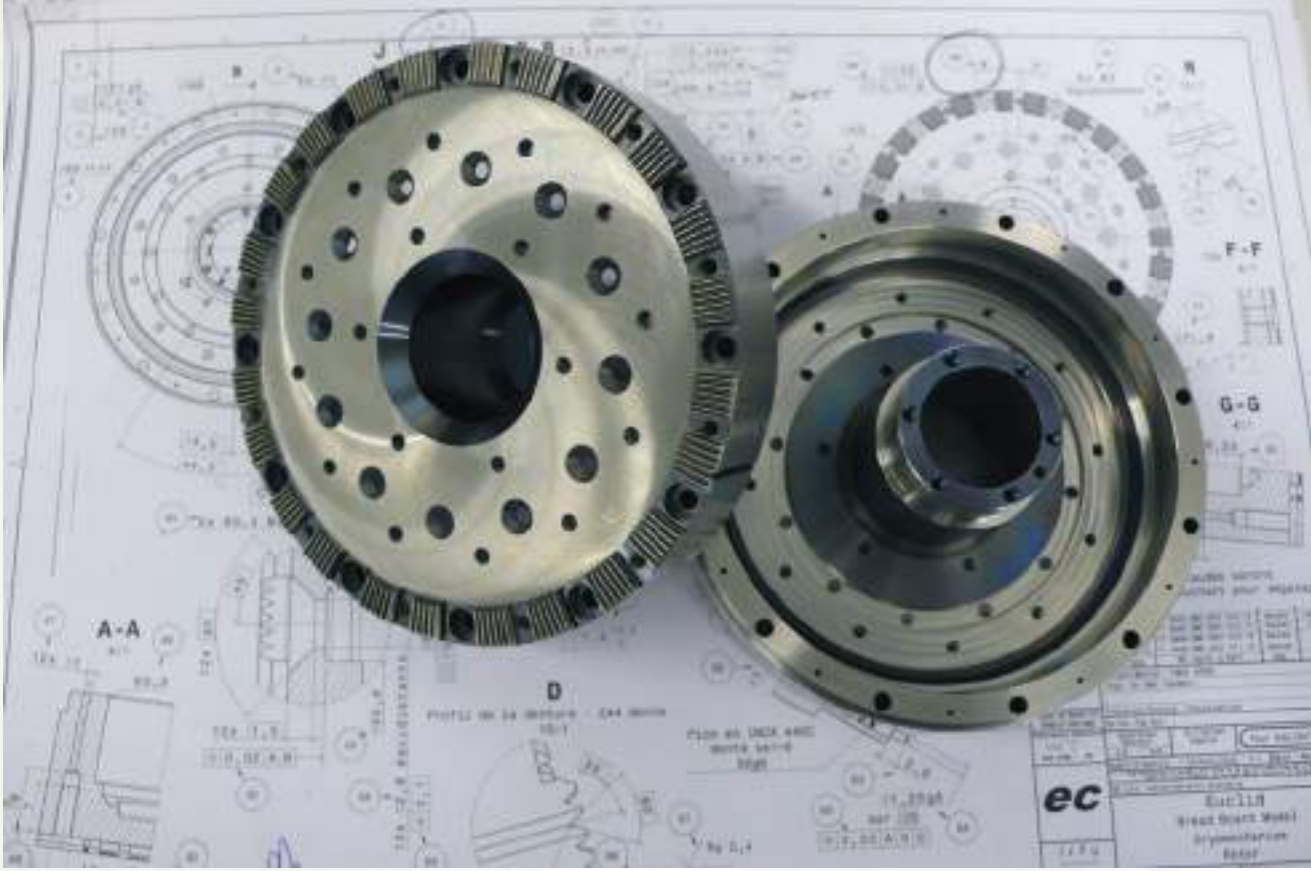
- [INTERNAL FUNDING] Deimos Sky Survey, implementation of SST telescopes and processing centre, 2015
- [ESA] Spanish System SST (S4T), 2014
- [ESA] SEISOP, Space weather prediction system, 2011
- [ESA, CDTI, INTERNAL], Various SST Object Cataloguing Campaigns based on Optical Observations, 2006-2014

Other contracts in Science & Space:

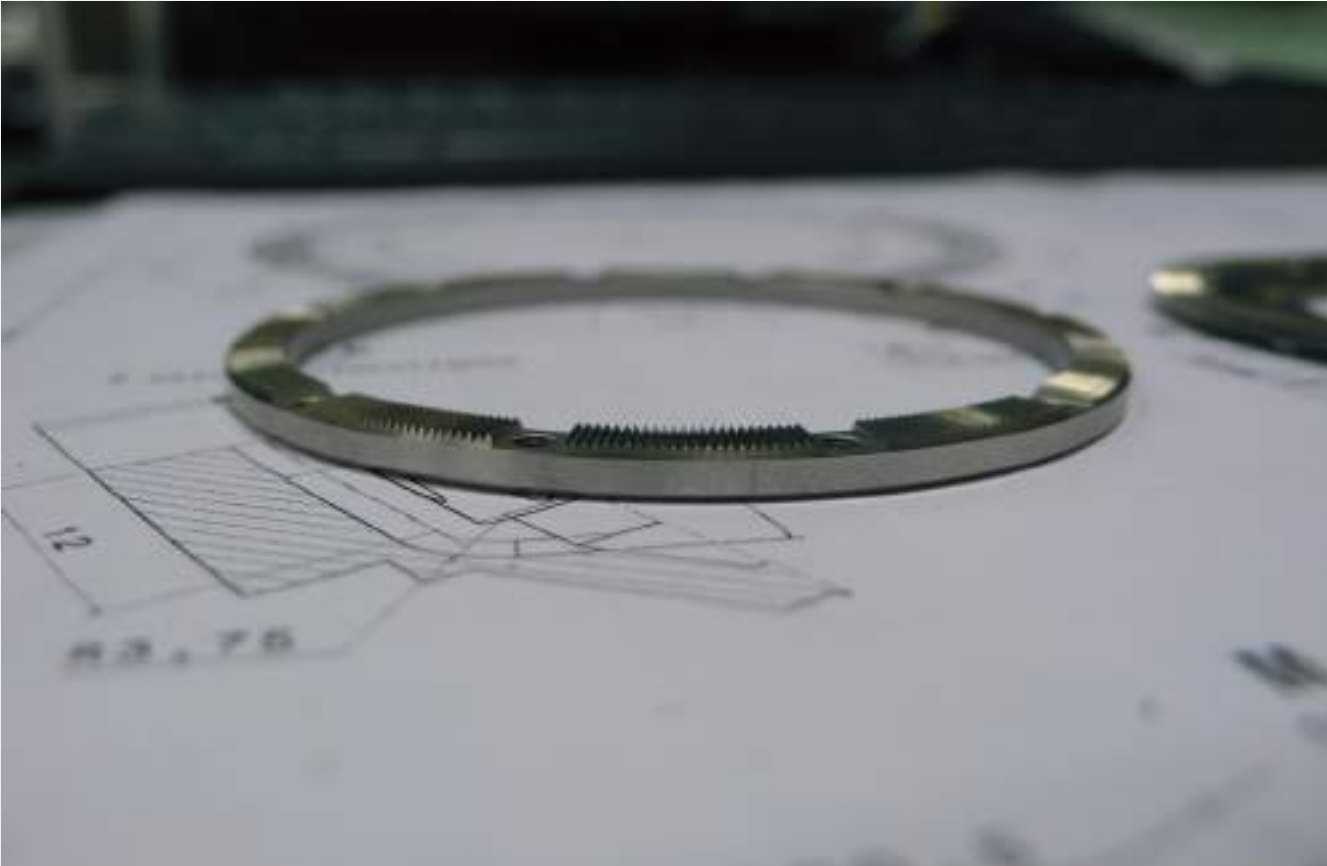
- [ESA] Mission Analysis for EUCLID, 2010-11
- [ESA] Euclid Mission Sky Mapping Strategy, 2012-13
- [INTERNAL FUNDING] Definition, integration, launch and operation of the Deimos-2 Earth Observation Very High Resolution satellite, 2011-2014
- [INTERNAL FUNDING] Development of the complete Earth Observation ground segment product suite gs4EO implemented for Deimos-2, 2011-2014

R&D projects in Science & Space:

- [ESA] Sentinel-3 Instrument Processing Facility, 2012
- [ESA] DCII – SSA Data Centre Processing Chain and Sensor Simulator, 2012
- [ESA] SN-VII NEO Impact Effects and Mitigation Measures, 2011
- [FP7 & H2020] NEOShield (1 & 2) 2 - Near-Earth Object Impact Mitigation & Prevention, 2012 & 2015



[CEA] EUCLID cryomotor, 2014



[CEA] Cryomechanism for EUCLID, 2014



Core business: Mechanics | Precision Machining Work and Supply of Produce

Employees: 100

Turnover/Year: 14 M€ (2013)

Contact: Mr Philippe ROULET
philippe@dmp.aero
Tel: +34 943 757 040

Address: Pol. INd. Kuritz Gain 12-13
20850 Mendaro (Gipuzkoa)

Web page: www.egile.es

Company activities:

- Design and manufacturing of ultra-precision components
- Free form optical and RF components
- Positioning systems and air-bearing solutions
- Complex gears

Contracts in Astronomy:

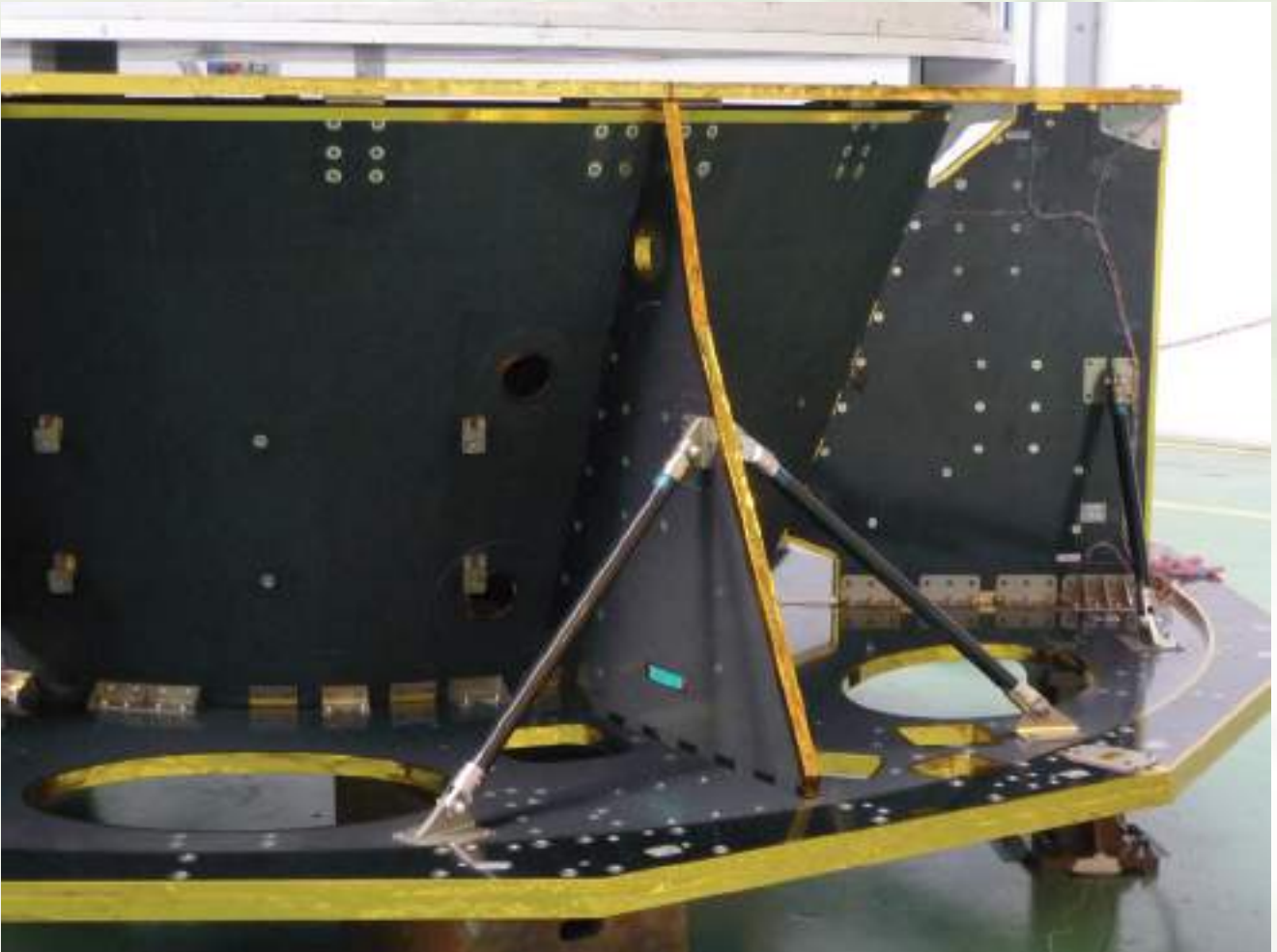
- [ESA/CEA] EUCLID cryo-mechanism, 2014

Other contracts in Science & Space:

- [THALES ALENIA SPACE] Ka band corrugated antenna, 2011
- [CIEMAT] Buncher for the IFMIF/EVEDA Accelerator Prototype
- [XFEL] Sub-micrometer movers for the undulator intersections, 2012
- [ESS, CERN] Linac drift tubes

R&D projects in Science & Space:

- [CDTI] New concepts for the accelerating structures for the CLIC lineal collisioner, 2010-2013
- [REG. GOVERNMENT-SPRI] Design and manufacturing of a reconfigurable cryostatic manipulator, 2012



[ESA] GAIA Active Antenna, 2013

[ESA] GAIA Satellite Structure, 2011



Core business:	Mechanics Manufacture and Supply of produce Specialized manufacturing
Employees:	400
Turnover/Year:	105.4 M€ (2013)
Contact:	Mr. José Juan Guillamón jose.guillamon@astrium.eads.net Tel: +34 915 857 927
Address:	Avda. Aragón 404 28022 Madrid
Web page:	www.casaespacio.es

Company activities:

- Design and manufacturing of state-of-the-art space technologies, satellites and launchers, including design of structures for very stringent environments and antenna subsystems (both arrays and reflector antennas).

Contracts in Astronomy:

- [ESA] GAIA satellite structure, launched 2013.
- [ESA] GAIA active antenna, launched 2013.
- [ESA] CHEOPS mission Phase 1 prime contractor, 2014

Other contracts in Science & Space:

- [CERN] Large Hadron Collider Support Posts (4600 items delivered). 2010-2011.
- [CERN] Cylinder for the ATLAS experiment of the LHC, 2010-2011
- [F4E] ITER Pre-compression rings (in glass fiber), 2013-current date.
- [ARIANESPACE] ARIANE 5 structures. First delivery in 1999 and 6 deliveries/year since then.
- [ESA] ATV External Module, Avionics Module and Separation System. 5 deliveries since 2008.
- [ESA] ExoMars 2016 mission central tube and orbital harness, ExoMars 2016 descent module front shield structure and harness, ExoMars 2018 mission hold-down and release mechanism

R&D projects in Science & Space:

- [FP7] European Space Qualified Carbon Fibres and Pre-impregnated Based Materials (EURCARBON), 2013-current date



[GTC] Dome & Telescope Mechanism. Engineering & Design, 1997 -2006

[LSST) EPCM Telescope Mount Assembly,
2014 - Ongoing





Core business: Engineering-consultancies-
studies-research, Software and
Inspection, Testing & Control

Employees: 1,000

Turnover/Year: 72 M€ (2013)

Contact: Luis García Marchena
lgm@empre.es
Tel: +34 913 098 081

Address: Magallanes, 3
28015 Madrid

Web page: www.empresariosagrupados.es

Company activities:

- Engineering & Design in large, multidisciplinary technological industrial projects.
- Services extend from consultancy in specialized tasks to turnkey projects, mainly in: Electric Power Generation, Large Telescopes, Energy Innovative Projects, Systems Simulation and Aerospace.

Contracts in Astronomy:

- [ESO] FEED studies of the Telescope Main Structure for the E-ELT (42m & 39m) including Design, Cost Reviews and Firm-Fixed Price Offers. 2009-2011
- [ESO] EPC Offer for the E-ELT (Dome & Main Structure), 2014-Ongoing
- [GTC] Dome & Telescope Mechanism. Engineering & Design. 1997-2006
- [LSST] EPCM Telescope Mount Assembly. Project Management, Engineering, Design, Procurement & Construction Management, Inspection & Commissioning. 2014 - Ongoing
- [TMT] Enclosure Design Report and Enclosure & Telescope Cost Estimates for Thirty Meter Telescope (TMT), 2012 & 2014 – Ongoing

Other contracts in Science & Space:

- [ESA/NASA/CSA/CNES/ISRO] EcosimPro software for Space Propulsion Simulation Program and Environmental Control & Life Support Systems (ECLSS)
- [EFET] Development of the Engineering & Design of the ITER Project
- [F4E] ITER Buildings. Architect-Engineering & Construction Management
- [F4E] ITER Main Safety Signal Processing and Cabinet System for the first plasma control systems. Design and Procurement Management
- [SCK-CEN] MYRRHA Project. Front End Engineering & Design.

R&D projects in Science & Space:

- [FP7] Participation in the following projects: ADEL, ARCHER, CDT, CRESCENDO, EURODESAL, GOFASR, HYCYCLES, HYNET, HYSAFE, IPRO, JHR-CP, LEADER, MAX, PDS + XADS, SILER
- [FP6] Participation in the following projects: ELSY, EISO FAR, EUROTRANS, EXTREMAT, CP-ESFR, GCFR-STREP, HYTHEC, INNOHYP-CA, RAPHAEL, RED-IMPACT, SARNET, VIVACE



[CDTI/REG.GOV], Feasibility study of innovative pupil systems (VIENTOS), 2010-2012 and Feasibility study for the design and characterization of high resolution gratings, 2009.



[UCM-FRACTAL] Fibres and microlenses characterization test bench.



Core business: Engineering-consultancies-
studies-research

Employees: 7

Turnover/Year: 0.75 M€ (2014)

Contact: María Luisa García Vargas
marisa.garcia@fractal-es.com
Tel: +34 916 379 640

Address: Las Rozas (Madrid)

Web page: www.fractal-es.com

Company activities:

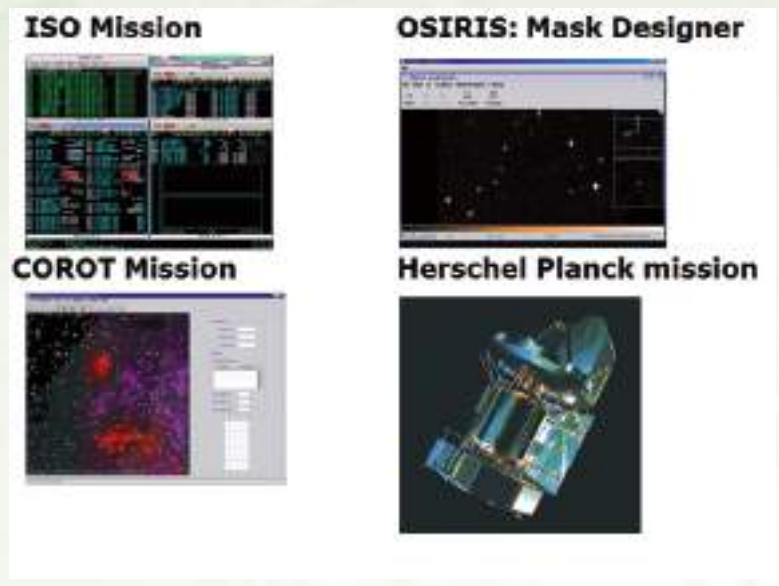
- Engineering consultancy and services for professional Astronomy
- Management and System Engineering
- Instrumentation development: from requirements to AIV
- Software development

Contracts in Astronomy:

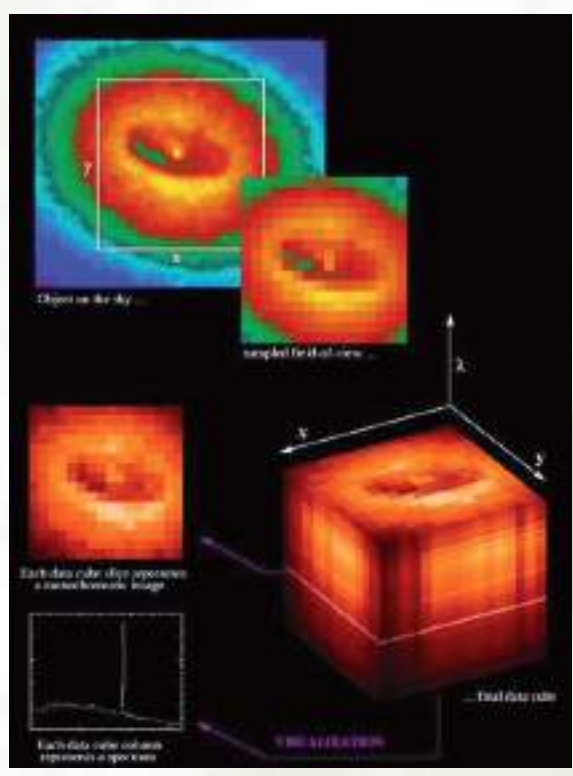
- [GTC/UCM], Engineering services for MEGARA (Management, System Engineering, Spectrograph Optics, Opto-mechanics, detector characterization, fiber bundles package: coordination, bundles characterization and microlens coupling), AIV in all phases (2010 – 2017). Also for IAA S/W for the preparation of the Multi-Object observations with MEGARA .In progress
- [IA-UNAM (Mexico)]. Management and System Engineering plans in the Preliminary Design Phase of San Pedro Mártir 6.5m Telescope, 2015. In progress.
- [LWS (Landessternwarte Königstuhl-ZAH (Heidelberg, Germany))], “Management and System Engineering services for CARMENES project at CAHA”; 2013-2015 (in progress)
- [Gemini, our customer IAA] Opto-mechanical design and cryogenics of the OCTOCAM project for the approved Conceptual Design Phase, 2015 (in progress)
- [ESO] Software Development for the pipelines of VLT instruments. 2008-2010
- [ESO] Preparation of data reduction procedures for the ESO VLT pipelines, and the implementation of these parts in ANSI-C with the ESO-CPL library, 2010-2012

R&D projects in Science & Space:

- [COMUNIDAD DE MADRID], Feasibility study for the design and characterization of high resolution gratings, 2009.
- [CDTI], VIENTOS, Feasibility study of innovative pupil systems to be implemented in the new generation instruments for large telescopes, 2010-2012.
- [INTERNAL FUNDING] FRACTAL Software Suite for Management, System Engineering, Operation and Maintenance of professional Astrophysics (GECO, DOCMA, MANATEE, SUMO). Internal R+D. 2007 – 2014
- [UCM-FRACTAL] Detector Test Bench, 2011 – 2014
- [UCM-FRACTAL] Fibers and Microlenses, 2014 - 2015



[IAA] COROT SKY, 2006



[CDTI-UCM] SPECTRO 3D: Generic processing framework for 3D spectroscopy, 2010



Core business: Scientific Software | Consultancy-
Data processing | Training-Data
processing

Employees: 500

Turnover/Year: 55 M€ (2014)

Contact: Mr. Miguel Ángel Molina
mamc@gmv.com
Tel: +34 918 072 139

Address: Isaac Newton 11
28760 Tres Cantos (Madrid)

Web page: www.gmv.com

Company activities:

- Development of critical software and systems in the space market
- Development of Instrument Processing Facilities & Cal/Val Tools, Archiving, Dissemination and Analysis
- System engineering (Modelisation, System Infrastructure, Support Databases, AI)
- Instrument Control & Telescope Scheduling
- Meteorological System and science missions
- Environmental research in climate change and sensor data fusion

Contracts in Astronomy:

- [GTC] Development of the Image Processing System for OSIRIS instrument in GTC, 2002
- [ESA] GAIA mission Data Access & Analysis Study, 2001
- [ESA] Hershel & Plank Scientific Database, 2000
- [UB] GAIA Initial Data Treatment, 2006
- [ESA/IAA] CoRoT Mission Center. 2004
- [UCM] GTC-MEGARA instrument Software Development Plan, 2009
- [UCM] Cherenkov Telescope Array RAMS Analysis, 2010
- [CDTI] Ground segment design for the World Space Observatory Ultraviolet camera, 2007
- [CDTI] ISO Infrared Space Observatory, 2002

Other contracts in Science & Space:

- [ESA-ESAC] Exomars "Rover Operation Control Centre: M&C, Data Processing, Data Assessment and Plannign, Dissemination" 2014
- [ESA-ESAC] Bepi Colombo/Rosetta "Proposal Handling and Planning and Scheduling Facility Design and Development" 2014
- [ESA-ESAC] Bepi Colombo/Rosetta "Data Processing Pipeline Facility Desing and Development" 2014
- [ESA-ESAC] Hershel "Data Analysis Tools Design and Development" 2014

R&D projects in Science & Space:

- [CDTI] SPECTRO3D Generic Processing Framework for 3D Spectroscopy, 2010



[CNES/ESA] Europe Space Port Main Control Centre, 2014-2016



[CTA] Scheduler for CTA, from 2010



Core business: Engineering-consultancies-studies-research | Information Technology | Electronics

Employees: 170

Turnover/Year: 16 M€ (2013)

Contact: Ricardo Bennassar
ricardo.bennassar@gtd.eu
Tel: +34 934 939 300

Address: Pg. García Fària 17
08005 Barcelona

Web page: www.gtd.es

Company activities:

- Design and development of software systems and control centers
- System integration (Hardware + Software): Real time systems, PLC, instrumentation, including power conductors and supplies, cables and telecommunication systems
- Consultancy and maintenance outsourcing services
- Integration of support systems (HVC, etc.) and security and safety systems (access control, fire detection etc.)

Contracts in Astronomy:

- [ESO] Outsourcing contract for maintenance of ALMA Common Software, 2014-2016
- [ESA] Development of GAIA's mission Optimum Compression Algorithm (GOCA)
- [ESA] Software Validation of BepiColombo's mission platform, payload and AOCS Software (for Airbus DS)
- [ESA/ESOC] On Board Software applications for XMM & INTEGRAL

Other contracts in Science & Space:

- [F4E] Framework contract for the provision of instrumentation and control integration services
- [ESA] Design and validation of embedded software for Ariane 5 and VEGA launchers
- [ESA] Ground segment of Ariane, Soyuz and Vega launchers at the European Spaceport in French Guiana
- [ESA] Main control centre (Jupiter) at the European Spaceport in French Guiana

R&D projects in Science & Space:

- [CDTI] Scheduling system for the Cherenkov Telescope Array observatory (CTA), 2010
- [INTERNAL FUNDING] Feasibility studies of robotic telescopes for Space Surveillance and Tracking, 2014
- [INTERNAL FUNDING] Square Kilometer Array Telescope Manager, since 2012



[IDOM] Manufacturing of the DKIST/ATST (for IDOM), 2012-2014





Core business: Construction of steel structures
| Manufacture and Supply of
Produce | Custom made large pieces

Employees: 40

Turnover/Year: 3.4 M€ (2013)

Contact: Mr. Igor Zarandona
izarandona@hilfa.com
Tel: +34 944 493 750

Address: Arteagoiti 8
48970 Basauri (Bizkaia)

Web page: www.hilfa.com

Company activities:

- Manufacturing of heavy mechanical equipment....
- Machining of big mechanical components.

Contracts in Astronomy:

- [IDOM] Manufacturing of the Daniel K. Inouye Solar Telescope/Advanced Technology Solar Telescope, 2012-2014

Other contracts in Science & Space:

- [F4E] Toroidal Field Coils Bench, for ELYTT, 2011



[ESO] FEED Study for the E-ELT Dome and Foundations, 2009-2011

[GTC] GTC Folded Cassegrain Sets (Instrument Rotator and A&G Optomechanics), 2010-2012





Core business: Engineering-consultancies-
studies-research (Advanced
Design & Analysis Division)

Employees: 1,983

Turnover/Year: 223 M€ (2013)

Contact: Mr. Gaizka Murga
gzk@idom.com
Tel: +34 944 797 676

Address: Avenida Zarandoa 23
48015 Bilbao

Web page: www.idom.com

Company activities:

- Design and Fabrication of Telescope Domes and Mounts, Telescope Systems and Astronomical Instruments.
- Design and Fabrication of Systems for Material Science & Particle Physics
- Design and Fabrication of Test Systems and Test Facilities

Contracts in Astronomy:

- [ESO] Preliminary Design of E-ELT Dome and Foundations, 2007-2008
- [ESO] FEED Study for the E-ELT Dome and Foundations, 2009-2011
- [AURA] DKIST (formerly known as ATST) Enclosure Design, Fabrication, Factory Assembly and Testing, 2010-2014
- [GTC] GTC Folded Cassegrain Sets (Instrument Rotator and A&G Optomechanics), 2010-2012
- [IAC] QUIJOTE CMB First/Second Telescope, 2007 and 2014
- [IAC] Design and Manufacturing of the FastCam instrument, 2009-2010
- [UPV-EHU] Design & Manufacturing of the PlanetCam low-noise camera, 2011-2012

Other contracts in Science & Space:

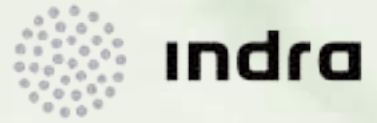
- [F4E] Integration Design of Diagnostics into ITER Ports, 2014
- [F4E] Engineering services in the area of Test Blanket Module (TBM) Systems
- [ESS-Bilbao/Oak Ridge Lab] Development of rotating target technologies for neutron spallation sources

R&D projects in Science & Space:

- [CDTI] Rotary Mechanisms in Cryogenics, 2012
- [FP7] European Solar Telescope Design Study, 2008-2011
- [INTEK] Development of a Crawler Mechanism, 2011-2012



[ESA] Galileo TTC station (Kiruna)



Core business: Consultancy | Project development, integration and implementation | IT outsourcing and BPO

Employees: 40,000

Turnover/Year: 2,900 M€ (2014)

Contact: Guillermo Monzón
gmonzon@indra.es
Tel: +34 91 627 30 40

Address: Mar Egeo, 4, Polígono Industrial 1
28830 San Fernando de Henares (Madrid)

Web page: www.indracompany.com

Company activities:

- Design and manufacturing of electronic equipment
- Space Systems
- Information Technologies
- Defense Systems

Contracts in Astronomy:

- [ESA/ESOC] Antenna Holography Measurement System for 35-m deep space antennas, 2011-2014
- [ESA/INTA/HISPASAT] Control and servo systems to point and track Satellites. Several contracts with ESA-Ariane, ESA-Galileo, HISPASAT and INTA, between 2000-2015

Other contracts in Science & Space:

- [ITER] Framework contract for CODAC Operation Application Engineering Support, 2011-2015
- [F4E] Framework service contract for the provision of system and instrumentation engineering support, 2011-2015
- [CIEMAT] Manufacturing and supply of the RF Subsystem for IFMIF-EVEDA Linac Accelerator, 2012-2015
- [EUMETSAT] System Engineering and Development of Complete Ground Stations, including antennas, RF parts (up to Ka-band), TT&C processing units and Monitoring and Control and for ESA, EUMETSAT, between 2000-2015



[JST] Design & Construction of the Javalambre survey telescope T250 main Dome, 2014



Core business: Mechanics | Manufacture and Supply of Produce

Employees: 116

Turnover/Year: 12.9 M€ (Consolidation Group 2013)

Contact: Mr. Javier Collado
jcollado@ingemetal.es
Tel: +34 976 59 10 30

Address: Paseo Rosales 26
50008 Zaragoza

Web page: www.ingemetal.es

Company activities:

- Design and manufacturing of large electro-mechanical components including large telescope domes
- Design of solar collectors, cylinder parabolic 2D, including manufacturing and erection activities
- Design of solar disc collectors 3D, both heliostats and Stirling collectors
- Design and construction of dynamic metallic structures
- General metallic structures, including large infrastructures as football stadiums, bridges or airports

Contracts in Astronomy:

- [CEFCA, OAJ] Design and construction of main dome for the Javalambre survey telescope T250, 2013-2014

Other contracts in Science & Space:

- [INTERNAL FUNDING] Conceptual design of the Javalambre survey telescope T250 dome, 2013

R&D projects in Science & Space:

- [INTERNAL FUNDING] Design of main dome for Javalambre survey telescope - T250, 2013
- [ITA-INNOVA] CFD wind loads analysis on structures. 2014
- [INTERNAL FUNDING] New calibration procedure for mirrors in thermosolar heliostats
- [INTERNAL FUNDING] Optical characteristics of solar collectors, and testing and validation of components for thermosolar power technology. 2008-2013



[ESO] Glycol chillers for Auxiliary Telescopes at Paranal site (Chile), 2013-2014

Core business: Heating, cooling, Ventilation,
Air conditioning | Refrigeration
equipment

Employees: 69

Turnover/Year: 6.5 M€ (2014)

Contact: Mr. Aurelio García Blázquez
agarcia@intarcon.com
Tel: +34 957 509 293

Address: Apdo. Correos 410
14900 Lucena (Córdoba)

Web page: www.intarcon.com

Company activities:

- Design, manufacturing, marketing and after-sales service of refrigeration equipment for positive and negative temperature applications
- Clients include food industry, health industry, research institutions, military centers, residential buildings, etc.

Contracts in Astronomy:

- [ESO] Glycol chillers for the VLT Auxiliary Telescopes (4 for ATs + 1 for spare), 2013-2014

Other contracts in Science & Space:

- [PRIVATE COMPANIES] Test rooms for Alestis Aerospace, as subcontractor to ELEC NOR/TECNIFRÍO – Sevilla, 2013-2014
- [CERN] Glycol chillers for LHC, 2013
- [UNIV. CÁDIZ] Laboratory units of direct expansion refrigerators

R&D projects in Science & Space:

- [INTERNAL FUNDING] Autonomous systems for the production of drinking water by ambient air condensation in remote areas



[ESA] Test Bed Telescopes, Design, Development and Installation of 2 Robotic Telescopes, 2012-2014.



[ESA] Cebreros optical telescope, 2013



Core business: Engineering-consultancies-
studies-research

Employees: 1,551

Turnover/Year: 140 M€ (2013)

Contact: Mr. Vicente Ruiz
vruiz@isdefe.es
Tel: +34 918 131 112

Address: Calle Beatriz de Bobadilla, 3
28040 Madrid

Web page: www.isdefe.es

Company activities:

- Consultancy
- Technical Assistance
- Engineering and Operations Services
- Turn-key Projects

Contracts in Astronomy:

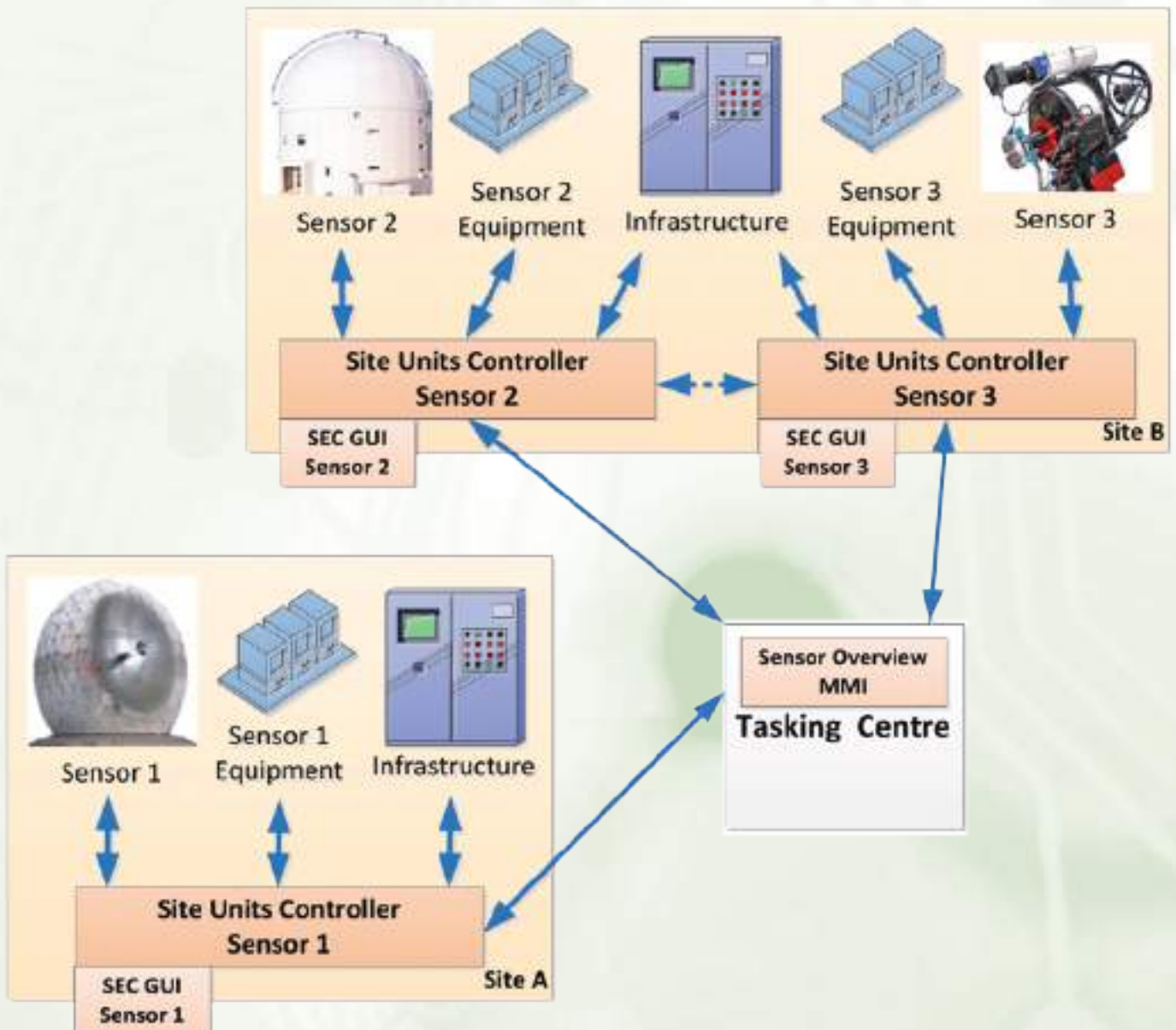
- [GTC] Participation in the OSIRIS instrument design and development, 2005-2014.
- [ESA] ESAC Scientific Astronomy Operations and Development Support, several contracts from 2005 to date, 60 Engineers and Scientists
- [ESA] Test Bed Telescopes, Design, Development and Installation of 2 Robotic Telescopes, 2012 to date.
- [NASA] Support to Radio-astronomy Activities in Madrid Deep Space Communications Centre, MDSCC, 2000 to date.

R&D projects in Science & Space:

- [CDTI] Cherenkov Telescope Array Feasibility Study for CTA, 2010
- [IAC] Collaboration Agreement, 2011
- [INTERNAL FUNDING] Cooperation in Education for Science and Astronomy Research CESAR, 2010-to date



[ESA] Web HMI of the Remote Telescope Test Bed for SSA, 2014



[ESA] Concept of the generic sensor controller being developed in SSA DCIV project, 2013-2015

Core business: Information Technology |
Software & Robotics

Employees: 30

Turnover/Year: 1.2 M€ (2014)

Contact: Mr. Francisco J. Barreiro
fbarreiro@ixion.es
Tel: +34 914 401 833

Address: Julián Camarillo 21-B
28037 Madrid

Web page: www.ixion.es

Company activities:

- Advanced Monitoring & Control systems for complex infrastructures
- Computer Vision Systems
- Advanced Navigation and Control systems for unmanned vehicles
- Industrial robotic systems

Contracts in Astronomy:

- [INTA-CAB] Development of a remote telescope control system for the robotic telescopes of the Center of Astrobiology (CAB), 2007-2008
- [ESA] Monitoring and Control Prototype for ESA's SSA (Space Situational Awareness) telescopes, radio-telescopes, radars, ..., 2013-2015
- [ESA] Demonstration Test-Bed for the Remote Control of an Automated Follow-Up Telescope, 2012-2015

Other contracts in Science & Space:

- [ESA] Frame Contract for the Maintenance and Engineering Support of ESA's Front-End Controller (controller of ESA's antennas, deployed in all ESA's network of Ground Stations), 2010-2016.

R&D projects in Science & Space:

- [ADE] Prototype of a remote Raman-LIBS spectrometer, 2007-2013



[JEMA] Company facilities

Core business: Power Supply Components
Employees: 110 | 2500 (Irizar group)
Turnover/Year: 20 M€ (2013), 500 M€ (Irizar group)
Contact: Mr. Bas Eikelboom
Tel: +34 943 376 400
Address: Paseo del Circuito 10
20160 Lasarte-Oria (Gipuzkoa)
Web page: www.jemaenergy.com

Company activities:

- Design and manufacturing of Customized power conversion systems
- Reactive Power Compensators (SVC, STATCOM)
- Battery Energy Storage Systems (BESS)
- AC & DC UPS systems
- Solar Inverters

Contracts in Astronomy:

- [NASA] Emergency power supply system for MDSCC (Madrid Deep Space Communications Complex), 2010

Other contracts in Science & Space:

- [ESS-Bilbao] Klystron modulator
- [IFMIF] Tetrode high voltage power supplies
- [CERN] LHC high precision magnet power supplies
- [RAL] High precision magnet power supplies for ISIS
- [CEA-JT60] Supply of superconducting magnets power supplies for JT60-SA tokamak (Japan), ongoing



[ESO] Manufacturing of ALMA Foundation Alignment Tool, 2009

Core business: Precision Machining Work and
Supply of Produce | Training
-Opto-mechanical Engineering | welding, precision welding

Employees: 225

Turnover/Year: 23 M€ (2013)

Contact: Mr. Marcos Pérez
mperez@leadingenterprises.es
Tel: +34 647 637 789

Address: Isabel Torres, 1
39011 Santander

Web page: www.leadingenterprises.es

Company activities:

- Opto-Mechanical engineering
- Design and manufacturing of precision machining systems & solutions
- Precision welding and joining technologies
- Complete electro-mechanical integration (mechanical + control devices)
- Manufacturing of series of components

Contracts in Astronomy:

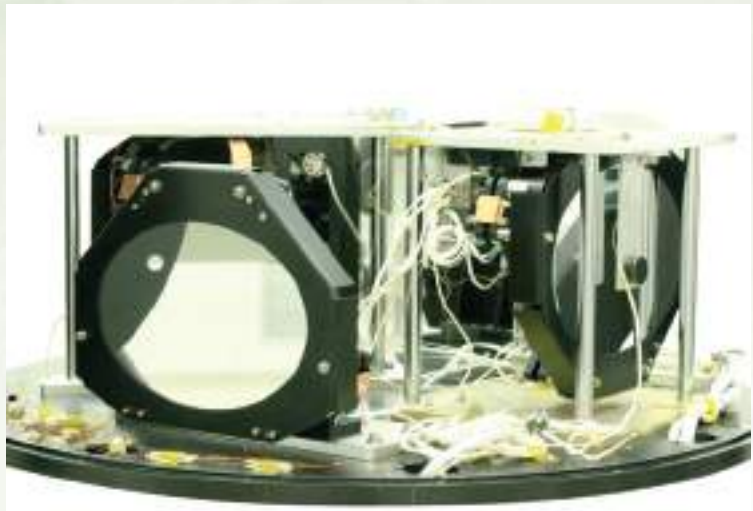
- [ESO] Manufacturing of ALMA Foundation Alignment Tool, 2009

Other contracts in Science & Space:

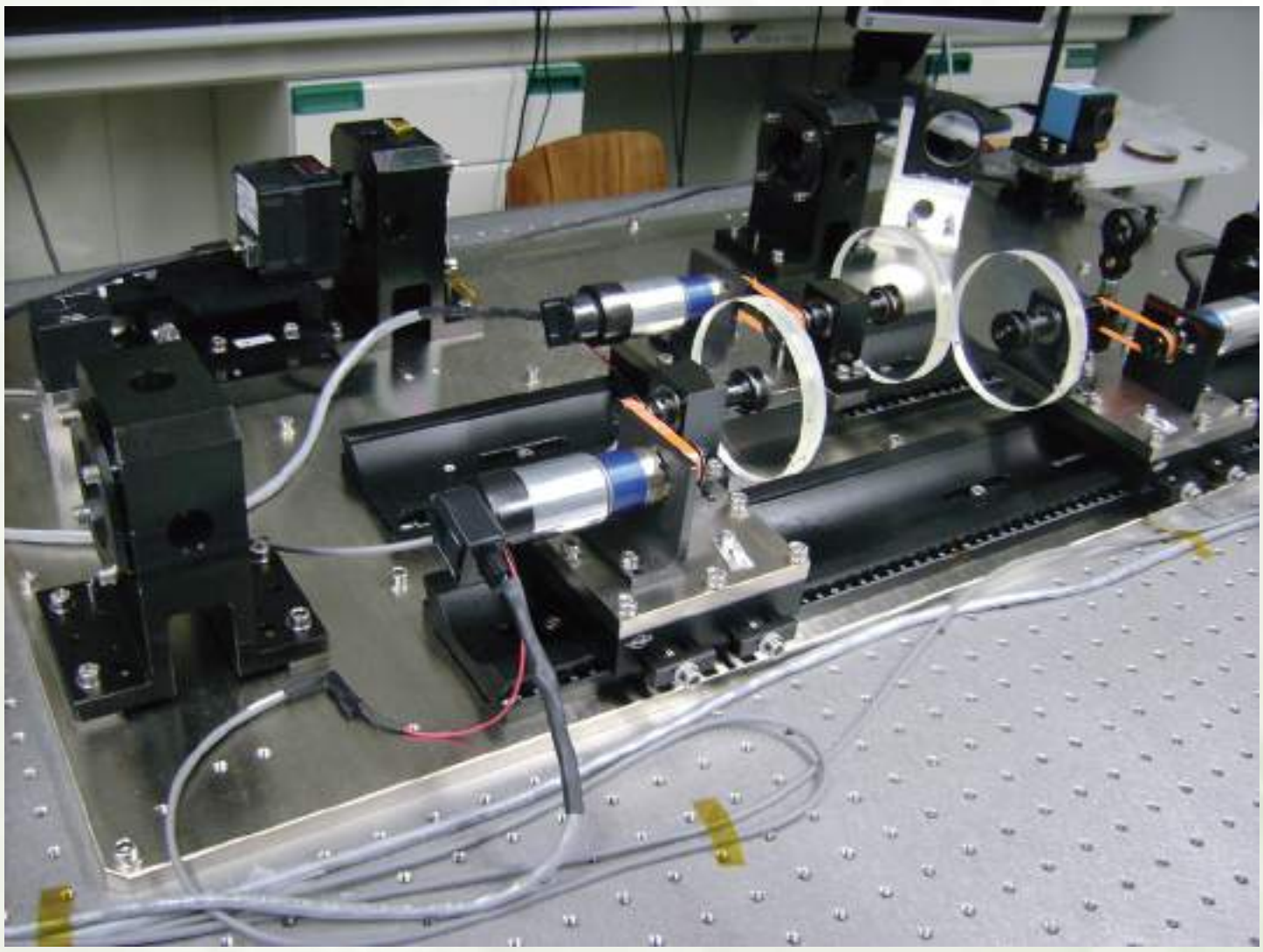
- [F4E/ITER] Engineering Support, 2009
- [F4E/ITER] ITER First Wall Panel Semi-prototype, 2012
- [F4E] ITER First Wall Panel Full Scale Prototype, 2014

R&D projects in Science & Space:

- [CDTI] ITER Blankets: research on the development of ITER First Wall Panels, 2010
- [GOB CANTABRIA] COMP_ITER: research on the development ITER components, 2013
- [GOB CANTABRIA] ITERCUT: research on cutting processes for ITER First Wall Panels, 2014
- [GOB CANTABRIA] ITERCAST: research on plasma facing components manufacturing for ITER, 2014



[INTA] Cryogenic Active Folding Mirrors with remote rotation capability MIRI Telescope Simulator, 2011



[IAC] IACAT Atmospheric Turbulence Simulator Telescopes for Adaptive Optics, 2010



Core business: Engineering-consultancies-
studies-research |
Optomechanical Engineering | Manufacturing of opto-mechanical
devices

Employees: 25

Turnover/Year: 1.5 M€ (2014)

Contact: Mr. Jesus Aivar
jesus.aivar@lidax.com
Tel: +34 916 780 805

Address: Antonio Alonso Martin, 1
28860 Paracuellos de Jarama (Madrid)

Web page: www.lidax.com

Company activities:

- Design, Analysis, Assembly, Integration and Testing of High Accuracy Structures and/or Opto-mechanical Systems (Folding Mirrors, Focal Plane Assemblies, Spectrometers, etc)
- High Accuracy Positioning Systems under Hazardous Conditions (Vacuum, Cryogenic, etc): Cryogenic Actuators, Cryogenic Translation Unit and Cryogenic Mechanisms

Contracts in Astronomy:

- [GTC] Lateral Support for M1 Mirrors Interface with Ceramic Mirror Subsystems, 2010
- [IAC] IACAT Atmospheric Turbulence Simulator Telescopes for Adaptive Optics. Simulating Different GTC, WHT and OGS IAC Telescopes, 2011

Other contracts in Science & Space:

- [INTA] Cryogenic Active Folding Mirrors with remote rotation capability MIRI Telescope Simulator, 2011
- [INTA, Private Companies] Focal Plane Assemblies for Scientific/EO Space Instrumentation: MIXS Bepi Colombo, CAS-ATLID, PLATO, ISSIS WSO.
- [ESA] Development of a Family of Dry Lubricated Gearboxes, 2012
- [ESA] Optical Telescope Mounts for Meteosat Third Generation IRS & FCI Instruments, 2013

R&D projects in Science & Space:

- [Regional funding] Cryogenic Submicron Linear Actuator able to operate under Vacuum & Cryogenic Environment
- [Regional funding] Cryogenic Translation Unit able to operate under Vacuum & Cryogenic Environment
- [Regional funding] Superconductive magnetic levitation positioning systems



[XFEL] Manufacture, assembly, alignment, commissioning and supply of 40 Ondulators Support Structures, 2012-2014



[ESO] Ridge Interface plates for the foundation of antennas for the Atacama Large Millimeter Array (ALMA), 2010



Core business: Mechanics
Employees: 32
Turnover/Year: 5 M€ (2014)
Contact: Ms. Susana Fernández
comercial@nortemecanica.es
Tel: +34 985 579 857
Address: Área Industrial de Tabaza I, E-5,
33469 Carreño (Asturias)
Web page: www.nortemecanica.es

Company activities:

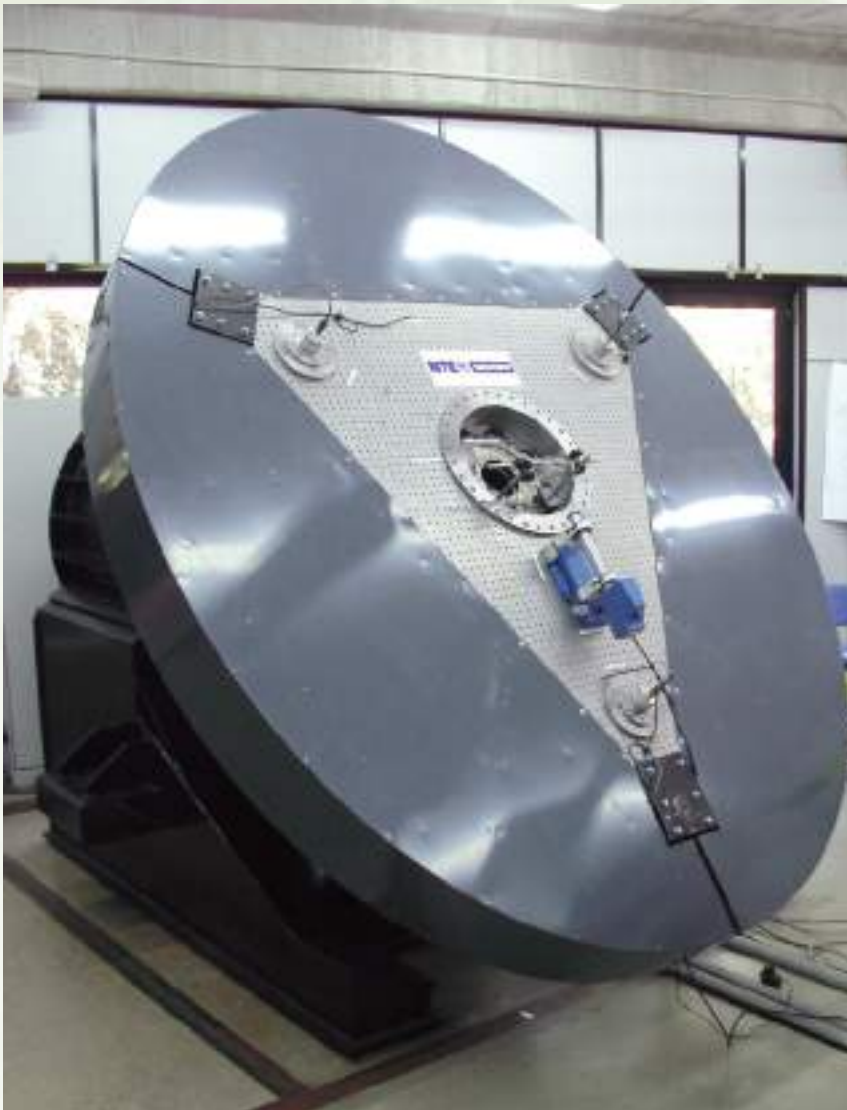
- Manufacturing, assembly and commissioning of capital goods, machinery and spare parts for the industry.
- Manufacture of undulator carriages (Insertion Devices Support Systems) for Synchrotron Radiation facilities.
- Manufacture of mechanical components for research organizations and engineering companies.
- High precision mechanics and alignment

Contracts in Astronomy:

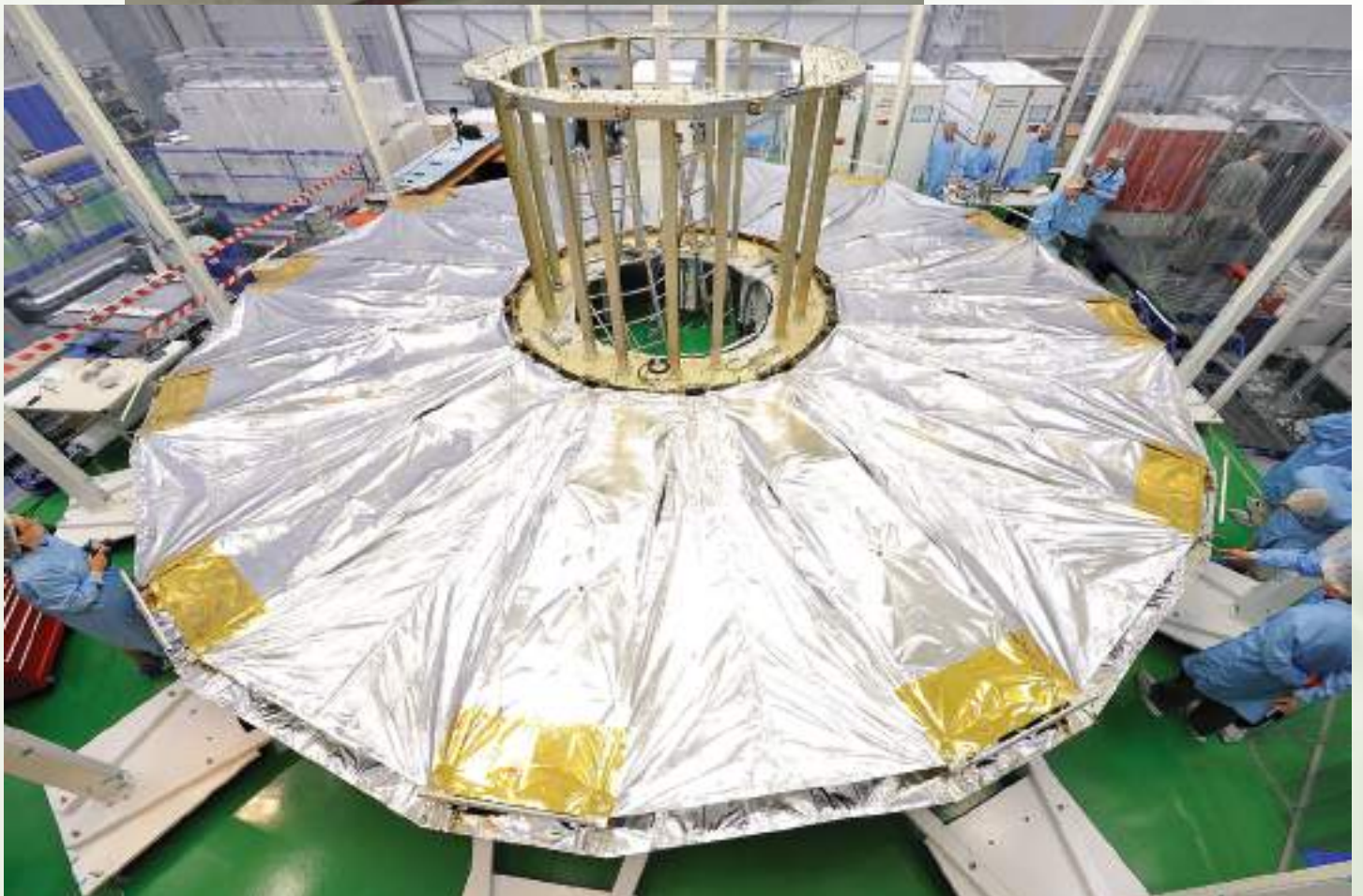
- [ESO] Manufacturing, testing and supply of 210 Ridge Interface plates for the foundation of antennas for the Atacama Large Millimeter Array (ALMA), 2010

Other contracts in Science & Space:

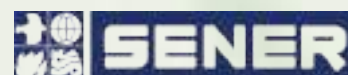
- [CERN] Manufacture and supply of 16 Shuffling Module Vacuum Vessels for the Large Hadron Collider (LHC), 2006
- [XFEL] Manufacture, assembly, alignment, commissioning and supply of 36 undulator segments and its prototypes for the European X-Ray Free Electron Laser Facility in Hamburg, 2010-2014
- [SESAME] Design and Manufacturing of Girder-system of the SESAME Storage Ring, Jordan, 2014-2015
- [ESRF] Manufacturing and supply of different types of Insertion Devive Support Systems (Apple II, In-vacuum ondulator mobile carriages, etc).



[ESO] E-ELT M5FU Conceptual design and Demonstrator Unit, 2007-2010



[ESA/ADS] GAIA M2 Mechanism & Deployment Sunshield, 2006-2014



Core business: Engineering-consultancies-
studies-research

Employees: 2,543

Turnover/Year: 557 M€ (2013)

Contact: Mr. Joan Manel Casalta
joanmanel.casalta@sener.es
Tel: +34 932 276 563

Address: C/ Creu Casas i Sicart, 86-88. Parc de l'Alba
08290 Cerdanyola del Vallès (Barcelona)

Web page: www.sener.com

Company activities:

- Aerospace and civil engineering turnkey projects.
- Custom-made opto-mechanical systems for space and ground astronomy.
- Instrumentation subsystems including optics, mechanics, electronics & SW.
- Mechatronics, mechanics, structures, actuators and control infrastructure.

Contracts in Astronomy:

- [ESO] E-ELT M5FU Conceptual design and Demonstrator Unit, 2007-2010
- [ESO] ALMA ACD Robotic Arms, 2008-2012
- [ESO] VLT GRAAL Main Assembly, 2007-2010
- [CEFC/Univ Sao Paolo] JPCam Actuator System, 2012-2015
- [IAC] GTC EMIR DTU & CSU Electronics and Control, 2005-2015
- [UGR] IRAIT M2 & M3 Units, 2004-2007
- [IAC] GTC OSIRIS Filter Wheels, 2002-2006
- [UK ATC/ESO] VISTA M2 Unit, 2002-2006
- [GTC] M2 Drive System, 2000-2005

Other contracts in Science & Space:

- [ESA/ADS] GAIA M2 Mechanism & Deployment Sunshield, 2006-2014
- [NASA/JPL] Mars Science Laboratory (Curiosity) High Gain Antenna Mechanism, 2006-2010
- [ESA] HERSCHEL/PLANCK Guidance And Control System 2002-2009
- [ESA] ROSETTA Deployable booms, louvers, filter wheels 1997-2004
- [ESA] SOLAR ORBITER Antennas & Instruments subsystems, Booms, 2010

R&D projects in Science & Space:

- [CDTI] Piezo Actuator HV cooled Amplifier, 2008-2010
- [FP7] EST M2 Drive System, 2007-2010
- [INTERNAL FUNDING] High Precision off-the-shelf Hexapod, 2010



[CTA] Data acquisition board, 2014



[KM3Net] White rabbit switch, 2014



Core business: Electronics
Employees: 10
Turnover/Year: 760 M€ (2014)
Contact: Ms. Javier Díaz
jdiaz@sevensols.com
Tel: +34 958 285 024
Address: Periodista Rafael Gómez Montero 2, Edificio Cetic
18014 Granada
Web page: www.sevensols.com

Company activities:

- Design and manufacturing of electronic circuits (PCB, FPGA cores, fabrication quality tests according to standards, functional tests, etc).
- Embedded software development (processors, DSPs, microcontrollers, etc)
- Timing and synchronization expertise and design (network switches and nodes for accurate timing)
- Expertise in safety critical systems

Contracts in Astronomy:

- [CTA] Data acquisition board, 2014.
- [HISCORE] Timing and synchronization electronic boards, 2013 and 2014.
- [KM3Net] Timing and synchronization switches and electronic customization, 2013 and 2014.

Other contracts in Science & Space:

- [CERN] Manufacturing of SPEC boards, Digital I/O (DIO) boards (tenders). 2013 and 2014.
- [GSI] Manufacturing of White Rabbit Switches. 2014.
- [GSI] CE labelling of White Rabbit Switches. 2014.
- [IFMIF-EVEDA] Low level RF control equipment and EPICS software. 2014

R&D projects in Science & Space:

- [CDTI] White Rabbit Technology, 2011-2012.
- [FP7-ARTEMIS PLATFORM] RECOMP: Reduced Certification Costs Using Trusted Multi-core Platforms, 2011-2013.
- [FP7-ARTEMIS PLATFORM] EMC2: Embedded Multi-Core systems for Mixed Criticality applications in dynamic and changeable real-time environments, 2015-2018
- [KM3Net] Customized White Rabbit System, 2013-2014.
- [CTA] Data acquisition board for CTA telescopes, 2013-2014.



Laboratory for Advanced Surfaces. Semi-industrial plasma nitriding by active screen or post-discharge (ASP) equipment.



TRIBOLAB station for the study of solid lubricant coatings for aerospace applications

Core business: Engineering-consultancies-
studies-research

Employees: 1,500

Turnover/Year: 120 M€ (2013)

Contact: Mr. Jesus Marcos
jesus.marcos@tecnalia.com
Tel: +34 620 921 924

Address: Paseo Mikeletegui 2
20009 San Sebastián

Web page: www.tecnalia.com

Company activities:

- Design and manufacturing of high dimensionally stable structures with advanced materials
- Mechanism design, automatization, robotics and handling tools
- Optical coatings and surface treatments for corrosion
- Joining techniques (EB, laser, brazing, cryogenic)

Contracts in Astronomy:

- [ESO] Alcatel Space contract study for ALMA CFRP structures, 2000
- [GTC] EMIR instrument-cryogenic chamber materials, 1998-2000
- [IAC] Astrotecnia: consultancy for business models of an astrophysics spin-off technical center, 2004

Other contracts in Science & Space:

- [F4E] Engineering support in the area of plant systems
- [F4E] Fabrication of a standard semi-prototype of the ITER first wall panels

R&D projects in Science & Space:

- [FP7] SOLARNET network, contributions to EST, 2013
- [INTERNAL FUNDING] Solid lubricants for tribological instruments
- [CDTI-INEUSTAR-TECNALIA] Agreement for special electron beam welding activities of use to large scientific infrastructures



[ESO] Controller for the Warping Harness Prototypes for positioning hexagonal mirrors of the EELT telescope, 2009



[Airbus DS] Equipment for 270Vdc High Voltage Distribution in aircrafts, 2012



Core business: Electronics | Measuring/testing instruments | Consultancy-
Optoelectronic Engineering

Employees: 21

Turnover/Year: 2.3 M€ (2014)

Contact: Mr. Luis Bussion
lbussion@temai-ingenieros.com
Tel: +34 916 722 731

Address: Rivas 10-12
28820 Coslada (Madrid)

Web page: www.temai-ingenieros.com

Company activities:

- Design and manufacturing of electronics and instruments, from the specification phase and requirements definition to manufacture and support, ensuring Critical Electronic certification and certified for flight Critical Software.
- Design and manufacturing of test benches and test validation both for industrial and research clients
- Engineering services, on-site and off-site

Contracts in Astronomy:

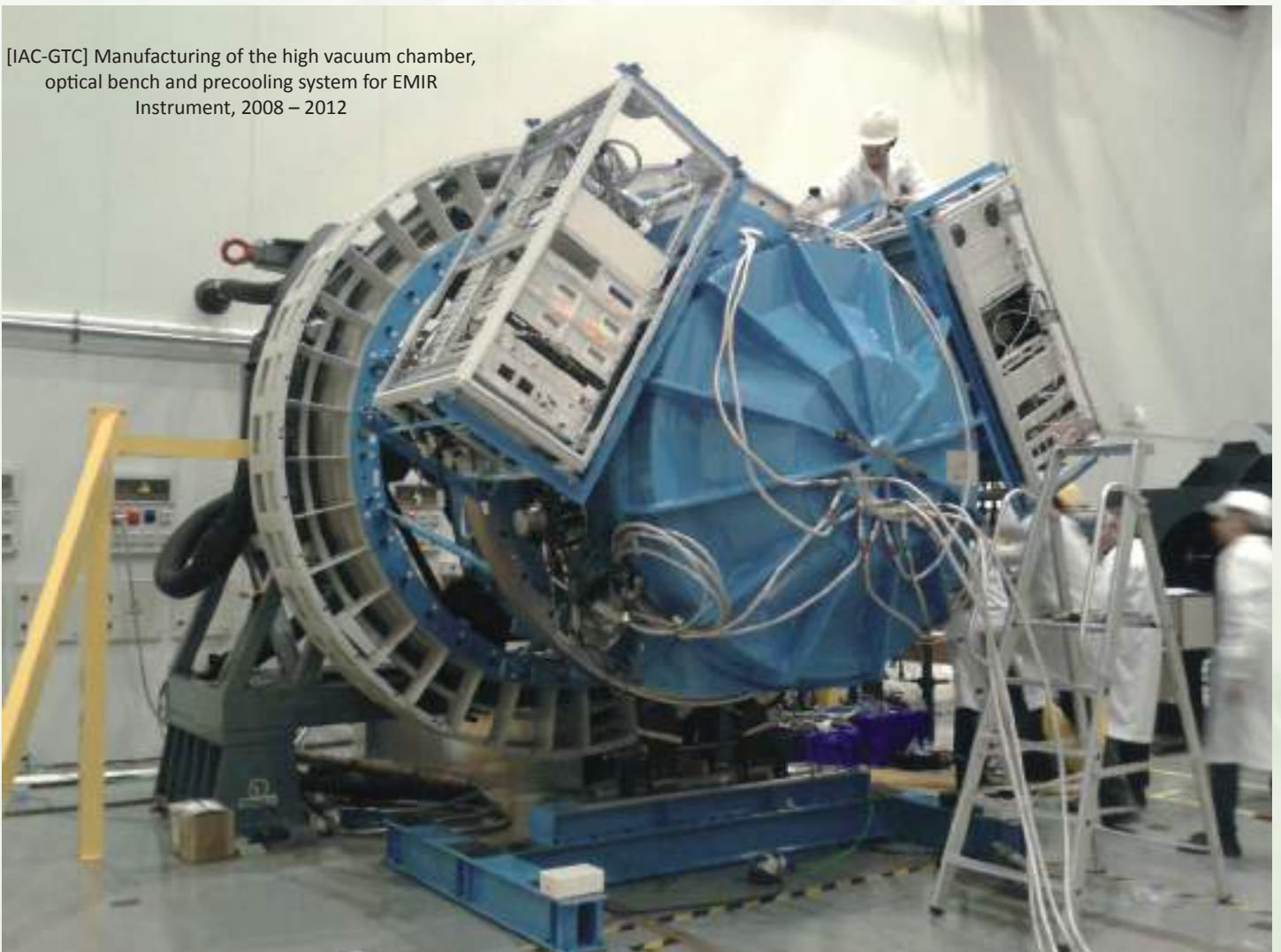
- [ESO] Controller for the positioning structures prototypes of hexagonal mirrors of the E-ELT telescope (as subco to CESA), 2009

R&D projects in Science & Space:

- [CDTI] New optical technologies for structural damage detection in composites structures using Lamb waves, 2010-2013.
- [FP7] New portable devices to allow early detection of life in disasters related to collapse buildings and ensure safety or rescue teams”, 2008-2012.



[INTA] Design, manufacturing and supply of a cryostat for 4° Kelvin, for optical and mechanical testing of components of the ESA/SAFARI instrument, 2013



[IAC-GTC] Manufacturing of the high vacuum chamber, optical bench and precooling system for EMIR Instrument, 2008 – 2012



Core business: Vacuum and Low Temperature Technology | Cryostats, chambers, vessels | Tubes, seals

Employees: 18

Turnover/Year: 2 M€ (2013)

Contact: Mr. José Gómez
j.gomez@vacuum-projects.net
Tel: +34 961 344 831

Address: Parque Empresarial Táctica C/Velluters 17
46988 Paterna (Valencia)

Web page: www.vacuum-projects.net

Company activities:

- Design and manufacturing of custom-made cryostats & high vacuum chambers
- Turnkey high vacuum @ cryogenic systems
- Design & manufacturing of custom-made high & ultra-high vacuum components
- Leak high vacuum & RGA analysis certification test

Contracts in Astronomy:

- [ESO] Supply of Flexible Helium Lines for the ALMA OSF Laboratories, 2013
- [GTC/IAC] Manufacturing high vacuum chamber, optical bench and precooling system for EMIR Instrument, 2008-2012
- [IAC] Manufacturing and supply of optical bench Espresso, 2014
- [IAC] Manufacturing and supply of cold 20K structure for TGI Instrument Cryostat Quijote

Other contracts in Science & Space:

- [CLPU] Design, manufacturing and supply of a laser compressor vacuum chamber for 200 TW laser, 2012
- [CIEMAT-DESY] Combined Superconducting Magnet Packages for the Main Linac of XFEL, 2012-2014.
- [CSIC] UHV chamber for deposition of thin films through various evaporation techniques, 2011
- [VSC-Val Space Consortium] High vacuum chamber with glass bell for satellite antennas tests, 2012

R&D projects in Science & Space:

- [INTA] Design, manufacturing and supply of a cryostat (4° Kelvin), for optical and mechanical testing of components of the SAFARI instrument, 2013
- [IAA] Design, manufacturing and supply of a cryostat (77° Kelvin), for optical testing of components, 2011.
- [UPC] Vacuum system for testing of aerospace electronic components, 2011



[ESO] 17MW multifuel power plant for ALMA, 2011





Core business: Elec.+power supply, wind/solar
| Water supply and treatment |
Low-voltage switchgear/boards

Employees: 772

Turnover/Year: 483 M€ (2013)

Contact: Mr. Jose Ignacio Martí
joseignacio.marti@tsk.es
Tel: +34 670 736 796

Address: Madrid

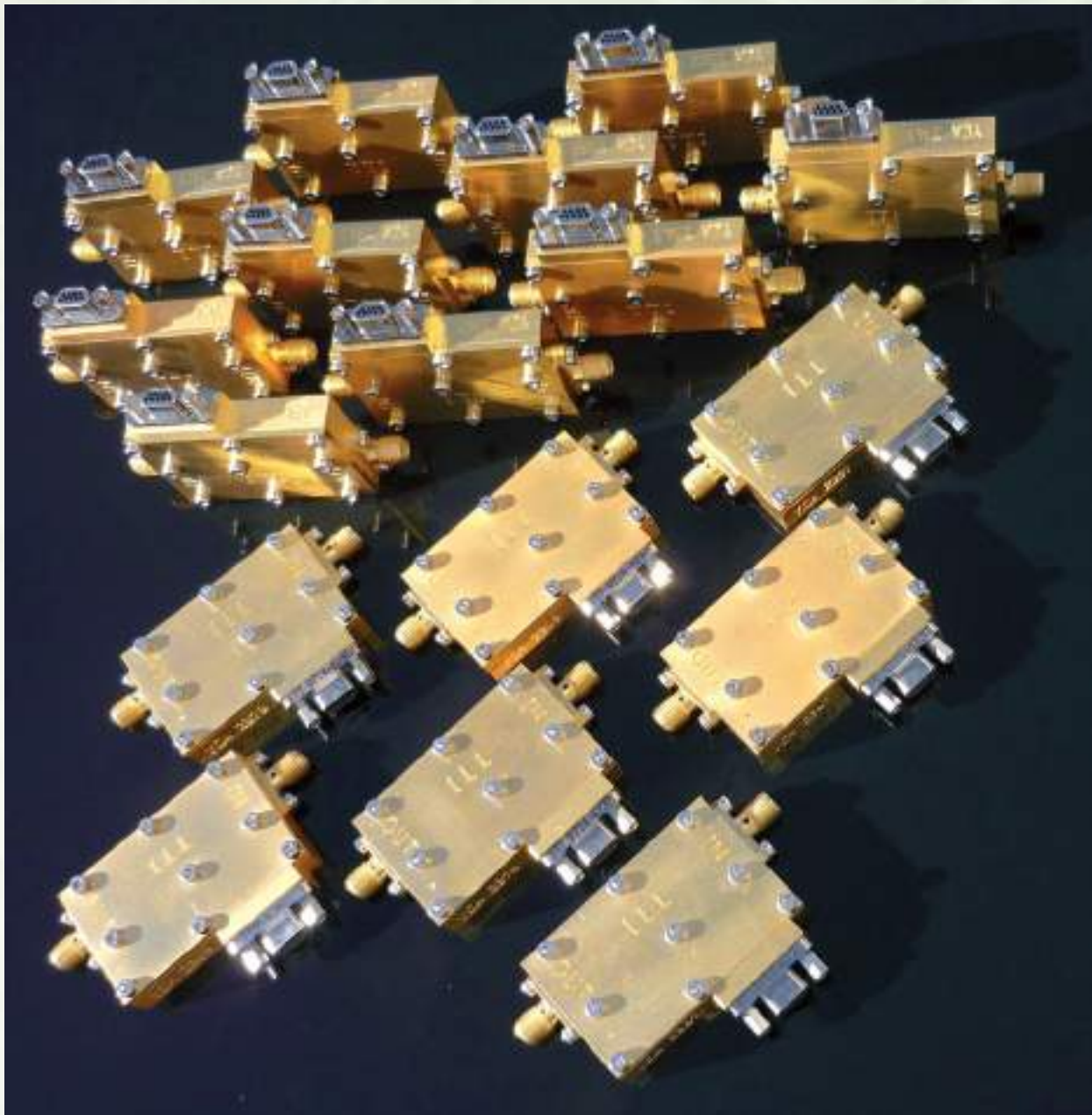
Web page: www.grupotsk.com

Company activities:

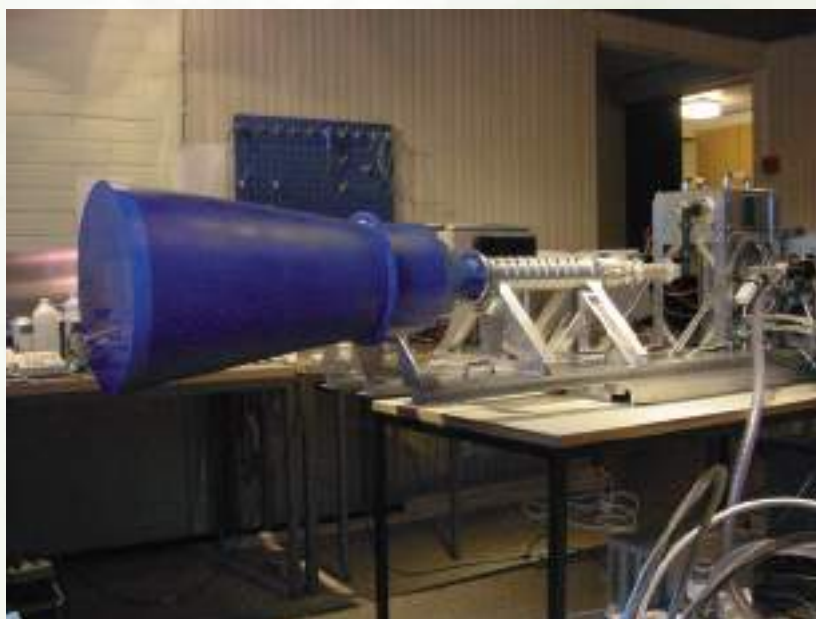
- Engineering, Procurement and Construction of Industrial Plants.
- Engineering, Procurement and Construction of Energy (Conventional and Renewable) Plants
- Engineering, Procurement and Construction of Electrical Infrastructures
- Engineering, Procurement and Construction of Water Treatment Plants

Contracts in Astronomy:

- [ESO] ALMA 17MW multifuel power plant, 2011



[ALMA/ESO] Cryogenic LNAs for the Band 7 Receiver Cartridge for ALMA, 2007



[Metsähovi Radio Observatory] Geodetic VLBI receiver, 2004



Core business: Electronics | RF and Microwave Components and Equipments | Vacuum and Low Temperature Technology

Employees: 100

Turnover/Year: 8 M€ (2013)

Contact: Mr. Miguel Peña
mpena@ttinorte.es
Tel: +34 942 291 212

Address: Santander

Web page: www.ttinorte.es

Company activities:

- Design and manufacturing of Cryogenic Low Noise Amplifiers
- Design and manufacturing of Low Noise, Highly Integrated Receivers for Cryogenic and Uncooled applications
- Design and manufacturing of Wide Bandwidth Feed Antennas for Dishes
- Cryostats (reconfigurable and tailor made solutions)

Contracts in Astronomy:

- [ESO] Cryogenic LNAs for the Band 5 Receiver Cartridge for ALMA, 2014
- [ESO] Cryogenic LNAs for the Band 7 Receiver Cartridge for ALMA, 2007
- [ESO] Cryogenic LNAs for the Band 9 Receiver Cartridge for ALMA, 2009
- [ESO] Room Temperature LNAs for the Band 5 Receiver Cartridge for ALMA, 2014
- [IRAM] Cryogenic LNAs for NOEMA, 2014
- [IRAM] Cryogenic LNAs for NIKA2, 2014
- [VIRAC] Development, installation, tests and training of receiver system for radio-telescopes RT-16 & RT-32, 2012
- [Metsähovi Radio Observatory] Geodetic VLBI receiver for the 10m diameter radio telescope, 2001
- [OAN/ Astronomical Centre of Yebes] Reconfigurable cryostat 4K

Other contracts in Science & Space:

- [CERN] Design and manufacturing of 10 kW solid state power amplifiers at 200 MHz
- [IFMIF/EVEDA] Design and manufacturing of the prototype RF chain, HW/SW of the RF module, and test bench for high power RF coupler conditioning
- [Huelva University] Design and manufacturing of a 1.2 kW solid state power amplifier at 80 MHz

R&D projects in Science & Space:

- [ESA] Experimental Cryo X band LNAs Prototyping, 2008
- [CDTI] Design and development of high-gradient superconducting RF cavities for particle accelerators
- [FP7-Space] SLOGAN - Space qualification Of High-Power SSPA based on GaN technology, 2014, ongoing
- [ESA] SMPA (Switch Mode Power Amplifier) for satellite radar in GaN technology, 2013, ongoing





OTHER COMPANIES



AERNOVA ENGINEERING DIVISION S.A.U.

www.aernnova.com



Core business: Engineering-Consultancies-Studies-Research
Employees: 200
Turnover/Year: 33.6 M€ (2013)
Contact: Mr. Juan Ramon Suarez / juanramon.suarez.perez@aernnova.com
Tel: +34 913 827 816
Address: Leonardo Da Vinci 14 - 01510 Miñano (Álava)

Company activities:

- Design and manufacturing of aeronautical, space, railway and ship structures both in metallic and composite materials
- Certification tests of aeronautical structures

Selected contracts:

- [ESA] SEOSAT INGENIO: Mechanical Ground Support Equipment
- [BOEING] 747/8 wing and fuselage sections (2008-09), 787 wing and tail sections, 747 LCF Swing zone mechanism (2004-05)
- [AIRBUS] A380 Fuselage and Tail (2000-05), A350 wing and tail (2010-14)
- [EMBRAER] 170/190 Rear Fuselage and Tail (1999-2002), 145 Wing (1993-96), KC-390 (2011-15)
- [BOMBARDIER] C-Series Center Wing Box (2009-15), CRJ700/800/1000Tail (2003-05)

ANALISIS Y SIMULACIÓN S.L.

www.analisisysimulacion.com



Core business: Consultancies-Mechanical Engineering
Employees: 40
Turnover/Year: 4.03 M€ / 2013
Contact: Mr. Jordi Estiu / jordi.estiu@ analisisysimulacion.com
Address: Parque Tecnológico de Álava, Leonardo da Vinci, 14, edificio PIE
01510 Miñano (Álava)

Company activities:

- Mechanical engineering
- Specialized in numerical simulation
- Instrumentation, data acquisition, data analysis.

Selected contracts:

- [B2B] Numerous projects in the industries space, aeronautic, automotive, wind energy, railway, biomechanic. 1997-2014.
- [TECNOTRANS] Modeling and mechanical features for the seismic analysis and “ébranlement” analysis of the refrigeration water entry nuclear plant filter system, 2011.
- [ITP – INGENIERIA DE TURBO PROPULSORES] Modeling and mechanical analysis –distortions and plastic residual stresses- in a Ni alloy aeronautic component been due to a laser manufacturing process, 2012.

COMET INGENIERÍA S.L.

www.comet-ingenieria.es



Core business: Consultancy- Mechanical, Electrical Engineering | Training – Mechanical Engineering
Employees: 15
Turnover/Year: 700 k€ (2013)
Contact: Mr. Ángel Sierra / asierra@comet-ingenieria.es / Tel. +34 963 409 850
Address: C/ Convento Carmelitas, 2 - 46010 Valencia

Company activities:

- Design of mechanical components, structures, machines and tooling.
- Structural analysis: static, dynamic, kinematic, thermal, fatigue, CFD, vibro-acoustic, etc.
- Manufacturing of prototypes, engineering support for testing activities.

Selected contracts:

- [AIRBUS D&S/CASA Espacio] Kinematic and mechanic analysis of a pointing mechanism for satellites, 2014.
- [RYMSA Espacio] Mechanical design and analysis of Ku-band TCR Global Horn antenna for Hispasat-1F satellite, 2014.
- [VOSSLOH Spain] Design of manufacturing tooling for CHEMNITZ and SHEFFIELD trams and METRO-LINK locomotive, 2012-2014.
- [AIRBUS D&S – Military Transport] Analysis of wing and winglets structures for installation in transport aircraft C295, 2012-2014.

ESTEYCO S.A.P.

www.esteyco.com

ESTEYCO



Core business: Engineering-consultancies-studies-research / Mechanical Engineering – Architect, Civil Engineering
Employees: 114
Turnover/Year: 10 M€ (2013)
Contact: Mr. Luis Maqueda / luis.maqueda@esteyco.es / Tel: +34 913 597 878
Address: Menéndez Pidal 17 - 28036 Madrid

Company activities:

- Design and analysis of complex mechanical and structural components
- Seismic engineering
- Design of singular structures in reinforced concrete and/or steel

Selected contracts:

- [ESA] Design and construction of the supporting base structure of the ESA's DSA-3 Deep Space Antenna in Malargue, Argentina 2010-2011
- [ESA] Design and construction of the supporting base structure of the ESA's DSA-2 Deep Space Antenna in Cebreros, Spain 2010-2011
- [F4E] Design of Test Blanket Modules sets and analyses, 2011-2014 (ref. on request, The Official Journal of the British Nuclear Institute. Sept/Oct 2012)
- [F4E] Seismic analysis of the Tokamak machine and its interface with the Tokamak building, 2010-2012 (ref. on request, SMiRT-22 conference, San Francisco, California, August 2013)

EXPOGRAFIC

www.expografic.es



Core business: Outreach services
Employees: 15
Turnover/Year: 1.5 M €
Contact: Mr. Pedro García / pgd@expografic.es / Tel: +34 935 893 132
Address: Av. J.M. Marcet 23 - 08193 Bellaterra, Barcelona

Company activities:

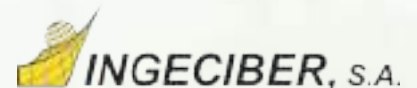
- Concept, design and production of Science Museums and Exhibitions
- Outreach and Education products: software, edition, video, multimedia.
- Assessment and coordination of Outreach and Educative Science Projects

Selected contracts for Science & Space facilities:

- [TEIDE NATIONAL PARK] Cañada Blanca Visitor Centre. Contents, design and installation of this centre that includes an area dedicated to Astronomy and Teide observatory. 1995
- [MINISTRY OF FOREIGN AFFAIRS. GOV. CHILE] National Public Astronomical Network. Preliminary Draft. 2012
- [FUNDACIÓN CHILE]. Chajnantor Astronomical Interpretation Centre. Preliminary Draft. 2013
- MUNICIPALITY OF GÉRGAL. Calar Alto Astrophysics Interpretation Centre. Contents, design and installation of planetary and museographical resources. 2001

INGECIBER

www.ingeciber.com



Core business: Finite Element Methode SW |
Consultancy | Training
Employees: 25
Turnover/Year: 1 M€ (2013)
Contact: Mr. Miguel Ángel Moreno / ma.moreno@ingeciber.com /
Tel: +34 913 862 222
Address: Avda. Monforte de Lemos 189 - 28035 Madrid

Company activities:

- Finite Element Analysis for Civil Engineering using Civil FEM: Buildings, structures, foundations, vibrations, seismic, etc.
- Finite Element Analysis for Mechanical engineering using ANSYS and MSC NASTRAN
- Fluid Computational Dynamics (CFD) analysis.
- Finite Element Analysis Training. Int'l online FEA Master's program at UNED. Specific FEM training courses.

Selected contracts for Science & Space facilities:

- [Company AVS] Finite element analysis for a low gravity sampling tool for planet exploration
- [CIEMAT, IAC] ANSYS training for applications in GTC and ITER
- [CDTI] Von Karman vortex shedding analysis for high Reynolds numbers. Critical and super-critical zones, 2010

NUMERICAL ANALYSIS TECHNOLOGIES S.L. (NATEC)

www.



Core business: Consultancies-Mechanical
Engineering | Architecture,Civil Engineering | Scientific Research

Employees: 13

Turnover/Year: 1 M€ (2013)

Contact: Mr Javier Ordieres / javiord@natec-ingenieros.com / Tel : +34 984 199 692

Address: Marqués de San Esteban – 52 Entlo D - 33206 Gijón (Asturias)

Company activities:

- Design and assessment of mechanical equipment for nuclear fusion facilities
- Welding distortion evaluation through FE simulation (ANSYS)
- Design and assessment of pressure vessels for nuclear fission facilities
- Design and manufacturing of lifting equipment and machinery for heavy loads in marine dock construction.

Selected contracts:

- [ITER, F4E] Plasma diagnostics engineering with emphasis on bolometer and visible infra-red.
- [ITER, F4E] Engineering support for mechanical, thermo-hydraulic and electro-magnetic analysis and structural assessment of ITER diagnostic components.

PROCON SYSTEMS

www.proconsystems.net



Core business: Control Systems | PLC Software |
System Engineering

Employees: 40

Turnover/Year: 8.7 M€ (2013)

Contact: Mr. Daniel Marchante / marchante@proconsystems.net
Tel: +34 934 609 940

Address: Arquímedes 26 - 08918 Badalona (Barcelona)

Company activities:

- Process Simulation and Engineering
- Hardware Engineering and PLC, SCADA and Software Development.
- Cabinets Fabrication and Electrical Installation.
- Commissioning and production support on site.

Selected contracts:

- [CERN] HVAC System for PS Accelerator Ring, 2012-2014
- [ITER] Prototyping Interlock Control Systems, 2010-2012
- [ITER] Internal Configuration Guidelines for I&C Cubicles, 2010-2012
- [ALBA] Personnel Safety System (PSS), 2007-2012
- [EFDA] Control Systems for DTP2 Remote Handling Systems, 2006-2007
- [ESO] Tender for ALMA Inventory Control and Computerized Maintenance Management System, 2007
- [ESO] Tender for Software Development for Integration of 2nd Generation VLTI Instruments in VLTI Software, 2009

SERTEC S.L.

www.sertec.net



Core business: Engineering-consultancies-studies-research
Employees: 50
Turnover/Year: 5.6 M€ (2013)
Contact: Mr. Eduardo Cano Corral / eduardo.cano@sertec.net / Tel: 34 917 241 775
Address: Eric Kandel 1, P.I. Tecnogetafe Edificio Upm-Lma - 28906 Getafe (Madrid)

Company activities:

- Optical, Mechanical and Civil engineering
- Optics measuring/testing instruments
- Structural design and manufacturing
- Structural testing

Selected contracts:

- [CIDAUT] Reflectometry test bench for termo-solar plant mirrors measuring
- [ESO] Tender for Feasibility study for measurement of mirrors deformation by deflectometry

SGENIA

www.sgenia.com



Core business: Engineering-consultancies-studies-research | Electronics | Precision Machining Work and Supply of Produce | Development Software, Compilers
Employees: 51
Turnover/Year: 2.96 M€ (2013)
Contact: Ms. Isabel Gil / igil@sgenia.com / Tel: +34 916 306 388
Address: Chile 4 Edificio II - 28230 Las Rozas (Madrid)

Company activities:

- Robotic system integration (mechanical, electric and control design, manufacturing, installation and start-up).
- Development of both, control and power, electronic devices.
- SW development and integration into large facilities.

Selected contracts:

- [ESA] Development and Test of a Plasma Bridge Neutralizer based on RF Ionization for Electric Propulsion Applications, ongoing.
- [ITER] Assistance to development, maintenance and user support of the CODAC (Control, Data Access and Communication Operation Applications) Core System, ongoing.
- [Others] Background in the aeronautics sector carrying out precision machining. Some programmes in which we have been involved have been: C-295 (Airbus), A-350 (Airbus), Embraer 170, Embraer 190, Superpuma (Eurocopter), NH90 (Eurocopter), S-92 (Sikorsky), C-Series, since 2004.

SOFTWARE

www.softwcare.com

Core business: Engineering-consultancies-studies-research | Data processing | IT-software
Employees: 10
Turnover/Year: 200 K (2013)
Contact: Mrs. Patricia Rodríguez / rodriguezdapena@softwcare.com
Tel: +34 986 241 485
Address: Avda Atlántida 100, 1º izq - 36208 Vigo (Pontevedra)

Company activities:

- Independent software verification and validation
- Software safety assessments/analysis – RAMS analyses
- Software quality assurance
- Software process assessment

Selected contracts:

- [ESA] Support to the GAIA Mission Control Centre safety analysis, 2011
- [ESA] Independent software verification and validation to the on board control software of the Vega II launcher, 2013
- [ESA] Independent software verification and validation to the on board control software of the MTG satellite and its instruments, Currently
- [ESA] Independent software verification and validation to the CryoSat I / II on board control software, 2008

TECNOBIT, S.L.U.

www.tecnobit.es

TECNOBIT

Core business: Electronics
Employees: 360
Turnover/Year: 38 M€ (2013)
Contact: Mr. Juan Carlos Castellanos / juancarlos.castellanos@tecnobit.es
Tel: +34 916 617 161
Address: Santa Leonor, 65M - 28037 Madrid

Company activities:

- Design and manufacturing of systems for Aerospace, Defence & Security
- Design and Manufacturing of Command and Control System
- Design and Manufacturing of Electro Optical Systems
- Secure Communications
- Test Benches & Support

Selected contracts:

- [AIRBUS DS] Small GEO Satellite Interface Control Unit and Power Supply Unit, 2012
- [Dutch Navy] Multi Data Link Processor, 2013
- [NATO] CRIPTO IRIDIUM Secure SAT Comms, 2010
- [AIRBUS DS] Audio Management System Airbus A-400M, Ongoing
- [AIRBUS DS] Eurofighter Radar Test Bench AGE, 2012



ASTRONOMY OBSERVATORIES

CENTRO ASTRONÓMICO HISPANO-ALEMÁN DE CALAR ALTO

www.caha.es



Hosting organization: Instituto de Astrofísica de Andalucía (IAA-CSIC)
Address: Sierra de Los Filabres, 04550 Gergal (Almería, Spain)
Contact: Jesús Aceituno | director@caha.es | +34 950 632 500

Description:

The German-Spanish Astronomical Center at Calar Alto is located in the Sierra de Los Filabres (Almería, Southern Spain). It is operated jointly by the Max-Planck-Institut für Astronomie (MPIA) in Heidelberg, Germany, and the Instituto de Astrofísica de Andalucía (IAA-CSIC) in Granada/Spain. Calar Alto provides three telescopes with apertures of 1.23m, 2.2m and 3.5m to the general community. A 1.5m-telescope, also located on the mountain, is operated under the control of the Observatory of Madrid

Main equipment:

- 3.5m telescope: optical: LAICA, MOSCA, PMAS, TWIN; NIR: OMEGA-2000
- 2.2m telescope: optical: BUSCA, CAFOS, AstraLux, CAFE; NIR: MAGIC
- 1.2m telescope: optical: CCD Camera

Instruments under development:

- CARMENES: a highly-stabilised, fibre-fed, double-channel, high-resolution spectrograph at the Zeiss 3.5 m telescope that will cover in one shot a wide spectral range from 550 to 1700 nm: It is especially designed for performing high-accuracy radial-velocity measurements of the brightest, latest, single M dwarfs of the solar neighbourhood. Currently, CARMENES is in the assembly, integration and verification phase (that is, the last phase of construction) and some elements are already finished or are being shipped to Calar Alto. The first main component to arrive the Observatory, in early March 2015, will be the front-end at the Cassegrain focus.
- PANIC: a near infrared camera for the 2.2 m and the 3.5 m. Commissioning will take place at telescope in autumn of 2014

Technology capabilities:

IAA Instrumental and Technological Development Unit: The unit participates in projects for the development of astronomical instrumentation for both ground-based telescopes and space missions. Areas of experience:

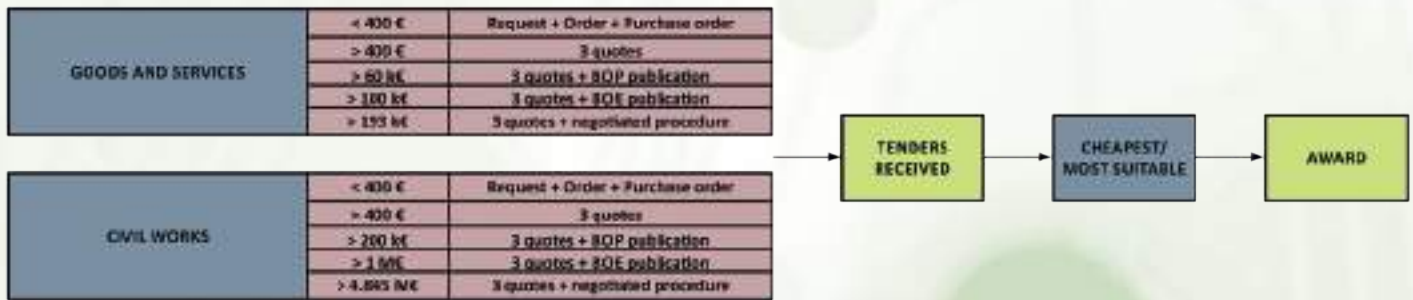
- Electronics: experience in analogic and digital fields, digital signal processing (hardware and software), design & development of circuits, power electronic, PCBs, among others.
- Mechanics: our main work is focused on development and maintenance of mechanical components for OSN and CAHA Observatories and instruments
- Optics: our designs and components have been tested and assembled in the most modern instruments.
- Project Management: projects developed by IAA: GIADA, OSIRIS, IMAX, HASI. We work with ECSS (European Cooperation for Space Standardization) standards in every management tasks.
- Software: experience in develop of pipeline processing astronomical data, data archives and control of instruments by software.
- **More information:** <https://udit.iaa.csic.es/en/node/27>



Summary of research services:

- CAHA will approve programmes in visitor and service mode: “Service mode” means “delegated service”, i.e CAHA staff will carry out the observations. Service programmes will be executed as A (priority) and B (backup).
- The Time Allocation Committee (TAC) evaluates the proposals for observing time at Calar Alto and for each proposal determines a rating and recommends a number of nights to be allocated.
- Target of opportunity (ToO) observations: observations of unpredictable events. Observers are required to submit a general application for observing time as for standard observations.
- Director’s discretionary time (DDT): A small fraction of the available time (about 5%) will be set aside for short-term allocation by the Calar Alto director.
- All observing data are made public by the Virtual Observatory (VO), Madrid, after a proprietary period of one year after the end of the observation. This does not apply for Spanish and MPIA guaranteed time proposals.

Procurement process:



BOE stands for Official State Bulletin, and BOP for Official Province Bulletin

GRAN TELESCOPIO CANARIAS

www.gtc.iac.es/



Hosting organization: GRANTECAN
Address: Centro de Astrofísica de La Palma. Cuesta de San José, s/n. Breña Baja. 38712 S/C de Tenerife
Contact: gtc@gtc.iac.es | Tel :+34 922 315 031

Description:

The Gran Telescopio CANARIAS (GTC), with a primary mirror 10.4 meters in diameter, is currently the world's largest optical-infrared telescope. The GTC is an initiative of the "Instituto de Astrofísica de Canarias" (IAC), with the support of the State Administration and the Canary Islands Autonomous Community and the international participation of institutions in Mexico "(Instituto de Astronomía de la Universidad Nacional Autónoma de México)" and the "Instituto Nacional de Astrofísica, Óptica y Electrónica)" and in the US (University of Florida). The public company Gran Telescopio Canarias, S.A. (GRANTECAN) is responsible for its construction, operation and future development. The GTC is fully operational since 2009.

Main equipment:

- The GTC can host different instruments that can operate with a simple switching between them. Up to five instruments to observe in the visible or infrared can be mounted in the five focal stations of the telescope. Currently three instruments are installed: OSIRIS, CanariCam and CIRCE. Other ones (EMIR, HORS, FRIDA, MEGARA and MIRADAS) are under development and will populate de telescope focal stations up to the end of the decade (www.gtc.iac.es/instruments/instrumentation.php).
- OSIRIS (available since 2009) is an imager and spectrograph for the optical wavelength range, located in the Nasmyth-B focus of GTC. Apart from the standard broad-band imaging and long-slit spectroscopy, it provides additional capability such as the narrow-band tunable filters imaging, charge-shuffling and multi-object spectroscopy. It covers the wavelength range from 0.365 to 1.05 μm with a total field of view of $7 \times 7 \text{ arcmin}$ (<http://www.gtc.iac.es/instruments/osiris/osiris.php>).
- CanariCam (available since 2012) is a mid-infrared (7.5 – 25 micron) imager with spectroscopic, coronagraphic, and polarimetric capabilities, located in the Nasmyth-B focus of GTC. It is designed to work as a diffraction-limited imager at 8 microns. The instrument uses a Raytheon 320x240 Si:As detector which covers a field of view of $\sim 26'' \times 19''$ on the sky. Temperature control of the detector ensures that its optimum operating temperature ($\sim 9\text{K}$) is stable (<http://www.gtc.iac.es/instruments/canaricam/canaricam.php>).
- CIRCE (available since 2015) is a NIR imager in JHKs bands, with a relatively wide field of view ($3.4' \times 3.4'$) and a plate scale of $0.1''/\text{pix}$. But apart from this CIRCE can function as a image polarimeter, and it's expected to include low-resolution spectroscopy in a future instrument upgrade. Due to its relatively low mass, CIRCE instrument is mounted in one of the Folded-Cass focus at GTC (<http://www.gtc.iac.es/instruments/circe/circe.php>).

Instruments under development:

- New instruments are under development to reach at the telescope along this decade: HORS, a high resolution ($R=25000$) echelle visible spectrograph; EMIR, a NIR camera and multi object spectrograph ($R=4000$); MEGARA, a fiber feed multi object and IFU spectrograph ($R=6000$ to 20000); FRIDA, a high resolution NIR imager (with adaptive optics) and IFU spectrograph (up to $R=30000$); and MIRADAS, a multi object NIR spectrograph ($R=20000$) (see <http://www.gtc.iac.es/instruments/instrumentation.php>)

Technology capabilities:

- GRANTECAN has expertise in the design of telescopes and their instrumentation that cover many related technologies like optics, mechanics, optomechanics, optoelectronics, visible and IR detectors and related systems, control, cryogenics, etc

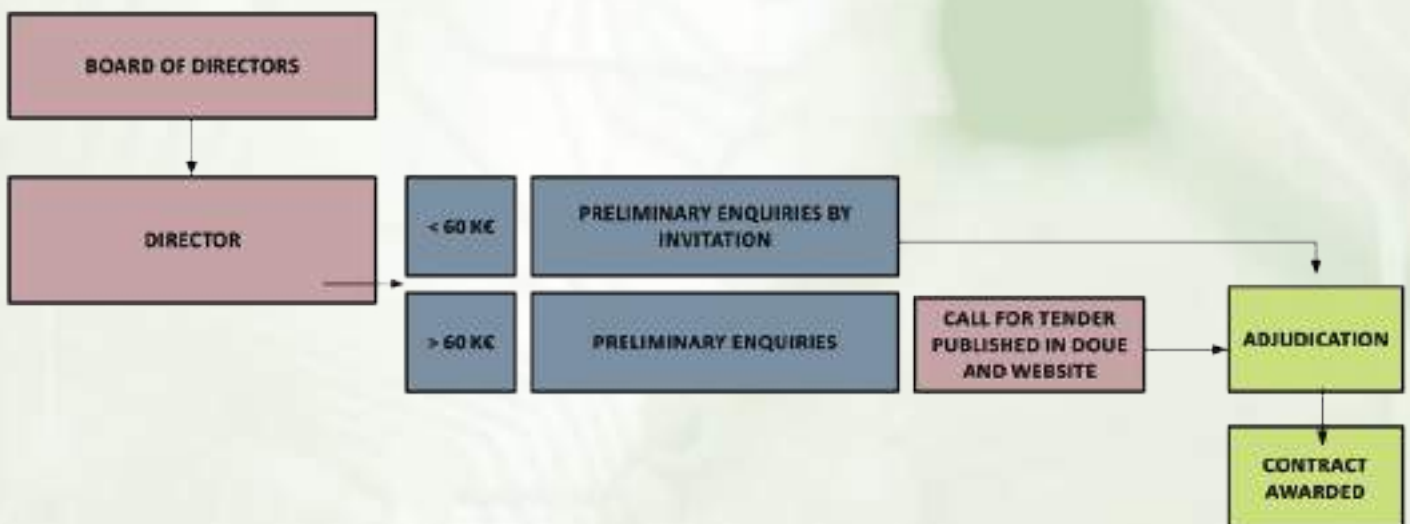


Photo: Grantecan

Summary of research services:

- The GTC provides multiple and advanced observing capabilities to the astronomical community. The GTC is a partnership between Spain, Mexico and the University of Florida (USA) but it is open to new partners or just users of this facility.
- Access to GTC can be done in service mode (queue mode) or in visiting mode. For more information visit <http://www.gtc.iac.es/observing/observing.php>

Procurement process:



OBSERVATORIOS DE CANARIAS

www.iac.es/eno.php?lang=en



Observatory:	Observatorio del Roque de los Muchachos (ORM) and Observatorio del Teide (OT)
Hosting organization:	Instituto de Astrofísica de Canarias (IAC)
Address:	Observatorio del Roque de los Muchachos: Pico del Roque de los Muchachos, Garafía (La Palma, Spain) Observatorio del Teide: Izaña (Tenerife, Spain)
Contact:	Rafael Rebolo director@iac.es +34 922 605 201 / +34 922 605 200

Description:

The “Observatorios de Canarias” (OCC) are formed by the “Observatorio del Roque de los Muchachos” (ORM, La Palma) and the “Observatorio del Teide” (OT, Tenerife), both at above 2,400 meters of altitude. The excellent astronomical quality of the sky at the Canary Islands - thoroughly characterized and protected by law - makes these observatories astronomical reserves, open to the international scientific community since 1979. Currently the OCC host telescopes and instruments belonging to 60 institutions from 20 countries, being the most important set of astrophysical infrastructures within the territory of the European Union (EU) for visible and infrared nocturnal and solar research, and the largest collection of multinational telescopes worldwide. Other experiments for high-energy astrophysics and the study of the cosmic microwave background complete the infrastructures available.

Main equipment:

- ORM offers one of the most complete telescope arrays around the world. There are a number of night-time observation telescopes: GTC, WHT, TNG, NOT, INT, LT, Mercator, SQFT and JKT. It also has two solar telescopes: SST and DOT, and other infrastructures like the Cherenkov telescopes MAGIC I and II and FACT, SuperWASP, two DIMMA, SHABAR and CILBO.
- OT is ideally suited for studying the sun, concentrating the best European solar telescopes: GREGOR, THEMIS and VTT. In addition, it also has a number of night-time observation telescopes: TCS, Stella I and II, OGS, SONG, IAC80, MONS, SLOOH I and II, BRT, EarthShine, TADn, TIZON, XO, MASTER, LCOGT CILBO, EAST and TIZON. The OT also has a Solar Physics Laboratory with some instruments: two telescopes –QUIJOTE I and II- to study the Cosmic Microwave Background Radiation and several experiments to check the sky quality: DIMMA, SHABAR, SQM-LE, AstMon.

Instruments under development:

- The IAC conducts projects on the operation and viability of telescopes (E-ELT, EST, FDI, OGS, OPTICON), instruments on space facilities (Herschel, Planck, IMAx, JEM-EUSO, IRCAM, NISP@EUCLID, SOPHI), infrared (EMIR, MIRADAS, FRIDA, HARMONI, CARMENES, HIRES) and visible (HORUS, ESPRESSO, GREGOR, WEAVE, DESI) instrumentation, adaptive optics (GTCAO and LGS, EDiFiSe, FastCam, AOLI) or microwaves (QUIJOTE)
- **More information:** www.iac.es/proyectos.php?op1=7&lang=en

Technology capabilities:

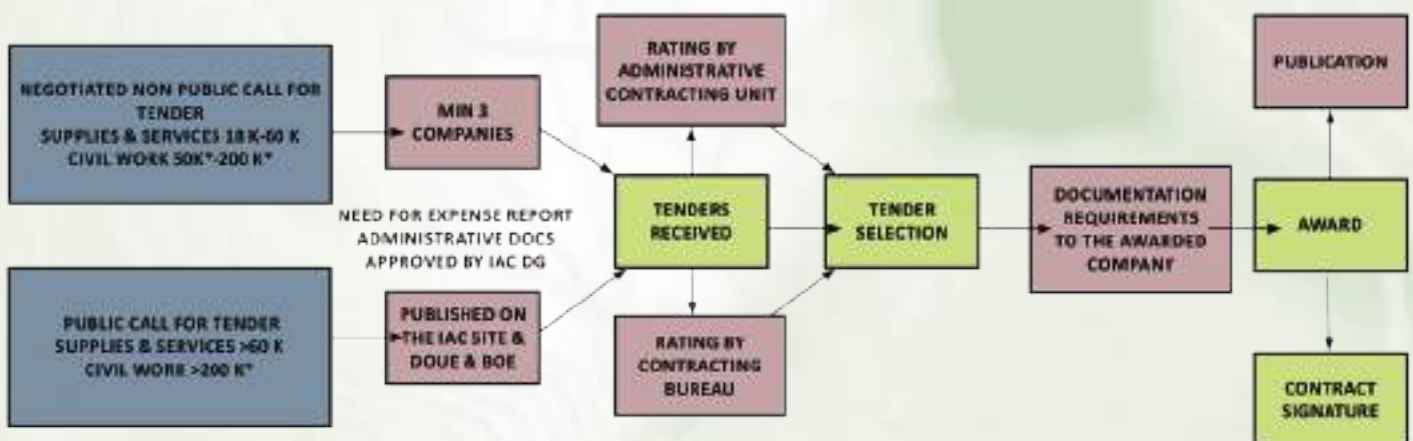
- The IAC develops much of the technology used for its research programmes in-house. The Technology Division is responsible for designing, developing and building the instruments needed for astrophysical observation. The IAC Instrumentation Area provides technology, development and production support for research and technological development projects. This area has staff who are highly qualified in the disciplines of mechanics, optics, electronics and software and have access to advanced development and production techniques. The Division is organized into Engineering and Production and structured as a matrix, with project managers coordinating the resources.
- Requests from individuals or public or private entities outside the IAC which relate to require human or material resources administered by the IAC Instrumentation Area are managed by the OTRI office.
- More information: www.otri.iac.es/CatalogoIACtech_2010.pdf



Summary of research services:

- Under the terms of the Agreement on Cooperation in Astrophysics, Spain provides the site in return for a percentage of the available observing time at each of the telescopes or instruments. Observing time is awarded through the Time Allocation Commission (CAT), comprising a Solar Committee and a Night Time Committee.
- There are different schemes to apply for observing time: ordinary calls (twice a year); Spain-Mexico GTC collaborative time; IAC-Nordic collaborative time; Director Discretionary Time; International Time Programme. Every semester, a number of nights of CAT time are available to service observations of short scientific programmes. The Service Time observations are carried out by the IAC's Support Astronomers Group and the presence of the user astronomer in the telescope is not required. The service time is available for six telescopes: WHT, INT, NOT and TNG at ORM, under CAT time, and TCS and IAC80 Telescopes at the OT, under non-CAT time.
- Pure research activities at the IAC are organized into six subject areas covering most fields within Astrophysics whether theoretical, observational or instrumental. The IAC conducts projects on earth and space telescopes, high resolution, infrared instrumentation, optics and microwaves, as well as technological support.
- **More information:** www.iac.es/eno.php?op1=1&lang=en

Procurement process:



BOE stands for Bulletin of the State; DOUE stands for Official Journal of the European Union; IAC stands for Instituto Astrofísico de Canarias

OBSERVATORIO ASTROFÍSICO DE JAVALAMBRE

www.cefca.es/en/general



Hosting organization: Centro de Estudios de Física del Cosmos de Aragón (CEFCA)
Address: Pico del Buitre, Arcos de las Salinas, Teruel
Contact: Mariano Moles | moles@cefca.es | +34 978 221 266

Description:

- The “Observatorio Astrofísico de Javalambre” (OAJ) is a new astronomical facility located at the Sierra de Javalambre (Teruel), fully funded by the Spanish Administration and the Government of Aragón (50% each) through the “Fondo de Inversiones de Teruel”. The OAJ requirement definition, control, supervision and acceptance of the OAJ deliverables is responsibility of the “Centro de Estudios de Física del Cosmos de Aragón” (CEFCA).
- CEFCA is a foundation of public interest of the “Departamento de Industria e Innovación” of the Government of Aragón which was created in 2008 to construct the OAJ and carry out its scientific exploitation. The main research lines of CEFCA are Cosmology and Galaxy Formation and Evolution.

Main equipment:

- The OAJ has been conceived for conducting large sky astronomical surveys. It will consist of two telescopes with large fields of view (FoV) and good image quality all over the entire FoV.
- JST/T250 (Javalambre Survey Telescope) is a 2.55m, F#3.5 alt-azimuthal telescope with a Ritchey-Chrétien-like configuration. The focal plane corresponds to a Cassegrain layout. M1 and M2 mirrors have hyperbolic aspheric surfaces
- JAST/T80 (Javalambre Auxiliary Telescope) is a 0.82m, F#4.5 telescope with a german-equatorial mount and a Ritchey-Chrétien optical configuration.
- The first light instrumentation of JAST/T80 is T80Cam, which contains a single large-format CCD and a set of 12 broad, intermediate and narrow band filters. The first light instrumentation of T250 is JPCam, a panoramic camera of 14 large format CCDs able to host up to 70 filters at once. Before the arrival of JPCam, a replica of T80Cam with modified optics, JPAS-PF, will be installed at the JST/T250.

Instruments under development:

- The observatory is finished. T80Cam is finished and installed at JAST/T80. JPAS-PF is ready at CEFCA’s laboratory. The final integration of JPCam, under development, is expected by beginning of 2016.

Technology capabilities:

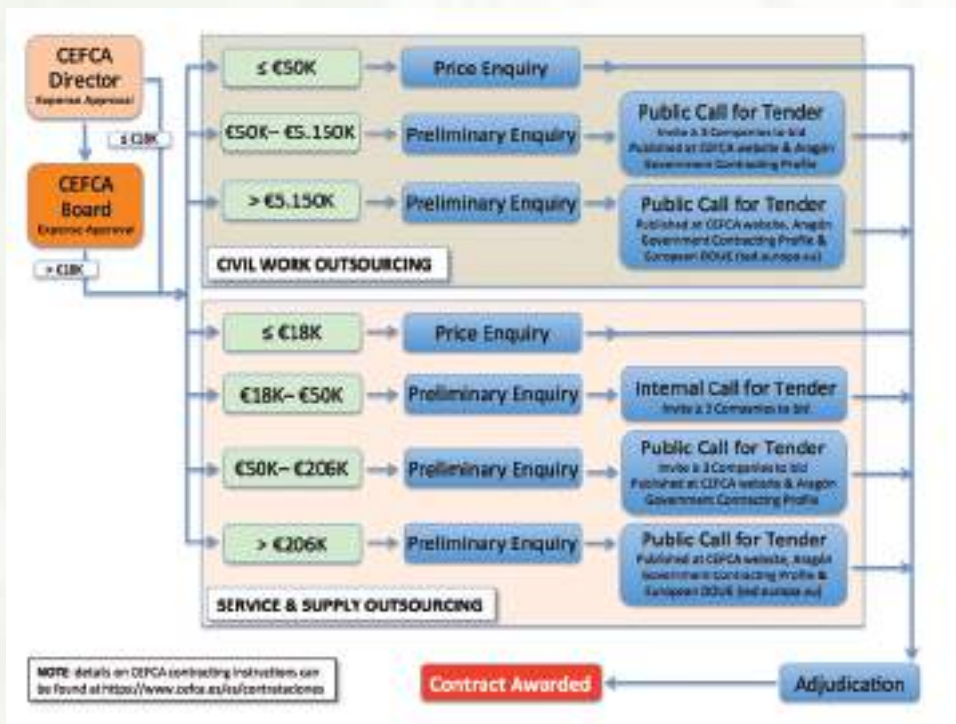
- The OAJ/UPAD personnel have an important expertise in telescope and instruments, control systems and pipelining. They are by now experts in wide field astronomy and in the management of large sets of data.

Summary of research services:

- J-PAS (Javalambre Physics of the Accelerating Universe Astrophysical Survey) is the key project that has motivated the construction of the OAJ. J-PAS will conduct an 8500 deg² photometric sky survey tailored for cosmology, in approximately 4 years.
- CEFCA has all the capacity to carry out the observations and to reduce, calibrate and give access of the data.
- Open access to the definition and implementation of the long-term projects is the first way to access to the OAJ telescopes and instruments. Moreover, public access to the data produced by the long-term projects will be the most important contribution from OAJ to the scientific community



Procurement process:



OBSERVATORIO RADIOASTRONÓMICO DE PICO VELETA

www.iram-institute.org



Hosting organization: Institut de Radio Astronomie Millimétrique (IRAM)
Address: Pico Veleta, Sierra Nevada (Granada, Spain)
Contact: Rafael Bachiller | r.bachiller@oan.es | Tel: +34 918 855 060/061

Description:

- The Institut de Radioastronomie Millimétrique (IRAM) was founded in 1979 and is operated as a French-German-Spanish collaboration. Its partner institutions are the Centre National de la Recherche Scientifique (CNRS) in France, the Max Planck Gesellschaft (MPG) in Germany and the Instituto Geográfico Nacional (IGN) in Spain. The IGN participates with a 6% of investment and operation expenses and, in return, IGN gets a 16% observing time on each IRAM telescopes and a prioritised participation in Administrative and Technical Committees. The observatories are supported by the IRAM offices and laboratories in Granada and Grenoble.
- IRAM operates two observatories, the Plateau de Bure Interferometer (France) and the observatory at Pico Veleta located in Sierra Nevada (Granada, Spain), 2850 m high.
- Partnership with national and international space research organisations includes ESA, NASA and CNES. IRAM also is a major partner in the international ALMA project, the giant radio observatory under construction in the Chilean desert.

Main equipment:

- The observatory at Pico Veleta houses a single dish radio telescope of 30 m in diameter. It allows taking radio continuous and bolometric measurements, microwave spectrometry and Very Long Baseline Interferometry (VLBI). The 30-meter telescope is equipped with a series of single pixel receivers operating at 3, 2, 1 and 0.8 millimeters and with two cameras working at 1 millimeter: HERA, with 9 pixels, for the mapping of molecular gas in extended nebulae and MAMBO; a camera, with 117 pixels, dedicated to the observation of dust emission from nearby molecular clouds and also out to the farthest known galaxies and black holes.

Instruments under development:

- IRAM has developed a plan for the design and construction of a new facility camera (called NIKA-II) which will be installed at the 30-m telescope and offered as a general purpose instrument to the IRAM community.

Technology capabilities:

- Design of parabolae and their control systems, design and production of ultra-sensitive super conducting detectors and complex receiver systems, high-speed digital electronics and advanced data reduction software
- Groups and laboratories at IRAM: Frontend team; SIS-Lab; Backend team; Mechanical workshop group; Computer group. The IRAM workshop is equipped with the latest generation of CNC lathes and milling machines and non-contact measuring microscopes.
- **More information:** <http://www.iram-institute.org/EN/content-page-35-4-35-0-0-0.html>

Summary of research services:

- The observing time must be obtained by international competition. Proposals for observations with the IRAM telescopes may be submitted twice per year through the Proposal Management System PMS. The submission period starts about three weeks before a deadline. Submission deadlines are currently around mid-March and mid-September each year for the summer (01 June-30 November) and winter (01 December-31 May) scheduling periods.



- A fraction of the observing time that normally belongs to scientists of the IRAM funding countries (France, Germany and Spain) is allocated to other European astronomers provided that their observing projects have been judged “excellent”. In return, IRAM obtains from the European Commission financial support to cover parts of the instrument operating costs. The IRAM telescopes are also open to scientists from non-European countries, such as Americans and Japanese, as long as they submit top science proposals.

Procurement process:

- Main contracts are awarded by IRAM-Grenoble. Moreover, the local contracts related to the operation of the IRAM 30-m radiotelescope (both for goods and services) are awarded by IRAM-Granada. In both cases, IRAM performs as a private company subjected to the French or the Spanish law, respectively.

OBSERVATORIO DE YEBES

www.fomento.es



Hosting organization: Instituto Geográfico Nacional (IGN)
Address: Yebe (Guadalajara, Spain)
Contact: Jesús Gómez | jggonzalez@fomento.es | +34 915 979 754

Description:

- The Yebe Observatory is located about 70 km. from Madrid, in Yebe (Guadalajara). It is placed at 980 m above sea level and provides good conditions for radio astronomy observations since the average precipitable water vapour is 6 mm, reaching a minimum of 2 mm in winter. The wind speed is less than 5 m /s over 90% of the time and the number of days with snow precipitations does not exceed one week per year.
- The Yebe Observatory is very well inserted in the international frame, and it is a crucial player in some important scientific Networks (EVN, IVS, IERS, IGRS, etc).The Yebe Observatory is also a technological and instrumental development center in the fields of Radio Astronomy, and related areas and applications.

Main equipment:

- 40m antenna equipped with 7 cryogenic receivers which cover frequency intervals between 2 and 100 GHz. The usage of the 40 m radiotelescope is shared between single dish and VLBI observations.
- Facilities and equipment for technological and instrumental developments:
 - o Microwave and millimeter wave laboratories equipped with instrumentation covering 2-140 GHz band.
 - o Workshop for prototyping (CNC milling machine and lathe).
 - o Chemistry laboratory for plating and surface treatment.
 - o Anechoic chamber for antenna testing covering the 2-140 GHz frequency band.

Instruments under development:

- A geodetic and astrometric VLBI interferometer (4 x 13,2m antennas) for the Atlantic Network of Geodynamical and Space Stations (RAEGE), to be installed at Yebe, Canaries (Tenerife) and Azores (Santa María and Flores). Starting operations is foreseen in 2017.
- Cryogenic LNA IF and RF amplifiers: Yebe Observatory is currently a European leader in the development of cryogenic amplifiers.
- New set of cryogenic receivers that will work simultaneously at three frequency bands: K, Q and W bands.
- New broad band delay receiver 2-14 GHz.
- Improvements of the existing Tri-band geodetic receiver which cover the main geodetic frequency bands (S and X bands) and also a simultaneous higher frequency band (Ka). This receiver has been developed at Yebe Observatory and currently three units have been already built.

Technology capabilities:

- Development of cryogenic HEMT amplifiers
- Development of millimeter and microwave receivers
- Development of spectral and continuum detectors (backends)
- Feed antenna characterization and test from 2 to 140 GHz.
- Within the frame of Herschel ESA mission, we have successfully transferred the technology of pro-



ducing cryogenic amplifiers to the Spanish microwave industry and flight qualified units for all the bands of the HIFI instruments. We will continue with the construction of the amplifiers for ALMA bands.

Summary of research services:

- The 40-m radio telescope, as a component of the EVN, can be accessed through the procedures put in place by this Network. There is an International Time Allocation Committee (EVN Program Committee, EVN PC).
- The 40-m radio telescope participates as well in observations for the Global Millimeter VLBI Array (GMVA), and VLBI observations with the RADIOASTRON satellite.
- The Yebes Observatory is a member of the International VLBI Service for Geodesy and Astrometry (IVS). With the 40-m radio telescope the observatory is currently participating in several major international projects: EUROPE, IVS-R1, IVS-R4 and IVS-T2 projects.



TECHNOLOGY MATRIX





ACRONYMS



ALBA-CELLS	Consortium for the Exploitation of the Synchrotron Light Laboratory (Spain)
ALMA	Atacama Large Millimeter/submillimeter Array
AURA	Association of Universities for Research in Astronomy
CAB	Centre for Astrobiology (Spain)
CDTI	Centre for the development of industrial technologies, Ministry of Economy and Competitiveness, Madrid
CEA	Commissariat à l'énergie atomique et aux énergies alternatives (France)
CEFCA	Centre for Studies on the Physics of Cosmos of Aragon (Spain)
CERN	European Organization for Nuclear Research
CIEMAT	Research Centre for Energy, Environment and Technology (Spain)
CLPU	The Spanish Pulsed Lasers Centre
CSA	Canadian Space Agency
CSIC	The Spanish National Research Council
CTA	Cherenkov Telescope Array
DKIST/ATST	Daniel K. Inouye Solar Telescope/Advanced Technology Solar Telescope
E-ELT	European Extremely Large Telescope
EFET	European Fusion Engineering & Technology
ESA	European Space Agency
ESO	European Southern Observatory
ESOC	European Space Operations Centre
ESFRI	European Strategy Forum on Research Infrastructures
ESRF	European synchrotron Radiation Facility
ESS	European Spallation Source
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
F4E	Fusion for Energy
FP7	Framework Programme 7
GSI	GSI Helmholtz Centre for Heavy Ion Research
GTC	Gran Telescopio de Canarias
H2020	Horizon 2020 EU Research and Innovation programme
HISCORE	Hundred Square Km Cosmic Origin Explorer
HISPASAT	Operating company for several Spanish communication satellites (Spain)
IAA	Instituto Astrofísico de Andalucía (Spain)
IAC	Instituto Astrofísico de Canarias (Spain)
IFMIF	International Fusion Materials Irradiation Facility
ILL	Institut Laue Langevin
INTA	Instituto Nacional de Técnicas Aeroespaciales (Spain)
IRAM	Institute de Radioastronomie Milimétrique
ISRO	Indian Space Research Organisation
ISIS	International Satellites for Ionospheric Studies
ITAINNOVA	Innovating Technological Institute in Aragon (Spain)
JT60	Japan Torus 60
KM3NET	Cubic Kilometre Neutrino Telescope

LSST	Large Synoptic Survey Telescope
MINETUR	Spanish Ministry of Industry, Energy and Tourism
NASA	National Aeronautics and Space Administration
OAJ	Javalambre Astrophysical Observatory (Spain)
OAN	Observatorio Astronómico Nacional (Spain)
OSN	Observatorio Sierra Nevada (Spain)
RAL	Radio Astronomy Laboratory (UK)
SEOSAT	Scientific Earth Observation Satellite (Spain)
SESAME	Synchrotron-light for Experimental Science and Applications in the Middle East
SCK-CEN	Studiecentrum voor Kernenergie; Centre d'Étude de l'énergie Nucléaire, Belgium
TMT	Thirty Meter Telescope
UB	Universitat de Barcelona (Spain)
UCM	Universidad Complutense de Madrid (Spain)
UFL	University of Florida
UGR	Universidad de Granada (Spain)
UK ATC	United Kingdom Astronomy Technology Centre
UPC	Universitat Politècnica de Catalunya
UPV-EHU	Universidad del País Vasco (Spain)
VIRAC	Ventspils International Radio Astronomy Center
VLT	Very Large Telescope
XFEL	European X-Ray Free-Electron Laser



CDTI

Centro para el
Desarrollo
Tecnológico
Industrial

