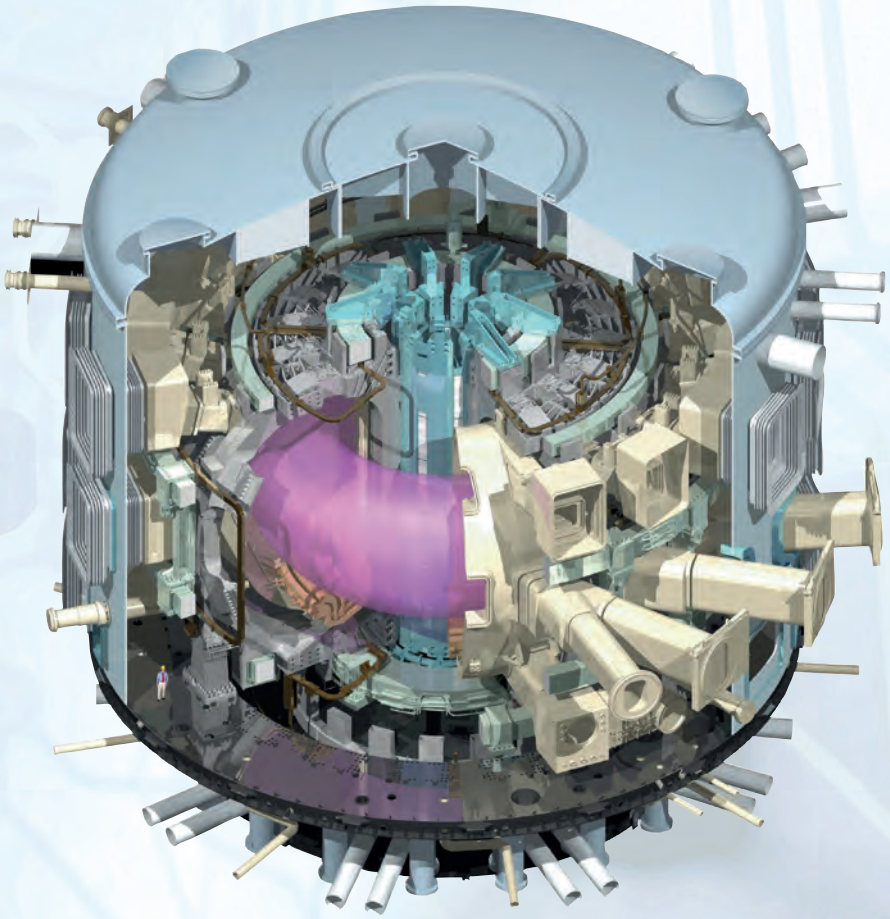
SPANISH INDUSTRY CAPACITIES AND ACTIVITIES IN FUSION ENERGY



MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

CDTI Centro para el Desarrollo Tecnológico Industrial

GOBIERNO DE ESPAÑA MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

Ciemat Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

Index

Foreword

Energy demand is foreseen to double by 2050 as population growth and energy consumption per capita in developing countries intensifies. Currently, the European Union (EU) imports more than 50% of its energy needs and relies heavily on fossil fuels. In view of this landscape, a growing consensus is emerging that only a few energy sources can contribute to sustainable energy dynamics in the long-run. Fusion energy, fuelling the stars and the sun, is one of them. From lithium and water, which are low-priced and abundant, fusion technology aims at creating energy without generating greenhouse gases and long-lived radioactive waste.

The ITER experiment, widely acknowledged as one of the biggest international scientific projects ever, is hosted by the EU with strong commitments from the USA, Japan, Russia, China, India and South Korea. Europe participates in ITER through its European Atomic Energy Community, and is the largest investor in the project. Half the world's population may benefit from the results of this massive undertaking. Currently under construction in Cadarache, France, ITER aims at providing a significant contribution to the world's energy production in the next decades. Its success would trigger a future source of unlimited, sustainable and safe energy and open the door to the potential commercialization of fusion power plants.

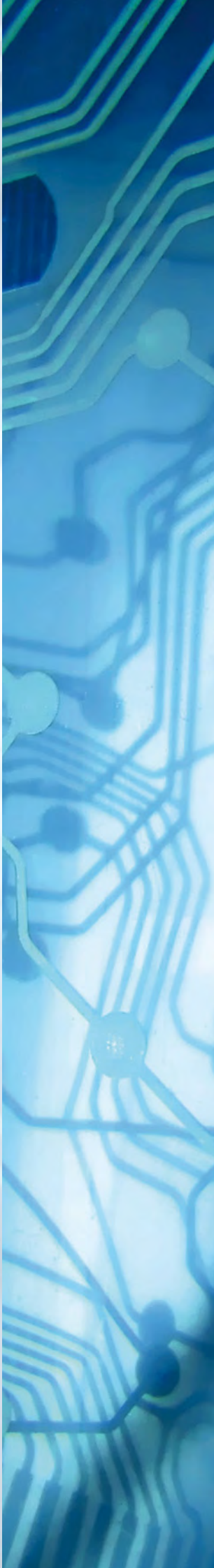
The EU's fusion research programme is among the world leaders thanks to the experience and knowledge accumulated by the close cooperation between the national Fusion Laboratories over decades.

For industry, ITER sparks expertise on cutting-edge technologies for the future reactor and an occasion to develop commercial products in industrial areas outside fusion energy. This cross-fertilization drives scientific and technological progress and will be of significance in the coming decades as the fusion programme balances its science-driven and industry-driven approaches. Once the DEMO reactor proves its successful operation, industry will in fact have a unique chance to take full ownership of commercial fusion power plants.

This catalogue summarizes the capacity of Spanishcompanies for fusion projects and includes not only a selection of recent success stories but also a complete picture of the skills and competitiveness of our national industry. With a consolidated industrial sector in this field, Spanish companies are willing to play a major role in the future to push forward technological breakthroughs. But they are also engaged in using the resulting know-how to expand their business with a proactive attitude beyond the fusion sector, and with a clear international dimension.

We hope that scientists and companies will find this compendium useful and that many successful partnerships will be encouraged to successfully face the challenges and opportunities ahead of us in the field of fusion energy research.

Mª Luisa Poncela
Secretary-General for Science, Technology and Innovation
President of the Spanish Innovation Agency (CDTI)



CIEMAT

Address: Av Complutense 40
Madrid, SPAIN

Web: www.ciemat.es

Contact person: Fernando Carbajo, *Fusion industry advisor*
+34 913 466 153
Fernando.carbajo@ciemat.es

Fusion activities:

Plasma physics:

- Stellarator physics: flexible heliac TJ-II,
- Role of magnetic topology
- Diagnostics development, in particular microwave and optical systems
- Low Z plasma wall physics: lithium coatings
- Turbulence & transport: role of zonal flows, transport of momentum, turbulence and rotation
- Advanced data processing: data mining, disruption and other event prediction
- Plasma theory: MHD, non diffusive transport, gyrokinetic modelling, physics of H&CD
- Participation in the JET experiment: fast cameras, ECE diagnostic upgrade, disruption prevention, ELM physics

Fusion Technology:

- Functional materials : optical elements, electrical insulators, cabling, RH components
- Structural materials : EUROFER, ODS steels , tungsten, SiC
- Neutron damage modeling,
- Breeding blankets: dual coolant technologies, liquid metals,
- Remote handling
- Neutronics and activation, safety, RAM

Activities under the “Broader Approach to fusion” EU-Japan:
Participation on IFERC: SiC development)
Design and procurement of the JT60 Cryostat
Design and development of components for IFMIF

- IFMIF EVEDA accelerator components :
  - RF system: 175 MHz 1MW
  - Beam dump
  - Coupling section
  - High energy transmission line & beam diagnostics
  - Collaboration in the half wave resonator linacs
- Engineering for the IFMIF test cell
- Medium flux module design,
- RH
- RAMI & Neutronics

IFMIF design integration

Awarded contracts and R&D projects:

F4E, ITER systems:

- Design of plasma position reflectometer
- Design of equatorial IR-Visible viewing system
- RH studies
- NBI auxiliary systems
- Tritium modeling and experimental activities for TBM
- Irradiation (gamma) of diagnostics components
- CODAC support

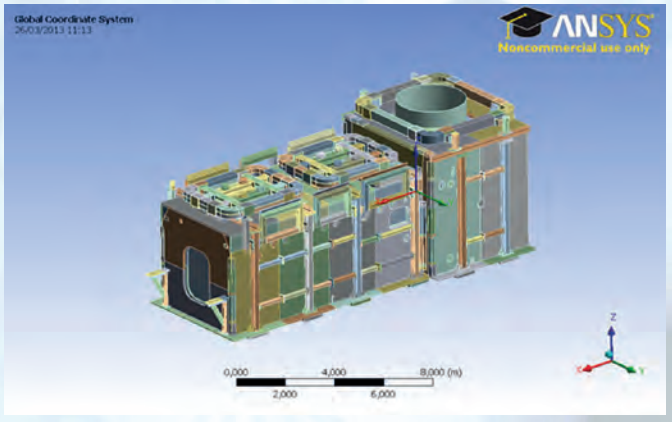
IO:
CODAC developments for ITER, engineering expert services

EFDA:
ITER activities:

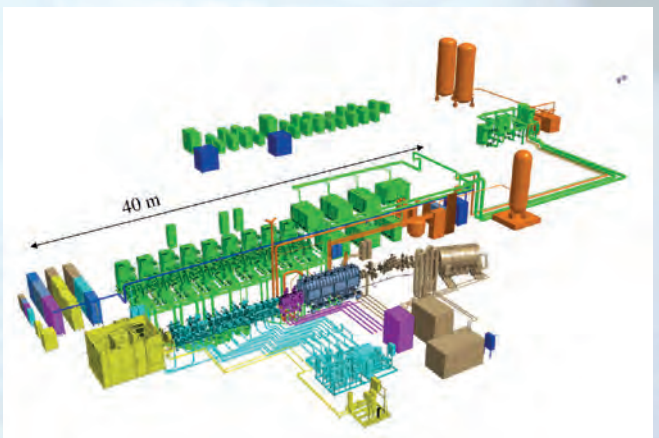
- Diagnostics development for ITER
- Port plug design for ITER

DEMO activities:

- Neutronics,
- RAMI,
- Stellarator reactor options
- Breeding blankets
- Structural materials
- Design codes.



Structural model of passive magnetic shield and ACCC coils for the ITER NBI system



IFMIF-EVDA RF system (parts in green color)

CDTI (CENTRE FOR THE DEVELOPMENT OF INDUSTRIAL TECHNOLOGY)

Address: Cid, 4
28001 Madrid, SPAIN

Web: www.cdti.es

Contact person: Belen del Cerro Gordo, *F4E Spanish ILO (Industrial Liaison Officer)*
+34 915 810 491
anabelen.delcerro@cdti.es

CDTI activities:

CDTI is a public entity, under the Spanish Ministry of Economy and Competitiveness, supporting industrial research and innovation of Spanish companies including Space and Large Scientific Facilities activities. Our main objectives are:

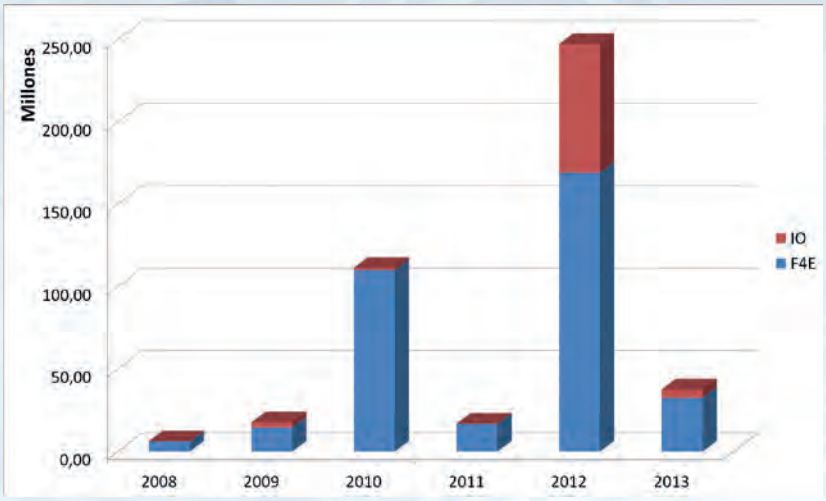
- To foster the Spanish industrial competitiveness by financing national R&D projects.
- To encourage the Spanish participation in international technological co-operation programs.
- To support technology transfer

CDTI promotes the participation of Spanish Industries in Large R&D Facilities as ITER, CERN, ESRF, ILL, ESO, FAIR, XFEL. CDTI is the "Spanish Industrial Liaison Officer" (ILO) for all of them. In relation to F4E, the ILOs network acts as an exchange information forum for matters concerning the F4E industrial policy, model contract, procurement procedures and procurement strategy, among other subjects. The network has the following goals:

- Raise awareness and inform potential contractors about forthcoming call for tenders to be launched by F4E or ITER and theirs working programs
- Assist potential contractors in their understanding of the technical, contractual and financial requirements of F4E within the frame of the above-mentioned calls
- Enhance partnership and networking activities
- Support F4E in the preparation of capacities mapping and foster the registration of European potential contractors in the F4E database
- Encourage the long-term participation of industry in fusion in view of realizing DEMO.

Spanish companies:

Since 2008, Spanish companies have increased the number and volume of contracts awarded in ITER. The peak was reached in 2012 with contracts worth more than 200 M€. So far, the Spanish industry has won more than 400 M€ in contracts for the construction of the ITER fusion project in a highly competitive market. As a result, Spain is currently the third country in ranking (behind France and Italy) of contracts managed by F4E. In addition, there are presently a lot of Spanish companies involved in on-going procurement processes and pre-qualifications.



Spanish F4E& IO awarded contracts

Our industrial capabilities cover a wide range of technological areas, from mechanical - electrical engineering and civil engineering to assembly, electronics, criogenics and vacuum systems, robotics, advanced materials, control systems and power supplies. Spanish companies are present in many ITER components such as the vacuum vessel, magnets, buildings, test blankets modules, plant systems, remote handling, safety, I&C and CODAC and in vessel components, to name but a few.

Spanish companies have also won important contracts in other fusion facilities as JET, TJ-II, and are currently participating in the Broader Approach projects JT-60 and IFMIF.

Main Spanish awarded contracts in fusion

ITER project faces significant challenges where Spanish industry wants to play a major role promoting the collaboration at European and international level and exploring technological-scientific synergies that provide solutions of high added value.

SPANISH ACTIVITIES

ACCIONA, S.A.

Address: Avenida de Europa 18
28108 Alcobendas (Madrid), SPAIN

Web: www.acciona.com/

Turnover: 7,016 M€ in year 2012

Contact person: Juan Félix Ambrosio Racic, *Chief Commercial Officer*
+34 600 905 038
juanfelix.ambrosio.racic@acciona.es

Company activities:

ACCIONA is one of the foremost Spanish business corporations, leader in the development and management of infrastructure, renewable energy, water and services. Listed on the selective Ibex-35 stock exchange index, it is a benchmark for the market. The Company was set up over a century ago and is made up of more than 30,000 employees and has a presence in more than 30 countries on five continents.

Fusion activities & ITER project interest:

ACCIONA is nowadays involved in several ITER tender and prequalification processes.
ACCIONA is interested in the wide range of ITER Engineering and Infrastructure projects.

Fusion main contracts awarded and R&D projects:

ACCIONA has been prequalified for:

- TB03: Civil Engineering and finishing works for Tokamak Complex, assembly hall and surrounding buildings including design, manufacture and installation of heavy nuclear doors (2011).
- TB05: Design & Build for Magnet Power Conversion Bldg. & Reactive Power Control Bldg. (2012).
- TB07: Design & Build for Cold Basin & Cooling Towers, Pumping Stations 6 Heat Exchangers (2012).
- Extension of the ITER Headquarters Building (2013). - TB06: External Power Supplies Equipment & Installation (2012) (Preq. process).

ACCIONA is pending of the following prequalification and bid processes resolutions:

- TB07: Design & Build for Cold Basin & Cooling Towers, Pumping Stations 6 Heat Exchangers (2013) (Bid process).

Moreover, ACCIONA has carried out an intensive program of R&D activities in the field of nuclear fusion in the recent years, which is supported by the fact that CDTI has awarded financial grants, through different funding programs, for several of such projects/initiatives:
Funding Programme: Space National Programme (CDTI)
Project Reference: PNE-20071049
Project Acronym/Title: NAHRIF / New applications of reinforced concretes for nuclear fusion installations.
Years: 2007-2009
Project Budget: 614.000 €
Funding Programme: Industry for Science support Programme (CDTI)

Project Reference: IDC-20101032
Project Acronym/Title: CUBICOM / Technical and economic feasibility study about the application of fibre-reinforced polymers (FRP) at the covering structure of the TOKAMAK building (ITER)
Years: 2010-2011
Project Budget: 178.000 €
Collaborative project carried out in cooperation with CIEMAT
ACCIONA is also an active member of the existing national initiatives and technological platforms relevant to the nuclear sector:

- Founder member of the Plataforma Tecnológica de Fusión (PTF), Spanish Fusion Technological Platform, being coordinator of the Civil Engineering working group of such platform
- Associate member of the Asociación Española de la Industria de la Ciencia (INEUSTAR)
- Associate member of the Spanish Technological Platform for Nuclear Fission (CEIDEN), being promoter of the creation of the Civil Engineering working group in 2008 and coordinator of such group until 2012.

ITER project site

APPLUS LABORATORIES

Address: Ctra. Acceso Facultad de Medicina - Campos UAB
08193 Bellaterra (Barcelona), SPAIN

Web: www.appluslaboratories.com/es/

Turnover: 57 M€ in year 2012

Contact person: María José de la Maza, *Commercial Director*
+34 629 440 827
maria.delamaza@applus.com

Company activities:

Applus+ Laboratories (LGAI) is your partner for preparing and adapting your product to the requirements and expectations of its target markets (Aerospace, Defence, Automotive, Energy, Payment systems, Industry)
Applus+ Laboratories (LGAI) specializes in developing technical solutions to enhance product competitiveness and faster innovation. Our experience in testing and our leading and recognized laboratories allow us to participate throughout the whole product value chain, offering different services as:

- Testing (destructive and non-destructive)
- Product system certification
- Engineering
- Technical assistance
- Inspection
- Quality assurance

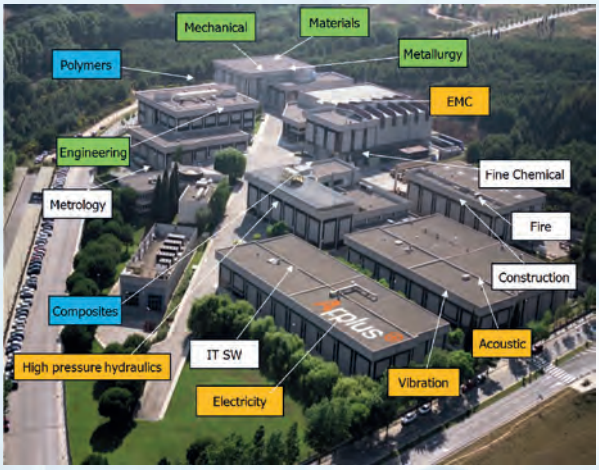
Fusion activities & ITER project interest:

In Fusion, we principally aim to perform the following activities:

1. Testing: in Applus + modern laboratories, we can carry out the testing and analysis of components and systems which will constitute the fusion facility, by using the most appropriate equipment and instrumentation. Based on the results obtained, Applus+ will help the corresponding manufacturers to achieve compliance with the strict quality and safety requirements applicable.
   We carry out: Mechanical Tests, Materials Tests, Electronic and Electromagnetic Compatibility, Noise, Harness and Vibration Tests, Climatic and Endurance, IT Tests and Fire Tests.
2. Engineering: Applus has long experience and knowledge on innovation and technological projects. Based on our expertise on Testing and inspections, we have an engineering team which is working for most technological sectors and which is capable of design, assembly and commissioning the following products: Electrical, hydraulic and mechanical Test Systems, Hardware and software for complex functionalities, Mechanical tooling for big structures testing and new Industrialization technologies.
3. Consultancy: our consultancy services are focused on the development of high quality product, pushing innovation by applying latest technology.

Fusion main contracts awarded and R&D projects:

APPLUS+ Laboratories has been awarded with the “Competitive Multiple Framework Service Contract” (F4E-OMF-357 Provision of CAD Design Support).



APPLUS Laboratories in Bellaterra, Spain.

ASTURFEITO S.A.

Address:	Área Industrial de Tabaza B-9 33438 Carreño (Asturias), SPAIN
Web:	www.asturfeito.com
Turnover:	17.8 M€ in year 2012
Contact person:	Ricardo Rodríguez, *Corporate Sales Manager* +34 985 514 024 rrodriguez@asturfeito.com

Company activities:

ASTURFEITO is a Spanish industrial group located in Asturias, we are specialised in the fabrication of capital goods and components for the most important organizations worldwide.
Asturfeito has a wide experiencie in the supply of mechanical components for the top scientific installations all around the world.
Our facilities located in the Port of Aviles, allow us to deal with large and complex projects, offering an experienced Project Management team and mechanical engineering services.
In our shops we deal with welding of different materials; including inconel, duplex as well as carbon and alloy steels. In addition we differentiate for in-house precision machining of large pieces, and we can perform mechanical, electrical and hydraulic assembly.
We have a highly skilled team, excellent technological capabilities and extensive facilities to meet the requirements of the most demanding clients in Scientific Facilities Sector.

Fusion activities & ITER project interest:

Vaccum Vessel
In Vessel Components
Remote Handling
Machine Assembly

Fusion main contracts awarded and R&D projects:

ASTURFEITO supplied to IDESA the machining, final mechanical assembly and dimensional control with laser tracker of the CRYOSTAT BASE for JT-60SA Tokamak Project.
This large structure of about 300tons has been machined in seven pieces ad then assembled in our workshop, to meet the high precision requirements of the customer.
ASTURFEITO was responsible for the supply of 25 radiotelescopes for ALMA project and was in charge of:

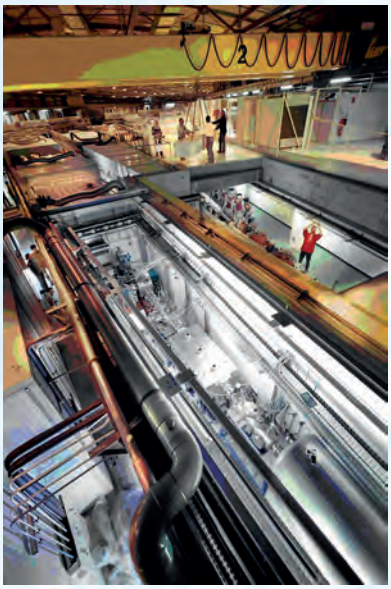
- Supply of raw material
- Manufacturing engineering & Welding procedures
- Welding, machining and painting
- Mechanical, electrical and hydraulic assembly
- Verification and functional tests
- Packing and transportation

ASTURFEITO has been involved in the construction of GRANTECAN in La Palma (Spain)

- Manufacturing of side extensions of DEL EMTCS Vacuum Vessel
- Manufacturing of Supports for Osiris Imaging System

ASTURFEITO has participated in the construction of the LHC (Large Hadron Collider), the biggest particle accelerator in the world to CERN, the European Organization For Nuclear Research, is one of the world's largest and most respected centres for scientific research. Its business is fundamental physics, finding out what the Universe is made of and how it works ASTURFEITO has collaborated with ILL manufacturing support detectors for the High Flux Reactor The Megajoule Laser (LMJ), which will make it possible to study the nuclear stage of weapon operation, is currently under construction at the CEA Cesta site (Bordeaux). ASTURFEITO has collaborated with ESRF manufacturing lot of parts for mirror assembly and components for beamline ID 16 . The European Synchrotron Radiation Facility is a joint research facility supported by 19 countries that operates the most powerful synchrotron radiation source in Europe, and is generally considered to be a world leading research facility.

ALMA Project



ESRF

Cryostat sector machining

Cryostat base

AVS (ADDED VALUE SOLUTIONS)

Address: Xixilion 2 bajo, Pabellón 10
20870 Elgóibar (Guipúzcoa), SPAIN

Web: www.a-v-s.es

Turnover: 3 M€ in year 2012

Contact person: Miguel Angel Carrera, *General Manager*
+34 943 821 841
macarrera@a-v-s.es

Company activities:

AVS is an international company, which aims at providing technology-based services to innovative and challenging projects. Strongly focused on development of outstanding devices, mechanisms and structures, our expertise covers from design, manufacturing, assembly, tests and supply under ISO 9001 EN 9100, providing our customers all the way up from the conceptual design to the turnkey.
AVS skills on engineering design, mechatronic, diagnostics and instrumentation, high-precision positioning systems in UHV, high magnetic fields and cryogenics, micro-mechanisms, opto-mechanical systems and neutron detection provided the path to successfully deliver projects in the fields of Particle Accelerators, Nuclear Fusion, Astrophysics and Space, Aeronautics, Renewable Energies, Large Machine Tools and more.
It is worth mentioning AVS experience in Heavy Machine Tools for nuclear facilities (e.g. 500 Tons articulated machines), which certifies AVS capabilities for ITER's near future challenging requests.

Fusion activities & ITER project interest:

Recent AVS activities in Nuclear Fusion are gathered around the Broader Approach agremeent and focalized in the IFMIF Engineering Validation and Engineering Design Activities.
AVS experience in project development for large-scale facilities e.g. RAL-ISIS, ILL, ESRF, CIEMAT, Berkeley Lab, ESA, CERN… match with current ITER needs. In addition, AVS's staff has relevant experience in diagnostics for fusion devices e.g. CXRS, BES, VIS-IR imaging, X-rays bolometers. Deep understanding of ITER idiosyncrasies and tight schedules together with the knowledge of the historial R&D steep path, brings AVS company as a reliable partner.
In view of the foregoing, AVS meet ITER's interests on engineering design and manufacturing of challenging devices for:

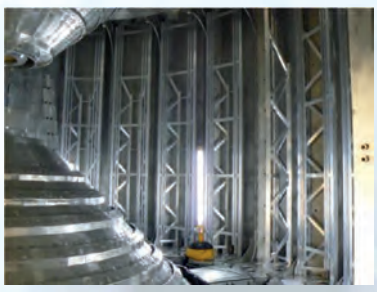
- Vacuum vessel
- In vessel components
- Diagnostic system
- Remote handling

Fusion main contracts awarded and R&D projects:

Design of a Transverse Halo Monitor diagnostic for a high current 9 MeV Deuteron beam, consisting on five independent movable probes (SOL-like probes) and linked with the Machine Protection System for the determination of the tails/halo of the particle distribution. The operation conditions are UHV and high radiation background. A fast probe retractable system was designed.

Design, manufacturing, assembly, tests, calibrations and final supply of beam scrapers for a high power CW operated 5 MeV deuteron beam. With four movable and water cooled scrapers, the really compact design (8 cm along beam axis) meets the outstanding project requirements which includes high precision and repeatability on positioning, operated in UHV with high radiation background.
Manufacturing, assembly and tests of a high precision table for magnets movement and alignment. With a very high repeatability (<1 µm), the high precision table successfully met the specifications during the tests.

IFMIF (LIPAc) beam scrapers



LET detector towers for neutron detection

AZBIL TELSTAR TECHNOLOGIES SLU

Address: Avinguda Font i Sagué, 55
08227 Terrassa (Barcelona), SPAIN

Web: www.telstar-vacuum.com

Turnover: 46.77 M€ in year 2011

Contact person: Ferran Costas, *Space & Science Business Development*
+34 937 361 600
fcostas@telstar.eu

Company activities:

Telstar Vacuum Business Division, within Azbil Telstar Technologies, is devoted to provide solutions to its customers, based on vacuum, cryogenics, mechanical and control technologies . Telstar has engineering, manufacturing, integration, installation and test capabilities, to provide operational systems on a turnkey basis.
Telstar Vacuum Business Division provides its solutions to:
Industrial sectors (electrical, refrigeration, automotive...): Leak detection machines, gas-filling machines, ...
Aerospace sector: Environmental test facilities (space simulation thermal vacuum chambers, altitude chambers, inert atmosphere temperature test chambers, ion thruster test systems...)
Large science facilities (including ITER): Special customized solutions related with vacuum and/or cryogenics technologies, such as multilayer sputtering, remote handling in vacuum environment, special vacuum systems, resine impregnation systems for superconducting magnets...

Fusion activities & ITER project interest:

Telstar has interests in fusion concerning:
Remote handling,
Diagnostics integration (support in vacuum technology and leak detection technology),
Manufacturing of high-vacuum components,
Cold Test facilities,
Gas handling systems,
Support to different projects concerning vacuum technology and cryogenics

Fusion main contracts awarded and R&D projects:

Divertor Remote Handling Prototyping
Telstar, under a EFDA contract , supplied full-scale prototypes for the Cassette Multifunctional Mover (CMM) and Second Cassette End Effector (SCEE). These are key elements of the future Divertor Remote Handling System, which will be needed for assembly and maintenance of the ITER Divertor System (made up of 54 remote-removable cassettes, each holding three plasma-facinf components and each weighting near 10 tons). They were based on technologies compatible with high vacuum and radioactive environtment (water hydraulics, special cabling, ...). They have been succesfully tested in DTP2 – Tampere - Finland.
Telstar is leading a Consortium that has been selected by F4E to submit a proposal for Divertor Remote Handling System on a turn-key basis

Vacuum systems

Telstar supplied pump-sets and vacuum control and measurement equipment for CIEMAT TJ-II Stellarator fusion research machine. This machine is located in Madrid CIEMAT facilities, and is devoted to plasma research.

Divertor RH Cassette Multifunctional Mover (CMM) and Second Cassette End Effector (SCEE) prototypes on a test stand

Divertor RH CMM+SCEE handling a 9-Ton dummy load simulating divertor cassette weight

BROAD TELECOM, S.A. (BTESA)

Address: Margarita Salas, 22
Parque Leganés Tecnológico
28918 Leganés (Madrid), SPAIN

Web: www.btesa.com

Turnover: 11.8 M€ in year 2011

Contact person: Carlos Rosa, *Sales Manager*
+34 913 274 363. Ext.411
c.rosa@btesa.com

Company activities:

BTESA is a leading technological group with long experience in the design and manufacturing of radiofrequency equipment
The key of our successful record of RF equipment delivered all over the world is our powerful R&D department: 30% of BTESA staff, with specialization in all systems related with Solid state RF power amplifiers:
- Radiofrequency: experience for reliable transistor circuits
- Software: for internal logic control system and remote control
- Electrical: we design our own power supplies, with special care for surge protection
- Mechanical: careful cooling extends lifetime

The experience gained through the installation of RF equipment which should work 24/7 in the most extreme environments helped to improve the robustness and reliability of all our equipment. The skill of the R&D team to design any RF product together with the flexibility to adapt to any project, allowed us to jump into the Scientific applications.

Fusion activities & ITER project interest:

Plasma Heating systems (RF Generator)

Fusion main contracts awarded and R&D projects:

IFMIF/EVEDA: awarded contract by CIEMAT Exp. 248.977: 2x16kW SSPA
Design, Manufacturing and supply of RF Solid State Power amplifiers at 175 MHz, for the Buncher cavities of the MEBT of the IFMIF/EVEDA Accelerator Prototype (LIPAc), presently under construction in Rokkasho (Japan).
Including Design, Supply, Installation and commissioning of:

- 2 **RF Power Chains (16kW, full Solid State) at 175MHz**, with High efficiency (> 70%) liquid cooled modules working in Active redundancy for TOTAL availability (even when 1 or 2 PA transistors are out of order, the Amplifier chain will operate at nominal power). To achieve this maximum efficiency of 70% even having additional PA modules for redundancy, an Intelligent management of power supplies has been implemented. Selection of working modes (degraded, high availability, high efficiency) can be automatic or manual.
- LLRF integration
- EPICS based remote communications via PLC, and integration within Accelerator central control system.
- RF Coaxial Lines and arc detectors

R&D projects

- Design and manufacturing of 2kW solid state amplifiers for ion cyclotron frequencies, capable of working in any frequency between 40 to 70MHz, with integrated AC/DC switch mode converters, in a 19” module, hot-plug
- Design of an integrated test bench for checking liquid-cooled amplifiers used in Accelerators.

SSPA 16kW for IFMIF

hot-plug liquid-cooled PA module 2kW

CAD TECH IBÉRICA, S.A.

Address: Avda. Leonardo da Vinci, 22 - P.E. La Carpetania
28906 Getafe (Madrid), SPAIN

Web: www.cadtech.es

Turnover: 1.02 M€ in year 2012

Contact person: Laura Marzal, *Account Management*
+34 932 768 925
Lmarzal@ctgrupo.com

Company activities:

All technologies & services you need to improve your Product Cycle Life Management. Integrators major scientific software solutions leaders in the national market, from the design to production and maintenance, including simulation and data management of mechanical products, buildings or infrastructure.

Solutions:

- Dassault Systemes: CATIA, SmarTeam, Enovia, Delmia, Abaqus,
- Autodesk: Autocad, Inventor, Revit, Factory, Plant 3D, Navisworks,
- Siemens PLM Software: NX, TeamCenter, NX Nastran
- IBM: Rational, Maximo, Tririga, Tivoli
- Transcat: MyV5, MyPLM and Qchecker

Professional Services:

- Business processes analysis and documentation
- Project defenition, ROI analysis
- Project implementation
- Delivering and Installing the systems and solutions
- Training & support (Open rooms, In Company and Enterprise training plans)
- Outsourcing In situ support

Fusion activities & ITER project interest:

Provide a unique interface between the software Industry's ISVs (Independent Software Vendor(s)) and Fusion for Energy. Objectives:

- Simple contract administration and management, through a single source channel for new license acquisitions and related services.
- Comprehensive license management services covering the complete software lifecycle (quotation, ordering and order trancking, delivery, license inventory, license compliance, reporting, …)

Provision of Scientific and Corporate Software Solutions
Provision of maintenance and informatics services.
Provision of implementation and training Software services
Development, implementation support and maintenance of a Engineering Data Management (EDM) System, based on Dassault Systemes Software

Fusion main contracts awarded and R&D projects:

F4E-2009-ADM/IT-06 "Software Acquisition Channel".
F4E/2013/55 "External Technical Support Services for the configuration and troubleshooting of the PLM products used by the users (CATIA, Enovia, 3D Via, etc..) " (as AVANTEK member of group CADTECH)

XUNTA DE GALICIA: CADTECH IBERICA, proposes the development of a Virtual Laboratory of Construction (LVC), which serve as a tool and means of spreading new ways of working in the construction and operation of buildings. The main objective of the project is the development of a Virtual Construction Lab that allows industry professionals rely on 3D models with INTELLIGENT INFORMATION for improving construction and maintenance processes, improve quality and prevent loss of resources (humans and materials). Expected End date: october 2013.

CAD TECH Headquarters

CEIT-IK4

Address: Paseo Manuel Lardizábal 15
20018 Donostia-San Sebastián, SPAIN

Web: www.ceit.es

Turnover: 15 M€ in year 2012, 14 M€ in year 2011, 16 M€ in year 2010

Contact person: Juan Meléndez, *Head of the Development Area*
+34 943 212 800
jmelendez@ceit.es

Company activities:

CEIT is a nonprofit private research centre, co-founder of the IK4 Research Alliance, with the mission to serve the industrial sector, carrying out projects of applied research and technological development. CEIT also trains young researchers through a comprehensive doctoral teaching program in the industrial area. CEIT is a multidisciplinary centre, and its activity is focused in different areas of R&D, among which are: Materials, Applied Mechanics, Electronics & Communications and Microelectronics & Microsystems, whose work is oriented to different sectors: Energy, Industrial/Manufacturing, Aeronautical, Automotive, Railway, ICT.

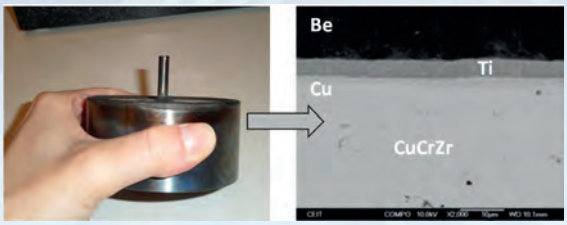
Fusion activities & ITER project interest:

CEIT's capabilities and interests with regard to fusion are:
- Development and processing metallic and ceramic powders. Equipped with atomizer to produce tailored metallic powders, and high temperature furnaces, HIP press…
- Development of materials and components for extreme environments: graphitic materials, oxidation resistant W alloys, ODS Steels, porous SiC.
- Solid state diffusion bonding. Equipped with Hot Press and HIP press. Access to industrial presses of HEDISA (only Spanish company using HIP in its manufacturing process).
- Failure analysis: identification of failure mechanisms (fatigue, corrosion, defects, HAZ…)
-Quality control, in-service inspection
- Physical, Mechanical and microstructural characterization
- Multiscale FEM of mechanical behavior (fracture, stresses…).

Fusion main contracts awarded and R&D projects:

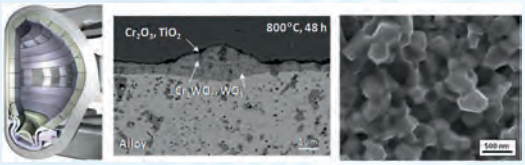
- F4E: F4E-OPE-394 (IV-PT): Fabrication of a standard semi-prototype of the ITER NHF First Wall Panels (FWP). Contribution in encapsulation before HIP
- F4E-OFC-167 (ES-MF) Material characterization at room at elevated temperatures. CEIT's taks: Thermal Conductivity measurements by LFA and microstructural characterization by TEM
- SPAIN, MINECO "Consolider-Ingenio 2010 "TECNO_FUS". CEIT's task: Development of porous SiC coated with a dense SiC coating for Flow Channel Insert application

- SPAIN, MINECO: ITER Blankets CDTI: Development of manufacturing technologies for ITER FWP. CEI T's task was diffusion bonding of Be and CuCrZr by HIP.



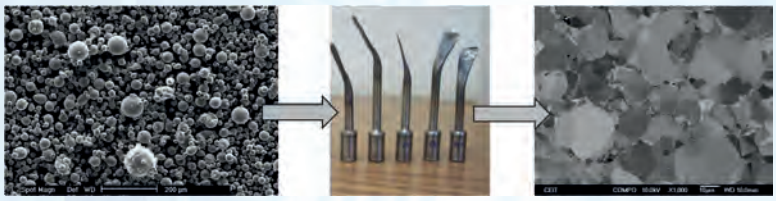
CuCrZr/Be joints obtained by HIP diffusion bonding

- EFDA:MAT-HHFM: WP 2009-2013: Manufacturing of self-passivating against oxidation at high temperatures W based alloys for armor application (DEMO)



Self-passivating against oxidation W alloys as armour material (DEMO)

- EFDA:MAT ODS FS: WP 2012-2013: Industrial production of nano-structured ODS FS following a simplified and inexpensive route (DEMO). The objective is to avoid Mechanical Alloying



Oxide Dispersion Strengthened Ferritic Steels (ODS FS) obtained by PM route, avoiding Mechanical Alloying

- EU, 6th FP: NMP-CT-2004-500253 (2004-2010): ExtreMat, New materials for extreme environments for ITER. The objective was to develop high performance graphitic materials for ITER (high thermal conductivity and mechanical strength and low chemical erosion)

COMSA EMTE

Address: Viriato, 47
08014 Barcelona, SPAIN

Web: www.comsaemte.com

Turnover: 1,767 M€ in year 2012

Contact person: Guillermo Barba, *Project Director*
+34 933 662 100
gbarba@comsaemte.com

Company activities:

COMSA EMTE set up its activity in 1891 and nowadays it is established in 24 countries around the five continents. COMSA EMTE concentrates its activity in Infrastructures & Engineering, Systems & Technology and Concessions & Renewable Energy.
COMSA EMTE, which is considered the eighth largest Spanish company in the sector, had a turnover of 1,767 M€ in year 2012 (652 M€ corresponding to international turnover) and has more than 10,000 direct staff.
The activity in Infrastructures & Engineering Area consists in worldwide infrastructures construction and maintenance, railway projects, roads construction, maritime and airport works, building construction, hydraulics, electromechanical engineering, installations, telecommunications and energy generation.
The activity in Systems & Technology Area consists in waste treatment and management, urban services, water engineering, energy efficiency and building energy generation plants, rail freight services, technological solutions and electromechanical maintenance.
The activity in Concessions & Renewable Energy Area consist in the management in infrastructure concessions and energy generation projects.

Fusion activities & ITER project interest:

COMSA is developing the infrastructure and civil works surrounding Fusion Buildings, on ITER site in Cadarache. The extensive experience and the high degree of specialization have consolidated COMSA as a major partner for F4E, implementing three urban development projects for it on the Cadarache platform.

Fusion main contracts awarded and R&D projects:

ITER-TB01: SITE ADAPTATION.WORKS. Construction of deep drainage system, temporary worksite power supply, outdoor lighting and roads. Design and construction of a Contractors Area (CA2) with all networks (drainage, power supply, potable water supply, telecom) and facilities (canteen for 1,500 workers, 500 m2 offices, infirmary), including a parking for 555 vehicles and a bus area.
ITER TBAP. Construction of the ancillary galleries around the TOKAMAK pit, where it will be placed all facilities needed for the operation of the TOKAMAK.
ITER-TB08. Design and construction of service trenches, service networks, service roads and parts of the Site General Infrastructures to be implemented on ITER site. The scope is the construction of the networks (industrial water drainage, sanitary drainage, outdoor lighting, and precipitation drainage), roads, parking and lay down areas (including fences and gates for general or specific zones), special foundations, Integrated Plant Earthing Grid (IPEG) and service & buried trenches for Potable Water, Fire Water, Hot Water, Cooling Water, Chilled Water System and Heat Rejection System.

TB1 - Site Adaptation Works

TBAlpha Galleries and drainage

CRISA

Address:	Calle Torres Quevedo, 9 (PTM) 28760 Tres cantos (Madrid), SPAIN
Web:	www.crisa.es
Turnover:	49 M€ in year 2013
Contact person:	Juan Jesús Rico Peña, *Director Comercial de la División de Potencia y Segmento Terreno* +34 918 068 808 JuanJesus.Rico@astrium.eads.net

Company activities:

Crisa, an Astrium company, is a well renowned supplier of complex on board electronics for space. More than 25 years' experience, 400 employees and 600 electronic units flown into space back Crisa's capabilities in the design and manufacturing of complex electronic equipment for satellites and launchers.
The company's activities cover a wide product range like system engineering, launcher electronics, driving electronics, electrical propulsion electronics, front-end electronics, on board computers, remote terminal units, DC/DC converters, power distribution units, power control units, cooler electronics, video processing, microelectronics or antenna driving. At the moment, the company is working on important programs like Ariane 5 and Vega launchers, the ATV vehicle, Alphabus and Eurostar platforms, or satellites like GAIA, LISA Pathfinder, Sentinel, Ingenio, Paz, BepiColombo, EarthCARE or SolarOrbiter.
Crisa has expanded its engineering and project management skills in other ground projects. Some of these projects include network architecture design for secure communications; control center implementation, operation and maintenance; archiving and cataloguing systems; remote operation.
Crisa is able to provide reliable electronics designed for harsh enviroments like space or fusion under radiation and no-maintenance conditions. The company has also a strong knowledge of system engineering and project management.

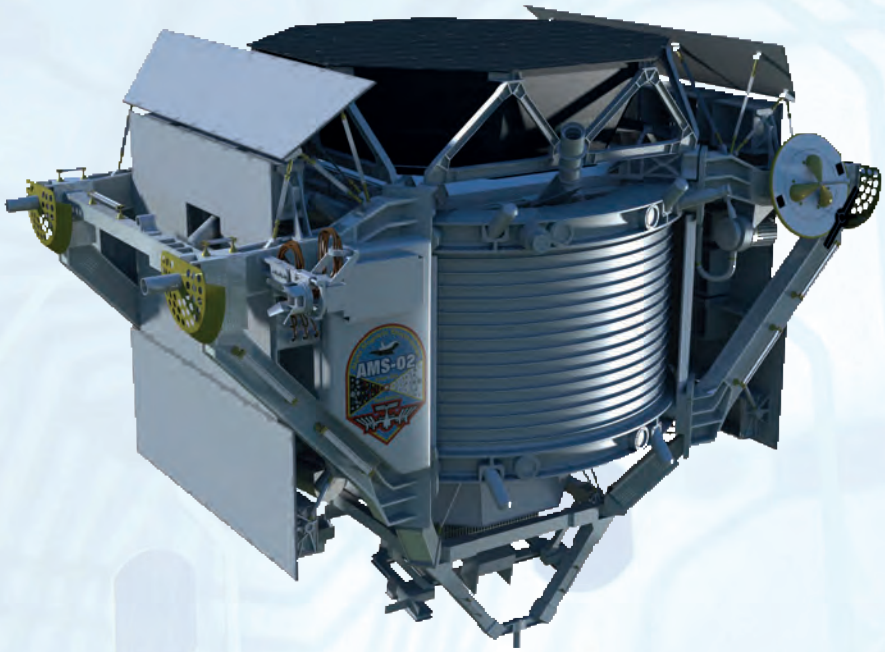
Fusion activities & ITER project interest:

Crisa engineering activities are mainly framed within the space environment. Development of electronics for space implies dealing with very high radiation levels, vacuum conditions, high temperature changes, tolerance to shocks, and most of all, reliability, since no repair is possible. Similar conditions can be found in fusion projects.
Electronics for High Energy particle Physics:
Crisa has been responsible for designing and manufacturing the Cryomagnet Avionics Box (CAB), a challenging electronic unit to power and monitor a superconducting dipole magnet that was built to form part of the Alpha Magnetic Spectrometer (AMS-02), a particle physics detector on board the International Space Station (ISS). The AMS was the first large superconducting magnet in space with application in radiation protection, propulsion system, power generation and energy storage.
The project was conducted under the technical supervision of CIEMAT, with funding provided by CIEMAT, CDTI and ETH-Zurich.

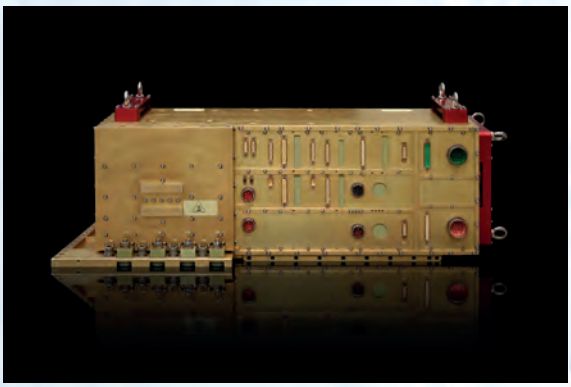
ITER project interest:
- Power converters, ADC, DC/DC converters
- Diagnostics, monitoring and control electronics
- Data acquisition systems, hardware/software
- Project management

Fusion main contracts awarded and R&D projects:

Crisa was awarded with an Engineering Support Framework Contract for Control & Data Acquisition Communication Systems (CODAC) and heating Current Drive division. Contract ref.: ITER/CT/6000000014



Alpha Magnetic Spectrometer (AMS-02) - Source NASA



Cryomagnet Avionics Box for the Alpha Magnetic Spectrometer (AMS-02)

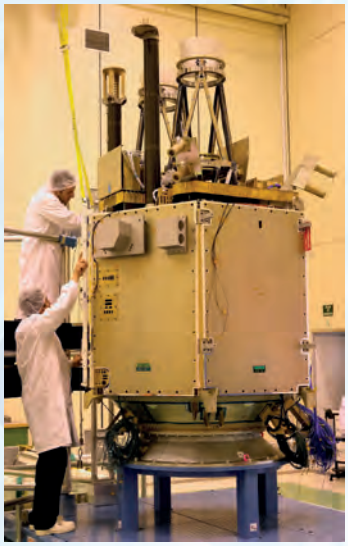
Manufacturing of complex electronic units

EADS-CASA ESPACIO

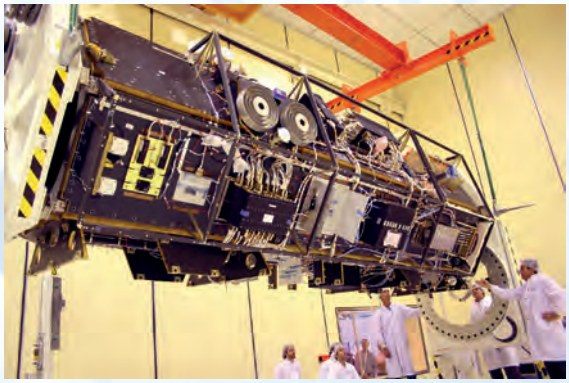
Address:	Avd. Aragón, 404 28022 Madrid (SPAIN)
Web:	www.casaespacio.es //www.astrium.eads.net
Turnover:	100 M€ in year 2012
Contact person:	José Guillamon, *Commercial & Strategy Director* +34 915 857 927 Jose.guillamon@astrium.eads.net

Company activities:

EADS-CASA Espacio is the leading company in the Space sector in Spain. It cover the design, integration and qualification of Satellites for Earth Observation mission, such as INGENIO and PAZ.

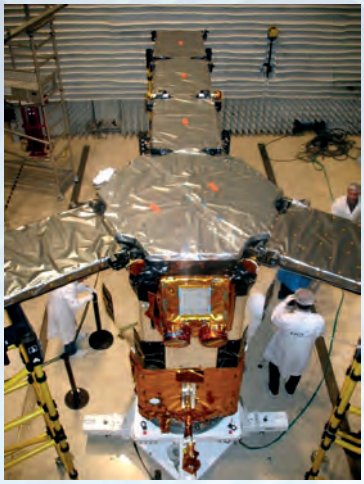


INGENIO Satellite Platform



PAZ Satellite

In satellites it performs system level activities as prime contractor of satellites, payloads and instruments. It is also a reference supplier of array and reflectors antennas, composite structures, thermal control and harnesses, covering the full range of applications such as telecommunications, Earth observation and scientific, either for commercial or institutional markets.
In launchers it specializes in large carbon fibre space structures, manufactured automatically in one single piece. The company is a reference supplier of the European launcher Ariane 5 and other like Soyuz, Rockot, Vega and the American Atlas V. Particularly interesting are the payload adapters produced to hold the satellites in place during launch, which include advanced separation systems.
The Company product portfolio includes as well the Design, Manufacturing and Testing of high stability structures for specific applications such as Space Intruments and Telescopes as well as the adequate thermal protections to protect them from the environmental conditions.
Other activities covered by the company background are the design and manufacturing of Antennas, Harnesses, Hold-down and Release Mechanisms.



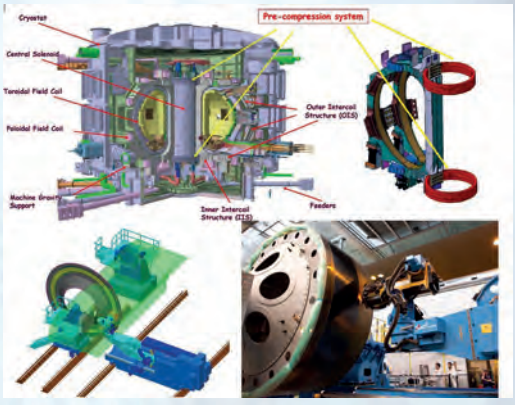
SMOS / MIRAS Synthetic aperture radiometer

Fusion activities & ITER project interest:

Areas of interests: High Stability structures.

Fusion main contracts awarded and R&D projects:

ITER PRE-COMPRESSION RINGS: It includes the Design, Manufacturing and Testing of the these high stability structures.
The activity includes the design, manufacturing and test of nine (9) pre-compression rings.
They are manufactured in glass fiber with epoxy resin.
The overall dimesions of the rings are 5m in diameter and a cross-section of 337 x 288 mm, with a total weight of 3,5 Tons each.
During more than 20 years of lifetime, they will be subject to 30.000 mechanical cycles with an operating temperature of 4˚ K. (-269˚ C).
The manufacturing process includes an extensive use of the Automatic Fiber Placement technology. It is widely use for large composite structures in satellites and launchers (ie Ariane 5).
The manufacturing process and the associated verification represents a technological challenge mainly due to the overall size fo the rings, type of material and weight.
That contract represents for EADS-CASA Espacio an outstanding achievement and also a clear demostration that the Space technology can bring an effective added value to some other sectors and aplication, such as the ITER programme.



ITER Pre-compression rings

ELYTT ENERGY

Address: Paseo de la Castellana 114
28046 Madrid, SPAIN

Web: www.elytt.com

Turnover: 4.5 M€ in year 2012

Contact person: Angel García-Franco, *Sales Manager*
+34 619 039 199
angel.garcia@elytt.com

Company activities:

Elytt Energy designs and manufactures, scientific installation components.
Design and manufacturing of warm and superconducting magnets (dipoles, quadrupoles, sextupoles, octupoles, undulators, septa…) for particle accelerators, spectrographs, magnet support frames, vacuum chamber design, cryogenics.
Electronic Power Supplies. Design and manufacturing for particle accelerators.
Engineering Services:

- 2D and 3D FEM and analytical electromagnetic calculations.
- 2D and 3D FEM and analytical stress calculations.
- 2D and 3D FEM and analytical thermal calculations.
- Ray tracing.
- Vacuum calculations.
- Dynamics.
- Coil cooling calculations.
- Cryogenic calculations.
- Support frame calculations

Fusion activities & ITER project interest:

Design of fusion reactor structural systems, design of superconducting magnets for material characterization, design of TF and PF coils (2D and 3D FEM and analytical electromagnetic calculations.2D and 3D FEM and analytical stress calculations.2D and 3D FEM and analytical thermal calculations.Support frame calculations)
Manufacturing of Superconducting Coils.

Fusion main contracts awarded and R&D projects:

1. Manufacturing of 10 Superconducting Toroidal Field coils for ITER/F4E in consortium with Iberdrola (Spain) and ASG (Italy). Elytt scope,
   - Conductor insulation
     - Manufacturing Process
     - Tool calculation and design
     - Tool manufacturing.
     - Tool qualification
     - Coil prototype manufacturing leading for conductor insulation

   Double Pancake Vacuum Pressure Impregnation
     - Manufacturing Process Definition
     - Tool calculation and design.
     - Tool manufacturing.
     - Coil prototype manufacturing leading for dp vpi

2. TF Coil Terminal Region Design and Analysis for ITER.
    - Study of the loads of the joint region during normal operation conditions.
    - The design of the support system capable to withstand the loads induced in the 2 worst case scenarios
3. TF conductor case specification for ITER.
    - Review and update the specification of austenitic steel forgings and plates, the specification of welding and the specification of non destructive testing
    - Review and update the design description of the TF Coil Structures.
4. Mechanical engineering for ITER/EFDA: 28.800 engineering hours & 28.800 CAD hours. TF superconducting coils, PF superconducting coils, Design of TF coil without radial plate.
    - TF superconducting coils:
        - Helium inlet/outlet new design.
        - Design of TF coil without radial plate.
        - Manufacturing tool design (winding, insulation, impregnation…)
    - PF superconducting coils:
    - Precompression ring
    - Manufacturing QA definition
5. Design of MRID (Magnetic Residual Ion Dump) for the NBI (Neutral Beam Injector) for EFDA
6. Blanket attachment design. EFDA/ITER

ITER Toroidal Field Coils Insulation Machine

EMPRESARIOS AGRUPADOS INTERNACIONAL, S.A.

Address: Calle Magallanes, 3
28015 Madrid (SPAIN)

Web: www.empre.es

Turnover: 37.89 M€ in year 2012

Contact person: María Teresa Domínguez Bautista, *Advanced Projects Director*
+34 913 098 022
mdb@empre.es

Company activities:

Empresarios Agrupados Internacional, S.A. (hereinafter EAI), founded in 1992 as part of the EA Group (EA). EA is a leading Spanish engineering organisation with significant international experience founded in 1971. EA is a leading engineering and systems company in the areas of Energy (including nuclear power), Information Technologies Space and Defense Systems, with a strong presence in the international markets. EA provides a full range of engineering procurement, construction, plant testing and commissioning services for nuclear and conventional power plant projects and related nuclear facilities, such as for radwaste management, disposal and storage, spent fuel storage and decommissioning. In the field of nuclear power generation, EA has been the primary or sole engineering company for six (6) 1000-MWe nuclear units in Spain, of both PWR and BWR types. EA provides engineering support services internationally to the new build of nuclear power plants performing feasibility studies, preconstruction activities and licensing support. EA also provides engineering support services to the nuclear units currently in operation in Spain and is involved in modernisation, uprating and life extension programmes for these plants. EA is an innovative company involved in several R&D EURATOM programmes for development of advanced nuclear technologies in fission reactors. EA is part of the consortium that has been selected as a preferent bidder for developing the Front Engineering Design of MYRRHA.

Fusion activities & ITER project interest:

Empresarios Agrupados Internacional, S.A. (EAI) has been participating in the European fusion programme since 1994 as a partner in the EFET consortium (European Fusion Engineering Technology). This consortium was awarded the contract with the European Union under the 5th and 6th Framework Programmes for the development of the design of the ITER facility IFMIF and other projects. Following completion of the design phase, and after the construction of ITER was approved in November 2006, EAI has awarded several contracts below indicated.
In the execution of these projects, EAI has acquired large experience in Safety, Remote Handling, Mechanical and Electrical System Design, Building Design, Integration, Machine Assembly and other specialties required for ITER completion in which EAI has interest to participate in future activities.

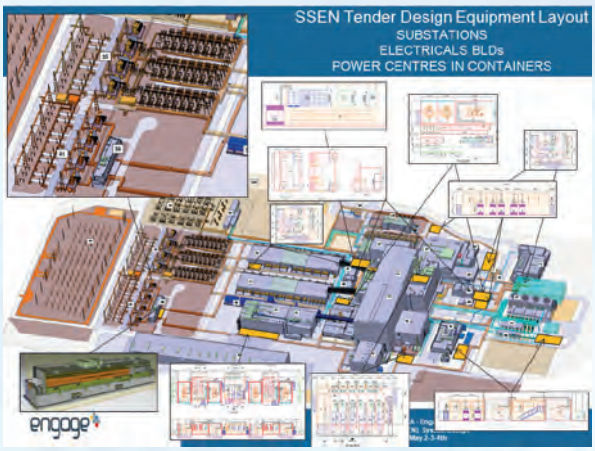
Fusion main contracts awarded and R&D projects:

F4E-2009-OPE-020 (SB.PS): Support in tendering the Design and Build (DB) ITER PF Coil Building Contract. Empresarios Agrupados was responsible in the support to F4E in the preparation of the technical specification, including Design, Safety and Health Protection Coordination (SHPC), Legal Inspection (LI) and Support to the Owner (SO) for this building in which the PF Coil will be manufactured at Cadarache site.

CIEMAT contract: "Servicio para el diseño detallado del sistema de refrigeración por agua para el sistema de radiofrecuencia de IFMIF-EVEDA". Empresarios Agrupados has been responsible of the development of the feasibility study for the cooling system for the radiofrequency IFMIF-EVEDA.

GRANT F4E-2010-GRT-254 (PNS-TBM): "Tritium Migration Modeling and Conceptual Design of the Tritium Accountancy Systems for the European Test Blanket Systems" (Actions I & II). Empresarios Agrupados has developed the software libraries to simulate the tritium transport with ECOSIM software package.

F4E-2009-OPE-058 (SB-PS): Architect Engineer Contract for ITER Buildings and Civil Infrastructures.



Architect Engineer Contract for ITER

The scope of the contract is the design and construction supervision of the ITER buildings, power distribution system and also power supply. The scope also includes the procurement processes of the different tender batches in which the procurement of the buildings has been splitted. Empresarios Agrupados is a member of the consortium ENGAGE. The contract was signed in 2010 with a duration of ten years. The team is located in Cadarache.

ITER contract: IO-12-CFN-70000045-BGD "Design, manufacture, qualification and installation of the Nuclear Safety Control System (SCS-N) of ITER"

The scope of the contract includes the design and procurement of the central safety system (CSS) and the design of the plant safety system (PSS) of ITER. As part of the design activities, the environmental qualification of the product is also inside of the scope. This qualification will include environmental, electromagnetic protection compatibility and seismic resistance. Empresarios Agrupados is leader of the consortium formed with INABENSA. The project has a duration of 6 (six) years.

F4E-OFC-433 (DG): Integration Design of Diagnostics into ITER Ports (in evaluation)

F4E-OMF-436: Project Management Support to F4E (Lots 1 to 4) (in evaluation)

F4E-OPE-0421: Preliminary Design of Main Water Detritiation System (Main-WDS) (in evaluation)

F4E-OPE-0500: Preliminary Design for the WDS Tanks (in evaluation)

EQUIPOS NUCLEARES, S.L. (ENSA)

Address: José Ortega y Gasset 20, 5º
28006 Madrid, SPAIN

Web: www.ensa.es

Turnover: 98.2 M€ in year 2012

Contact person: Francisco J. Adam Fernández, *Nuclear Business Marketing & Contracts*
+34 942 200 174
adam.fran@ensa.es

Company activities:

Ensa fabrication specializes in components such as reactor vessels including internals, supports and cover heads, steam generators, primary circuit piping, pressurizes, heat exchangers, fuel elements bundle heads, used fuel casks for storage and transport and fuel racks for both new and used fuel.

Fusion activities & ITER project interest:

1. Ensa is an experienced supplier of services and equipments for the international nuclear market since almost 40 years. Its portfolio includes engineering, design, licensing, manufacturing, testing, etc. services and a complete range of activities in support of nuclear power plants.
2. All capabilities developed for the fission field are subjet to be transferred to the fusion field such as manufacturing techniques, welding processes, inspection procedures, special tooling design, etc..
3. Ensa is mainly interested in the supply of large components to be manufactured or assembled as per strict nuclear standards and regulations.

Fusion main contracts awarded and R&D projects:

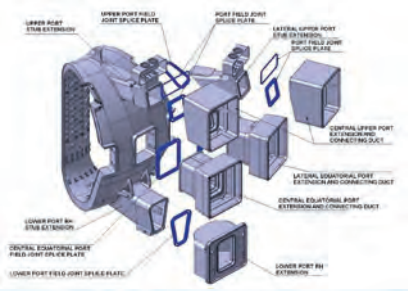
2007 Year: Feasibility Study for the development and manufacturing of European test modules for Iter project (EU-TBM).The target of this project was to anticipate the needs and capabilities of the Spanish industry in order to successfully face the EU ITER-TBM project through a technical analysis.
2007 Year: Feasibility Study for the Vacuum Vessel ITER project (EU-TBM). Feasibility study of the potential developments to be carried out and needed by Ensa during its expected involvement on ITER project. These technical developments were focused on the Vacuum Vessel Sectors fabrication,mainly on areas as manufacturing sequence, welding processes, testing procedures and tooling and first of a kind manufacturing devices.
2008 Year: Advance Distortion Simulation Techniques during themanufacturing of structures for large plants. Development of a reliable technique for the prediction of distortion in large precision structures for the nuclear fusion investigation and to extend obtained results to other fields. The extremely strict tolerances require innovative control processes during the fabrication of the components, in particular, the vacuum Vessel Sectors.
2012 Year: Contract for the Assembly of the Vacuum Vessel. The scope of this contract awarded in 2012 by ITER Organization is the assembly at site of the Vacuum Vessel Sectors. This work required the development of many qualifications, processes (welding, control, testing, etc.) and associated devices and tools.

(throught outstanding mechanical handling equipment) to their definitive position inside the Tokamak Building . Other auxiliary buildings included in TB03 contract are the Resistor Building , the Fluids Equipment Buildings or the Radio Frequency Heating Building . At last , we mention as included in TB03 contract the Control Building , a concrete framed building that houses the Control Room of the ITER Complex , that is a critical facility of the complex . The total surface of buildings under TB03 contract is about 100.000 m^2.

2013 Year:Start with the first project stage: Development Phase where Ensa team study all the techniques that will be used during the production pahse in Cadarache, the involved technologies are:

- Welding- Narrow Gap Tig
- Machining
- NDT (VT,PT,PTC,UT,RT,HE Test)
- Dimensional control
- Tooling (positioning, robots,

2013 Year: Contract for the Impact of narrow distance between welds and weld overlapping-Fabrication and NDT



Iter Vacuum Vessel and Port Assembly

FERROVIAL

Address: Ribera del Loira, 42
28042 Madrid, SPAIN

Web: www.ferrovial.com

Turnover: 7,686.4 M€ in year 2012

Contact person: Alfonso Balasch, *Industrial Construction Division*
+34 913 008 905
abc@ferrovial.com

Company activities:

Ferrovial Group is one of the world's leading infraestructure companies, with an average of69.000 employes during 2011 and operations in five continents in a range of sectors includingconstruction, industry, airports, toll road and facilities management . Ferrovial Agroman is the Group Ferrovial's Construction Branch. With an amount of turnover 4.325,6 M€ in year 2012 representing 56% of the whole Group.

Ensa Steam Generator

Fusion activities & ITER project interest:

Ferrovial Agroman has been involved in all major nuclear projects in Spain.
Concerning the ITER project, Ferrovial aims to offer its expertise in construction of large industrial facilities, as well as a deep knowledge of a wide range of civil works and M&E activities.

Fusion main contracts awarded and R&D projects:

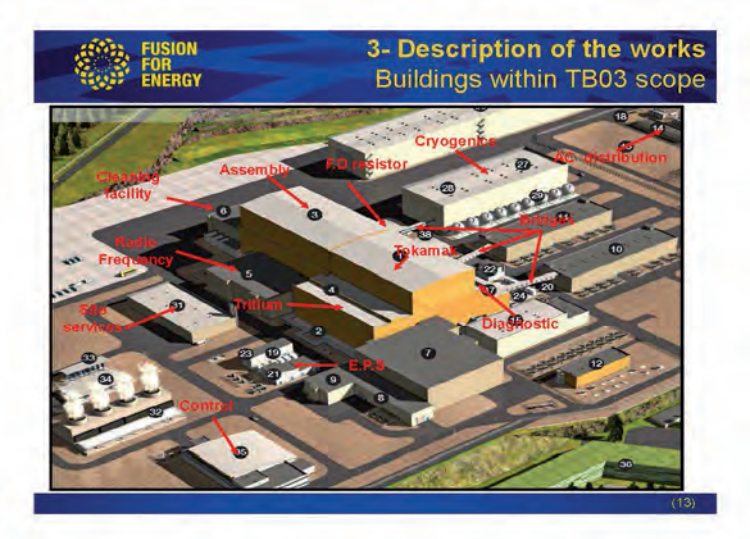
ITER TB03 package

Ferrovial Agroman, as member of a Consortium, has been awarded in 2012 the contract for the construction of the Package TB03 Main Civil & Finishing Works in the ITER Complex Cadarache. TB03 contract has been awarded by Fusion for Energy (F4E) , the European Domestic Agency of ITER Organisation . This contract includes the construction of the Tokamak Complex , a group of three reinforced concrete structure buildings (Tokamak Building , Diagnostic Building and Tritium Buikding) where the main facilities of the ITER complex , as the Tokamak itself (toroidal vacuum vessel) or the coil magnets are housed . As nuclear construction it is , Tokamak Complex must meet the very high quality standards required by our client as well as by French Nuclear Authorities . In addition , Tokamak Complex is the biggest Fusion Reactor ever built and this implies new outstanding and challenging technical requirements. Moreover the above mentioned Tokamak Complex buildings (Tokamak , Diagnostic and Tritium buildings) , TB03 contract includes the construction of other auxiliary buildings as the Assembly Building and the Cleaning Facilty Building , two steel framed buildings where all the components of the Tokamak Complex shall be first cleaned and then assembled and moved

ITER TB05 package

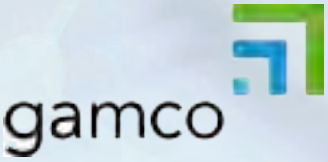
In 2013 , Ferrovial Agroman has been awarded the TB05 package that is a Design & Building contract for Magnet and Reactive Power Buildings . TB05 contract has been awarded by Fusion for Energy (F4E) , the European Domestic Agency of ITER Organisation (IO) .

TB05 package includes the design and construction of the two buildings that shall house the process electrical equipment that shall transform and convert the electrical power and to feed the big magnet coils that are placed inside the Tokamak Building . Each of this two buildings is a single floor building with a length about 150m and , a width about 30 m and about 8 m high . TB05 contract includes the design and construction of these two buildings , from foundations to building services (as Heating and Ventilation , Building Management System , Electrical Services and Fluid Networks) . As buildings inside an INB (Installation Nucléaire de Base) they are corresponding quality requirements are requested . As these buildings have to contain outstanding electrical currents there will be high intensity magnetic fields . This outstanding technical requirement has implications in design (from foundations to building services) and must be taken into account in each step of the design and construction . TB05 contract also includes the design and construction of Reactive Power Building , that have to house part of the process electrical equipment . The Reactive Power Building is a steel framed, single floor building . The total surface of buildings under TB05 contract is about 10.000 m^2.



TB03 – Main Civil & Finishing Works

GAMCO S.L.



Address: C/ Alcalá 20
28014 Madrid, SPAIN

Web: www.gamco.es

Turnover: 183 K€ in year 2012

Contact person: Fernando Pavón Pérez, *CTO*
+34 915 211 650
fernando.pavon@gamco.es

Company activities:

GAMCO is a software manufacturer that generates advanced computer models for solving complex problems via the use of historic and real-time data.
The company is currently participating in several national and international R+D projects: 7FP, EUREKA and Neotec.
GAMCO has developed solutions in different sectors: Energy, Financial, Fast Moving Consumer Goods (FMCG), Security (Federal Police), Health, Telecommunications, etc.
Some of the main advantages of our software: The models are dynamic and self-learning (they can adjust themselves in an automated fashion using newly updated data), real-time model execution and update and optimal TCO.
The main advantages of our solutions are:

- Fast and reliable models.
- Increasing accuracy: our models determine the relevant and irrelevant variables, useful in large and small datasets, and can work with poor quality data sets to determine the most probable value of the missing variables automatically.
- Fast adaptation to changing system conditions.
- Automation of the decision-making process.
- Capacity to work with very large datasets.
- Parallel execution: data can be collected from distributed databases, confirming our Artificial Intelligence technology as one of the best suited in the market, thanks to the capability for parallel execution.
- Ability to increase systems integration: we can “put together” automated systems and other software solutions, and increase their integration.
- Individual approach to each system or problem. Up-down analysis.

GAMCO is working in Fusion with the “Laboratorio Nacional de Fusión por Confinamiento” a laboratory in CIEMAT which is focused in R&D activities for the development of magnetic fusion confinement.
We are working with data from JET (Joint European Torus) making models for automatic discover different types of L-H and H-L transactions. The objective is to discover most important signals in these transactions and automatic fail recognition from the sensors readings.

Fusion activities & ITER project interest:

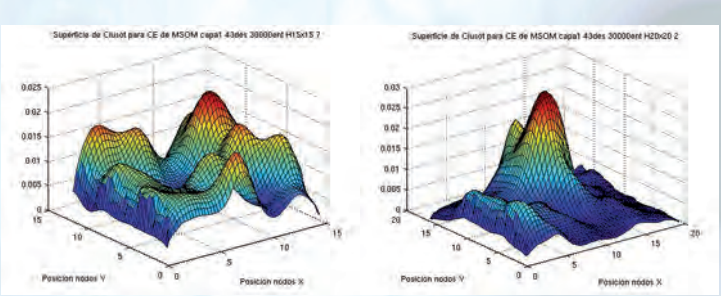
GAMCO is interesting in solve complex problems through automatic knowledge discovery in big repositories of data.
Our areas of interest are:

- Big data: manage big repositories of information with highly heterogeneous information, variable quality in much of the data, difficulty in detecting behavioral patterns, collating information from many different data sources and, in many cases, working with highly confidential information.
- Artificial Intelligence: use machine learning, case base reasoning and fuzzy logic for knowledge extraction of hidden predictive information from historical data.
- High performance computing: GAMCO has developed a pioneering platform called GENM (GAMCO Engine Neural Models). With this platform one can automatically generate models. Automated generation is achieved using a massively parallel numerical computation software/hardware architecture.
- Process optimization: use evolutionary algorithms for finding out solutions to optimization problems.
- Data visualization: use advanced 2D and 3D graphics for representing multivariable system, outputs of the evolutionary algorithms, segmentation, automatic clustering and variables linear or no-liar relationships.

The GAMCO's technology can be apply to fusion problems in many ways: prediction, fault detection in real time, process modelization, simulation, optimization, improve the quality of the sensor readings and detect faults in sensors in real time.

Fusion main contracts awarded and R&D projects:

Since 2010 we are working in THEFUMO (Thermonuclear Fusion Modeling) project which has public funding from CDTI.
In this project we are developing advanced algorithms for self-learning, visualization and modelization from a huge amount of data providing from JET. Our objective is developing real-time methods from automatic manage the signals and make predictive models. These models will be use for many different tasks: predictive maintenance, avoid ELMs, multi-signals analysis in L-H or H-L transitions, etc.



Instrumentation, control and diagnosis at the core of ITER.

GAS NATURAL FENOSA ENGINEERING S.L.U.

engineering

gasNatural fenosa

Address: Acanto, 11 – 13
28045 Madrid, SPAIN

Web: www.gasnaturalfenosa.com

Turnover: 81.02 M€ (2009); 71.03 M€ (2010); 53.73 M€ (2011)

Contact person: José Antonio Herrera Navarro, *Director Nuclear*
+34 912 577 005
jaherrera@gasnatural.com

Company activities:

GAS NATURAL FENOSA ENGINEERING, S.L.U. (GNFE; formerly SOCOIN, Soluziona and UFISA) is the energy engineering company of the GAS NATURAL FENOSA Group (GNF). GNFE started operations in 1989 as the engineering subsidiary of the Unión Fenosa company (previous Gas Natural Fenosa), specializing in the energy sector. Its main asset is its extensive experience in design, engineering, construction and operation of all kinds of installations such as generation, transmission and distribution of electricity and natural gas in both the domestic and international areas. Currently, GNFE has become the engineering subsidiary in charge of engineering and technology in the whole GAS NATURAL FENOSA Group. GNFE develops studies and projects in the field of nuclear power generation, as well as technical support for existing nuclear power stations. The nuclear division of GNFE has broad experience in the support engineering to nuclear plants.

Fusion activities & ITER project interest:

Its actual experience in fusion activities is based on the activities currently finished for F4E:

- "Cost Assessment of the ITER Cryoplant System. Evaluation of LN2 Plant Sizing and Rotating Machinery Options", in cryogenics area, that consisted in a first analysis of rotating machinery, pre-selection of technologies and suppliers and a first layout of the "Cold Box" and costs breakdown.
- "Review of PCDH Criteria and its Impact on the Plant Control System Supplies ", in I&C area, including an analysis of the "Plant Control Design Handbook" and related documents; and the design and insertion of the whole contents of a Data Base with the Classification Criteria.
- "Industrial Cost Evaluation of the Cooling Plant for PRIMA (MITICA and SPIDER Experiments)" , in the cooling systems area, consisted in the development of a breakdown costs of the cooling plant for the experimental devices of PRIMA (MITICA and SPIDER).
- "ITER cryoplant 80 K loops. Compressor technology validation, sizing of the cold box components", in cryogenics area, consisted of the following activities: Cold Box definition, complet market survey for centrifugal compressors and full validation of the pre-selected compressors supplier.

Recently GNFE is interested in Neutronics Analysis, so that has been prequalificated to the project "Neutronics Analysis Support" for ITER. Additional areas of interest come from the full scope of the current Frame Contract (see next point).
Considering our experience in all fields of the engineering, we are in the position to manage complex projects and contribute for any special tool to be required for handling of equipment under high level of radiation.

Fusion main contracts awarded and R&D projects:

GNFE leads the Frame Contract F4E-2008-OPE-017-02-01, “Engineering Support to F4E – Plant Systems (Lot 2)”, which includes the plant engineering support to F4E in the fields of:

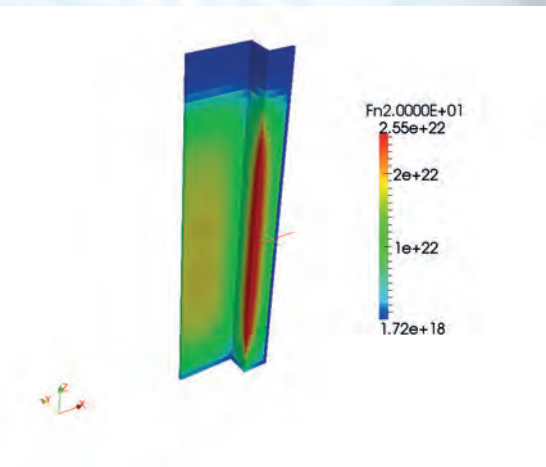
- Design of Systems: Water cooling systems; Heating, ventilation and air conditioning systems; Cryoplant and cryodistribution systems and components; Vacuum system; Electrical systems, power converters, emergency power supply and high voltage AC distribution systems; Instrumentation and control systems, CODAC; Other plant services and networks .
- Support to assembly, onsite installation and commissioning of the electrical systems and components.
- Support to factory and onsite testing of the equipment and to integrated system acceptance tests; elaboration of the as-built documentation of the system.
- Plant system integration.
- Planning and budgeting for plant installation.
- Integration studies of Test Blanket Module systems in ITER plant systems.
- Comparison of budeget prices for criostatic compressors
- Preparation of pre especification for criostatic compressors
- State of the art for compressors technology

Another relevant R&D projects are the following:

ZIRP PROJECT (ZORITA INTERNALS RESEARCH PROJECT): (880.000 euros final client EPRI-MRP, project ongoing). The project consists on the recovery and study of irradiated materials coming from the José Cabrera NPP reactor vessel internals. GNFE participates as spanish leader for both engineering and characterization analysis. Radiation analysis has been performed by GNFe.

JULES HOROWITH REACTOR (JHR): (total contribution 10 M€, final client CEA, project on going). Member of the Spanish consortium leads by CIEMAT, responsible together with TECNATOM of the JHR experiments simulator (EX-SIMU). Participation of GNFE has been focused on radiation transport calculation and HMI.

KOZLODUY NPP Resins Characterization: (client SERAW, 2,5 M€, project ongoing): this project consists on resin characterization methodology development including special remote handling tools for resins extraction, laboratory equipment specification and personnel training. This project is develop in consortium with ENSA, company that supplies the equipments. Sample remote handling equipment has been design to extract the resins with two different devices under very high activation levels. Additionally, some special containers for samples transportation, routes for transportation and handling of the samples are supplied.



Neutronic Fluence Pattern in PWR Reactor Baffle Plates

GTD SISTEMAS DE INFORMACIÓN S.A.U.

Address: Pg. Garcia Fària, 17
08005 Barcelona, SPAIN

Web: www.gtd.es

Turnover: 35 M€ in year 2012

Contact person: Javier Varas, *Deputy Director – Programs & Corporates*
+34 934 939 300
javier.varas@gtd.es

Company activities:

GTD is a **global technology company** committed with the Design, Integration and Operation of **high-value, complex, "mission-critical"** Applications and Systems all over the world. Excellence in securing performance, availability and robustness makes GTD the ideal choice for strategic projects.

The strengths of GTD are the **talent** of its engineers, their **skills** and **experience**, built on years of practitioning in state-of-the-art and cutting-edge projects. On this basis, GTD is bringing its customers and partners one step ahead of their competitors: **GTD is consistently building technology-based, competitive advantages for its customers and partners**.

GTD's culture is deeply rooted in:

- **Win-Win relationships** with its suppliers, employees, customers, partners; and also with our community;
- **Talent and knowledge fertilization** with active and dynamic skills acquisition, effective sharing of expertise and innovation promotion; and
- **Ethic Engineering**, meaning commitment to results over professional practitioning, thus delivering efficient yet sustainable solutions.

Also, a sustained commitment to quality, environment and security has consolidated GTD as a world-class reference in Spain:

- GTD has been the first Spanish engineering company to become ISO9001 certified, originally ISO9001:1994 and nowadays ISO9001:2000.
- In the defence field, GTD reference is the PECAL/AQAP 160 certificate and in the very demanding aeronautic domain, GTD is ISO9100:2003 certified.
- GTD is a recognized expert in RTA/DO178B/C, DO254 and IEC 61508 & 61511.
- GTD is CMMI(3) and is still working for improving up to higher levels.

Experience in GTD has grew up by means of continuous participation in large, demanding, cutting-edge projects. By the way, GTD has become a reference in fine engineering and wise application of the most demanding methodologies.

The main activity sectors of GTD are Space, Aeronautics, Defence & Security and Complex Utilities, including scientific laboratories, with a long tradition in several facilities including CELLS-ALBA, ILL, ESRF and CERN.

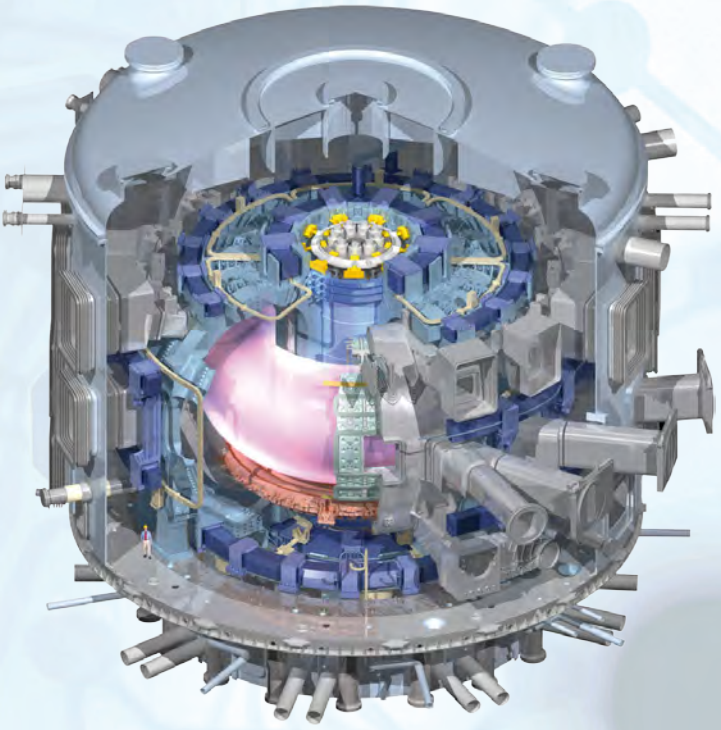
Fusion activities & ITER project interest:

In ITER Project, GTD is focusing efforts in "instrumentation and control activities", where the company contributes with the consolidated experience in particle accelerators and cross domain knowledge conveyed from Aerospace industry.

In connection with the framework focus in "Instrumentation and Control", GTD is specifically interested in: (1) the central control system (CODAC); (2) the complex operational diagnosis and its related big data analytics; and (3) the implementation of ITER control room.

Fusion main contracts awarded and R&D projects:

Framework contract for the provision of instrumentation and control integration services (F4E-OFC-361). These services will range from the implementation of the interface between industrial supplied systems and ITER CODAC (COntrol Data Access Communication), to the development of the complete control systems of a plant.



ITER Project

IBERDROLA INGENIERÍA Y CONSTRUCCIÓN, SAU

Address: Avenida de Manoteras, 20
28050 Madrid, SPAIN

Web: www.iberdrolaingenieria.com

Turnover: 723.87 M€ in year 2012

Contact person: Enrique Cayetano, *Department of Nuclear Proposals and Contract Management. Manager*
+34 917 132 021
ecrr@iberdrola.es

Company activities:

IBERDROLA Ingeniería y Construcción (IIC) was founded in 1995 and it is currently a world reference company in installations for electrical power generation, distribution and control and its offer of services include project management in all of its stages, engineering, supply, construction and commissioning, turnkey projects and operational support.
The Nuclear Division offers experience in full scope engineering for PWR (Westinghouse and KWU) and BWR (General Electric) plants and considerable expertise for other designs as VVER and CANDU reactors.
It renders a wide range of services to nuclear facilities, form conceptual and basic engineering, including systems definition and design, to operational support.
IEC's team provides nuclear experience and capabilities in the following areas:

- Mechanical and Structural Engineering
- Electrical and Instrumentation and Control Engineering
- Safety Engineering and Licensing
- Nuclear Fuel Engineering
- Radioactive Waste Management and Decommissioning
- On-Site Project Engineering
- NPP Support Services, including SAM training
- Supply of Equipment and Spare Parts

The Company works under the highest international standards such as ISO 9001, ISO 14001 and OHSAS 18001. Excellence in management was also recognized in 2010 with the 400+ EFQM Seal of European Excellence. IIC has managed a great number of international projects, including ITER, Fusion for Energy, EC (INSC, TACIS, PHARE) and EBRD funded and other international financed projects in more than 25 countries.

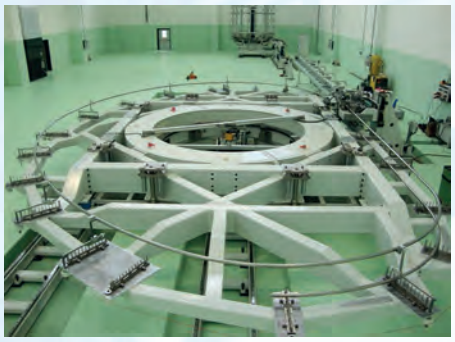
Fusion activities & ITER project interest:

GENERAL: Owner's Engineering, Mechanical, Electrical and I&C Engineering, Safety&License, Waste Treatment, Radiological Protection, Procurement and Construction, Maintenance, Services
FUSION: Design, Manufacturing, R&D, Assembly, Maintenance, Service, Control
ITER: Magnets, Vacuum Vessel, Remote Handling, Diagnostics, Buildings, CODAC, CIS, Power Supply, Cooling System, Vacuum Pumping, Auxiliary Systems

Fusion main contracts awarded and R&D projects:

1. ITER both Electrical and Mechanical/Components Engineering, Safety and License Engineering, Mechanical analysis for the Vacuum Vessel (several contracts)

2. Fabrication of a standard semi-prototype of the ITER NHF First Wall Panel: Both the small-scale mock-ups and the semi-prototype consist of a bi-metallic support structure made of CuCrZr bonded to a 316L (N) SS plate on which Beryllium tiles are joined.
3. Supply contract for Toroidal Field coil winding packs: manufacturing of 10 superconductor coils (9 + 1 spare). The project is split in three stages,
    - Stage 1: Qualification of processes, operators and tooling, supply of one SIDE prototype Double Pancake (each Winding Pack contains 7 Double Pancake) and several mock ups needed for processes and tooling qualification
    - Stage 2: Manufacture and delivery of the first TF Winding Pack
    - Stage 3: Manufacture and delivery of nine TF Winding Packs



Winding line of TF Coils

In the image, the vacuum chamber that will be used for the leak tightness test of the Double Pancakes (DP) and Winding Packs (WP) during the series production, and for the Paschen Test of the Winding Packs, where the integrity of the WP insulation will be demonstrated. (ASG workshop for the manufacturing of the TFC in La Spezia, Italy)

IDESA (INGENIERÍA Y DISEÑO EUROPEO, S.A.)

Address: C/Profesor Potter, 105
33203 Gijón (Asturias), SPAIN

Web: www.idesa.net

Turnover: 63 M€ in year 2012

Contact person: Iván Vázquez, *Business Development*
+34 985 175 705
ivan.vazquez@idesa.net

Company activities:

IDESA is a spanish company located in Asturias (Northern coast of Spain), created in 1993. The company has grown to become one of the most recognized companies in the design and fabrication of static and modular equipment worldwide. IDESA is well positioned in the Oil and Gas sector, and has also recently started to operate in the Offshore Wind Farms and Industrial Plants sectors. Our production is 95% for export.

Fusion activities & ITER project interest:

IDESA has capabilities with regard to Fusion activities in both engineering and fabrication fields, as can be found on the contracts listed below. We have mechanical design capabilities (including Finite Element Analysis) as well as drawing production (AutoCAD, SolidWorks). On the other hand, we can roll plates up to 180 mm, weld more than 200 mm in thickness (different materials: carbon, stainless, low alloy, cladded steels, exotic alloys) and fabricate equipment weighing more than 1000 ton.
IDESA is interested in collaborations with regard to Fusion covering all our capabilities as mentioned above.

Fusion main contracts awarded and R&D projects:

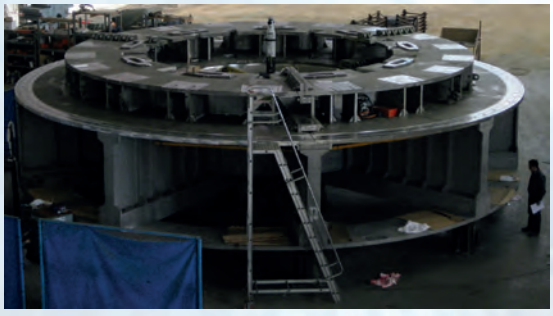
A) MANUFACTURING OF THE CRYOSTAT BASE FOR JT-60SA PROJECT

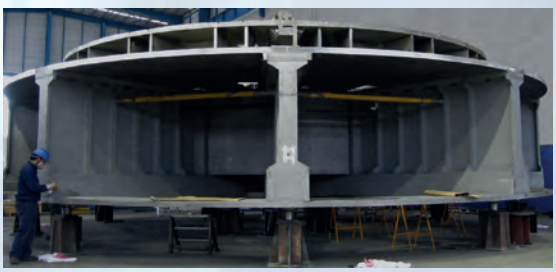
In the context of JT-60SA Project currently being developed in Naka (Japan), IDESA was awarded with the contract for the fabrication and shop assembly of the Cryostat Base. This structure, weighing around 300 ton and with a diameter of 12 meters, is an assembly comprising seven big stainless steel sectors, that are to be bolted together during final assembly in Japan. There are three “lower level” 120º sectors (the Lower Structure sectors), and three “upper level” 120º sectors (the Double Ring sectors) resting on the Lower Structure Sectors. The seventh piece is the Cylindrical Shell, located inside the DR sectors, and resting onto the LS sectors.This solution was adopted in view of the dimensional restrictions to the final land transport between Hitachi Port and final destination at Naka site.
The Lower Structure sectors are comprising three big beams each (thus, nine beams in total) which are resting on the beam ends via two support rings (inner and outer).
The Double Ring Sectors are made up of two big horizontal plates with a number of big formed gussets in between. They are staggered with respect to the LS sectors.
The Cylindrical Shell is a cylinder welded to a flat bottom, which rests directly onto LS beams, and will be welded at site to the DR inner edges.

The number of bolts used to bolt together the seven parts is around 600, in sizes up to M64. The thicknesses of the structure are mostly between 80 and 100 mm. Most of welds are butt or corner welds, full penetration type, so a great amount of weldment is involved. Thus, the control of the distorsion produced during welding activities was essential to fabricate a welded structure that at a later stage can be machined within the required tolerances.
The contract included a shop assembly of the seven sectors to validate the fabrication and the final dimensions of each of the sectors.
The material was delivered at Avilés Port (Spain) in November, 2012. After a two-months travel, it arrived at Hitachi Port in Japan by middle January, 2013. The final assembly at Naka site was completed by March 2013.

B) REVISION AND UPDATE OF SDC-IC CODE FOR ITER PROJECT

Several ITER components, referred to as In-vessel Components, are located inside the ITER Vacuum Vessel; they will be subjected to special operating and environmental conditions (neutron radiation, high heat fluxes, electromagnetic forces, etc.). The effects of irradiation on them, including embrittlement, swelling and creep, are not addressed in the existing commercial codes. These conditions are different from conditions in fission reactors and create challenging issues related to the design of these components. For this reason the Structural Design Criteria for ITER In-vessel Components (SDC-IC) was developed in 2001 for design purposes.
In 2008, some issues were identified with regard to the existing version of SDC-IC:
(1) Some parts had not been fully prepared to cover all needed areas for design
(2) Some important topics needed to be improved
(3) New editions of codes on pressure equipment had been published
(4) No manufacturing rules were included, so consistency between manufacturing rules to be used and design rules in SDC-IC needed to be demonstrated
(5) Compliance with the ESP (French Decree concerning the Pressure Equipment Directive 97/23/EC for non-nuclear pressure vessels) and ESPN (French Order applicable for pressure vessels intended for nuclear facilities) needed to be addressed
The Contract was awarded by Fusion For Energy (European Union´s Joint Undertaking for ITER) to the consortia between Idesa and Natec and the tasks covered are:
(a) Modification of design rules, incorporating rules from recently developed codes, and development of specific design rules to cover ITER specific issues and operational conditions
(b) Demonstration of consistency between design rules in SDC-IC and european standards used for manufacturing, in particular EN 13445; identifying areas where consistency is not provided
(c) Assessment of the compliance with the Essential Safety Requirements of the French Regulations (ESP and ESPN)





Cryostat Base

IDOM

Address: Av. Zarandoa, 23
48015 Bilbao (Vizcaya), SPAIN

Web: www.idom.com

Turnover: IDOM (GROUP) 300 M€ in year 2011

Contact person: Miguel Navarro Larrauri, *Director of Nuclear Services Area*
+34 944 797 600
nuclear@idom.com

Company activities:

Industry & Energy | Infrastructure | Architecture | Consultancy

Fusion activities & ITER project interest:

Idom have been working on the Cadarache site, alongside the engineers from Halcrow and Altran (i.e., ENERGHIA Consortium), in the role of "Support to the Owner" services to Fusion For Energy, the organization that represents Europe in the ITER project and that is responsible for the project management of civil works, installations and "housing" for the nuclear project.
Idom is working on the analysis of the overall performance of the Tokamak reactor and its coupling with the main structure of the building, studying protections against accidental dynamic loads of seismic and electromagnetic nature.
Idom is also participating in the development of the two European Test Blanket Module concepts, originally designed by CEA and KIT. The feasibility of different alternatives is also being studied, encompassing a global approach using advanced simulation tools (e.g., FEM, CFD, Monte Carlo). Idom is collaborating with Fusion for Energy in the study of the technical feasibility of new TBM (test blanket module) concepts in order to reduce their ferritic martensitic steel content, since recent studies have shown that a significant presence of ferromagnetic material within the vacuum vessel could hinder the fulfillment of certain plasma control objectives in ITER.
Concerning the control of the tritium leakage, Idom has conducted different simulations to analyze the temporal evolution of the concentration of the radioactive gas and optimize the detection system for each room, minimizing the detection time. The optimal strategy for air diffusion in these chambers has also been studied, as well as the strategy of air and gas extraction from each of the chambers.
In the field of Cryogenics, Idom is responsible for designing the main components of the cryopumps cryodistribution (e.g., cold valve boxes, warm regeneration system, control valves). To carry the current design to a procurement level, Idom is using advanced tools of FEM analysis and is also performing process analyses that are helping ITER Organization to confirm the design of this system.
For the first time, Idom has demonstrated the technical feasibility and developed specific software that allows the nuclear heating to be automatically extracted from MCNPX software and introduced into computational fluid dynamics software, ANSYS Fluent ®.
ITER INTERESTS: Vacuum Vessel; Blanket; Divertor; Vacuum Pumping and Fueling; Tritium Plant; Neutral Beam Heating System; Diagnostics; Buildings; Test Blanket Modules; Engineering Support; Quality Assurance and Project Management

Fusion main contracts awarded and R&D projects:

- **F4E-2009-OPE-024** (SB-PS) General Support to the Owner Contract. As member of the Energhia Consortium (i.e., Altran Technologies, Halcrow Group Ltd, Idom).
- **F4E-2009-OPE-074** Mechanical CAD support in the context of Vacuum Vessel Procurement.
- **F4E-2008-OPE-011** Support in the area of civil engineering analysis. Lot 1: Seismic analyses.
- **F4E-2008-OPE-011** Support in the area of civil engineering analysis. Lot 2: Effects of explosions and impacts.
- **F4E-2008-OPE-011** Support in the area of civil engineering analysis. Lot 3: Structural analysis of ITER Buildings.
- **F4E-GRT-288** Study of three design configurations for HCLL and HCPB TBM.
- **F4E-OMF-331** Engineering support in the area of TBM systems design and technological demonstration. Lot 1: Design of TBM sets, analyses and design validation. Design of TBM prototypical mock-ups. Assessment of TBS neutronics, shielding, dose rate, decay heat, hazards, ORE & waste.
- **F4E-2009-OPE-031** Framework Contract for Engineering Analysis in the area of Fluid dynamics Analysis. Lot 2: Fluid dynamics. Provision of Engineering Support to Develop Analysis in the Areas of Fluid Dynamics.
- **F4E-2011-OPE-289** Update and Completion of the Design of the Front-end Cryopumps Cryodistribution.

Test Blanket Module

IK4 - TEKNIKER

Address:	Polo Tecnológico de Eibar - Calle Iñaki Goenaga Nº5 20600 Eibar (Guipúzcoa), SPAIN
Web:	www.tekniker.es
Turnover:	22 M€ in year 2012
Contact person:	Josu Eguia Ibarzabal, *Head of the Industry of Science Division* +34 943 206 744 josu.eguia@tekniker.es

Company activities:

TEKNIKER is a technological centre and legally constituted as a private not-for-profit Foundation. Its mission is to help industry sector to increase its innovative capacity by means of generating and applying technology and knowledge to compete. The total income of the company is around 22 Million euros (updated as of end of 2012).
The activity is carried out by 260 highly trained and commited people, of which 12% hold a PhD degree people in its personnel, 50% show MsC, engineering or equivalent long-course degrees, being the rest technicians, short-course degree holders and trainees.
TEKNIKER likes to define itself as a Mechatronics, Manufacturing Technologies and Microtechnologies centre. In a commonly accepted terminology, TEKNIKER is a manufacturing or industrial production and design centre. It mainly specialises in

- Designing consumer and industrial products.
- Solving problems related to friction, wear and lubrication
- Incorporating information technologies and communications in the plant
- High precision, miniaturisation and micro/nanotechnologies.

To a project like ITER, and other scientific facilities likewise, TEKNIKER offers the following capabilities:

- Design and Manufacturing of advanced mechatronic products
- Advanced calculations and simulations
- Process knowledge on a wide range of manufacturing technologies: Chip removal processes (milling, turning, drilling, WEDM, penetration EDM, high speed machining, laser machining, ultrasonic assisted machining, micro-machining, ultraprecision process etc.), laser welding etc.
- Thin layer deposition by PVD, micro-nano engineering of layers, design, development and characterization of thin layers etc.

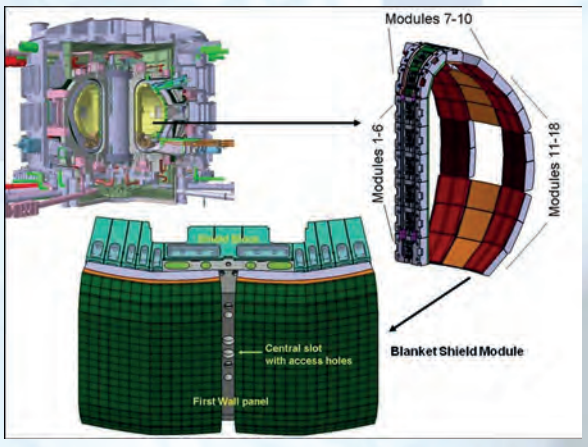
On a different, non manufacturing level, offered activities and technologies include: System regulation and control (machine tools, chemical plants, wind energy, actuators, converters), automation of processes and means, magnetic levitation, electronics (wireless communications, plug and play devices, power harvesting), information systems (data mining, health monitoring, diagnostics and prediction, semantics), cognitive systems (2D and 3D vision, image processing, positioning and navigation, human-machine interaction).
All this is offered as a complete solution to the customer: From the innovative idea to a high added value product , including the integration of heterogeneous technologies (optics, nanotechnologies, mechanics, materials) into a single solution in order to develop advanced solutions, up to the product design and industrial-scale production.

Fusion activities & ITER project interest:

Our main interest deals with the design development and procurement of vacuum test equipment for in vessel components. Current research and development activities and bids placed refer to large vessels for the Hot Helium Leak Tests of in vessel components and the similar tests of associated elements-.
On a different subject, TEKNIKER is strongly investing in adapting conventional manufacturing equipment for the manufacturing of beryllium tiles, necessary for the first wall panels and others. Faithful to its mission, TEKNIKER is transferring technology and process knowledge to allow companies to effectively and safely manufacture beryllium components.
Finally, TEKNIKER wishes to work in the design, manufacturing and assembly of complex in vessel systems with challenging restrictions and requirements.
Some of the industrial sectors where we offer solutions with results: Machine tool and equipment, renewable energies, scientific equipment, electronic products and ICTs, automotive, aerospace

Fusion main contracts awarded and R&D projects:

ITER BLANKETS CDTI (2010): Applied research project for the development of the "First Wall Panels" of the new nuclear fusion reactor ITER. Project led by MIB with the participation of CT INNOVA, TEKNIKER and others supported by a public funding provided by a competitive program of CDTI.



ITER First Wall Panels

INDRA SISTEMAS, S.A.

indra

Address: Avda. de Bruselas, 35
28108 Alcobendas (Madrid), SPAIN

Web: http://www.indracompany.com/

Turnover: 2,688 M€ in year 2011

Contact person: Fernando Sastre Beceiro, *Energy Control Systems Director*
+34 914 809 109
fsastre@indra.es

Company activities:

Indra is a global company, leader in high value-added solutions and services based on TECHNOLOGY, finding innovative solutions to the challenges that clients face as: Energy Control Systems, Air Traffic Management, Simulators, Automatic Tests Systems, Radar or Viewing Systems.

Fusion activities & ITER project interest:

Company's Skills applicable to Fusion sector:

- Energy Technologies: Control technologies (I&C, SCADA, Data Acquisition,…), Metering systems, Modelization & Monitoring applications, Technical consultancy
- Space Technologies: Digital signal processing, Radio frequency, IP protocols and multimedia, Real-time, critical and embedded SW & HW, big DB, ...
- Simulators (full scale and compact) & Automatic Test Facilities
- RADAR, RF & Microwave Design, RF Power Modules, SSPAs (Solid State Power Amplifiers, Amplifiers based on solid state technology -LDMOS-),...
- Cross-Sectors Technologies: HW / FW Design, Critical SW Design, Electrical, Mechanical & Test Engineering, Electro-Optics,...

Company's Interest Areas in Fusion Programmes:
The interest areas of Indra in the field of big international Fusion projects are: I&C, Control Systems (Plant Control, CODAC, etc.), Diagnostics, RF Heating Systems & Particle Accelerators, Remote Handling, Remote Participation in experiments and General IT Support (corporate and business processes).

Fusion main contracts awarded and R&D projects:

IO/CT/6-134 "Framework Contract for CODAC Operation Application Engineering Support":
Framework Contract for the development of CODAC operation applications, inside the CCS environment (CODAC Core). Contract for 5 years, awarded to 2 different consortia, Task Orders assigned under restricted competence. The scope of the services covered in the contract is broken down into three different lots:

- Lot 1. Software development services for supervisor, scheduler and remote participation.
- Lot 2. Software development services for PCS.
- Lot 3. Software development services for data handling (acquisition, archiving, access).

Involved technologies: Linux, C, C++, Python, ECLIPSE RCP, Web Services, XML, EPICS, MATLAB/SIMULINK, HDF-5,...

F4E-OFC-169 (PS-IC) “FRAMEWORK SERVICE CONTRACT FOR PROVISION OF SYSTEM AND INSTRUMENTATION ENGINEERING SUPPORT”:
Tender in 2010-2011. Under execution from September 2011. Duration 4 years. Is a Framework Contract for Engineering Support service to F4E in the field of Instrumentation and Control Systems engineering. Project team develops their activities at F4E premises in Barcelona (In-sourcing) or at Consortium offices (Out-sourcing).
On-going tasks are covering several work packages and plant systems with significant safety requirements: Remote Handling, Buildings, Magnets (e.g. PFC), Cryogenic Plant, Tritium Plant, Test Blankets, Diagnostics, PCS, Heating Systems (i.e. NB Test Facility, ECH, ICH).
These services include client support in their activities related to CODAC and I&C systems. Also covers maintaining a technical knowledge base to support F4E TROs and suppliers on CODAC technologies and standards, in special on CODAC Core System and Plant Control Design Handbook (ITER - PDCH).
CIEMAT Exp. 241.286: Manufacturing and supply of the RF Subsystem for IFMIF-EVEDA LIPAc Accelerator:
Includes Supply, Installation, and Support of:
16 RF Power Chains (i.e. 8 x 105kW & 8 x 200kW) at 175Mhz, including RF Coaxial Lines and Low Voltage Distribution and Control.
Integration and commissioning laboratory for the RF Amplifiers and Conditioning of the RF Couplers
RF System EPICS based Local Control and Cooling Control Systems. All the control systems are based in Simatic S7-300 series PLCs and the control SW is developed under EPICS.

IFMIF-EVEDA Laboratory

INGECIBER S.A.

Address: Avenida Monforte de Lemos 189
28035 Madrid, SPAIN

Web: www.ingeciber.com

Turnover: 1.76 M€ in year 2011

Contact person: Miguel Angel Moreno, *CEO*
+ 34 913 862 222
ma.moreno@ingeciber .com

Company activities:

Ingeciber is an engineering company founded in 1986 specialized in Finite Element Method (**FEM**) and **CAE simulation tools**. Provides Engineering Services, Software Development and Support and Training Services in civil, mechanical and CFD sectors.
Consultancy Engineering – we are involved in Nuclear Power Plants since 25 years ago. We have the knowledge and computing resources to develop any simulation analysis using ANSYS, Nastran, Marc, CivilFEM, CFX and CFD++ among others.
In Mechanic Engineering we develop structural, fatigue, thermal, electromagnetic, dynamics and CFD analyses. In Civil Engineering: structural – concrete and steel structures -, foundations, fluid – structure non linear interaction and seismic analyses.
Software Development and Support: Ingeciber developed CivilFEM 18 years ago a CAE software application for civil engineering. Later on came CivilFEM NPP to check and validate civil engineering aspects involved in a Nuclear Power Plant: containment and auxiliary buildings foundation, structural and roof seismic analyses among others. Most countries nuclear codes are built-in, ITER Structural Design Code too.
Ingeciber is **Certified as Qualified Suppplier** for the Nuclear Industry by major nuclear companies. To maintain this condition Ingeciber software development procedures are audited every two years by AREVA, Westinghouse and Bechtel.
Training: since 1994 Ingeciber administers with UNED University the "International Master's in Theoretical & Practical Application of Finite Element Method and CAE Simulation". A 2 year on-line Master with 2 branches - Mechanical and Construction.
R & D Projects: Since Ingeciber was founded it has searched new innovative fields for FEM and CAE Simulation before they become cost-effective such as CiviFEM NPP module of CivilFEM or integrating ITER Structural Design Code into CivlFEM.

Fusion activities & ITER project interest:

FUSION CAPACITIES: Analyisis, checking and validation using Finite Element Method and CAE Simulation tools of Mechanical and Construction components involved in ITER Project: Structural, Thermal, Dynamic, Non Linear, Electromagnetic and CFD anlysis
ITER INTEREST: Engineering Services such as: Finite Element Analysis and Consultancy, Software Developer, provide Training Courses, and Software and Technical Support provider.

Fusion main contracts awarded and R&D projects:

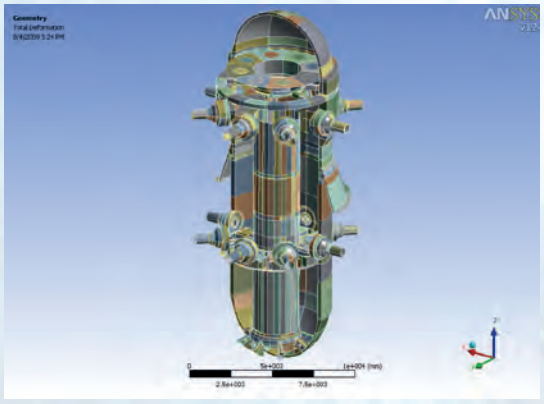
AWARDED CONTRACTS:

1. **F4E - OMF – 356** Framework service Contract for the "**Provision of Engineering Support in the field of Mechanical analysis for the Vacuum Vessel**". Awarded (IO Portal) October 2012.

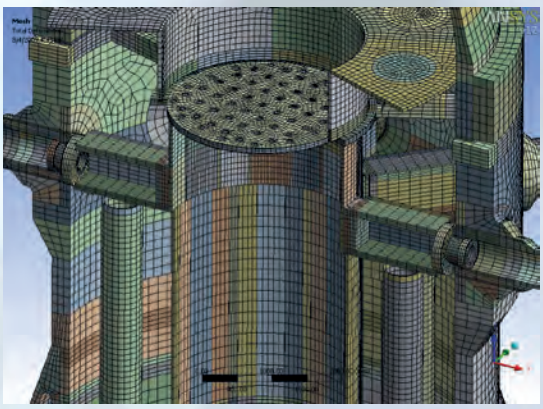
2. "**Modeling and Design Features for the Seismic Analysis of the IRIS Vessel, Core Barrel and Internals**". ENSA, 2010. The main result of the non-linear dynamic analysis was the evaluation of the effects of including the isolator device on the seismic response of the reactor in addition to its compliance to applicable standards.
3. "**Design and Checking of Structural Elements of Buildings of the Nuclear Plant Type AP 1000**". Westinghouse, 2011. Ingeciber did the structural analysis, checking & validation with ACI 349 and AISC NF 690, with ANSYS and CivilFEM NPP - Nuclear Power Plant module.

R & D PROJECTS:

1. "**Development of CivilFEM NPP - Nuclear Power Plant - Module**": checking design according to NPP Codes, Quality Assurance (NRC 10 CFR Part 21 and 50), analysis of concrete facilities, generator pedestals, pipe support systems, containment buildings, pressure vessels, seismic, thermal creep, soil structure interaction, swelling materials, pressure capacity limits. CivilFEM NPP was developed in 2005 and it is updated every year.
2. "**Integration of ITER Structural Design Code in CivilFEM**". The structural design criteria for ITER contains specific rules for the structural design. Ingeciber built this Code into CivilFEM to address all ITER project aspects. It was developed in 2005 and it is updated every year.
3. "**Development of a software application to perform seismic analysis of supporting system for electric cable trays and HVAC conduits in Nuclear Power Plants**". The software used was Ansys and CivilFEM. Client: General Directorate of Innovation and Competitiveness, Ministry of Economy of Spain. Project spanning over three years starting in 2008.



Geometry of New Reactor NPP



Mesh of New Reactor NPP

JEMA ENERGY S.A.

Address: Paseo del Circuito 10
20160 Lasarte-Oria (Guipúzcoa) SPAIN

Web: www.jemaenergy.com

Turnover: 19.54 M€ in year 2012

Contact person: Ibon Cerro, *Technical Area Manager*
+34 943 376 400
i.cerro@jema.es

Company activities:

Since 60 years, Jema designs and manufactures Static Power Converters for different sectors, such as Power Plants, Oil & Gas, Plasma Physics, Particle Accelerators, Magnetic Resonance Imaginary (MRI), Railways and Renewable Energy. We are customer orientated, developing bespoke systems and solutions which meet specific requirements of each project. These are innovative solutions with high technological content. The company is part of Irizar Group (3500 employees and yearly turnover of 500 M€).

Fusion activities & ITER project interest:

Jema can supply a range of Power Supplies for the different magnet coils and heating systems used in a nuclear fusion installation.
Over 20 years, JEMA Energy has developed several custom power supplies for most of the Experimental Fusion Reactors in Europe (MAST, JET, W7X, TJ-II, TCV, etc). As ITER is the next step in Fusion Reactors, JEMA is interested in continuing its commitment with the Fusion Community. Especially in Power Supplies for the different magnet coils and heating systems used in a nuclear fusion installation.

Fusion main contracts awarded and R&D projects:

CEA – JT60-SA (Japan), under development. Supply of superconducting magnets power supplies (SCMPS) for JT60SA project. For Japan, the contract includes the design, manufacturing, transportation, installation and commissioning of the toroidal field coils' power supplies (TF PS) and of four equilibrium field coil power supplies (EF2, EF3, EF4 and EF5 PS).
ENEA – JT60-SA (Japan), under development. Supply of 6 poloidal field and 2 fast plasma positioning power supplies for JT60-SA.
CCFE – MAST upgrade (UK), under development. Toroidal Field Power Supplies, 340Vdc, 133kA. These systems will be delivered for a major project to upgrade CCFE Mega Amp Spherical Tokamak (MAST) fusion research facility at the Culham Science Centre. The MAST experiment uses a Toroidal Field (TF) Coil to produce the main toroidal magnetic field for magnetic confinement of the plasma.
CCFE – MAST upgrade (UK), under development. Divertor Field Power Conversion Units, 700Vdc, 4 to 10 kA. These systems will be delivered for a major project to upgrade CCFE Mega Amp Spherical Tokamak (MAST) fusion research facility at the Culham Science Centre. MAST has an array of Poloidal Coils arranged to control the position, shape and stability of the plasma.

UKAEA – MAST upgrade (UK), 2010. NBI High Voltage Power Supplies for MAST project, 80kVdc/70A, 10s On/590s Off, Vout rise time 200 to 500usec, switch off time < 7us, 500 reapplications/pulse max., insulation test 160kVdc / 110kVac, controlled at the low voltage side, natural cooling, allocated into shelters and commissioning included.
EFDA – JET (UK), 2009. ERFA (Enhanced Radial Field Amplifier): 4 x Seriable Power Supplies ±12kVdc/±5kA 60MVA. The positioning of the plasma in the JET nuclear fusion reactor, it included installation and commissioning.
CIEMAT – TJ-II (Spain), 2007. HVPPS for Electron-Cyclotron Resonant Heating (ECRH) gyrotron 80kVdc/50A.
EFDA – JET (UK), 2009 and 2003. 6 x HVPPS for Neutral Beam Enhancement (NBE) 130kVdc/130A and LTT crowbars.
CIEMAT – TJ-II Stellerator in Madrid (Spain), 2000, 1994 and 1991.
IPP – Stellerator W-7x Max Planck Institute (Germany), 2002.
CRPP – Research Centre for Plasma Physics (Switzerland), 2005 and 1996.

HV Solid State Klystron Modulator: 85kV, 160A, 14 MW peak, 1.5ms pulse, 60Hz repetition rate. ESS Bilbao (Spain) and SNS Oak Ridge National Laboratory (USA). © JEMA

Engineers at testing facilities, R & D area, JEMA Energy company. © JEMA

Deutsches Elektronen-Synchrotron Laboratory, Hamburg, Germany. ©DESY

LEADING ENTERPRISES GROUP

Address:	Barrio la Agüera, s/n 39409 San Felices de Buelna (Cantabria), SPAIN
Web:	www.leadingenterprises.es
Turnover:	35 M€ in year 2012
Contact person:	Marcos Pérez, *Technical & Business Development Director* +34 942 814 052 mperez@leadingenterprises.es

Company activities:

Leading Enterprises Group started its industrial activity in 1971. During these 30 years the Company has established itself as a Reference European level Group, providing added value in all its products, and investing in technological renovation, R&D and quality as differentiation factors. Leading Enterprises Group is organized with various powerful divisions; all equipped with the latest production tools and invested during many years in diversifying its services offer, from research & development of high-technological systems to large series production parts.The services include the elaboration of high technological products through different possible metallic processes (forged, casting, and machining) with different characteristics, being all the formerly mentioned complemented with the engineering capabilities and the global outsourcing services offering a complete Management, Execution, and Control of the outsourced production process and always bearing in mind our commitment regarding the quality of our products.

CT INNOVA (www.ct-innova.com) - **R&D Nuclear Engineering**
Research and development. Product design and development. Design and development of machines. Design, optimization and implementation of manufacturing processes. R&D&I Management. Certifications: ISO 9001, EN 9100.

MIB (www.mecanicabuelna.com) - **Advanced Machinning**
Machinning. Unitary production: Prototypes, tooling, spare parts, special parts (small batches). Rail, nuclear, pumps and valves. Serial Production: Large batch of parts. Sectors: Aeronautics, Industrial Vehicles, Automotive, Elevators. Materials: normal and special steels, stainless steel, aluminum, brass, Inconel, Cobalt, Titanium. Diversification of Materials: Casting, Forging, Bar, Tube. Certifications: ISO 9001, ISO 14001 and EN 9100.

TMT (www.modelosytroquel.com) - **Tooling**
Design and construction of models, core boxes and tooling for various casting processes. Repair and maintenance of core boxes. Construction of prototypes using rapid-manufacturing technologies. Construction of containers, manifolds, differential boxes, benches. Certifications: ISO 9001, ISO 14001.

TAF (www.tafsl.com) - **Services for Casting Industries**
Services for casting industries. Automated deburring advanced Systems. Automatic lines for painting and finishing.TAF has the capacity to develop turnkey projects, manufacturing models from the casting and integrating the machining to deliver the customer a completely finished product. Certifications: ISO 9001.

EPS (www.epsltd-uk.com) - **Oil & Gas Engineering**
Development, engineering and advanced manufacturing of Oil & Gas systems. Topside metering. Steam metering. Subsea metering. Certifications: ISO 9001.

LEADING INTEGRA (www.l-integra.com) - **LI Supply Chain Management**
Integral management of industrial supply process. Possibility to integrate our own products with other products that can be delivered anywhere in the world. Management y commercial networking.Trading.. Onsite Industrial Maintenance. Logistics Services thanks to our own fleet. Warehouse Management. Certifications ISO 9001

Fusion activities & ITER project interest:

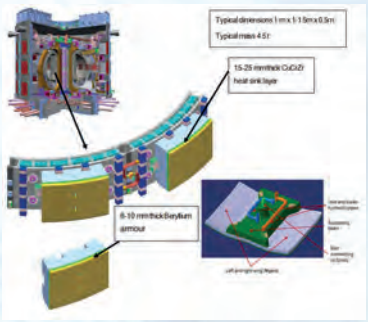
Test Blanket module: TBM fabrication qualification, Engineering support and analysis for PE (TBM). Engineering Framework Contract for the finalisation of TBS conceptual design &techno demonstration, Development of TBM fabrication technologies &mock-ups
Tritium Plant
Divertor: Pre-production qualification (supply of 3 prototypes), Manufacturing of full scale prototype
First Wall: Manufacture of a full scale prototype, Remote Handling (info day foseen for March or April), Engineering Support Framework contractA

Fusion main contracts awarded and R&D projects:

Awarded by F4E:
- F4E-2008-0PE-17 (ES-AC) Engineering Support in the area of Plant Systems (Lot 2) and with the
- F4E-OPE-394 (IV-PT) Fabrication of a standard semi-prototype of the ITER Normal Heat Flux (NHF) First Wall (FW) panels: http://fusionforenergy.europa.eu/mediacorner/newsview.aspx?content=660

Pending of evaluation y F4E:
- F4E-OMF-0444 - Manufacturing of the ITER Divertor Cassette Bodies
- F4E-OMF-0457 - MECHANICAL ANALYSES OF ITER COMPONENTS

R&D Projects:
- R & D project “ITER Blankets” (IDC-20101156) within the CDTI call “Industry of the Science” for the development of advanced technologies for the design of the preliminary FWP concepts.



Conceptual view of the First Wall Panels

NUMERICAL ANALYSIS TECHNOLOGIES S.L. (NATEC)

Address: Marqués de San Esteban 52, Entlo D
33207 Gijón (Asturias), SPAIN

Web: www.natec-ingenieros.com

Turnover: 705 K€ in year 2012

Contact person: Javier Ordieres, *Organization Manager*
+34 984 199 692
javiord@natec-ingenieros.com

Company activities:

Engineering assesment and numerical simulation of nuclear and non nuclear components. Fracture Mechanics, Mechanical , Thermal and Electromagnetic fields. Manufacturing specifications of nuclear equipment.

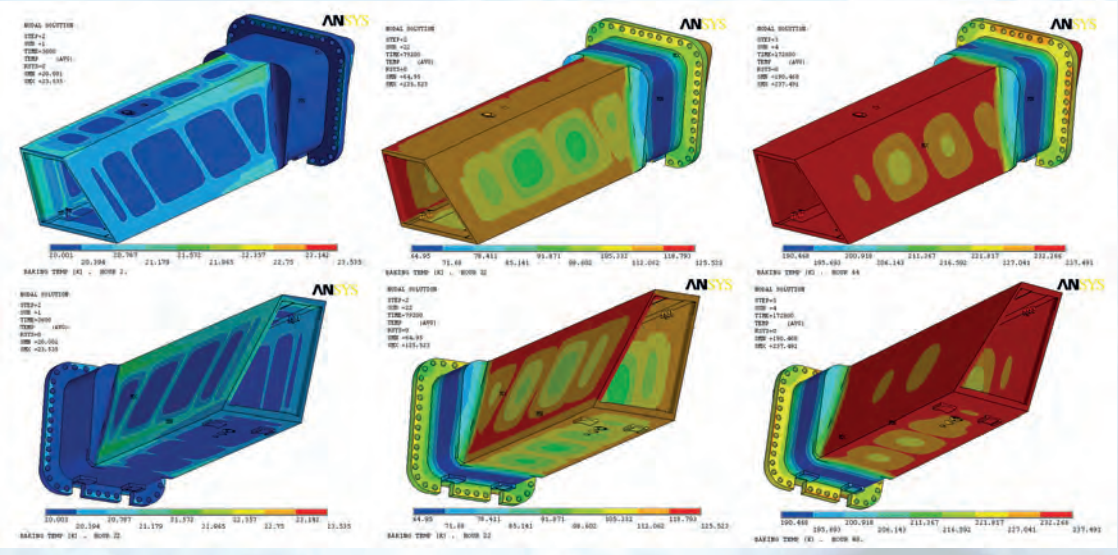
Fusion activities & ITER project interest:

NATEC is an engineering company specialized in advanced analysis: nonlinear and coupled analysis in the mechanical, thermal and electromagnetic fields. Main capabilities demonstrated in projects carried out in the framework of ITER are:
Structural integrity assessment according to nuclear codes (RCC-MR, ASME and SDC-IC) of VV components, Port Plugs and In-Vessel components.
Mechanical design, engineering and manufacturing analysis of ITER Equatorial and Upper Prot Plugs.
Welding process simulation to predict distortions during the manufacturing of the ITER components:, Diagnostic Port Plugs, Toroidal Field Coil Cases and Vacuum Vessel.

Fusion main contracts awarded and R&D projects:

1. ITER/CT/10/4300000295: PROVISION OF MECHANICAL, THERMO-HYDRAULIC AND LECTRO- MAGNETIC ANALYSIS OF ITER DIAGNOSTICS COMPONENTS. The analysis performed included TH, EM, Structural, Seismic and Modal, leading to a Transient Dynamic analysis under EM loads from a Plasma Disruption event, and structural integrity assessment.
2. ITER/CT/12/4300000598: ENGINEERING SUPPORT FOR MECHANICAL, THERMO-HYDRAULIC AND ELECTRO- MAGNETIC ANALYSIS OF ITER DIAGNOSTICS COMPONENTS. Thermo-hydraulic and electromagnetic analysis of ITER diagnostics components.
3. ITER/4300000793: STRUCTURAL ASSESSMENT OF ITER DIAGNOSTICS COMPONENTS
4. ITER/4300000850: DIAGNOSTICS ENGINEERING WITH EMPHASIS ON BOLOMETER AND VISIBLE INFRA-RED
5. PROCUREMENT FRAMEWORK CONTRACT F4E-OMF-356: PROVISION OF ENGINEERING SUPPORT IN THE AREA OF MECHANICAL ANALYSIS FOR THE VACUUM VESSEL (ESMAVV).
6. PROCUREMENT FRAMEWORK CONTRACT F4E-2008-OPE-07(ES-AC): PROVISSION OF ENGINEERING SUPPORT IN THE AREA OF MECHANICAL ANALYSIS. LOTE 1: VACUUM VESSEL ANALYSIS. Mechanical, structural, thermo-mechanical and coupled analysis oriented to code assessment.
7. PROCUREMENT F4E-2008-OPE-297 (ES-AC): TOROIDAL FIELD COIL CASE WELDING SIMULATION. This work was intended to simulate numerically the deformations/distortions induced in the TF coil structure by the closure welding procedure.

8. PROCUREMENT F4E-2009-OPE-033 (ES-AC): REVISION OF THE STRUCTURAL DESIGN CRITERIA FOR IN-VESSEL COMPONENTS (SDC-IC). The Structural Design Criteria for In-Vessels Components (SDC-IC) was reviewed in order to incorporate the modifications included in the last versions of nuclear pressure equipment codes as ASME, RCC-MX and RCC-MR.
9. PROCUREMENT FRAMEWORK CONTRACT F4E-2008-OPE-06(ES-AC): PROVISSION OF ENGINEERING SUPPORT IN THE AREA OF ELECTROMAGNETIC ANALYSIS. LOT 1 : ELECTROMECHANICAL ANALYSIS OF ITER COMPONENTS
10. GRANT F4E-2008-GRT-024 (PMS-DG): DETAILED DESIGN OF A REPRESENTATIVE EQUATORIAL PORT PLUG.
11. PROCUREMENT FRAMEWORK CONTRACT F4E-2008-OPE-017 (ES-AC): FRAMEWORK SERVICE CONTRACT FOR ENGINEERING SUPPORT TO F4E.



Transient thermo - hydraulic analysis of ITER Generic Upper Port Plug during Baking. Temperature plots at different stages

PROCON SYSTEMS, S.A.

Address: Arquímedes 26
08918 Badalona (Barcelona), SPAIN

Web: www.proconsystems.net

Turnover: 6.6 M€ in year 2012

Contact person: Daniel Marchante, *Sales Manager*
+34 934 609 940
marchante@proconsystems.net

Company activities:

PROCON SYSTEMS is an industrial engineering company specialized in process automation, instrumentation and control. We are in the market since 1995 and our headquarters are located in Badalona (Spain).
The team of PROCON SYSTEMS is formed by a group of young engineers and technicians with a wide expertise and experience. The staff of about 40 employees is composed by an 80% of engineers and technicians. PROCON SYSTEMS has adapted its organization to the growth achieved due to the continuous confidence of our customers during the last years.
Our project teams are based on qualified professionals with expertise in various technologies, and are responsible for the total integration of the project.
Thanks to the confidence of our customers, PROCON SYSTEMS has consolidated as one of the leading companies in the market, developing its activities both in the domestic and international market. (80% export sales).
PROCON SYSTEMS is a very dynamic company, oriented to the quick utilization of the last available technologies in the market. The projects developed by the company include a wide range of services for the industry.
The main business areas are the automotive and the big scientific facilities, including CERN, EFDA, ITER , CELLS-ALBA,..

Fusion activities & ITER project interest:

As a control engineering company, PROCON SYSTEMS is interested in projects where the following fields of expertise are required:

- I&C Hardware Engineering
- I&C Software Engineering
- I&C Cubicle Fabrication
- I&C Electrical installation and Commissioning

Fusion main contracts awarded and R&D projects:

1. CONTROL SYSTEM FOR THE PROTOTYPE CASSETTE MULTIFUNCTIONAL MOVER (CMM), SECOND CASSETTE END EFFECTOR (SCEE) AND CASSETTE TOROIDAL MOVER (CTM) FOR EFDA (2006-2007).
   The subject of the project was the detailed design, construction and certification of the electrical & electronics hardware part of the Cassette Multifunctional Mover (CMM) Control System plus the supply of the Cassette Toroidal Mover (CTM) Control System Extension, which are used to operate equipment in the DTP2 facility in Tampere / Finland.

2. PROTOTYPING INTERLOCK CONTROL SYSTEM FOR ITER (2010-2012).
   The purpose of the contract was to design and implement Interlock Control Systems (ICS) prototypes, to design and implement an ICS Test-Platform and to perform the assessment of the ICS Prototypes to validate standard components and architectures to be included in the future releases of the Plant Control Design Handbook (PCDH).
3. INTERNAL CONFIGURATION GUIDELINES FOR I&C CUBICLES AND SUPPLY SMALL BATCH OF I&C CUBICLES (2010-2012).
   The scope of services included in PROCON SYSTEMS project included two main milestones:
   a) Define internal mechanical and cabling configuration guidelines to be used for all I&C cubicles oh the ITER plant. At the last stage, this document is a part of the satellite documents of PCDH.
   b) As example of the result of the guideline done, a small batch of I&C cubicles had been supplied to several DA.

   All these services had been done according to PCDH (Plant Control Design handbook) and they help to illustrate the ITER standards and support the plant system I&C prototyping activities.

I&C Cabinets

SENER, INGENIERÍA Y SISTEMAS, S.A.

Address: Avda. Zugazarte, 56,
48930 Las Arenas (Vizcaya), SPAIN

Web: www.sener.es

Turnover: 512 M€ in year 2012

Contact person: Mª Rosa Sacristán Díaz, *Manager Nuclear Projects*
+34 616 235 888
mrosa.sacristan@sener.es

Company activities:

- SENER Ingenieria y Sistemas, S.A. is an Engineering and Construction company backed by more than 50 years experience. Innovation, commitment to quality and independence are our corporate values. International leader in Civil Engineering and Architecture, Aerospace Engineering, Aeronautics and Vehicles, Actuator and Control Systems, Power and Processes and Marine Engineering.
- SENER carries out projects from design to construction of complete facilities regarding all technical disciplines: Process, Mechanical, Piping, Civil and Structures, Instrumentation & Control, HVAC Systems, Fire detection/protection.

Fusion activities & ITER project interest:

Due to the multidisciplinarity of the company, SENER can provide services for all the ITER components in the Tokamak (magnets, vacuum vessel, blanket system, divertor, diagnostics, external heating, cryostat) and for the External Systems (vacuum systems, cryogenics, remote handling, power supply, fuel cycle, hot cell, cooling water, tritium breeding) as well as for the buildings packages.

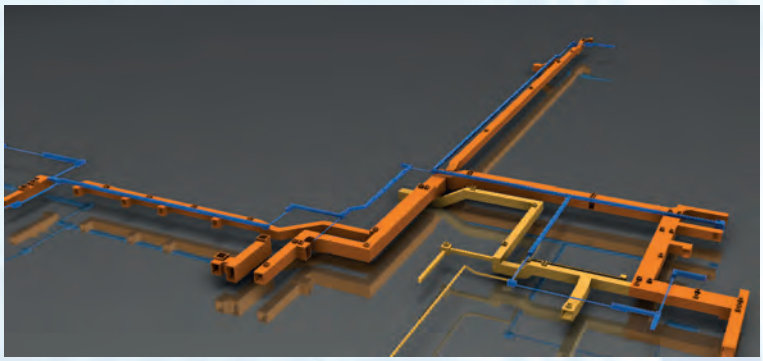
- Possible Project scopes: Conceptual, basic and detail Design and Procurement and Construction.
- SENER is a member of some technological platforms and associations relevant to the nuclear sector as INEUSTAR, INDUCIENCIA, SNE, Foro Nuclear and FORATOM.

Fusion main contracts awarded and R&D projects:

TJ-II facility studies: Preliminary estimation of the cost of the TJ-II fusion machine and facility for CIEMAT.
ITER Project: Robotics, Electrical engineering, Design of mechanical equipment for handling, lifting, maintaining, Civil, HVAC, Site validation studies, Cost studies, Several studies for DEMO alternatives as IBERTEF in the European Consortium EFET. For EURATOM-CIEMAT early studies which led to the preselection of the Vandellós site, Vandellós site validation studies, design of a special crane for the ITER NBI system, analysis for conceptual variants for the DEMO, etc.
In 2012-2013, Multiscale Finite Element analysis (FEM) for the Pre-compression Rings, directly for ITER: approach employing various scales of ABAQUS FEM models and other analysis tools to calculate the response and performance of the rings over the design life of the structure. Contract extension approved in July 2013 including update of the multiscale analysis and calculations (new fibre orientations associated with fibre placement manufacturing and geometrical data for the TF flange and new load case data from ITER) and test specifications.

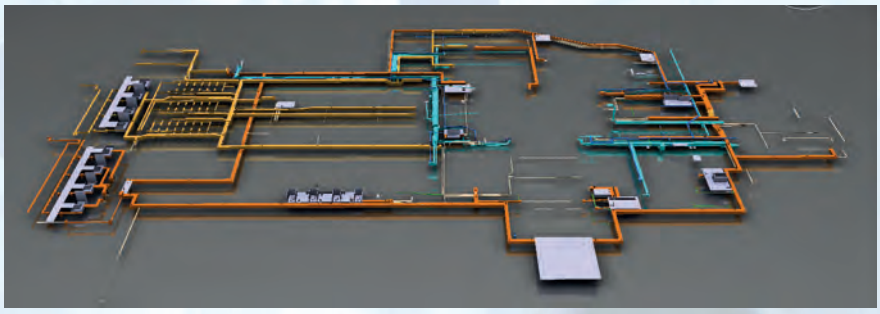
From 2013 to 2014, as COMSA subcontractors for TB08: Definition design, Construction design, Execution design for Industrial Water Drainage, Sanitary drainage and Construction design and Execution design based on Tender Design documentation for Outdoor lighting, Precipitation drainage, Roads, parking and laydown areas, Special Foundations, Services Trenches, , Integrated plant earthing grid and Fencing and gates. As options of the contract, Potable Water buried network, Fire Water buried network, Hot Water buried network, Cooling Water buried networks, Trenches and galleries lighting. Also as COMSA subcontractor, Drawings for TB-Alpha execution design including galleries formwork and reinforcements, galleries earthing grid and bridges foundations formworks and reinforcements.

Fuskite: R&D project (CDTI) consisting on a Permeator Against Vacuum Prototype to recover efficiently tritium, for fusion reactors self-sufficiency. Pre-conceptual design carried out by CIEMAT. SENER is responsible for the turnkey project including Conceptual and detailed design (Process, Structural, Mechanical, Instrumentation and Control and Electricity), Manufacturing, assembly and commissioning of the demonstrator (2011-ongoing). Awarded as best lecture in fusion category in the 38th Annual Meeting of the SNE.

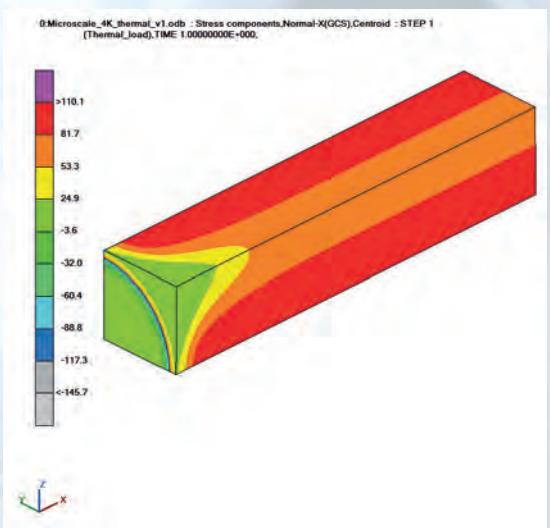


TB08 3D design view 1

TB08 3D design view 2



Fuskite assembly process



Micro scale FEM thermal stresses (4K)

SGENIA

Address: C/ Chile, nº 4, Edificio II, 2ª planta
28230 Las Rozas (Madrid), SPAIN

Web: www.sgenia.com

Turnover: 3.6 M€ in year 2012

Contact person: Ms. Gil, *Technology Responsible*
+34 916 306 388
igil@sgenia.com

Company activities:

Sgenia is an engineering company which provides turn-key projects (both: development of new products and processes improvement) in, mainly, two sectors: industry (automotive, aeronautics, railway, electric vehicle and telecommunication) and energy (fusion, solar energy, wind power).
Sgenia designs, integrates, supplies, installs and keeps the maintenance of advanced Industrial Control and Automation systems to be implemented in industrial processes.
As electronic systems developers, Sgenia designs, develops and integrates power and control electronics systems for the railway industry, aeronautics and electric vehicle fields.
Regarding aeronautics sector, Sgenia provides not only mechanical engineering, but also manufacturing of different machinery and its associated control electronics.

Fusion activities & ITER project interest:

- Sgenia, as an engineering company, can develop electro-mechanical, thermo-mechanical and electro-magnetic design, modeling and simulation, we can carry out Finite Element Analysis (FEA) and Computational Fluids Dynamics (CFD) simulations.
- But, apart from engineering activities, Sgenia is specialised in automation and advanced control system (Remote-Handling field), State-of-the-art sensor systems (Diagnostics field), power electronics systems and industrial&intrumentation equipment (Instrumentation&Control field).

Fusion main contracts awarded and R&D projects:

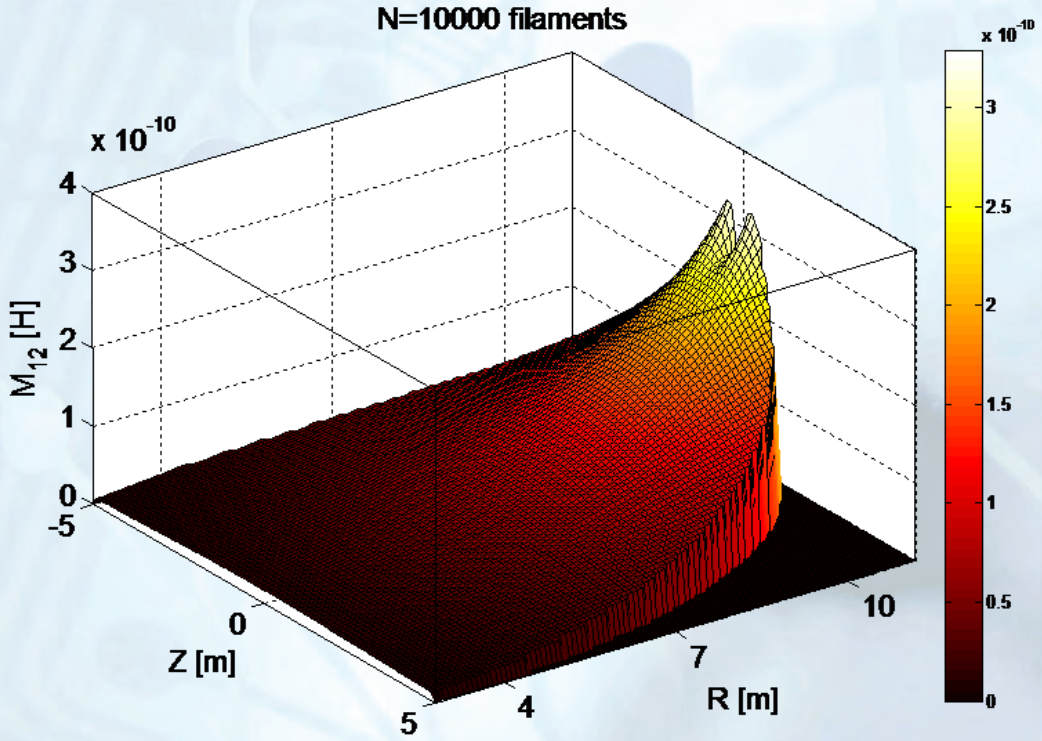
R&D project: A plasma tomographic reconstruction system based on a new superconductor and accurate sensor system together with a Bayesian algorithms development.
Contracts Awarded:
The consortium comprised of IPP (Institut für PlasmaPhysik) and Sgenia has been selected for the award of the tender **F4E-FPA-364 (DG): Diagnostic Development and Design: Pressure Gauges**.
Sgenia will be responsible of the following technical tasks:

- Conversion of CAD models of Diagnostic Pressure Gauges (DPG) from CATIA to a format suitable for ANSYS calculations.
- Mechanical, thermal, fluid and electromagnetic engineering analysis using static and dynamic FEA to applicable codes and standards of the DPGs.
- The analysis will incorporate neutron and gamma radiation loads as given by IPP or other third party.
- Exact boundary conditions for the calculations will be defined in the Kick-Off meeting for the FPA and within subsequent Specific Contracts.

- Optimization of ion gauge performance through simulations of electron and ion transport in the gauge head immersed in strong magnetic field including the interaction with neutral gas.

KIT jointly with the other members of the TBM-CA consortium and NRG have been awarded the three Actions of the tender **F4E-FPA-380. Regarding Action 2: Test Blanket System Instrumentation Development**, Sgenia, as a third party of Ciemat (Spain) will be in charge of feasibility studies for prototype development of EM sensors including.

ITER awarded the tender **IO/CFN/12/7-0038/JTR CODAC engineering** to the Consortium set up by Indra, Ciemat and UPM and SGENIA, where SGENIA, as a partner, will assist the CODAC (Control, Data Access and Communication system responsible for operating the ITER device) section and its contractors in developing the CODAC Operation Applications by providing assistance for the development, maintenance and user support of the CODAC Core System.



Mutual inductances between filaments representing the plasma current and the superconductor and accurate sensor proposed to measure of magnetic field

TECNALIA

tecnalia Inspiring Business

Address: Parque Tecnológico de San Sebastián. Mikeletegui Paselekua San Sebastián, SPAIN

Web: www.tecnalia.com

Turnover: 110 M€ in year 2012

Contact person: Iñaki Inzunza, *Industry of Science Programme Director*
+34 902 760 002
inaki.inzunza@tecnalia.com

Company activities:

Tecnalia generates and develops business opportunities through applied research. The keys turning the vision of Tecnalia into reality are marked by the following:

- Its private nature.
- The focusing of its activity on Applied Research.
- The fact that it is a Centre of international excellence (international R+D contracts, foreign researchers, and international accompaniment of local industries, licences, IP, etc.).
- The impact it has on local industry (R+D and Innovation projects with companies, spin offs, training, E+C services).
- Its openness; and the fact that it has become a Centre that attracts people who want to develop their creativity, and organizations (networks) keen to interact and co-generate knowledge with Tecnalia

Fusion activities & ITER project interest:

FUSION ACTIVITIES:
The aim of TECNALIA in the FUSION related activities, is to offer solutions and services to different sectorial players in order to provide technological and applied research, collaborating on specifications for equipment, systems and installations. By providing special services, being a necessary partner to enable the creation of installations and instruments to develop basic science programs.
ITER PROJECT INTEREST:

- R & D solutions and Technological Services to enable the creation of installations and instruments to develop basic science programs, in the following areas:
  - Construction & Environment.
  - Energy efficiency.
  - Advanced materials and processes.
  - CODAC (Control, Data Adquisition & Communication), and RH (Remote Handling).
  - Testing & Certification.
- Design support.
- Consultancy support.

Fusion main contracts awarded and R&D projects:

- F4E-2008-OPE-017-02-01 (ES-AC) Lot 2 – Engineering Support in the area of Plant Systems.
- CDTI project. R&D Activities for ITER Blankets.(2010)
- F4E-OFC-167 (ES-MF) Material characterization at room at elevated temperatures
- F4E-FPA-380 “Activities of Support of the Conceptual and Preliminary Design of the European
- Test Blanket Systems”

- F4E-OPE-394 Fabrication of a standard semi-prototype of the ITER NHF First Wall (FW) Panels.

TECNALIA activities are mainly focused on:

- Metal materials characterization (steels, stainless steels, copper alloys, aluminium alloys, titanium base alloys, nickel base alloys, Tungsten, vanadium alloys), Composites (glass/resin composites, carbon fibre composites), Super conducting strands (Nb3Sn, copper, NbTi) and Joints (welding, brazing..). Mechanical tests, physical properties measurements and microstructural analysis.
- Collaborates in the development of instruments for equipment, as part of the activities to support the conceptual and preliminary design of the European test blanket systems [covers experimental activities, instrumentation development, qualification of functional materials, etc].
- Develops thermal treatments and welding technologies for ½ scale prototype.

F4E-OFC-167 Kick off meeting

TECNATOM, S.A.

Address: Avenida Montes de Oca, 1
28703 San Sebastián de los Reyes (Madrid), SPAIN

Web: www.tecnatom.es

Turnover: 115.12 M€ in year 2012

Contact person: Helena Eugercios, *Business Development*
+34 916 598 898
heugercios@tecnatom.es

Company activities:

The limited company TECNATOM is a private engineering firm that has provided services in the nuclear sector since it was set up in 1957. The company is currently owned by the Spanish electricity utilities with assets in the country's nuclear power plants.

Business objective

The company's most significant activities are: Training Centres; Simulation and Simulators; Inspection and Operations Engineering; Inspection and Testing Services; Equipment Design and Development; Spares Managements; Radiological Protection; Laboratories; Safety Management; Advanced Reactors (Research and Fusion).

TECNATOM carries out projects in over 30 countries, both in Spain and in the United States, Japan, France, Sweden, Finland, South Korea, Taiwan, China, Brazil, Argentina, Mexico, Russia, Ukraine, Eastern European countries, etc., its working methods having been validated by different clients and regulatory authorities at international level.

Fusion activities & ITER project interest:

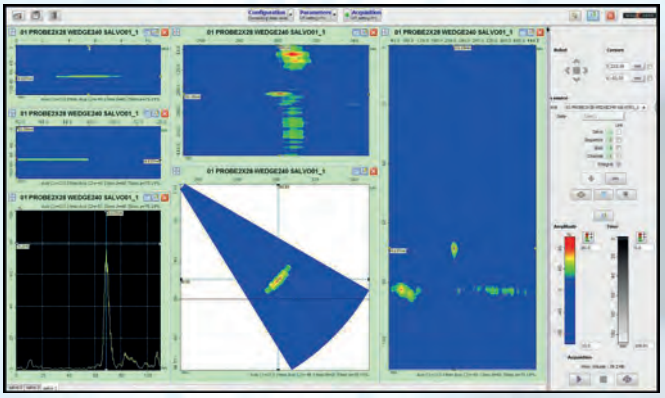
Capabilities and interests:

- Inspection, including Non Destructive Examination (NDE) equipment and services
- Remote Handling activities
- Instrumentation and Control
- Neutronics analysis
- Simulation, Control room design and manufacturing, Man-machine interface, Human factors

Fusion main contracts awarded and R&D projects:

- **"Ultrasonic examination of divertor mock-ups with artificial defects"** To describe the ultrasonic inspections carried out on divertor mock-ups manufactured with artificial defects: W flat tiles, CFC monoblocks, W monoblocks. The results are aimed at identifying a suitable NDT procedure - US test complementary to the IR technique - for the final acceptance of divertor PFC's. The mock-ups based on different joint techniques have been fabricated by two different manufacturers
- Assessment of Remote Handling of NBI Maintenance **"Feasibility study of the cut and weld operations by RH on the cooling pipes of ITER NBI components"** for CIEMAT – ITER. The objective of this project was to assess the viability of remotely disconnecting the cooling pipes of the NBI's main components. Accessibility studies and cut, weld and inspection technique selection were done in first place. Based on those studies, tools basic designs, process sequence definition and off-the-shelf components pre-selection were done.

- **“Assessment of Automatic Inspection of Vacuum Vessel Welds”**. In order to investigate the feasibility of automatic inspections of outer welds of the ITER Vacuum Vessel, it has been made an assessment of potential ultrasonic inspection techniques, a study of scanning requirements and experimental trials with an automatic scanner and phased array probes.
- **“Qualification of NDE inspection for Vacuum Vessel Welds”**
- **“NDE of Pre-Compression Rings”.** Among the components, the vacuum vessel and the set of toroidal field (TF) coils will be manufactured. To suppress the undesirable “breathing” effect and ensure that the keys do not become loose in their slots, each TF coil is put under a centripetal load of 60MN at operating conditions thanks to 2 sets of 3 glass fiber rings placed on top and bottom of the TF coils. As part of the manufacturing process, the quality and the integrity of pre-compression rings must be assessed. NDT techniques (ultrasonic and radiographic techniques) have been proposed to demonstrate that the pre-compression rings are free of defects.
- **“Workshop on the implications of the presentation of safety issues in publications and conferences”** for ITER. The objective of the workshop is to reinforce clear expectations within the ITER organization of the need to act at all times in such a way as to ensure adherence to the safety assessment submitted to the regulatory authority (ASN). In this respect the workshop reinforces understanding of the basis of the safety assessment, helps to understand the reasons for the behaviors underlying the organization of the workshop and provides methods to establish expectations regarding behavior and act accordingly, through coaching or correction.



Results of an ultrasonic technique for ITER Vacuum Vessel sectors welds inspection

TRINOS VACUUM-PROJECTS, S.L.

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

Web: www.vacuum-projects.net

Turnover: 2 M€ in year 2012

Contact person: José Gómez Fernández, *General Manager*
+34 961 344 831
j.gomez@vacuum-projects.net

Company activities:

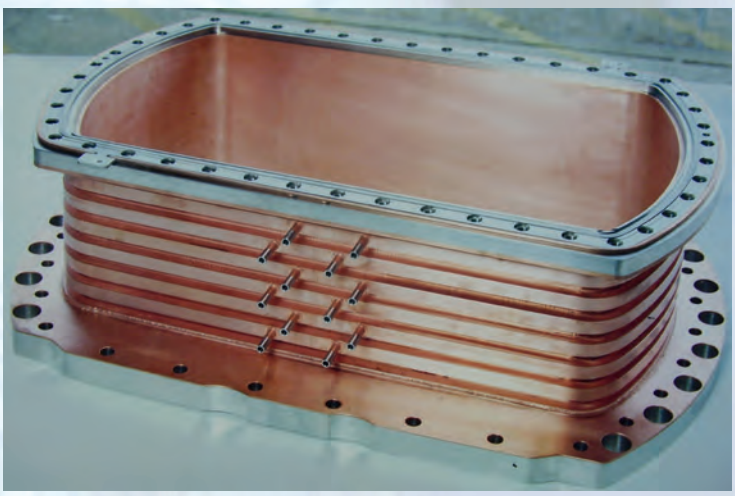
Trinos Vacuum-Projects is an engineering and manufacturing company supported by more than 20 years of experience in high vacuum, ultra high vacuum and cryogenic areas in the most relevant International Research Centers.
Our engineering, manufacturing and laboratory test capabilities, provide our customer turnkeys equipements and mechanical avanced solutions in research areas like fusion, high energy particles laboratories, materials science, aerospatial and astrophysic between others.

Fusion activities & ITER project interest:

Our capabilities developing equipements and solutions in HV, UHV and cryogenics in several R&D areas, including fusion field, are subject to be transferred to R&D fusion such as process engineering, mechanical solutions, welding process (TIG, EBW, Brazing,...), test and inspection procedures, special tooling design,...
Trinos Vacuum-Projects is mainly interested in the supply of HV, UHV chambers and cryogenics equipements.

Fusion main contracts awarded and R&D projects:

In 2010 year, we manufactured a prototype to refrigeration of Beam Dump for IFMIF EVEDA (CIEMAT), using vacuum technologies and EBW (Electron Beam Welding) for cupper/cupper unions.
In 2002 – 2003 years, we manufactured diferent Ion Source Bodies for the neutral injection line to JET (Joint European Torus), The Ion Source provides additional heating for plasma. We used different technologies including vacuum solutions, EBW (Electron Beam Welding) and explosion welding for cupper/stainless steel union.



Ion source body

Beam dump

TTI

Address:	PCTCAN. C/ Albert Einstein 14 39011 Santander, SPAIN
Web:	www.ttinorte.es
Turnover:	8 M€ in year 2012
Contact person:	Miguel Peña, *Commercial Manager* +34 942 291 212 mpena@ttinorte.es

Company activities:

TTI works in the technological forefronts of **space, military, telecommunications, science, and information technology** sectors. TTI design equipments in the radiofrequency and antenna technology area developing new products (detailed design, prototyping, testing and validation) for its later mass production, as well as integrating complex communication systems, providing turnkey solutions.
For fusion activities, the main areas of expertise are:

- **Solid State Power Amplifiers**: based on LDMOS Solid State Technology, up to tens of kWs and covering a wide range of frequencies. The equipment is developed according to reliability, technical efficiency and lower cost criteria
- **RF Passive Devices**: For any devices, TTI develops conceptual, detailed and manufacturing designs, Quality Control Protocol design according to operating conditions and Operation Testing design
  - Development of waveguide components for Multi-Megawatt Particle Accelerators and for a lot of applications in Ultra-High Vacuum conditions at different working frequencies (S, C, and X Band)
  - Coaxial High Power Coupler for RF Cavities
  - High Power Test-Box RF Cavities for RF coupler conditioning (Capacitive and Inductive type)
  - Coaxial Power Combiner
  - RF cavities for linear accelerator both normal conducting and super conducting designed to work both in CW and pulsed mode operation.

Fusion activities & ITER project interest:

TTI has experienced technical staff for defining the conceptual, detailed and manufacturing design related to fusion installations, is able as well to take over the responsibility of the integration, testing, validation, commissioning and starting-up. TTI can also provide personal for maintenance and diagnostic for controlling related installations.
The capabilities of TTI also includes Cryogenic, High Power and Ultra-High Vacuum Laboratories, equipment and other installations for directly making the more complicated operations like adjusting, testing and validation works. TTI infrastructures comprise: production room (mechanical, integration), Clean Room, RF Lab, Anechoic Chamber for antenna testing.
So, the main areas of interest within fusion and ITER activities are:

- Diagnostic, plasma heating and control Systems
- Power Amplifiers
- RF Passive Devices

- o RF and LLRF Devices
- o Test Bench and other similar equipment
- o Machine Assembly
- o Auxiliary Systems
- o Engineering and Services
- o Remote Handling

Fusion main contracts awarded and R&D projects:

IFMIF/EVEDA:
- Design and manufacturing of the prototype RF chain
- Detailed design of protection system/devices HW/SW of RF module.
- Design and manufacturing of Test Bench for High Power RF coupler conditioning.

CERN:
- Design and supply of the X-band Bi-directional coupler with RF pickups.
- Design and Manufacturing 10 kW Solid State Power Amplifier @ 200 MHz

LINAC RESEARCH FACILITY for HUELVA UNIVERSITY
- Design and Manufacturing standalone 1.2 kW Solid State Power Amplifier @ 80Mhz.
- Design and manufacturing of high gradient superconducting quarter-wave resonator RF cavity.

R&D projects:
- ACELTEC (INTERCONNECTA-CDTI): Design and development of High-Gradient Superconducting RF Cavities for Particle Accelerator Applications

ESSBILBAO:
- Detailed design of high power inductive coaxial couplers water cooled and air cooled, capable to stand up to 400 kW for a RFQ.
- Detailed design of a coaxial cavity for the high power conditioning of the coaxial coupler

SSPA 10KW_200Mhz

Test-Box for High power RF coupler conditioning

X band Bi-directional coupler

SPANISH CAPACITIES OVERVIEW

SPANISH ACTIVE COMPANIES IN FUSION

	MAGNETS	VACUUM VESSEL	IN VESSEL COMPONENTS (Blankets, Divertor...)	REMOTE HANDLING	TRITIUM PLANT, WASTE TREATMENT AND RADIOLOGICAL PROTECTION	CRYOGENICS (CRYOPLANT AND CRYODRISTRIBUTION)	PULSE POWER SUPPLY AND STEADY STATE ELECTRICAL POWER NETWORK	PLASMA HEATING SYSTEM (ICH, ECH, NBI & Current Drive)	DIAGNOSTICS	BUILDINGS	ENGINEERING AND SERVICES	I&C and CODAC	MACHINE ASSEMBLY	AUXILIARY SYSTEMS (Vacuum Pumping & Fuelling, Cooling Water System, Cryostat, Thermal Shield)
ACCIONA										●				
APPLUS LABORATORIES											●			
ASTURFEITO			●											●
AVS (Added Value Solutions)		●	●	●					●		●		●	
AZBIL TELSTAR TECHNOLOGIES SLU	●		●	●					●					●
BROAD TELECOM, S.A. (BTESA)								●						
CAD TECH IBÉRICA, S.A.											●			
CEIT-IK4			●											
COMSA EMTE										●	●			●
CRISA												●		
EADS CASA ESPACIO	●													
ELYTT ENERGY	●										●			
EMPRESARIOS AGRUPADOS INTERNACIONAL, S.A.	●	●	●	●	●	●	●	●	●	●	●	●	●	●
EQUIPOS NUCLEARES, S.L. (ENSA)		●	●	●	●						●		●	●
FERROVIAL										●				
GAMCO S.L.									●					
GAS NATURAL FENOSA ENGINEERING S.L.U.				●	●	●					●	●		●
GTD SISTEMAS DE INFORMACIÓN S.A.										●		●		
IBERDROLA INGENIERÍA Y CONSTRUCCIÓN S.A.U.	●	●	●	●			●		●	●	●	●		
IDESA (Ingeniería y Diseño Europeo, S.A.)											●			●
IDOM		●	●		●	●			●	●	●			●
IK4-TEKNIKER		●	●											
INDRA SISTEMAS, S.A.				●				●	●			●		
INGECIBER S.A.		●									●			
JEMA ENERGY S.A.							●	●						
LEADING ENTERPRISES GROUP.			●								●			
NUMERICAL ANALYSIS TECHNOLOGIES (NATEC)		●	●		●				●		●		●	
PROCON SYSTEMS, S.A.												●		
SENER INGENIERÍA Y SISTEMAS, S.A.	●	●	●	●	●		●	●	●	●	●	●		●
SGENIA									●			●		
TECNALIA			●						●		●			
TECNATOM	●	●	●	●					●		●	●		
TRINOS VACUUM-PROJECTS, S.L.		●				●								
TTI							●		●		●	●		

NB: The data contained in this chart are included for information purposes. They have been provided by companies themselves and checked whenever possible. However, the editors of this publication shall not be held liable for the accuracy or truthfulness of this information or the damages its use may cause to third parties. In case you are interested, you should contact companies directly. There are other firms with similar capabilities. For more information, you should contact CDTI (Centre for the Development of Industrial Technology) (www.cdti.es)

OTHER SPANISH CAPACITIES IN FUSION

	MAGNETS	VACUUM VESSEL	IN VESSEL COMPONENTS (Blankets, Divertor...)	REMOTE HANDLING	TRITIUM PLANT, WASTE TREATMENT AND RADIOLOGICAL PROTECTION	CRYOGENICS (CRYOPLANT AND CRYODRISTRIBUTION)	PULSE POWER SUPPLY AND STEADY STATE ELECTRICAL POWER NETWORK	PLASMA HEATING SYSTEM (ICH, ECH, NBI & Current Drive)	DIAGNOSTICS	BUILDINGS	ENGINEERING AND SERVICES	I&C and CODAC	MACHINE ASSEMBLY	AUXILIARY SYSTEMS (Vacuum Pumping & Fuelling, Cooling Water System, Cryostat, Thermal Shield)
AERNNOVA AEROSPACE, S.A.									●		●		●	
ALTER TECHNOLOGY TÜV NORD, SAU											●		●	
ANÁLISIS Y SIMULACIÓN											●			
APLICACIÓN NUEVAS TECNOLOGÍAS, ANTEC S.A.	●													
ARQUIMEA INGENIERÍA, S.L.				●					●		●	●		
ARRAELA S.L.					●					●				
ASEA BROWN BOVERI, S.A. (ABB, S.A.)							●		●		●			
CADINOX, S.A.		●	●	●										
CESA				●				●						
COMET INGENIERÍA											●			
COPISA CONSTRUCTORA PIRENAICA, S.A.										●				
CRYOVAC S.L.		●				●					●			●
DAS PHOTONICS									●					
EMBEDDED INSTRUMENTS AND SYSTEMS S.L.												●		
FELGUERA CALDERERÍA PESADA, S.A. (FCP)		●				●							●	●
GRUPO DOMINGUIS (LAINSA, REVANTI, TITANIA,...)				●	●						●			
INBISA CONSTRUCCIÓN										●				
INPROCESS TECHNOLOGY AND CONSULTING GROUP, S.L.					●									
INTECSA-INARSA, S.A.										●				
INTEGRASYS S.A.												●		
MASTER S.A. DE INGENIERÍA Y ARQUITECTURA										●				
MECANIZADOS ESCRIBANO, S.L.									●					
MONOCROM S.L.									●					
MOTUSA		●												
NATIONAL INSTRUMENTS SPAIN, S.L.									●			●		
NORTEMECÁNICA	●	●												
OHL										●				
SISTEMAS AVANZADOS DE CONTROL S.A.											●	●		
SCIENTIFICA INTERNATIONAL, S.L.									●					
SEGULA TECHNOLOGIES											●			
SERTEC				●						●	●		●	
SEVEN SOLUTIONS												●		
THARSIS TECHNOLOGY S.L.									●					
TRANSGRUMA, S.A.										●	●		●	
VÁLVULAS Y CONEXIONES IBÉRICA, S.L.U.														●

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OTHER SPANISH CAPACITIES

AERNNOVA AEROSPACE, S.A.

Address: C/ Leonardo Da Vinci, nº 13, Parque Tecnológico
01510 Miñano (Alava), SPAIN

Web: www.aernnova.com

Turnover: 534 M€ in year 2012

Contact person: Miguel Á. Castillo Acero, *VP Technology Development*
+34 913 827 844
miguelangel.castillo@aernnova.com

Company activities:

Aernnova is a Leading Airframe Company, Tier One, in **Design and Manufacturing**. Our current capabilities and capacities enable us to assume **full responsibility** of the programs over the **Product Life Cycle**: From Conceptual and Detail Design, Testing & Certification to Serial Production and in Service Support.

Fusion capacities & ITER interest:

Aernnova internal know-how and expertise in **Light Weight Structures** Design, Stress Check, **FEM** method, **Fatigue and Damage Tolerance analysis**, Materials and Processes selection, Quality Management and **Configuration Control** are applicable for the development of ITER Fusion related Activities.

Main contracts and R&D projects:

EU FP	Acronym	Name
7FP	FLY- BAG 2	Advanced technologies for bomb –proof cargo containers and blast containment units.
7FP	CLEAN SKY	Smart Fixed Wing Aircraft
7FP	DAEDALOS	Dynamics in Design and Analysis for Light Structures
7FP	LAYSA	Multifunctional Layers for Safer Composite Structures
VI FP	ADVICE	Autonomous Damage Detection - Vibration Control System
VI FP	TATEM	Technologies and Techniques for New Maintenance
VI FP	COCOMAT	Composite Structures Accurate simulation of Collapse
VI FP	ARTIMA	Aircraft Reliability Through Intelligent Materials Application

Full Composite Central Wing Box Assembly for Single Aisle Airplane and Aernnova Berantevilla Plant overview

ALTER TECHNOLOGY TÜV NORD, SAU

Address: C/ La Majada 3
28760 Tres Cantos (Madrid), SPAIN

Web: www.altertechnology.com

Turnover: 40 M€ in year 2012

Contact person: Rafael Rodríguez, *Integration Manager*
+34 918 064 663
rafael.rodriguez@altertechnology.com

Company activities:

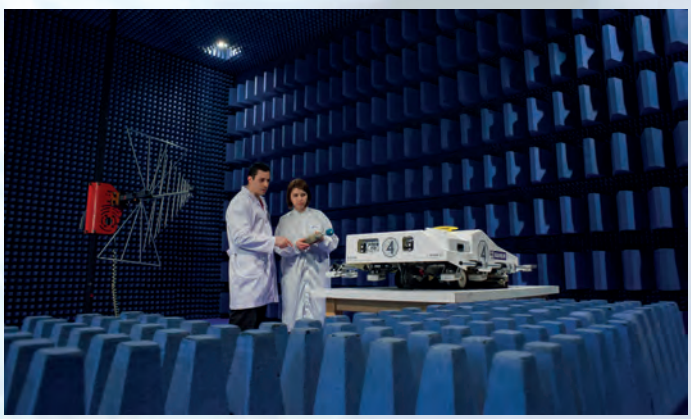
ALTER TECHNOLOGY TÜV NORD SAU (hereafter ATN), a member company of TÜV NORD GROUP, is a quality driven company providing procurement, engineering and test services for electronic systems and E.E.E. components, within the space and harsh environment markets. **TÜV NORD** is a technical service provider with worldwide activities, with around 14.000 employees, is a reference in the provision of consultancy, testing and inspection services for the Industry.

Fusion capacities & ITER interest:

ATN provides engineering services regarding regulatory and product conformity requirements, particularly CE Marking Directives application and product certification as well as dedicated engineering and testing services for components evaluation for harsh environments. ATN has specialized in highly complex systems integrating equipment under different directives like MACHINERY, EMC LVD, R&TTE, CPD/CPR. In addition, ATN provides a complete set of in-house testing capabilities for parts reliability testing. A full range of certification and inspection services can be provided in the areas of industrial Inspection, regulatory inspection, radiation protection, pressure equipment and installations (PED, SPVD) and explosive atmospheres (ATEX).
ATN provides services as independent functional safety assessor (ISA) and complete RAMs analysis (EN 61508 framework standard, IEC 61513 (Nuclear Power Plants) and IEC 62061 (Machinery).

Main contracts and R&D projects:

ATN has a very large experience as prime contractor within the European Space Agency for the engineering and reliability testing of components for harsh environment application covering all range of technologies
ATN is leading a Spanish consortium in the frame of CDTI - INNTERCONECTA regarding R&D activities for Linear Accelerator for Radioisotopes development and components radiation test application.
TÜV NORD IBERIA has performed the Helium vessels inspection for DESY XFEL (X-Ray Free-Electron Laser) for CIEMAT.



ALTER EMC Anechoic Chamber (Madrid)

ANÁLISIS Y SIMULACIÓN, S.L.

Address: C/ Leonardo Da Vinci, 14, edificio PIE
Parque Tecnológico de Álava
01510 Miñano (Álava), SPAIN

Web: www.analisisysimulacion.com

Turnover: 3.7 M€ in year 2012

Contact person: Mario Díaz, *Deputy Director*
+34 902 105 496
mario.diaz@analisisysimulacion.com

Company activities:

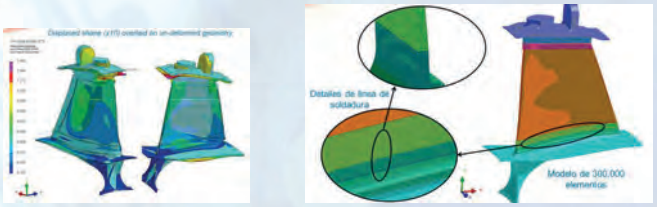
ANÁLISIS Y SIMULACIÓN S.L. is a company founded in 1997.
We are a company involved in the mechanical engineering, with experience and know&how in different fields of the mechanical engineering: conceptual design, industrial development –CAD 3D, drawings, BOM,...- but highly focused and with deep experience and know&how in the fields of numerical simulation (structural, fluid dynamic and manufacturing process) and instrumentation & data acquisition & data analysis.
We are working in the business of software implementation and in the business of mechanical engineering services.
Our staff, 48 engineers / technicians, has a lot of years of experience and knowledge in the main industries: space, aeronautic, automotive, wind energy, railway, biomechanic,...
We are certified ISO 9001:2008 and ISO 14001:2004 for the activities described.

Fusion capacities & ITER interest:

Our interest is to provide ITER/F4E, mainly, our know-how in the field of numerical simulation. Also our know-how in the field of mechanical engineering. Our interest is to help ITER to achieve the success.

Main contracts and R&D projects:

1. B2B: a lot of projects in the industries described.
2. “Modeling and mechanical features for the seismic analysis and “ébranlement” analysis of the refrigeration water entry nuclear plant filter system”. TECNOTRANS, 2011.
3. “Modeling and mechanical analysis –distortions and plastic residual stresses- in a Ni alloy aeronautic component been due to a laser welding manufacturing process”. ITP – INGENIERIA DE TURBO PROPULSORES, 2012.



ITER Welding Analysis numerical model

APLICACIÓN NUEVAS TECNOLOGÍAS, ANTEC S.A.

Address: Ramón y Cajal, 74
48920 Portugalete (Vizcaya), SPAIN

Web: www.antecsa.com

Turnover: 9.5 M€ in year 2012

Contact person: Rafael Iturbe, *R&D Director*
+34 944 724 164
r.iturbe@antecsa.com

Company activities:

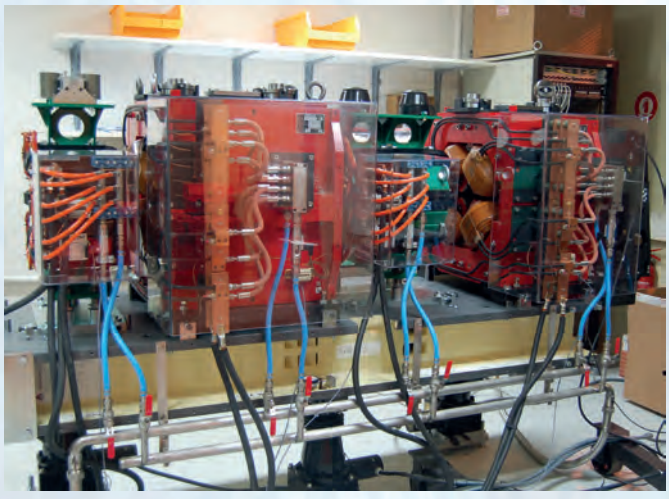
Design and manufacture of magnets for accelerators and physic experiments. Warm, superconducting and permanent magnets.

Fusion capacities & ITER interest:

Warm, superconducting and permanent magnets.

Main contracts and R&D projects:

Manufacture and tests of 1500 sextupole superconducting corrector magnets for LHC (CERN)
Manufacture and tests of 200 octupole superconducting corrector magnets for LHC (CERN)
Manufacture of 102 combined superconducting magnets (2 dipoles + superferric quadrupole) for X-FEL (Hamburg)
Design, manufacture and tests of the prototype warm combined quadrupole (2 steerer dipoles + quadrupole) for the MEBT LIPAC of IFMIF
Manufacture of the 70 Booster warm quadrupoles for ALBA Synchrotron (Barcelona)
Manufacture of 12 warm quadrupoles for the upgrade of low beta long sections of the ESRF Synchrotron (Grenoble)
Manufacture of 6 corrector dipole warm magnets for the LINAC 4 Project (CERN)
Manufacture of 5 corrector dipoles warm magnets for ISOLDE (CERN)
Design, manufacture and tests of the QTL quadrupole warm magnet QTL for ESS Bilbao Project



ESRF Cuadrupole

MO Octupole

ARQUIMEA INGENIERIA S.L.

ARQUIMEA
Space Technology Partner

Address: C/ Margarita Salas, 16
28919 Leganés (Madrid), SPAIN

Web: www.arquimea.com

Turnover: 1.44 M€ in year 2012

Contact person: Francisco Gutiérrez Macías, *Business Development Manager*
+34 916 898 094
fgutierrez@arquimea.com

Company activities:

Radiation hard microelectronic components developement, SMA based actuators, application specific sensors and robotic components.

Fusion capacities & ITER interest:

Radiation hard ASICS for electronic system working under radiartion conditions, SMA actuators and robotic joints to work at high temperatures (in vessel). In vessel sensing systems.

Main contracts and R&D projects:

Microelectronics:

- Mixed signal reconfigurable rad hard ASICS for COSMIC VISION (Mediun Frequency and High Frequency ASICS). Customer: ESA
- ELSA/REDSAT: rad hard Mixed Signal ASICchipset for antenna array, RF chain control: Customer: EADS CASA
- LVDS transceiver development. Customer: ESA
- Development of a rad hard Mixed Signal AISC for avionics. Customer: IHP/SpaceTech/DLR
- DETECTA: Feasibility study for read out electronic for high energy particles detector for HYDE. Customer: Industria para la Ciencia (CDTI)

SAM actuators:

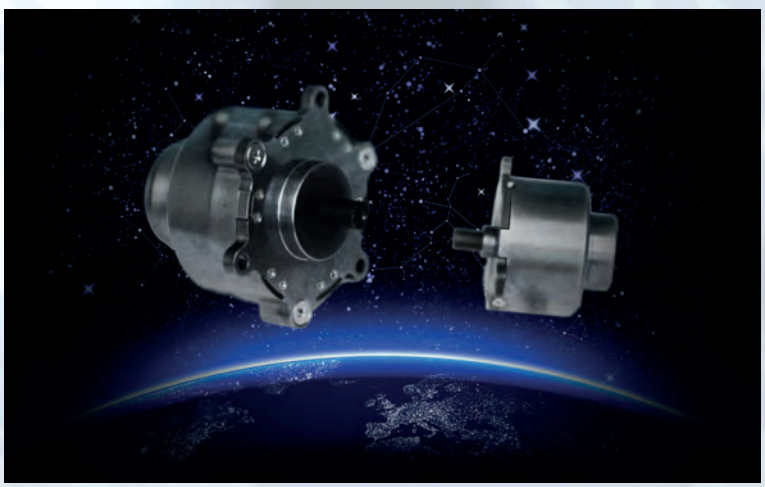
- European Pin Puller (based on SMA technology). Customer: ESA
- Resettable Hold Down and Release Actuator (based on SMA technology). Customer: ESA

Sensors:

- Dust sensor based on IR interferometry: Customer: INTA/Finish Meteorological Institute/METNET project.
- LDEPP: Dust plasma sensor based on electromagnetic fields. Customer: ESA

Robotics:

- ESMAT : Development of artificial muscles for astronauts support. Customer: EU (FP7)



Mechanical actuators for harsh environment

ARRAELA S.L.

Address: Rúa Peteiro, Parcela M-3
Polígono Vilar Do Colo
15621 Cabanas (La Coruña), SPAIN

Web: www.arraela.com

Turnover: 0.24 M€ in year 2012

Contact person: Juan Manuel Caruncho Rodado, *CEO*
+34 981 396 454
jmcr@arraela.com

Company activities:

The company Arraela S.L. is mainly engaged in materials research. Our studies focus on different fields of study, however the company specializes in the development and manufacture of nuclear shielding. Other areas of work are materials for thermal energy storage, marine concrete and polyvalent electromagnetic shielding concrete.

Fusion capacities & ITER interest:

Arraela has developed diferent types of shielding materials for different kinds of radiation. Thus, we have an ligth concrete for neutron shileding (CONTEK®-RNH), a heavy concrete for gamma and X-rays radiation supporting temperatures up to 1200 ºC (CONTEK®-RFH), and a polyvalent material that could work with both neutron and gamma radiation (CONTEK®-RNB). Our interest in ITER is about radiation shielding or storage energy.

Main contracts and R&D projects:

Arraela has manufactured both LINACS plug's and hutches guillotines for ALBA SYNCHOTRON in Barcelona. Also, Arraela has offered delivery and installation of 2 hutches in lead for ALBA storage rings at CELLS. These two hutches corresponds to Optical station and Experimental Station, and a hoist with 1000 kg of capacity. Hutches were self-supporting structures.
Besides Arraela has manufactured a neutron shielding door for "Neutron Pattern Laboratory for CIEMAT" , a door and a vault for an industrial tomography machine for Instituto Catalán de Paleontología, and a high number of radiological protection doors for a lot of hospital in Spain and Portugal. More than 50 vaults with poured heavy concrete in these hospitals and research centers as ITN in Portugal, Hospital Santa María de Lisboa, Hospital Gregorio Marañón Madrid, Hospital Reina Sofía Córdoba, …

ALBA SYNCHROTRON Civil Works

ASEA BROWN BOVERI, S.A. (ABB, S.A.)

Power and productivity for a better world™

Address: C/ San Romualdo, 13
28037 Madrid, SPAIN

Web: www.abb.com/es

Turnover: 652 M€ in year 2012

Contact person: Ladislao García, *PSSS Service Manager*
+34 957 469 213
ladislao.garcia@es.abb.com

Company activities:

ABB is leading company in electrotechnical and automation technologies that enables utility companies (electricity, gas and water) and industries to improve their performance while lowering environmental impact. ABB Group operates in around 100 countries, employing around 117.000 people.

Fusion capacities & ITER interest:

Nowadays, from our factories we supply a wide range of electrical equipment for Nuclear Power Plants also applicable for fusion sector:

- Transformers
- Low, Medium and High Voltage generator circuit breaker
- Medium and low voltage cabinets
- Measuring and Protection equipment
- Medium voltage motors and generators
- Regulation and generator exciter cabinets

During the last years ABB has been working in nuclear sector also as a Service company. ABB also have an extensive service networks composed by experts dedicated to the installation, repair, maintenance activities and improvements of installed base of electric and automatic equipment, and was recognized by the Suppliers Evaluation Group (GES) according to UNE 73:401 as approved supplier.

Main contracts and R&D projects:

Consulting services to assess the performance functional specification for the reactive compensation system at ITER site in Marseille (France)
Activities included steady-state and dynamic studies covering the different load profiles for the installation in order to quantify the reactive power necessities and to determine control features to ensure required voltage quality.
Project reference: ITER/RFQ/09/017/PBS
Project performed during 2009/2010

ABB Subestation, including transformers and circuit breakers

CADINOX, S.A.

Address: Okobio, 32
20491 Belauntza (Guipúzcoa), SPAIN

Web: www.cadinox.com

Turnover: 10.5 M€ in year 2012

Contact person: Andoni Isasti, *Managing Director*
+ 34 943 697 033
cadinox@cadinox.com

Company activities:

Cadinox is dedicated to the design, fabrication, assembly and testing of mechatronic, vacuum, UHV and cryogenic instruments and equipments using high-quality materials such as stainless steel, alluminium and other alloys, for large-scale scientific facilities in the fields of particle science, astrophisics and energy generation.

Fusion capacities & ITER interest:

Our expertise and know-how are very adequated for the requirements of equipments of the vacuum vessel, divertor, cryostat, remote handling and some other systems, wherever vacuum or pressure mechanowelded components, as well as structural and lineal mechatronics are required.

Main contracts and R&D projects:

Medium and big vacuum vessels for Neutron and Particle Science: Let and Polaris tank for ISIS, IN16B for ILL, SAXS for ESRF, NA62 for CERN.
Rotator structure for GTC (Grant Telescopio de Canarias) in astrophysics.

LET vacuum chamber for ISIS

CESA

COMPAÑIA ESPAÑOLA DE SISTEMAS AERONAUTICOS S.A

Address: Pº de John Lennon, nº4
28906 Getafe (Madrid), SPAIN

Web: www.cesa.aero

Turnover: 67 M€ in year 2012

Contact person: Fernando Enrich González, *Business Development Manager*
+34 916 240 173
fernando.enrich@cesa.aero

Company activities:

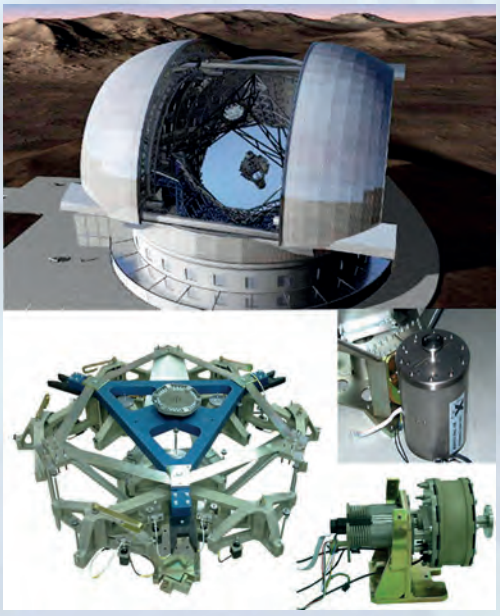
A) The design, development, production, qualification and maintenance / logistic support of electro and fluidmechanics components and systems for aerospace, defence and civil applications.
B) The assembly and maintenance / logistic support of electro and fluidmechanics components ans systems for defnce applications.

Fusion capacities & ITER interest:

Structural Analysis (Hydraulic)
EC Launchers - Steering mirror mechanism

Main contracts and R&D projects:

Mirror for CIEMAT: Actuation of steel Mirror located in vacuum environment with high angular accuracy and without backlash. Poloidal rotation is performed using a linear electric motor with encoder included, which acts directly on the mirror support via a connecting rod. The electrical motor is capable of providing jumps that result in turning the mirror in steps of 0º 0‘ 36“ (0.01 º) .
GRANTECAM & ELT Telescopes: CESA has developed the Electromechanical Actuators with hydraulic output stage, for the segment active stabilization subsystem of the primary mirror (resolution 5x10-9 m). It also produces the Mechanical Support of the segments of the primary mirror.
PROSAVE 2: CENIT programme launched by the Spanish Ministry of Science and Innovation.
E-RUDDER: Advanced Flight control system – Design Development and Manufacturing of an Electro Mechanical Actuator with associated Electronic Control Unit and dedicated Test Bench (FP7_CLEANSKY)



E-ELT Electromechanical actuators

COMET INGENIERÍA

Address: C/ Convento Carmelitas nº2, entresuelo 2
46010 Valencia, SPAIN

Web: www.comet-ingenieria.es

Turnover: 750 K€ in year 2012

Contact person: Manuel Ángel Sierra Hernández, *Development & Quality Manager*
+34 963 409 850 / +34 660 470 440
asierra@comet-ingenieria.es

Company activities:

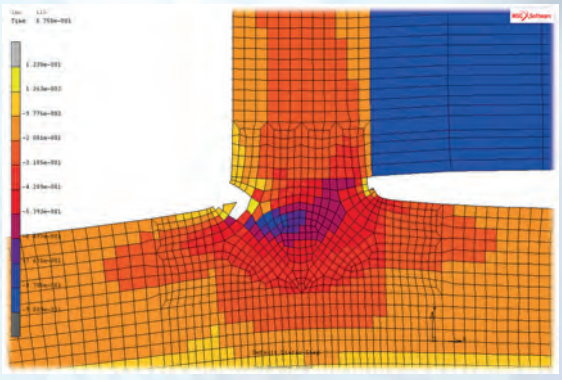
Engineering services for the mechanical design and analysis of components, structures and mechanisms, mainly in aeronautics, space, defense, rail, automotion and science industries

Fusion capacities & ITER interest:

Mechanical design (3D/2D) of components, structures, mechanisms and systems. Structural analysis (finite elements) in different disciplines: statics (linear, non linear, stochastic), dynamics (vibrational, seismic), fatigue, thermal, thermo-elastic, electromagnetic, etc.

Main contracts and R&D projects:

- IDI-10001 (ESA-European Space Agency): Assembly of space CFRP structures with racing sailing boats technology. Design of components traditionally made of aluminium with CFRP using advanced sailing technology
- OF-13330 (RYMSA): Structural analysis of antenna Arabsat 6B Ka TX Global Horn. Static and dynamic analysis of the antenna boarded in the Arabsat 6B satellite.
- OF-12267 (VOSSLOH): Design of manufacturing tooling for Citilink rail vehicles. Mechanical design of the tooling needed to manufacture the main frame of the wagons.
- OF-12259 (IBERESPACIO): Analysis of Deployable Thermal Radiator. Structural analysis (mechanical and thermo-elastic) of the thermal radiator unit boarded on a generic satellite.



Simulation of progressive failure on a composite material component

COPISA CONSTRUCTORA PIRENAICA, S.A.

Address:	Hospitalet de Llobregat (Barcelona), SPAIN
Web:	www.grupocopisa.com
Turnover:	621 M€ in year 2011
Contact person:	Josep Bartolí García, *Construction Manager* +34 934 930 100 josep.bartoli@copisa.com

Company activities:

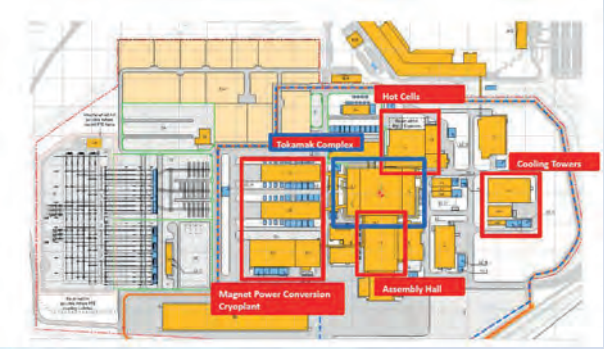
COPISA CONSTRUCTORA PIRENAICA with over 50 years of experience, embraces four ambits of action, **Civil engineering work** (infrastructure projects, hydraulic works, energy production stations), **Concessions** (roads, Institutional infrastructure, port infrastructure, car parks, service areas, water management infrastructure), **Infrastructure maintenance** (public infrastructure maintenance, nuclear power stations maintenance), **Building Works** (industrial construction, car parks, public buildings).

Fusion capacities & ITER interest:

Copisa has large experience in nuclear energy production stations including Vandellós II Nuclear Power Station, Ascó Nuclear Power Station and Trillo NPP. Copisa is interested in using that experience on helping on the design and construction of buildings and technical areas of the ITER project.

Main contracts and R&D projects:

COPISA submitted the tender " Site infrastructure works (F4E-OPE-304) TB08" and it was ranked second. Design, construction and test of precipitation drainage, service trenches, industrial water drainage, sanitary drainage, outdoor lighting, buried networks, integrated plant earthing grid, special foundations, footpaths, storage areas, roads and parking and lay down areas.



ITER Buildings

CRYOVAC S.L.

Address: C/Arquímedes 40
28946 Fuenlabrada (Madrid), SPAIN

Web: www.cryovac.es

Turnover: 391 K€ in year 2012

Contact person: Samuel Gilliland, *Technical Director*
+34 916 065 463
info@cryovac.es

Company activities:

Cryogenics, vacuum, fabrication and installation of high pressure equipment and precision machining and welding.

Fusion capacities & ITER interest:

Vacuum chambers: We manufacture custom made chambers with a variety of materials, shapes, sizes, openings and vacuum levels (up to UHV). We also provide auxiliary systems such as lifting mechanisms, tables, pumps and instrumentation.
Cryogenic transfer lines: We fabricate and install customisable vacuum insulated lines for all cryogenic liquids (including helium). Our lines have low thermal losses and easy to connect invar junctions.
Cryogenic and vacuum engineering: Our technical office is able to perform calculations and simulations using finite element analysis to design a range of cryogenic and vacuum components.
Cryostats: We make cryostats with customisable size, materials, thermal insulation, openings and auxiliary equipment for cooling by cryogenic liquid or mechanical cooler.

Main contracts and R&D projects:

Vacuum chambers: We realised CERN project DO-27581 for the supply of 5 stainless steel tanks with 1000 litre capacity for H2 at pressures between vacuum and 5 bar. We also fabricated stainless steel UHV chambers for magnetron sputtering and magnetic mesurements for UCLM and IMA respectively.
Cryogenic transfer lines: Among our projects are a 4” cryogenic line installation at an Air Liquide production plant, a 1” and 3/4” cryogenic line installation at foreign manufacturing facility and an installation of 3/4” and 1/2” lines and valves for the bank of cryogenic freezers at CNIO.
Cryogenic and vacuum engineering: We designed an automatic cryogenic filling system for the infrared telescope at Sierra Nevada Observatory, provided engineering calculations and designs for the cryogenic line installation at a Messer production plant and maintain an ongoing contract for vacuum services related to an INDRA military project.
Cryostats: Cryovac fabricated a Cryostat for Tecnalia with dimensions 2000x1200x400mm. We also realised the INTA planetary simulation chamber and control system for temperatures between -200 and 600ºC, pressures up to 10kbar and volumes up to 10cm3.

Cryostat for testing superconducting coils at 10K

DAS PHOTONICS

Address: Camino de Vera s/n. Edificio 8F
46022 Valencia, SPAIN

Web: www.dasphotonics.com

Turnover: 1.44 M€ in year 2012

Contact person: Sebastián Pantoja, *R&D Director*
+34 626 479 258
spantoja@dasphotonics.com

Company activities:

DAS PHOTONICS is an SME, at the forefront of R&D in Photonics for Defence, Aeronautics and Space applications, focused on the development of innovative value-adding products based on our proprietary photonics technology. Our activity is mainly driven in two directions:

- Design of photonic chips based on proprietary Silicon Photonics technology
- System integration using our own integrated circuits as well as commercially-available devices in the field of microwave photonics.

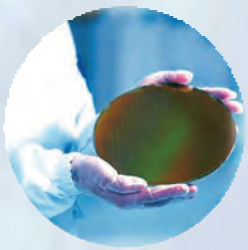
Because its innovative approach, it has been participating in several FP6 and FP7 projects also working for ESA, EDA and ESO. Within our 750 square meter, state-of-the-art facility we provide complete photonic, electronic, and mechanical design & development, project management, low-volume printed circuit board assembly, systems integration; repair Services and acceptance testing to deliver complex, high-quality systems to global markets.

Fusion capacities & ITER interest:

Diagnostic system:
Optical system design, integration and qualification for highly demanding markets and for state-of-the-art scientific equipment. Of special relevance for that case, DAS Phototonics has proprietary technology for optical laser control and stabilization for it use with Fibre Bragg gratings. This technology is applicable for high-precision interrogators for FBG sensors as the required here. On the other hand, DAS Photonics has a wide experience in designing and fabricating systems for phase and time control of signals and in the control of light both guided in fibre or in free space. These capabilities and experience is the required for implementing precise displacement sensors with very stringent requirements as required here.

Main contracts and R&D projects:

Generation of very-high RF signals for ESO: This project focuses on the design and implementation of the photonic LO Test Reference System for ALMA (Atacama Large Millimiter/submillimiter Array) Radiotelescope. This system integrates several photonic components, including filters based on Fiber Bragg Gratings, is capable of LO generation with extraordinary spectral purity and stability in the range of 200 MHz to 124 GHz using photonic harmonic conversion techniques.



DAS Photonics develops Photonics Integrated Circuits (PIC) and Fiber-Optics technologies for Defense, Aerospace and Instrumentation oriented to specialized High-End applications

EMBEDDED INSTRUMENTS AND SYSTEMS S.L.

Address: Parque Científico y Empresarial, Edificio Quorum IV
Avda. de la Universidad s/n
03202 Elche (Alicante) , SPAIN

Web: www.emxys.com

Turnover: 300 K€ in year 2012

Contact person: José A Carrasco, *CEO*
+34 966 442 304
joseacarrasco@emxys.com

Company activities:

Electronic design of sensors and actuators, including high speed electronics, for operation in harsh evironments: extedded temperature range, radiation and vacuum. FMECA, Part Stress, Worst Case and Reliability analysis.

Fusion capacities & ITER interest:

Position and angular sensing technologies.
High speed driving and conditioning electronics, shaping and coincidence.

Main contracts and R&D projects:

- Electrically Coupled Angular Encoder for Long Life Mechanisms. Contract number 4000104613/12/NL/AD under Artes 5.2 program for the European Space Agency.
- Photonic Transceiver for Secure Quantum Communications. Contract number 21460/08/NL/IA for the European Space Agency.

Power converter distribution and harness for space system platform

FELGUERA CALDERERÍA PESADA, S.A. (FCP)

Address: Travesía del Mar, s/n
33212 Gijón (Asturias), SPAIN

Web: www.dfdurofelguera.com

Turnover: 18.92 M€ in year 2012

Contact person: Bárbara Pato, *Nuclear Business Development Manager*
+34 985 322 600
barbara.pato@durofelguera.com

Company activities:

Felguera Calderería Pesada (FCP) is the company belonging to Duro Felguera group (DF) that specialises in the manufacturing of high quality pressure vessels for the oil&gas, petrochemical and nuclear industry.
Together with other DF companies belonging to DF Manufacturing line has participated in several international laboratories and research centers (see references below).

Fusion capacities & ITER interest:

Fel guera Calderería Pesada (FCP) facilities, over 76,000 square meters and only 1.5km from Gijón Commercial Port, are equipped with state-of-the-art manufacturing technologies and provide direct access to the sea through their own dock.
Besides, FCP is certified according to the main international Codes and standards for nuclear and non-nuclear projects. Thus, FCP currently holds among others, N, NPT and NS ASME Certificates of Authorization.ThEiSecertifications signify FCP capabilities to meet the highest quality requirements of the nuclear market.

Main contracts and R&D projects:

- Manufacturing of 403 Vacuum Vessels for CERN (Switzerland) and KEK (Japan)
- Manufacturing of 106 Services Modules for LHC (Switzerland)
- Manufacturing of a prototype Vacuum Vessel and Cold Mass for X-FEL (Germany)
- Manufacturing of 2 hadronic wedge calorimeters for CMS Detector (Switzerland)
- Manufacturing of 8 Cryostats for ATLAS Detector (Switzerland)

FELGUERA Calderería Pesada Facilities

GRUPO DOMINGUIS (LAINSA, REVANTI, TITANIA, ...)

Address: Avda. de las Cortes Valencianas, 58 - Sorolla Center
Valencia, SPAIN

Web: www.grupodominguis.com

Turnover: 95 M€ in year 2012

Contact person: Iván Maqueda Iglesias, *Business Development Engineer*
+34 963 540 300
i.maqueda@grupodominguis.com

Company activities:

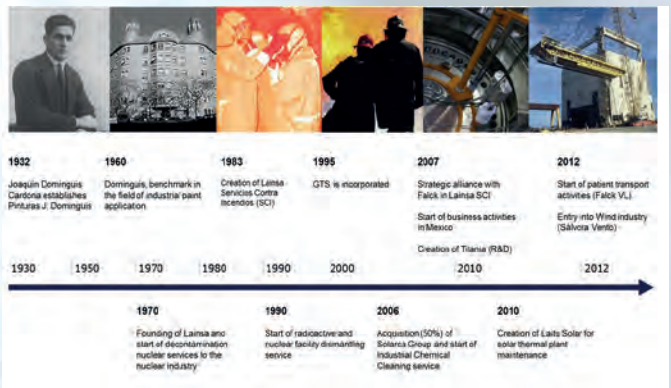
Grupo Dominguis and its companies have over **80 years of experience** as provider of Services to Nuclear, Energy, Industry: Decontamination, Decommissioning, RadWaste Management, Radiological Protection, Controlled Area Cleaning; Industrial, Chemical and Mechanical Cleaning (steam generators, heat exchangers, turbines, pipelines); Corrosion Protection (Manual and Robotized Metallization, Special-Decontaminables-RadHard Coatings, Fireproofing, Industrial & Civil Painting); Emergencies (Fire Fighting Corps in Nuclear & Chemical plants; Search & Rescue Corps; Ambulances); Operation & Maintenance (Nuclear and Renewables); Logistic services.

Fusion capacities & ITER interest:

Our **experience** in all stages of the life-cycle of a NUCLEAR power plant (construction, maintenance, rewamping, decommissioning and dismantling) as well as our vocation for **technological development and innovation** can be effectively applied to the case of FUSION.
In special, in ITER project is for: Assistance in engineering phase (Radioprotection, emergencies, waste management, decontamination topics); Some intervention in the constuction phase (painting, corrosion protection, metallization); Pre-commissioning (industrial an chemical cleaning, pressure tests, line blowing, etc); Service on operation (robotized cleaning of controlled area, decontamination, Radioprotection, waste management and conditioning).

Main contracts and R&D projects:

(March 2013). Contract for dismantling the Nuclear Research Reactor in Italy. R&D and Services Project. The Italian Ministry of Defence has commissioned the Grupo Dominguis to undertake the dismantling of the RTS-1 Galileo Galilei, an open pool type research reactor. This project includes activities for the dismantling of the research reactor at the CISAM.
(September 2013). FARN Project- Nuclear Rapid Action Force. R&D and Services Project. The project is placed as frame of response in emergencies by means of water feedback of the refrigeration systems of the affected power plant, in case of similar emergencies to Fukushima´s accident.
(2010 -2013). EDF - Project PACCO Preventive Acid Chemical Cleaning Operation. R&D and Services Project. The principal objective of this project is to formulate and develop a chemical cleaning procedure that significantly reduce the presence of magnetite in steam generators.



Grupo Dominguis History

INBISA CONSTRUCCIÓN

Address:	Carretera Bilbao-Plencia, 31 - 2º Erandio-Asua (Vizcaya), SPAIN
Web:	www.inbisaconstruccion.com
Turnover:	78.5 M€ in year 2012
Contact person:	Alejandra Zabala, *Dpto Contratación* +34 610 111 788 azabala@inbisa.com

Company activities:

Inbisa Construccion (BYCO, S.A.) is a construction firm with over 30 years' experience and a large multidisciplinary team implemented in 4 countries: Spain, France, México, Brazil and Angola. Major clients such as Aernnova, Banco Santander, BBVA, Coca-Cola, Fiat, Iberdrola, Ikea, La Caixa, Mango, Mc Donald's, Mutua Madrileña, Repsol Toyota, etc. have already trusted Inbisa with the construction of different building types: industrial, logistics, residential, tertiary, public & Institutional, fitting-out and Renovation. We are specialists in turn-key quality projects with energy-efficiency criteria.

Fusion capacities & ITER interest:

Our aim is to collaborate with ITER in the construction of industrial buildings and logistic Platform, which is our specialization. We look upon our company's end-to-end management of all the construction processes and after-sales service as a strategic commitment to quality.

Main contracts and R&D projects:

SAN MAMES BARRIA, new football stadium in Bilbao (LEED)-

- Toyota logistics center in Toledo (BREEAM)
- BBVA Campus in Madrid (LEED)
- Municipal Sports Institute in Bilbao (LEED)
- Municipal Social Building in Roses - Girona (LEED)
- 102 apartments in Anglet - France (BBC Effinergie)
- Logistics platform for Casbega (Coca-Cola)
- Logistics platform for Naeko In Barcelona
- Industrial building for Concerto in Girona
- Logistics platform for Eroski in Bilbao
- Logistics platform and office building for Aeroblade in Bilbao
- Office building for Aernnova in Bilbao
- Industrial building extension for Synergy Real Estate & Aernnova in Alava.
- Industrial building and offices for Deltavigo in Toledo
- ITP Building offices' renovation in Bilbao.
- Industrial building for Talgo in Alava
- Extension of Euskalduna Concert Hall in Bilbao
- Wind Farm in Palencia
- Atrium Centre for Ikea in Valladolid

Inbisa Tower, Barcelona Headquarters

INPROCESS TECHNOLOGY AND CONSULTING GROUP, S.L.

Address: Gran Via de Carles III, 86 – Torre Est, 9è 1ª
08028 Barcelona, SPAIN

Web: www.inprocessgroup.com

Turnover: 1.92 M€ in year 2012

Contact person: Oriol Millan Lorman, *General Manager*
+34 933 308 205
oriol.millan@inprocessgroup.com

Company activities:

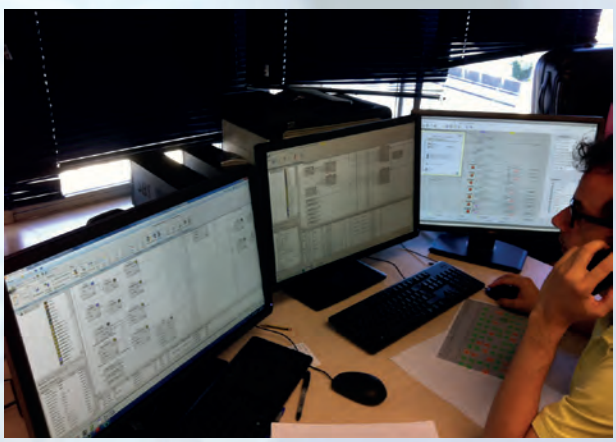
Inprocess is the process simulation knowledge provider for the process industry. Inprocess mission is to help its clients to maximise the benefits from their process simulation investment.
The members of inprocess core team have an average of over 10 years industry experience and a proven track record of assisting clients to exploit process simulation technology.
Whether you require an innovative solution to a current operational problem, a dynamic simulation study to confirm a safe design, or a tailored training program to maximise your process simulation capability, Inprocess delivers.
Process Simulation and Optimisation are used in the process industry on a daily basis but are rarely exploited to their full potential.
INPROCESS Services are: Training, Dynamic Modelling, Operator Training Systems, Flare Analysis, Flow Assurance, Software Extensions and Inprocess' own Applications

Fusion capacities & ITER interest:

Knowledge of formal chemical processing plants design procedures and disciplines
Design of Experimental tritium / R&D facilities through advanced steady state or dynamic modelling (Aspen+ / Aspen HYSYS)
Specific Experience on the design of tritium plant systems and integration and qualification through advanced steady state or dynamic modelling (Aspen+ / Aspen HYSYS)
R&D Management experience on tritium technology and fusion reactor design
Tritium handling codes and standards
Skills as tritium fuel systems components designer and modeller
Development / Use of tritium modelling and design computational tools

Main contracts and R&D projects:

Dynamic Extension for a Commercial controller simulation tool
Simulation-based online monitoring of a twin heat exchanger
Operator Training System for a remote gas field processing plant
Eureka Project to develop a training tool for plant operators based on dynamic simulation
Leadership of Trittek-WDS Industrial Consortium



Operator Training System for an Industrial Plant

INTECSA-INARSA, S.A.

Address: Santa Leonor, 32
28037 Madrid, SPAIN

Web: www.intecsa-inarsa.snclavalin.com

Turnover: 27.29 M€ in year 2012

Contact person: José Pedro García Atienza, *Building and Urbanism Manager*
+34 915 673 957
josepedro.garcia@snclavalin.com

Company activities:

INTECSA-INARSA, S.A. is a Spanish engineering company founded in 1965. We offer Consultancy and Engineering services which include the performance of studies, projects and management of civil, environmental and industrial works. In March, 2007, INTECSA-INARSA became part of the SNC-Lavalin Group, an international leader in engineering and construction.

Fusion capacities & ITER interest:

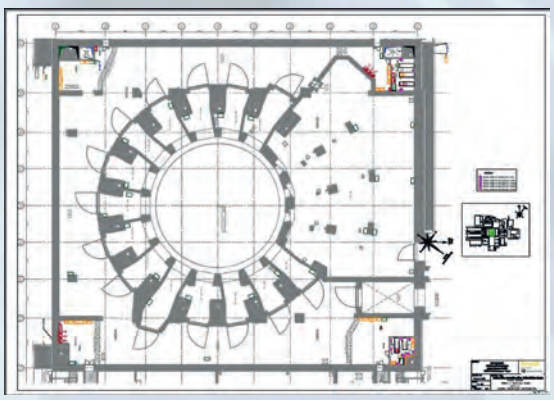
INTECSA-INARSA, S.A. has extensive experience in the area of building and industrial plants which gives large capacity in the development of engineering and EPC project. INTECSA-INARSA, S.A. was prequalified and successfully completed the technical phase of lot TB04 regarding buildings and installations for ITER project.

Main contracts and R&D projects:

INTECSA-INARSA, S.A. was prequalified for:
TB04 - Mechanical and Electrical Installations (HVAC including nuclear, Building Electrical systems, Fire Detection and Protection, I&C, Gas and Liquid networks, Mechanical Handling, etc)
INTECSA-INARSA, S.A. has performed the following contracts among others:

- Design of a building with two research centers (Mathematics and Theoretical Physics) in the Autonomous University of Madrid with shared common areas (CSIC, 2007)
- Basic and final design, site management and subsequent expansion, related to the refurbishment of the National Institute of Biotechnology in the Autonomous University of Madrid (CSIC, 2005)
- Basic design, master plan, final design, safety and health study for the refurbishment of Medicine School of the Complutense University of Madrid (2008).
- Design and works management of the Microbiology Center of the Carlos III Health Institute (Health Ministry 2010).
- Basic and detail project of the CIEMAT building E-20 adaptation (laboratory of neutron patterns and brachytherapy, neutron measurements), works supervision, health and safety coordination and legalization process support.

INTECSA-INARSA, S.A. participates in the I+D project SHERIFF "**Hybrid and Economic System for the Flexible Integrated Restoration of Façades**" of the Ministry of Economy and Competitiveness. The project pretends to develop new tools in order to optimise the different phases of the climatic restoration of buildings.



ITER Tokamak

INTEGRASYS S.A

Address: Calle Esquilo 1
28232 Las Rozas (Madrid), SPAIN

Web: www.integrasys-sa.com

Turnover: 1 M€ in year 2012

Contact person: Juan Manuel Martínez, *Technical Area Manager*
+34 916 316 846
juan.martinez@integrasys-sa.com

Company activities:

Integrasys, established in 1990, is an SME software development and engineering company specialized in the design, development and integration of both Real-Time and Non Real-Time software for automated systems in the telecommunication and aeronautical fields. equipment.

Fusion capacities & ITER interest:

Integrasys main capacities for ITER activities are to provide R&D and consultancy services in software based monitoring and control systems. Our main skills in this regard are in signal monitoring, network manager and managed applications over SNMP, middleware, RF & microwave automated test and measurement systems, development of software and technology based on open standards and for embedded systems, etc. Therefore our main interest in ITER is in CODAC related activities.

Main contracts and R&D projects:

- **WHITE-RABBIT,** CERN, 2010-2012 PROJECT: development and integration of industrial control systems (up to 200 nodes) with a fully deterministic Elthernet-based network for general purpose data transfer and synchronization with sub-ns accuracy and picoseconds precision, over fibre and copper lengths of up to 10 kms. Integrasys has developed and integrated the overall control system, the switching embedded driver, routing table unit, remote management functions and conformance testing.
- **WILDCRAFT,** CleanSky, 2012-2014 project: development and integration of a fully automated system for inspecting the state of an aircraft structure. Integrasys participates by integrating the large amount of data coming from the Wireless Sensor Networks.
- **CALSAT,** Integrasys product: High-throughput instrumentation and control system addressing an Automated Calibration System for Absolute EIRP Measurements of Satellite Carriers

Integrasys personnel working on a testbench for signal monitoring

MASTER S.A. DE INGENIERIA Y ARQUITECTURA

Address: Ronda General Mitre, 126, 4th. Floor
08021 Barcelona, SPAIN

Web: www.masteringenieria.com

Turnover: 13 M€ in year 2012

Contact person: Antonio Merino Gonzalo, *CEO*
+34 933 086 016
tonin.merino@masteringenieria.com

Company activities:

MASTER SA DE INGENIERÍA Y ARQUITECTURA, founded in 1972, provide consulting, planning, design and construction services. It is specialised in the design and construction of industrial plants, corporate headquarters, data processing centers, large scientific infrastructure projects, biomedical and pharmaceutical laboratories and hospital infrastructures. Other fields of activity are industrial & logistics parks, telecommunications infrastructures, airport installations, urban planning projects, hotels, and shopping centers. The company has been awarded ISO 9001:2008 Quality, ISO 14001:2004 Environmental and OSHAS 18001:2007 Occupational Hazard Prevention certifications.
Currently, MASTER has offices in Barcelona, Casablanca (Morocco), Santiago (Chile) and Bogota (Colombia).

Fusion capacities & ITER interest:

Fusion Capabilities of MASTER: Design, procurement and construction supervision capability of complete facilities regarding all technical disciplines: process, mechanical, piping, civil and structures, instrumentation & control, HVAC systems, fire detection/protection, waste treatment, radiological protection.
MASTER is interested in using the technological know-how resulting from the Alba Synchrotron building and set-up of the equipment, added to the knowledge gained by our company over the last 40 years in the design and construction of other relevant R&D infraestructures, to develop new and challenging scientific projects in the fusion sector.

Main contracts and R&D projects:

Design of the Technofusión Complex in Leganés (Madrid, Spain): research building for the National Center for Fusion Technologies (TechnoFusión) to house the Production and Materials Processing Facilities, and the facilities for Characterization Techniques (II) with a laboratory of macromechanical properties, X-ray diffraction and scanning electron microscope.

Design and construction supervision of ALBA Synchrotron Light Source Laboratory

MECANIZADOS ESCRIBANO, S.L.

Address: Avda. Punto ES, 10 – P.T. Tecnoalcala
28805 Alcalá de Henares (Madrid), SPAIN

Web: www.escribano.aero

Turnover: 7.6 M€ in year 2012

Contact person: Juan M. García, *Business Development Director*
+34 911 898 293
jmgarcia@mecaes.es

Company activities:

The company's main business is the very high precision machining of parts and components in aluminum, titanium, inconel and other technological alloys used typically in the aerospace and defense businesses. We too have the in-house capability for surface treatments and coatings. Our machining dimensional limitation is 1.5 meters. We also have the capability for producing optics and mirrors typically for defense applications. Given the businesess we are in since 1998, we are used to very stringent measurement and quality requirements.

Fusion capacities & ITER interest:

Mecanizados Escribano's capabilities are in the area of very high precision machining and integration/testing of assemblies/subassemblies. As such, we don't have a finished product or technology for use in fusion technology but believe that with our means, industrial capabilities and expertise are in an excellent position to support mechanical requirements the project may have.

Main contracts and R&D projects:

Mecanizados Escribano's main customers include the leading aerospace and defense companies such as Raytheon, Rockwell Collins, Cassidian, Airbus Military, MBDA, Atlas Elektronik or Meggit, to name just a few. We are a build-to-print type organization. R&D activities revolve around the improvement of industrial processes focusing on cost reduction, improving quality and delivery times.

High precision machining components

MONOCROM SL

Address: C/Vilanoveta, 6
08800 Vilanova i la Geltrú (Barcelona), SPAIN

Web: www.monocrom.com

Turnover: 2 M€ in 2012

Contact person: Jordi García Céspedes, *Project leader and Researcher*
+34 938 149 450
j.garcia@monocrom.com

Company activities:

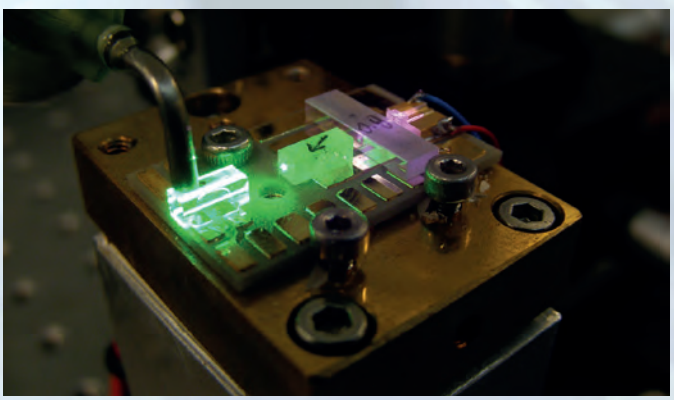
MONOCROM S.L. was founded in 1993. Its main activities comprise the development, production and commercialisation of diode and solid state lasers. The company strategy is defined through the creation of innovative and high-added-value products, with a performance not fulfilled by any other manufacturer, making a highly competitive company.
At present, MONOCROM is the only Spanish company producing lasers in its sector, being a World leader in manufacturing lasers for hair removal, with a market quote of almost 100 % at national level and with a growing presence at international level, which represents a 50% of its current turnover.
MONOCROM has a wide experience in the production of customized laser units, for different application purposes (medical, aesthetics, range-finding, material processing, spectroscopy, etc.), where specific optical, thermal, electrical and mechanical requirements are demanded. All these R&D activities have provided the company with a strong background and manufacture capabilities in the field of high power diode lasers and solid-state lasers, not only regarding the laser itself, but its integration in more complex final equipment.

Fusion capacities & ITER interest:

Monocrom's interest in ITER project is related to the viewing system based on laser ranging for assessing the extent of surface damage on the vacuum chamber inner wall. Monocrom aims to participate as a subcontracted company for the diagnostic system.

Main contracts and R&D projects:

The main projects on diagnosis and analysis systems are the following ones:
Exomars: design and development of a green laser as excitation source for Raman spectroscopy measurements in the ESA Exomars space mission.
LIWA : "Laser induced breakdown spectroscopy instrument for water analysis" CRAFT European Project, FP5 framework "Energy, Environment and Sustainable Development" (2003-2004). Development of laser prototypes for the water analysis using atomic emission spectrometry.
Research on new fast, low-cost and portable diagnosis and systems for medical field. (ACC10) (2010-2012)



Assembly tests of a green laser for Raman spectroscopy

MOTUSA

Address: Requejada B-20
39312 Polanco (Cantabria), SPAIN

Web: www.motusa.es

Turnover: 3.5 M€ in year 2012

Contact person: Aurelio Landaluce, *General Manager*
+34 942 824 411
motusa@motusa.es

Company activities:

MOTUSA was founded in 1.958, and is specialized in design, manufacturing, mounting and repairs pressure vessels, piping and boiler Kettles in general. Is also specialized in works for chemical, paper, thermosolar and water treatment plants. Working with materials as carbon steel, stainless steel, zirconium, titanium, duplex, superduplex. MOTUSA is certificated by Intertek according to ISO 9001 : 2008

Fusion capacities & ITER interest:

MOTUSA is specializated for the construction and erection of tanks and boilers of big dimensions and the piping necessary for the procesing, with welders homologated for stainles steal, carbon steal, zirconium, titanium, super austenic steels, austenitic steels, alloys etc.

Main contracts and R&D projects:

We have offered the construction and erection of of (4) Water Holding Tanks 20 cubic meter and another (2) of 100 cubic meter for ITER project.

- Pressure Vessel Reactor

NATIONAL INSTRUMENTS SPAIN, S.L.

Address: Calle Rozabella, 2 - Europa Empresarial - Edif. Berlín 1ª pl.
28290 Las Rozas (Madrid), SPAIN

Web: www.ni.com/physics

Turnover: $1.14B in year 2012 (Global NI turnover information)

Contact person: Carlos Ríos, *Area Sales Manager, Spain*
+34 916 400 085
carlos.rios@ni.com

Company activities:

National Instruments Spain, as a fully owned subsidiary of National Instruments Corporation, has been working with fusion scientists and engineers in Spain and around the world for many years. National Instruments offers customizable commercial off-the-shelf (COTS) software and hardware to help them meet their needs for hardware and software for measurement, diagnostic, control, interlock and safety systems. From being able to program embedded real-time systems based on multicore processors and field-programmable gate arrays (FPGAs) to working with high-speed data acquisition systems requiring timing and synchronization.

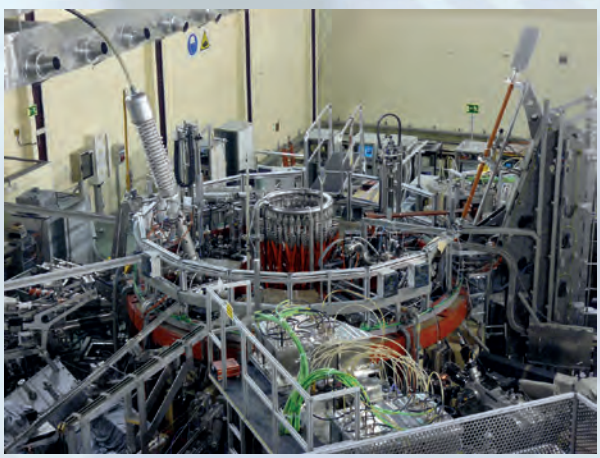
Fusion capacities & ITER interest:

National Instruments Spain as part of the National Instruments Corporation, locally inherits the same capacities and interests:

- ITER standardized on NI PXIe for Fast Controllers for control and interlocks
- FPGA based NI FlexRIO for diagnostics data acquisition for magnetics, neutronics, and ICH
- NI CompactRIO used for plant system interlock
- NI fast controllers, image acquisition and NI CompactRIO for Remote Handling applications
- IEEE 1588 based timing and synchronization modules for ITER TCN
- Open source and documented Linux drivers with EPICS support
- NI devices integrated with ITER CODAC Core Software
- Rear panel connectivity cubicle configurations for fast controllers
- RASM analysis and life cycle management for select NI products

Main contracts and R&D projects:

- Data acquisition system and diagnostic control systems for the TJ-II fusion device. Dr. Jesús Vega – Ciemat.
- Intelligent Data Acquisition Systems for Fusion experiments. Dr. Mariano Ruíz – UPM, Dr. Jesús Vega – Ciemat.
- ITER Fast Plant Controller System Prototype, Dr. Mariano Ruíz – UPM, Dr. Jesús Vega – Ciemat.
- Micro fission chamber (neutronics) prototype for ITER (with support of Ciemat and UPM)
- Framework Contract for Fast ICS Architecture Study and Performance Analysis. Consortium of NI Spain, Ciemat and UPM (leadered by NI Spain).



TJ-II

NORTEMECÁNICA

Nortemecánica

Address: Area Industrial de Tabaza I, parcela E5
33469 Carreño (Asturias), SPAIN

Web: www.nortemecanica.es

Turnover: 5 M€ in year 2012

Contact person: Susana Fernández, *Commercial Manager*
+ 34 985 579 857
comercial@nortemecanica.es

Company activities:

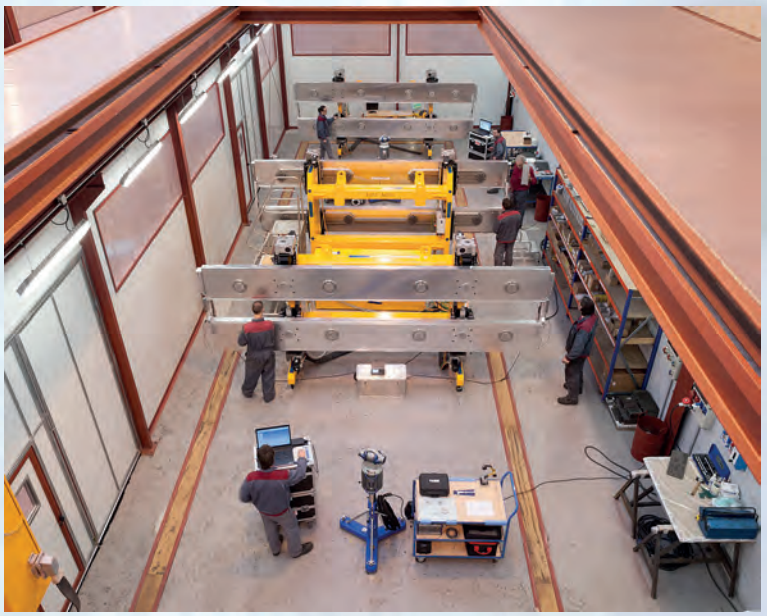
Manufacturing of mechanical components, support systems and welded-machined capital goods for research organizations and laboratories.
Manufacturing of mechanical components at a constant temperature to avoid dimensional changes in the components. Verification of tiny tolerances with laser trackers at constant temperature.

Fusion capacities & ITER interest:

Manufacturing of mechanical components for the sub-systems and components of the ITER Tokamak

Main contracts and R&D projects:

Manufacture, assembly, alignment, comissioning and supply of 40 Ondulator Support Structures designed by the European XFEL. Customer: European X-Ray Free Electron Laser Facility (EXFEL), Hamburg (Germany).
Manufacturing and supply of 14 Schuffling Module Vacuum Vessels and 2 prototypes for the Large Hadron Collider (LHC). Customer: CERN.



40 Ondulator Support Structures (XFEL)

OHL

Address: Paseo de la Castellana 259 D
28046 Madrid, SPAIN

Web: www.ohl.es

Turnover: 4,029 M€ in year 2012

Contact person: Carolina Olivero, *Business Development, OHL Construcción*
+34 913 484 563
Carolina.olivero@ohl.es

Company activities:

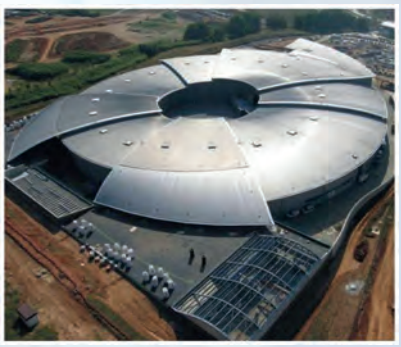
OHL is one of the largest international concessions and construction groups. The Group's main business activities are organized into four operating divisions: OHL Concessions, OHL Construction, OHL Industrial and OHL Developments. The Group operates in 28 countries of the five continents, reflecting the important and balanced geographical diversification that OHL has achieved.

Fusion capacities & ITER interest:

OHL participated in the ALBA project. ALBA is a synchrotron radiation facility in Cerdanyola del Vallès near Barcelona, Spain. It is constructed and operated by the CELLS (Consortium for the Exploitation of the Synchrotron Light Laboratory) consortium, and co-financed by the Spanish and Catalan governments. After nearly ten years of planning and design work by the Spanish scientific community, the project was approved in 2002 by the Spanish and the Catalan governments.
The OHL Group is very interested in participating on ITER projects in order to offer its expertise in construction of large facilities. Its valuable experience in the use of constructive solutions can be used to solve complex scientific works.

Main contracts and R&D projects:

The ALBA synchrotron radiation facility shows the great interest OHL demonstrates in the High Level scientific facilities area. The construction was awarded to OHL in two phases. The contract for Phase 1 comprised the civil works, earthworks, service tunnel, foundation, drainage, grounding critical area and tunnel civil works for the Alba Project. The contract for Phase 2 was consistent with the architecture of the synchrotron, construction of the interior of the main building and outbuildings urbanization of the Synchrotron Light Laboratory.



ALBA SYNCHROTRON

SISTEMAS AVANZADOS DE CONTROL S.A.

Address: C/ Colquide nº 6
28230 Las Rozas (Madrid), SPAIN

Web: www.sacnet.es

Turnover: 13 M€ in year 2012

Contact person: Javier Pérez Sosusa, *Corporate Manager*
+34 916 363 540
jpsousa@sacnet.es

Company activities:

SAC is a leader, 28 years old company, that belongs to the international electrical group ARTECHE, and focused to Automation, Control and Smart Grids projects in the following areas of energy industry and services:

- Electrical Area: Substation Automation Systems for the electrical transmission and distribution network.
- Industrial Plants Area: Automation Systems for Electricity Generation, Oil&Gas, Mining and Water Treatment Plants.
- Fire Protection and Security Systems for Substations and Critical Infraestructures.
- Renewable Energy operation and automation systems.
- Smart Grid Systems: automatic energy metering, distribution automation and energy sensors.

Fusion capacities & ITER interest:

SAC has worked in the nuclear generation area in Spain as a control supplier for our client Iberdrola. Moreover, SAC has worked for the main spanish electrical companies such as REE (Red Electrica de España), ENDESA and GAS NATURAL FENOSA. Its main capacities are:

- Turnkey automation projects for every area of activity.
- Instrumentation, control and electrical engineering.
- Software and hardware design for special applications.
- Programming, commissioning and maintenance services of control systems.

Main contracts and R&D projects:

SAC activity has always been related to the development of projects supported by CDTI and other public administration programs such as:

- ENERGOS Project leaded by Gas Natual Fenosa, supported by the public Zenit Program, dedicated to energy measurement and Smart Grids Development products.
- PRICE GEN&PRICE RED supported by the public INNPACTO program, for the Smart Grids deployment in Madrid Area.
- SEDACS project supported by CDTI FEDER program, for development of substation automation products and Scada under IEC-61850 communications standards.

Nuclear Plant Digital Alarm System

SCIENTIFICA INTERNATIONAL, S.L.

Address: Xixilion 2 bajo, Pabellon 10
20870 Elgoibar (Guipúzcoa), SPAIN

Web: www.scientifica.es

Turnover: 400 K€ in year 2012

Contact person: Lander Gonzalez Larrea, *Business Development Manager*
+34 943 127 285
lglarrea@scientifica.es

Company activities:

SCIENTIFICA INTERNACIONAL, S.L. is a company devoted to the development and manufacturing of instrumentation equipment for the science market.
With experience and technical skills in 3 main core technologies, such as, precision mechanics, electronics & signal processing, and composite materials, SCIENTIFICA has collaborated with several European scientific facilities and institutions, like, ISIS, CIEMAT, ESS-Bilbao, ILL, HZB and CERN.
It has and important activity in the development of position sensitive neutron detectors for neutron scattering applications. It has delivered detectors for neutron scattering facilities, like ISIS (UK), and has developed its own Position Sensitive Neutron Detector technology.

Fusion capacities & ITER interest:

SCIENTIFICA is interested in bringing the knowledge generated in the development of neutron detectors so far, in the field of fusion. Thus, it is involved in the development of neutron detectors for applications in fusion.

Main contracts and R&D projects:

Internal R+D Project for development of particle detectors for applications in fusion.

SEGULA TECHNOLOGIES

Address: Dos Castillas, 33. Edificio Ática, 7 Planta Baja
28224 Pozuelo de Alarcón (Madrid), SPAIN

Web: www.segula.es

Turnover: 44 M€ in year 2012

Contact person: Damien Grillon, *Director Industry Department*
+34 917 991 112
dgrillon@segula.es

Company activities:

Segula Technologies is formed by 3 companies:

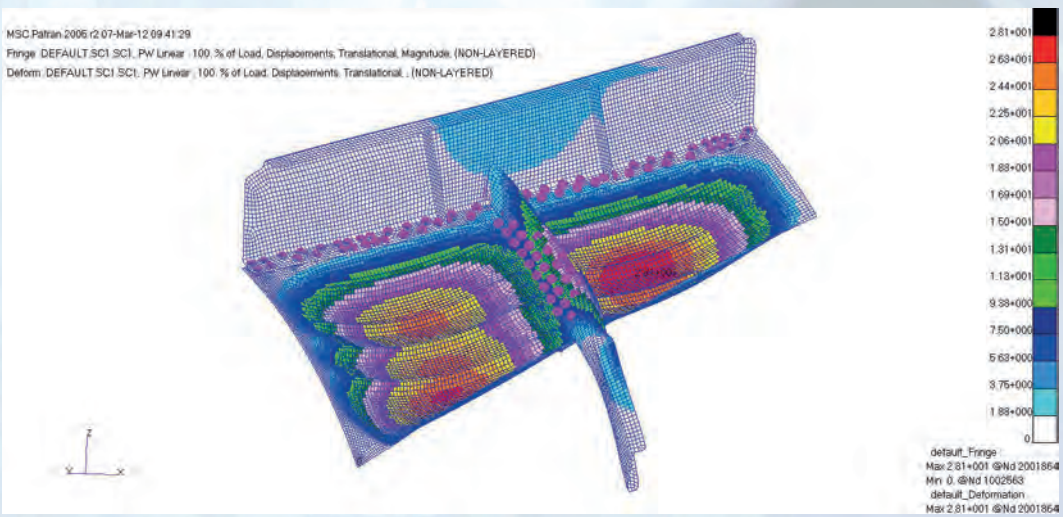
- Segula Tecnologies: provides engineering and consultancy services in automotive, railway, automotive, industry and renewable energies.
- Teccon: provides engineering services in Aeronautical Design and Stress Analysis (Static and Fatigue).
- Abgam: provides CATIA, ENOVIA, SIMULIA, DELMIA consultancy services.

Fusion capacities & ITER interest:

INTERESTS IN FUSION PROGRAM: the interest of the group is related to Stress Analysis (Static and Fatigue), and Mechanical Design with Catia, where we have extensive capacities

Main contracts and R&D projects:

- Stress Analysis Support of A380 Section 19
- Stress engineering support for Modifications and NC assessment
- Fatigue and Damage Tolerance support A380 s.19 y 19.1
- A350 S19 -1000 & Weight saving analysis



Structural FEM Analysis of the Upper Firewall Frame Compartment
Static Validation. FEM displacements for test loadcase

SERTEC

Address:	Eric Kandel, 1 - Tecnogetafe 28906 Getafe (Madrid), SPAIN
Web:	www.sertec.net
Turnover:	2.5 M€ in year 2012
Contact person:	Eduardo Cano, *Business Manager* +34 917 241 775 eduardo.cano@sertec.net

Company activities:

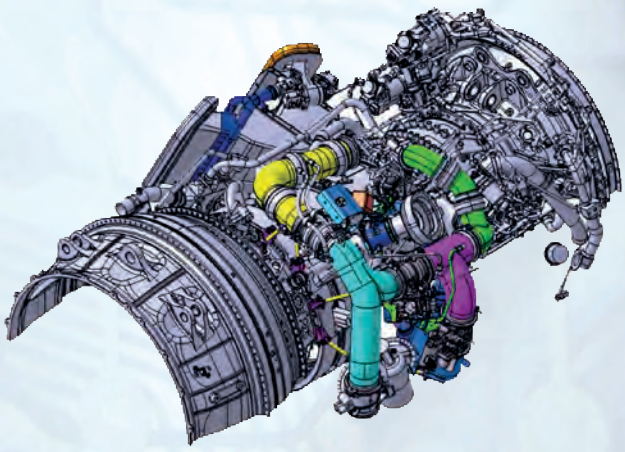
Sertec is a Spanish company with 18 years of experience in the aeronautical and defense industry. Its main activities are focused in Mechanical Engineering, Test and Instrumentation of aeronautical structures, Composite materials manufacturing processes, tooling, control systems, unmanned vehicles and Aircraft upgrades.

Fusion capacities & ITER interest:

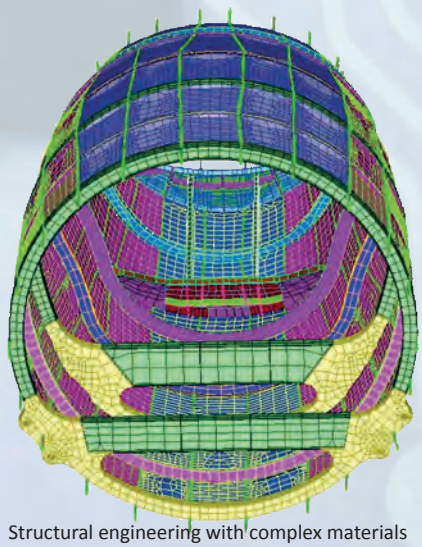
Structural & Systems engineering, systems integration, software, vision systems, test benches, automatization and Robotics.

Main contracts and R&D projects:

- Development of unmanned vehicles, remote systems manipulators.
  EUROPEAN COMISSION CLEANSKY PROJECT PROUD. Automated systems for wings assemblies.
- Protection Materials Development.
  SPANISH ARMY.PROJECT TMAC07. STRUCTURAL MATERIAL S for protection. Based on the use of composites and steel layers.
- Structural testing Test benches.
  EUROPEAN COMISSION CLEANSKY PROJECT WISDOM. Complete aircraft wing mobile system for 1G upbending test.



SERTEC System engineering integration & turn key complex projects



Structural engineering with complex materials

SEVEN SOLUTIONS

Address: C. Baza, parcela 19(3), Polígono Ind. Juncaril
18210 Peligros (Granada), SPAIN

Web: www.sevensols.com

Turnover: 352 K€ in year 2012

Contact person: Eduardo Ros, *Head of R&D Department*
+34 958 285 024
eduardo@sevensols.com

Company activities:

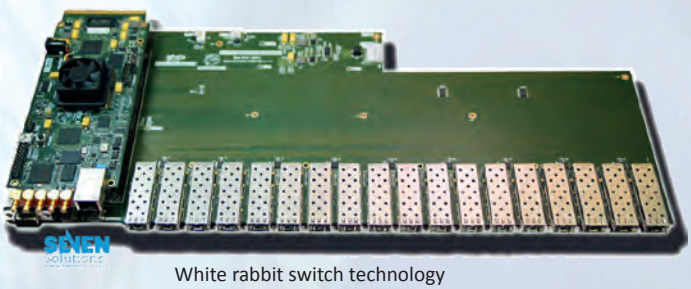
Seven Solutions,S.L. is a technology-based company specialized in the design of embedded systems and in hardware acceleration for Industry for science and other industrial application fields. Seven Solutions contributes to major scientific projects (Energy, Aerospace, Astrophysics, …) in partnership with different research institutions (such as CERN). We develop custom-made systems to fullfill our customers needs such as fast control systems, high performance timing technology, artificial vision, etc.
We have participated in the White Rabbit Timing Technology project in collaboration with CERN, GSI and other scientific infraestructures towards developing an open cutting edge timing technology (reliable, deterministic and with nanosecong timing accuracy). (http://www.sevensols.com/whiterabbitsolution/).
We also have expertise in safety critical systems (RECOMP EU project).

Fusion capacities & ITER interest:

We have expertise in high performance timing technology (for instance White Rabbit Technology) which is of interest for fast control. Furthermore, we have long expertise in FPGA based platforms for high performance processing, embedded systems and safety critical applications. We have development capabilities in FPGA technology, DSPs, microprocessors, etc; developing PCBs, gateware and firmware. Therefore our main interest is in Fast control and related modules.

Main contracts and R&D projects:

CERN & GSI: White Rabbit Timing Technology. We have collaborated in the development of the White Rabbit Switch which is one of the key elements supporting the White Rabbit Technology, currently being used at CERN, GSI, DESY, etc. We have also expertise in LLRF for accelerators in HEP (High Energy Physics).
As subcontractors of IAA we have also participated in several aerospace projects. Mainly related with FPGA, real-time processing and real-time operating systems (such as RTOS, RTEMS).
ACELTEC (Technology development for a LINAC facility in Huelva). Timing Tech.
RECOMP EU Project (Reduced Certification Costs for Trusted Multi-core Platforms) acquiring expertise in multicore certification procedures.



White rabbit switch technology

THARSIS TECHNOLOGY S.L.

Address: C/Villa de Madrid 17
21001 Huelva, SPAIN

Web: www.tharsistechnology.com

Turnover: 200 K€ in year 2012

Contact person: Rafael Berjillos Morente, *General Manager*
+34 607 931 356
rafael.berjillos@tharsistechnology.com

Company activities:

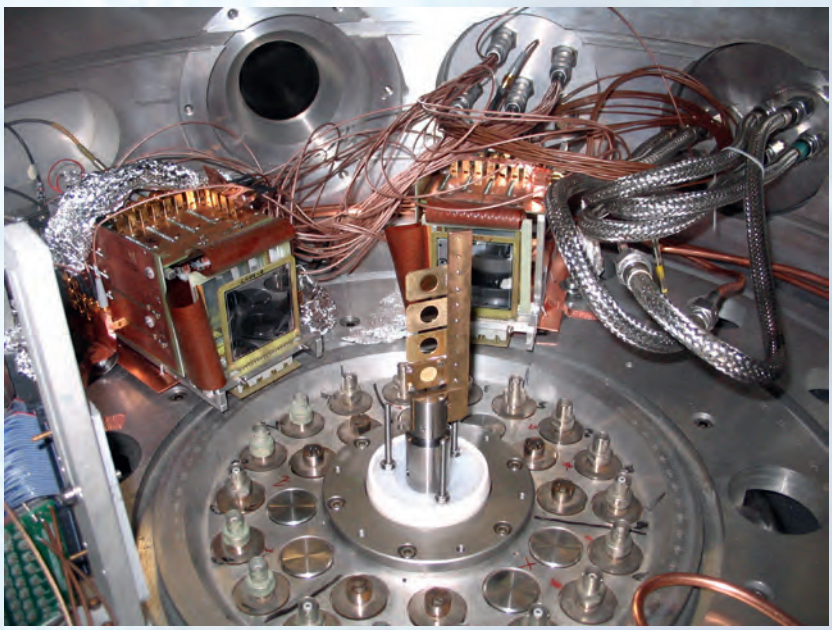
R&D Engineering - 3D and electronic designs – High vacuum, detectors and beam diagnostic systems.

Fusion capacities & ITER interest:

Tharsis Technology (Tharsis) has experience designing different instrumentation for linear accelerators. The company can contribute with 3D structures designs and studying what kind of electronic systems can be used in any environment.

Main contracts and R&D projects:

Tharsis is involved in the design of different beam diagnostic systems for LINACs (INTERCONNECTA 2011) and GANTRYs for cancer therapy (INTERCONNECTA 2013) and moreover the company is designing different electronic devices for data acquisition, like preamplifiers, shapers, CFD, TAC and a control module.
Apart of this, Tharsis is offering a catalogue of vacuum fitting pieces and standard electronic devices for data acquisition systems.



Telescope system with silicon detectors

TRANSGRUMA, S.A.

Address: Calle Palier, 12-14
28914 Leganés (Madrid), SPAIN

Web: www.transgruma.com

Turnover: 5.82 M€ in year 2012

Contact person:

English: Javier Herranz Ruiz,
Head of Spanish Division
+34 649 896 599
rrhh@transgruma.com

French: Julián Bravo Costoya,
Head of French Division
+33 (0) 642 812 023
comercial2@transgruma.com

Company activities:

Transgruma is a machinery rental company, it was founded by Manuel Aguado in 1989, it possesses a fleet of about 100 modern vehicles, that it allows by itself being a nationwide reference.
We are a service company whose job is to hire out machinery with operator:

- concrete pumps
- truck-mounted cranes
- telescopic cranes
- mini spider cranes
- mobile lifting platforms on truck for persons
- machinery for distribution of aggregate (mobile conveyor trucks aggregates “Telebelt”, mobile conveyor tower aggregates “Towerbelt”, aggregate dump trucks, fixed discharge hopper feeders and truck unloaders moving on wheels) and the transportation of any type of goods nationally or internationally, as well as the execution of all types of works and provision of building supplies.

Fusion capacities & ITER interest:

As result of the internacional expansion of Transgruma, it should be noted the presence of machinery works and services in France and Portugal.

Main contracts and R&D projects:

The company has a wide background lifting loads and pumping concrete for construction and industrial enterprises in Spain, and nowadays in some worksites of France:

- LGV (High-speed railway from Tours to Bordeaux) for Vinci and Demathieu et Bard
- New Bordeaux Stadium for GTM Bâtiment

Transgruma cranes

VALVULAS Y CONEXIONES IBERICA, S.L.U.

Address: Parque Empresarial Cervello, S.L.U., C/ Xarelo, 2
08758 Cervello (Barcelona), SPAIN

Web: www.swagelok.es

Turnover: 5 M€ in year 2012

Contact person: Jordi Villanueva Prades, *Director General*
+34 902 185 185
info@iberica.swagelok.com

Company activities:

Swagelok is a major developer and provider of fluid system solutions, including products, assemblies and services. Manufacturing, research, technical support and distribution facilities support a global network in 57 countries. Válvulas y Conexiones Ibérica, s.l.u. is the Spanish Swagelok distributor, since 1973.

Fusion capacities & ITER interest:

As one of the boldest scientific endeavors ever undertaken, ITER presents a variety of technical and logistical challenges. Components and systems must be of the highest quality since repair will be difficult and operating conditions will be extreme. Components and systems must be compatible and consistent across all regions. And the supplier must provide worldwide coordination of delivery and technical assistance over the many years it will take for ITER to become a reality. We are experienced in coordinating complex projects that span multiple continents and we are currently working with a number of ITER locations.

Main contracts and R&D projects:

- Suppliers of fluid components for the ALBA Synchrotron in Barcelona
- Related with ITER project, suppliers of fluid components to Telstar for the construction of a prototype for the Cassette Multifunctional Mover (CMM).

Swagelok, safe and efficient fluid systems components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