

INTERCAMPUS



SCIENCE AND TECHNOLOGY PARK

This edition of Intercampus focuses on the Science and Technology Park of the Technical University of Madrid, a dynamic project fundamental to the R+D+I of this University. Through the creation and location of new research centres, incubators for new businesses and specialised laboratories, and together with the participation of both private and public bodies, the UPM Park promotes transfer of technology in a wide range of scientific and technological areas.

The UPM, at the service of R+D+I and business competition

The Technical University of Madrid offers invigoration into its R+D+I activity and the transfer of knowledge to society as part of its strategy. This is one of its commitments as a public university. As a result, the UPM is now the number one Spanish university in obtaining external resources for its R+D+I. Through this concept, it has established collaboration agreements with both private and public bodies worth 120 million Euros in the past year.

The UPM's support for the business sector is very close. It signs around 600 contracts annually and has more than 75 University-Business Chairs. In some cases this collaboration has led to the creation of spin off companies as well as the growing participation of the business sector in its postgraduate programs.

In this international context, the UPM is also the leading Spanish university in the number of research projects signed within the 6th Framework Program of the European Union, as well as within the current 7th Framework Program, in which it has already obtained financing for 77 projects.

There is also growing attention being paid to the exploitation of the results of research, both in the number of patents taken out and the creation of technology companies. These data reflect the vocation of the UPM to contribute to the generation of a new, innovative business style and its capacity to transfer the knowledge deriving from its research structures as well as its "transformation" into technological developments applied to the production sector.

Thus, the Science and Technology Park of the Technical University of Madrid (UPM Park) is an initiative arising from the objective of favouring the R+D+I activity in an environment of collaboration with other private and public entities, at the same time as expressly invigorating the research activity and the transfer of knowledge from a multidisciplinary perspective.

Javier Uceda

Rector of the Technical University of Madrid



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PUBLISHING TEAM:

EU DE INFORMÁTICA: Nuria Gómez Blas, EUIT
 AGRÍCOLA: Tomás Ramón Herrero Tejedor, ETSI DE MONTES: Fernando Blasco, ETS DE ARQUITECTURA: Guillermo Cabeza, EU DE ARQUITECTURA TÉCNICA: Agustín Rodríguez, RECTORADO: Adolfo Cazorla, EUIT FORESTAL: Alfonso Cobos, ETSI TOPOGRAFÍA: Julián Aguirre, ETSI AERONÁUTICOS: Vanesa García, GABINETE DEL RECTOR: Victoria Ferreiro, ETSI AGRÓNOMOS: Cristina Velilla, ETSI INDUSTRIALES: Ángeles Soler, ETSI NAVALES: Miguel Ángel Herreros, CENTRO SUPERIOR DE DISEÑO Y MODA -CENTRO ADSCRITO- Mercedes Jarmart, INEF: Javier Pérez Tejedor, EUIT INDUSTRIAL: Javier Albéniz, ETSI DE TELECOMUNICACIÓN: Alberto Almendra, ETSI DE TELECOMUNICACIÓN: Alberto Hernández, ETSI DE MINAS: Alberto Ramos, FACULTAD DE INFORMÁTICA: Xavier Ferré, RECTORADO: Cristina Pérez, RECTORADO: Antonio Pérez Yuste, EUIT DE TELECOMUNICACIÓN: Rafael Herradón, ETSI DE AERONÁUTICA: Ángel Antonio Rodríguez, ETSI DE CAMINOS, CANALES Y PUERTOS: Javier Valero, EUIT DE OBRAS PÚBLICAS: Rafael Soler

EDITORIAL TEAM (CR):

José Luis VALVERDE, Ángel José GUTIÉRREZ, Inés BERNABÉU, Victoria FERREIRO, Cristina CEBRIÁN, Marta ORTIZ

PHOTOGRAPHY:

Lucía CASTILLO

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The UPM Park, an evolving project **23**

"The UPM Park is a fundamental tool for the transfer of technology to society"

The Technical University of Madrid carries out intensive R+D+I activities in cooperation with both the business sector and the Public Administrations.

Specifically, the UPM collaborates with the business sector in more than a thousand R+D+I projects and services, whose value has exceeded seventy million Euros from a total of 118 million Euros-worth of R+D+I activities contracted in 2008. In this context, the UPM Park is conceived from a vision of invigoration in its research activity and the transfer of its results, thus favouring the creation of innovative start-up businesses.

Gonzalo León, Vice Rector for research at the Technical University of Madrid, reflects on the essential aspects of the UPM Park, a fundamental tool of this university to intensify its R+D activity and the transfer of knowledge to society.

the operative support of the *Fundación General* of the UPM, which is the body that manages and promotes the Park.

At what stage is the project currently? How is it financed?

It is a long-term project that began in 2002, in which the setting up of new research and start-up business centres is gradually taking place.



¿What are the main strategic objectives of the UPM Park?

The UPM Park is an example of a science and technology park promoted by universities. Its objectives are specifically to support the creation of new R+D+I centres, both of the university itself and in conjunction with other private and public bodies, and the creation and strengthening of new technological companies. The Park also promotes laboratories for testing and trialling, as well as other R+D services in its centres together with the increased training of its researchers.

¿How is it structured?

The UPM Park has four centres located within the *Comunidad de Madrid*: Campus Sur (Vallecas), Montegancedo (Pozuelo de Alarcón), Tecno-Getafe (Getafe) and Valdelacasa (Alcobendas). However, it has a single general management, with an integrated vision from the Rectorado (The Rector's Office) and

It is financed from various public and private sources, although a large part of the financing comes from the call to aid science and technology parks from the Ministry of Science and Innovation, as well as resources provided by the *Comunidad de Madrid* from an agreement with IMADE (a department of the *Consejería de Economía y Hacienda*).

What are the scientific and technological areas involved? What type of synergies have come about with other UPM structures?

It has not been considered suitable to establish an area of priority focusing on each of the centres, but to take advantage of the opportunities that arise from the development of new research centres and R+D services.

As an example, the Montegancedo site is the location of the *Centro de Biotecnología y Genómica de Plantas* created jointly with INIA, the *Centro de Investigación en Tecnología Aeronáutica*

(Aerospace Research and Development Centre), and the *Centro de Domótica Integral*. IMDEA Software, promoted by the *Comunidad de Madrid*, and the *Centro de Tecnología Biomédica*, whose construction began this year are also located there. The *Centro de Servicios de Supercomputación* (CeSViMa) which has the second most powerful computer in Spain (MAGERIT) is also located on the site.

As well as the UPMs own centres, *IMDEA Materiales* and the pilot plant of the *Centro Tecnológico del Silicio* (CENTESIL), together with the *Departamento de Silicio* of the *Instituto de Energía Solar* is located on the Getafe site. It is hoped that the site will also be the location of the future *Centro de Investigación en Tecno-Fusión* in a close relationship with CIEMAT which is the result of an agreement between the *Comunidad de Madrid* and the Ministry of Science and Innovation.

INSIA, dedicated to automobile safety, is located in the Campus Sur as is the *Centro Láser*. The setting up of three research centres in conjunction with CSIC is envisaged for Valdelacasa (Alcobendas): in Robotics, in Acoustics and Non-Destructive Evaluation, and in Construction.

¿How is the creation of new businesses supported?

The creation of new technology businesses is a priority for the UPM. 56 businesses have been set up in recent years, with 11 new businesses in 2008, within the institutional program in which 163 new business ideas have been presented. This year, 2009, has seen 266 new business ideas proposed and we hope that they will lead to 15 or 20 businesses.

In this context, the UPM Park has two functioning business centres, one in Campus Sur and the other in Montegancedo, both of which host technology companies related to the UPM. A third one is under construction at the Getafe site.

CENTRO DE BIOTECNOLOGÍA Y GENÓMICA DE PLANTAS (CBGP)



BIOTECHNOLOGY AND PLANT GENOME CENTRE

The *Centro de Biotecnología y Genómica de Plantas* is a joint centre of the Technical University of Madrid (UPM) and the *Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria* (INIA) (National Institute for Agrarian and Food Technology research). Created in 2005 and operative since 2008, its main objective is to develop research excellence focusing on cutting edge technology (genomics, proteomics, systems biology, biotechnology, etc.), with the aim of achieving a greater knowledge of plants and their associated microorganisms, which will bring about the development of new strategies for agricultural production which is of interest to the socioeconomic fabric of the country.

The aim of the CBGP is to contribute to the development of the Bio-economy, based on the knowledge, through which

quality research is necessary. It is structured into three areas: Biology of Plant Development, Plant-Microorganism Interaction and Functional Genomics.

The lines of research are directed towards the achievement of a greater efficiency in plant production, decisive in the future of agriculture. Thus, the search is undertaken for the understanding of processes such as the differentiation of roots, flowering, the development of seeds or the suspension of growth and development during the winter, which are key to understanding and manipulating plant production, as it affects the obtaining of water and nutrients, as well as the production of fruit and seeds or that of wood.

How plants adapt to adverse conditions is also analysed. For example, the salinity of the soil, of such great importance in semi-arid climates as in our environment, or the defence mechanisms (resistance and tolerance) to pathogenic

The centre researches in cutting edge technologies such as genomics, proteomics, systems biology or biotechnology



microorganisms (virus, bacteria and fungus), and their pathogeny. Consequently, the development of research at the CBGP requires the use of model species, such as the well-known *Arabidopsis thaliana*, and species that are important crops, such as, rice and barley, vines, tomatoes and melons, chestnut and poplar trees.

With regard to the teaching function, the researchers at the CBGP teach the Official Master's Degree in Agro-Forestry Biotechnology as well as collaborate in the training of laboratory technicians.

This Centre is open to the productive sectors and its location in the Science and Technology Park of the UPM

favours collaboration. The main building of the CBGP is approximately 8,000 m² set out on four floors. It also has a plant cultivation laboratory, a new annex of around 600 m², connected to the greenhouses, which takes up 1,350 m². There are also two floors with laboratories in the main building (14 in total) for the Research Groups, a lower ground floor in which the CBGP service laboratories are located, a space dedicated to the growing of plants and three laboratories for the future installation of businesses.

The CBGP has numerous research support services, among which, are laboratories dedicated to proteomics, genomics,

microscopy, radioisotopes, and sterilization and cleaning. The centre has modern facilities for the cultivation of plants with 1,350m² of greenhouses, 250 m² of which are of P2 security for the cultivation of transgenic plants, also eight walk-in plant growth chambers, as well as different-sized cultivation chambers, adaptable to the different growing conditions of the plants required by the CBGP Groups.

In spite of its youth, a considerable percentage of the research funds of the CBGP come from agreements with businesses in the food and agriculture, and forestry sectors. Outstanding among them are, ISAGRO Ricerca, COOPAMAN and ZetaSeeds.

LINES OF RESEARCH

Biology of Plant Development

- Winter dormancy and acclimatization of woody plants to the cold.
- Seed biotechnology.
- Defence genes in plants.
- Regulation of floral development.
- Transition phases in plant development.
- Regulation of the development of lateral roots.
- Functional genomics of vines.

Functional Genomics

- Tolerance to stress and the metabolic performance in trees.
- Ionic homeostasis and tolerance to salinity in plants.
- Regulatory networks in seeds: development integration, metabolism and environmental conditions.
- Long-distance signalling in response to biotic and abiotic stress.

Plant-Microorganism Interaction

- Innate immunity and resistance to necrotic fungi.
- Species reactive to oxygen and defensive responses.
- Plant-virus interaction.
- Plant virus biotechnology.
- Plant pathological bacteria.
- Interaction between symbiotic bacteria and plants.

CENTRO DE INVESTIGACIÓN Y DESARROLLO AEROSPACIAL (CIDA)



AEROSPACE RESEARCH AND DEVELOPMENT CENTRE

Situated in the Montegancedo Campus, the *Centro de Investigación y Desarrollo Aeroespacial* (CIDA) is part of the *Escuela Técnica Superior de Ingenieros Aeronáuticos*:

It is structurally divided into two large sections.

Instituto Universitario de Microgravedad "Ignacio da Riva"

This is a centre oriented towards research, development and training activities in areas of aerospace sciences and technologies.

It has advanced facilities for numerical calculation and trials in aerodynamic tunnels to determine the action of the wind on buildings and structures, both aeronautical and non-aeronautical (civil aerodynamics), as well as the calibration of anemometers. There are currently two wind tunnel working and another four under construction and which will come into use during 2009.

Its main lines of work related to experimental aerodynamics are trials on the effect of wind on obstacles of very diverse natures (buildings, stadiums, airport control towers, terminal buildings, bridges, etc.). In the past ten years more than a hundred trials have been carried out for both Spanish and international companies. The calibration of cup and sonic anemometers is included within the same group.

The "*Ignacio da Riva*" Microgravity University Institute is accredited by ENAC as a calibrating body in accordance with the UNE-EN ISO/IEC 17025 regulation, and is the only Spanish laboratory that is a member of the MEASNET European network, accredited to calibrate anemometers in accordance with its procedures.

E-USOC

The E-USOC (User Support Operations Centre) is one of ten European centres in charge of carrying out experimental operations on board the International

Space Station (ISS), of the European Space Agency.

It has a control room connected to the tracking of the Earth on the ISS and a laboratory dedicated to the mechanics of fluids. Its main line of activity is research into the physics of fluids in microgravity, in the transfer and processing of scientific data and the optimization of earth tracking.

Among other E-USOC projects, is the development of the software necessary for processing earth data, that necessary to receive the telemetry and send the tele-commands necessary to operate the experiment from the Earth, as well as that which must be carried out in the laboratory on board the ISS.

The main projects in which researchers from the E-USOC participate are the VIFLU II (Vibration of fluids in Microgravity. National Space Plan), ULISSE (The USOCs KnowLedge Integration and Dissemination for Space Science Experimentation. 7th Framework Program) and GENSO (Global Educational Network for Satellite Operations. ESA).

CENTRO DE DOMÓTICA INTEGRAL (CeDInt)



INTEGRAL SMART BUILDING CENTRE-DOMOTICS

CeDInt is an R+D own centre of Technical University of Madrid. Of a multidisciplinary nature, it brings together researchers from diverse areas of Telecommunications and Computer Engineering.

Its main mission is to become a reference and support of the technology necessary for the *domótica* (smart building) industry, integrating business and industry specialists with scientists and technologists from the University. It also acts as a driving force for innovation and facilitates the transfer of technology to businesses in the same environment. Among its objectives is the carrying out of training activities through its Masters Degree in Smart Buildings and Digital Homes.

CeDInt is located in a bioclimatic building of more than 3,000m², which has laboratories dedicated to optics, virtual reality, robotics, hardware, a demonstration room and an immersive system of virtual reality, consisting of a five-sided Cave Automatic Virtual Environment (CAVE).

Research into recognition systems based on iris, fingerprint or face for high-security applications

CeDInt is structured by means of different Research Groups who carry out their work in three large areas:

- Area of *Domotic* Engineering: work in this area centres on electronic devices for the management of both domotic and inmotoc environments. The main focus of CeDInt is centred on energy efficiency and sustainability. That is why work in the centre focuses on residential walkways. Intelligent systems have been designed for the efficient management of energy consumption and comfort (including the control of domestic appliances), and the control of mobile architectural elements (such as partitions, mobile panels, canopies, etc.).
- In the Area of Optical Engineering work is carried out on advanced optical systems for four types of application: illumination based on LEDs, concentration for solar energy, wireless communications and ultra-compact projection applications.

- The Area of Virtual Reality: work in this area focuses on applications based on virtual reality for the simulation of *domotic* environments. The objectives are twofold. On the one hand, to facilitate the integration of people suffering reduced mobility, be it a disability or advanced age. On the other hand, work takes place on support systems for medical professional, in the field of legal medicine and prosthesis implantation.

CeDInt is currently in the process of establishing itself as a world-renowned research centre in the field of *domotic* engineering, energy efficiency, advanced optics and virtual reality. In order to achieve this objective, CeDInt is making a great effort to increase the number of R+D projects, both individual as in the collaboration with businesses in the sector at a national level in the 7th Framework Program of the EU as well as through collaborations with universities, businesses and R+D centres in the USA.

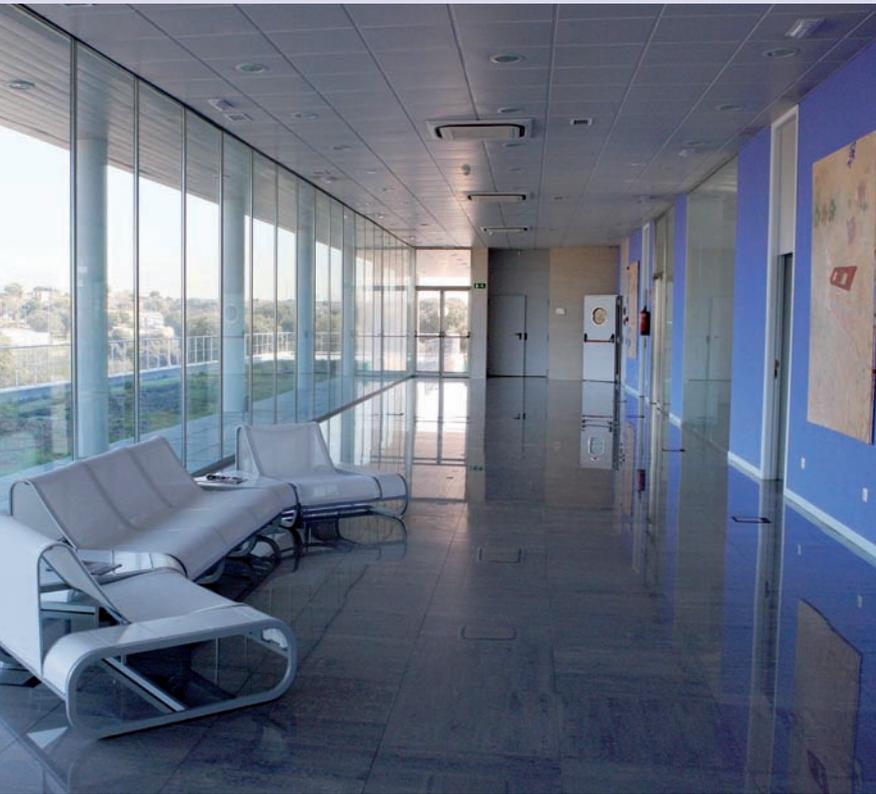
MAIN PROJECTS

Area of *Domotic* Engineering: Development of *Domotic* Systems for the Monitoring and Control of Energy Consumption in Homes (DENISE). *Ministerio de Industria, Turismo y Comercio*. 2007-2010.

Area of Optical Engineering: Development of Anamorphic Imaging Optical Systems (DEFFIO). *Ministerio de Educación y Ciencia*. 2008-2010.

Area of Virtual Reality: Design and Implementation of Software Solutions in the area of Legal Medicine and Virtual Surgery (CRANEO). *Ministerio de Industria, Turismo y Comercio*. 2008-2010.

CENTRO DE SUPERCOMPUTACIÓN Y VISUALIZACIÓN DE MADRID (CeSViMa)



MADRID SUPERCOMPUTER AND VISUALISATION CENTRE

Created at the end of 2004, the *Centro de Supercomputación y Visualización de Madrid* (CeSViMa) is dedicated to the massive storage of information, high performance computation and advanced interactive visualization.

Its objectives are:

- To make supercomputing and interactive visualization available to users, offering added-value services to facilitate the incorporation of these technologies into their fields of activity.
- To promote the use of high-performance computing and advanced visualisation techniques in all scientific, business and administration environments.
- To carry out research activities related to the generation of specialised software for the exploitation of supercomputing and visualisation in

different engineering, energy and environmental domains.

The main infrastructure of CeSViMa is Magerit supercomputer, the second most important hub in the Spanish supercomputing network. It is made up of 1,036 eServer BladeCenter JS20 nodes, each of which has two PPC processors of 2.2 GHz (8.8 GFlops) with 4 GB of RAM, as well as 168 eServer BladeCenter JS21 nodes with four PPC 2.3 GHz processors (9.2 GFlops) with 8 GB of RAM. A high performance Myrinet fibre-optic network is used for its interconnection, together with Gigabit auxiliary networks for its control and management.

The system has a local storage capacity of around 192 TB, provided by 256 disks of 750 GB, that uses a distributed system which is fault tolerant (GPFS). The external connection is made by

means of RedIRIS through a 1 Gb link. It is envisaged that it will be enlarged to 10 Gb as deemed necessary.

The real occupation rate of Magerit during 2008 was 84%, which assumes its continuous use 24 hours a day.

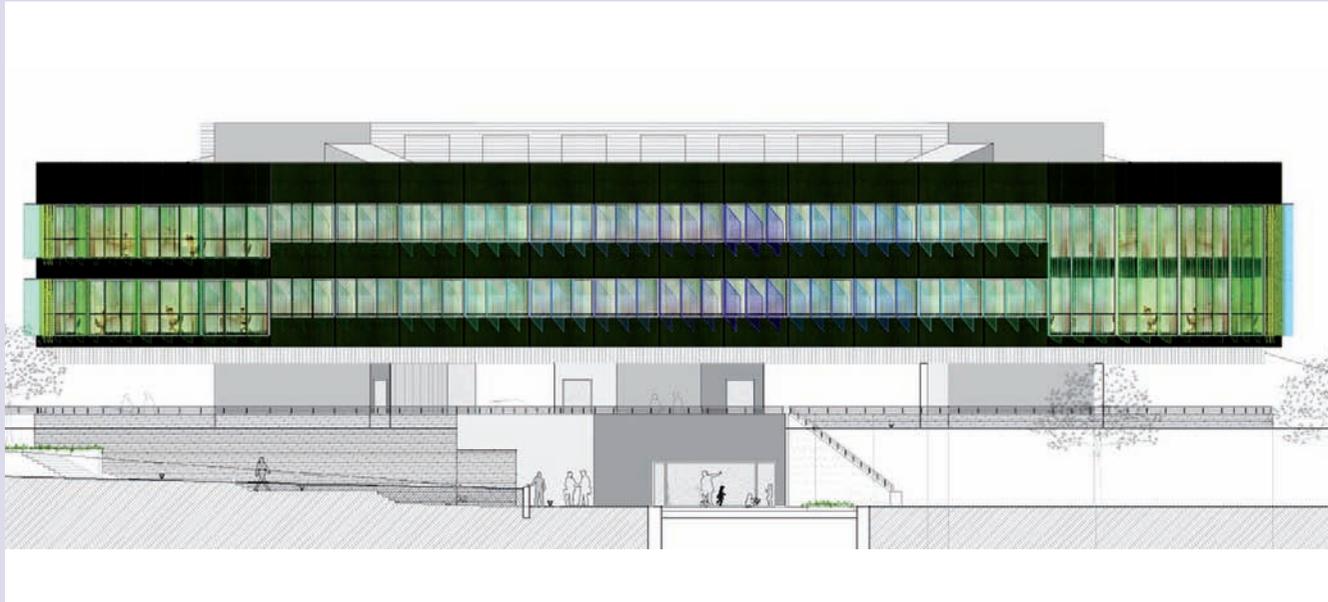
Access to the use of Magerit is carried out through two channels. 62% of the time available is offered by means of the *Comité de Acceso de la Red Española de Supercomputación* (RES) (Committee for Access to

the Spanish Supercomputer Network. During 2008, the projects assigned by RES consumed 10,575,006 hours of CPU.

For its part, the projects developed by the UPM, during 2008, have consumed 6,628,895 hours of CPU, which is 38% of the total. This time is distributed among research projects of the different Centres, both from the UPM and other universities and bodies.

Magerit supercomputer is the second most important hub in the Spanish Supercomputer Network

IMDEA SOFTWARE



Design of the IMDEA Software building carried out by Estudio Lamela Arquitectos.

IMDEA SOFTWARE

IMDEA Software forms part of the *Fundación Instituto Madrileño de Estudios Avanzados* (IMDEA) (Madrid Foundation Institute of Advanced Studies), a network of international research centres promoted by the *Comunidad de Madrid*, for the carrying out of research excellence in areas of high economic impact in the region of Madrid.

Within this framework, the main objective of the IMDEA Software Research Institute is the development of research excellence oriented towards the construction of methods that allow the efficient development of software products with a sophisticated functionality and high quality, that is, secure, reliable, and efficient. The interest of the Institute includes all of the development phases of the software (analysis, design, implementation, validation and verification), as well as its corresponding methodologies, languages and tools. The main characteristic of the research developed in the Institute lies in the use of techniques that are both rigorous and allow the construction of practical tools.

The Institute carries out activities in three aspects:

- Research excellence at a competitive level to advance the state of the art in areas pertaining to the Institute.
- Transfer of knowledge and skills to industry and, in general, practical knowledge on the technologies related to the work carried out in the Institute.
- Education and training activities, to participate in and develop postgraduate studies in collaboration with universities, and offer its education and training services, centred both on researchers and professionals in industry.

The Institute work on the development of safe, reliable and efficient software products

In order to carry out these activities successfully, the Institute has signed agreements with different universities and research centres located in the *Comunidad de Madrid*. These agreements establish a suitable framework in which to develop collaborations involving the joint use of resources, equipment and infrastructures, the

employment of staff, joint participation in research projects and PhD programs or the association of researchers and Research Groups to the Institute.

With the aim of providing its researchers with a competitive environment at an international level, IMDEA Software will be located in a new building, situated in the Montegancedo Campus of the UPM.

The IMDEA Software research Institute is currently participating as an academic member in a "European Integrated Project" (IP), of the 6th Framework Program, known as MOBIUS, of which it is coordinator. It is an IP project oriented towards the development of innovative technologies for safe overall computation, which is supported in the "proof-carrying code" in order to guarantee users the security and reliability of Java applications used on mobile telephones and PDAs.

It also forms part of the HATS consortium, "European Integrated Project" (IP), of the recently approved 7th Framework program.

IMDEA Software also participates, in a PROFIT-AVANZA project, known as R+D, oriented towards the development of a standard and open web platform.

CENTRO DE TECNOLOGÍA BIOMÉDICA (CTB)



BIOMEDICAL TECHNOLOGY CENTRE

The *Centro de Tecnología Biomédica* (CTB) has been conceived to bring together researchers from different disciplines in Biomedical Technology in several technological laboratories, which are stable and with a suitable infrastructure, essential to deal successfully with some of the current greatest scientific challenges in terms of Health and Biomedicine.

It is a common project which brings together specific biomedical lines of research, technological laboratories and a training program for researchers.

The lines of research at the CTB are:

- Design and manufacture of biocompatible and stable nanostructures in the biological media for their use as markers/contrasts (RM and MEG) for the early diagnosis of neurodegenerative diseases.
- Instrumentation for the external guidance of magnetic nanostructures for the transport of therapeutic molecules and focusing on target tissues/cells. Hyperthermia oncological treatments or targeted release of drugs.

- Development of advanced functional and quantitative image analysis techniques for the early diagnosis of neuropathologies (PET, MR, MEG) and cardiac pathologies (US, MR, CT).
- Research into the micro-organization of the cerebral cortex.
- Analysis of cerebral connectivity by means of high time (MEG/EEG) and

spatial (RMI/PET)-resolution functional techniques for cognitive neuroscience and early biological markers for Alzheimer's disease.

- Research into cerebral communication mechanisms with very low-frequency and strength pulsed magnetic fields. New actuator devices.
- Simulation, virtual reality and image guidance technologies for training and planning in minimally invasive surgery.
- Research into closed-loop control systems in diabetes: artificial telemedicine pancreas.
- Thermo-mechanical characterization of human blood vessels for application in surgical procedures.
- Integration, multi-scale analysis of biomedical information, modelling and simulation in translational research. Application in neurodegenerative diseases. Systems Biology.
- Technology for ubiquitous, personal and health care for chronic, disabled and fragile patients. Smart environments for monitoring and knowledge extraction, lab on a chip, sensor networks, interoperability.
- Clinical and "omic" information integration and retrieval systems. Text and data mining. Artificial intelligence in medicine. Information systems to aid genomic and regenerative medicine.

LABORATORIES OF THE CTB

- Bioinstrumentation Laboratory.
- Bioelectromagnetism Laboratory. Physical and functional characterization of nanostructures.
- Biofuncionalization Laboratory.
- Biochemistry Laboratory.
- Cultivations Laboratory.
- Microscopy. Fluorescence, patch clamp and voltage clamp.
- Cellular and Animal Model Laboratory.
- Laboratory on the Biological Effects of Electromagnetic Fields.
- Cajal Laboratory in Cortical Circuits.
- HPC Laboratory: High-Performance Computation.
- Biomedical Computing Laboratory.
- BIO-TIC Laboratory.
- Biomedical Image Analysis Laboratory: Neuro-images.
- Brain Connectivity and Synchronization Laboratory.
- Magnetoencephalography Centre (MEG).
- Cognitive Neuroscience Laboratory.
- Biomaterials Laboratory.

CENTRO DE EMPRESAS

BUSINESS CENTRE

This Business Centre at the Montegancedo Science and Technology Park of the UPM is a business support space to support the consolidation of new technological businesses, mainly university spin-offs.

With this Centre, the UPM establishes a space destined to become a reference for the creation of new technological businesses, promoted by researchers, teachers and students. The objective is to locate recently created businesses in the 'incubator' for three years, with the possibility of extending the period.

The centre offers help to businesses in their early phases, advice in the drawing up of their strategic and commercial plans, specific training in the protection of the research results and studies about the possibilities for internationalization.

The building has four floors, distributed in 3,642 m². It has space for twenty businesses, a room for presentations and four meeting rooms for shared use, as well as space for laboratories and heavy equipment. AIDIT and Algenex are just two of the businesses that can be found in the Centre.



AIDIT: evaluation and management of innovation

The AIDIT agency is a body created by the *Universidades Politécnicas de Madrid* (UPM) and *Cataluña* (UPC), with the objective of being the reference organization in the evaluation and management of innovation, contributing to the improvement in competition and the driving force behind the R+D and innovation in Spain. It is currently presided over by Gonzalo León, Vice Rector for Research at the UPM, and managed by Anna María Sánchez. Its mission is to provide knowledge, experience and its organisational structure to the management and evaluation of research and innovation, and the technology transfer enhancement. Its contribution is demonstrated through the certification of projects, staff and R+D+I management systems.

AIDIT is the only certification body of a university nature, with work oriented towards the generation of value and support to the relationship in all of the vertices of the triple helix, the university, business and the Administration. One of the main objectives of AIDIT "to move on to a future conditioned by the legislative changes to a planned one based on the improvement of its presence and generation of value in the universities".

Algenex: production of recombinant proteins

Algenex is a biotechnology company, whose fundamental activity is based on the discovery of new products of interest in the pharmaceutical industry. Its developments allow it to participate in great sub-segments of the market, with exponential growth, such as the

expression and production of recombinant proteins, vaccines, diagnosis reagents and therapeutic molecules of interest in both human and animal health.

Founded in 2005 as a spin-off of the Biotechnology Department of the INIA (*Instituto Nacional de Investigación y Tecnología Agraria*) (National Institute for Agrarian Research and Technology), Algenex's products are characterized by having high added value, by being unique on the market or of higher quality than those currently available, and at a sufficiently competitive price for them to be commercialized in those areas not attended to by the pharmaceutical industry for cost reasons.

Algenex is the first European platform created for the production of recombinant proteins of pharmaceutical interest, through the use of insects as in-vivo bioreactors.

CENTRO TECNOLÓGICO AERONÁUTICO



AERONAUTICAL TECHNOLOGICAL CENTRE

The *Centro Tecnológico Aeronáutico* channels its research activity by means of two Laboratories.

Fluid-dynamic trials Laboratory (LEF)

Its objective is to develop a research centre in experimental fluid-dynamics oriented toward supporting research activities, development and innovation for businesses requiring the use of advanced instrumentation such as anemometry with laser techniques, high-speed visualization or high-resolution aero-acoustic measurements.

In its early days, the LEF was created to carry out research work in aircraft engine turbines by means of a collaboration established with *Industria de Turbo Propulsores SA* (ITP) in 2003. During the period 2003 - 2008 this collaboration materialised into the development of facilities and experimental techniques for the aerodynamic characterization of low pressure turbine blades, taking part in the experimental evaluation of the blades integrated into Rolls Royce Trent 900 and 1000 engines, which propel the new generation of commercial aircrafts (Airbus 380 and Boeing 787).

In its new location, the Laboratory has a useful working area of 1,100 m². The

experimental facilities include linear cascades of turbine blades and wind tunnels for boundary layer studies. For experimental characterizations, the Laboratory has Hot Wire, Laser-Doppler (LDA) and Particle Image Velocimetry (PIV) anemometry equipment, as well as high-precision multi-channel systems for the measurement of pressure, temperature and convection heat transfer.

Development in the middle term includes the construction of a high-speed, closed aerodynamic tunnel to test turbine blades in identical conditions to those found during the functioning of an aircraft engine during flight as well as facilities for the fluid-dynamic evaluation of the aircraft engine nozzles.

In order to develop its research activity, LEF participates in projects in a regional, national and European environment. It also has a collaboration agreement with ITP, with which it participates in the Cénit project "New Aircraft and Engine Configurations for the Future System of Air transport (OPENAER)".

The Composite Materials and Smart Structures Laboratory

This Laboratory has wide-ranging experience in collaboration with the industry through different technological research programs, which include from

the carrying out of specialized trials on materials and carbon/epoxy composite material structures, to the development of new sensors which promise to be more efficient than the current ones in the qualification and maintenance of aeronautical structures.

Its group of researchers has been working intensively on different composite material programs since 1983 as well as in the field of intelligent structures since 1994. It has the following facilities:

- **Composite Materials Laboratory**, which includes an autoclave (3 x 1 m), machines for mechanical, static and dynamic trials (MTS 810 and MTS TestWork4), equipment for inspection using C-Scan ultrasound, optical and electronic microscopy, mechanizing of MtC graduated cylinders using a diamond disc, equipment for physical-chemical characterization (DSC, DMTA, FTIR, GPC).
- **Laboratory for intelligent materials and structures**, including UV laser equipment for the etching of Fibre Bragg Gratings, FBG reading equipment with 1 pm resolution (Micron 720), optical spectrum analyser, equipment for the connection and covering of optical fibre, optical sources, data logger, equipment for PZT excitation.

CENTRO TECNOLÓGICO INDUSTRIAL

INDUSTRIAL TECHNOLOGICAL CENTRE

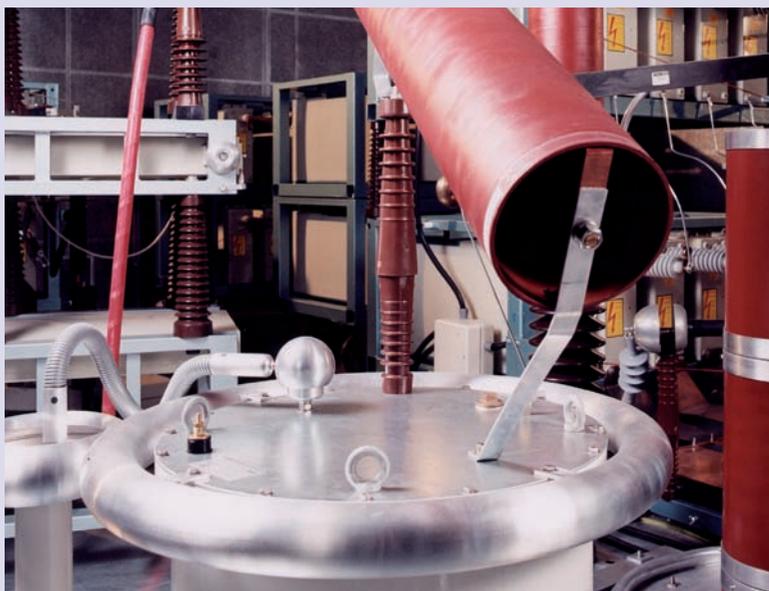
The *Centro Tecnológico Industrial* of the UPM is a group of highly specialised laboratories made up of the High Voltage Laboratory, the Low Voltage and EMC Laboratory, Vehicle Laboratory (automobile and its components) and the Solar Hydrogen Energy Laboratory (LEHS).

Its main objective is to help industry through design, analysis, technological trial studies, demands for industrial safety and quality. It also offers technological support to the *Comunidad de Madrid*, especially in the southern area, and promotes scientific and technological research to diminish obsolescence detected in industrial products.

The most significant R+D+I projects that are currently being carried out are:

- Evaluation of lightning impulses with superimposed oscillations.
- Studies into the transient voltage surge induced in the shields of high-voltage cables.
- Behaviour of nanotube structures in compound materials for protection against lightning.
- Studies into the lifecycle of high voltage cables.
- LED-type systems in illuminated signs.
- Studies into the voltage induced in overhead railway power cables.
- Photometry.

The Industrial Technological Centre forms part of the Foundation for the Promotion of Industrial Innovation in which it collaborates with 23 officially approved laboratories of the *ETSI Industriales* of the UPM and with the Foundation's six own centres (CTIMA, CENIM, CITEF, CCCAS, OFITE and CADES). Equally, it also collaborates with different international (CIGRE, CEN/CENLES, etc.) and national (ENAC, CEM, etc.) organizations.



ACTIVITIES

Area for testing high voltage electrical equipment

Dielectric trials of partial discharges and radio interference, artificial contamination, short-circuit, lightning rods for the protection of buildings and surges in current.

Area for testing low-voltage electrical equipment

- Electrical safety trials and user and environmental protection against risks derived from the use of electrical equipment in electrical appliances.
- Aptitude trials on the function, energy consumption of electrical appliances.
- Trials for the determination of the photometrical characteristics of illumination.

Area for testing electromagnetic compatibility

This area includes trials on the conducted and radiated emission and immunity.

Different electromagnetic radiations measurements are also taken

in situ that affect living beings, in accordance with the recommendations of the European Union.

Area for testing automobiles and their components

The following trials are carried out in this area: admissible sound level, acoustic alarms, rear-view mirrors, disturbance suppression, electromagnetic compatibility, retro-reflectors, stop and warning lights, direction indicators, number plate illumination, fog lights, reversing lights, driver's field of vision, command identification, safety glass and glass installation.

Solar Hydrogen Energy Laboratory (LEHS)

It is envisaged that a set of solar devices will be assembled in this Laboratory, which will allow obtaining high temperature in the appropriate fluids, which serve as the basis for chemical reactors in which hydrogen production reactions are being carried out.

CENTRO TECNOLÓGICO DE RECURSOS ENERGÉTICOS MINERALES Y MATERIALES AVANZADOS



TECHNOLOGICAL CENTRE FOR MINERAL ENERGY RESOURCES AND ADVANCED MATERIALS

Two official Laboratories and a research centre make up the *Centro Tecnológico de Recursos Energéticos Minerales y Materiales Avanzados*:

Gómez-Pardo Research Centre (CIGP)

The CIGP houses the Oil Product Laboratory (LPP) of the *Fundación Gómez-Pardo*, dedicated to the downstream of oil and gas, and the Petro-Physics Laboratory (LP) of the Petro-physics Institute Foundation, dedicated to the upstream of oil and gas.

The objective of the CIGP is to cover the industrial demands for R+D+I in the fields of refining and the exploration and production of oil as well as the geological storage of natural gas and CO₂.

Among the lines of research of the Oil Product Laboratory it is worth highlighting biomass gasification, the nitration of lubricating oils and the development of new insulating oils. In the Petro-Physics Laboratory research on physico-chemical fluid-rock interactions in CO₂ geologic storage, the fluid-mechanical behaviour of CO₂ under storage conditions and the determination of the mechanical properties of rocks under reservoir conditions is being carried out.

Centro Tecnológico Energía Tierra y Materiales (LOM)

The Official *José María de Madariaga* Laboratory (LOM), founded in 1979, is a Centre belonging to the Universidad Politécnica de Madrid recognised as an official laboratory as set out in the ITC of the *Reglamento General de Normas Básicas de Seguridad Minera* (RGNBSM).

The LOM is currently, within the framework of the New Focus, the only Spanish body approved under the Explosives Directive for their civil use (93/15/CEE) and Apparatuses and Protection systems for use in potentially explosive atmospheres, ATEX (94/9/CE), one of the Spanish bodies approved for the Machines Directive (2006/46/CE) and the reference Spanish body in the *Manual de Pruebas y Criterios de Naciones Unidas*.

It is also an Authorized Laboratory for the CE 2003/2003 regulation on Fertilizers, as well as an Accredited Official Laboratory for the *Reglamento General de Normas Básicas de Seguridad Minera y el Reglamento de Explosivos*.

The LOM is also the scientific-technological body specialised in the analysis and study of Conditions for Industrial Safety, Work Safety and Environmental Safety.

Official Laboratory for the Testing of Construction Materials (LOEMCO)

Created in 1980, as a joint proposal of the Ministries of Industry and Energy, and Education and Science, it is integrated into the Technical University of Madrid, attached to the *ETSI de Minas*, with a dedicated vocation for service to the industry and support for university teaching.

The functions of the LOEMCO are grouped together as follows:

- Testing of Construction Materials, acting as the Laboratory that verifies the application of the Regulations set out by the Ministry of Industry, Tourism and Trade, in the application of the Directive on construction products for the European Community marking and in the voluntary certifications for the quality marks of products.
- Studies, technical reports and research into the characteristics and quality of construction materials and their raw materials, and into the technologies of the manufacturing processes of the aforementioned materials entrusted by the Ministry of Industry, Tourism and Trade, by the *Universidad Politécnica de Madrid* and by the industrialists in the sector or their professional bodies.
- Teaching and research work.

CENTRO DE TECNOLOGÍA DEL SILICIO SOLAR (CENTESIL)



TECHNOLOGICAL CENTRE FOR SOLAR SILICON

The *Centro de Tecnología del Silicio Solar* (CENTESIL) is an organisation resulting from the collaboration between the Technical University of Madrid through its *Instituto de Energía Solar*, the *Departamento de Ingeniería Química* of the *Universidad Complutense de Madrid* and the companies *Técnicas Reunidas*, *Isofotón* and *DCWafers*.

Its objective is to develop its own technology for the ultra-refinement of silicon through synthesis, distillation and the later reduction of chlorosilanes. There are several production plant projects for the production of polysilicon in Spain, all of which are carried out using imported technology. This project, however, aims to develop an own technology for the ultra-refinement of polysilicon with the objective of commercially supplying the technology for the construction of polysilicon factories in Spain and throughout the world.

For this reason CENTESIL is contemplating the setting up of a pilot plant with the capacity to produce a hundred tonnes of polysilicon per year. It has to be borne in mind that, although the physical and chemical principles that govern the ultra-refinement process

from chlorosilanes are well-known in their basic aspects, their practical implementation involves a multitude of scientific and technological challenges, so that until recently there were only nine

It is considering the setting up of a pilot plant with the capacity to obtain a hundred tonnes of polysilicon per year

companies in the world that possessed this technology and supplied silicon to chip manufacturers and to photovoltaic industry. This technology was protected under a high level of secrecy. The polysilicon specifications required for solar cells are not exactly those of microelectronics, in such a way that the modification of the basic process must be researched in order to obtain a polysilicon of sufficient quality for photovoltaics, as inexpensively as possible.

The CENTESIL proposal is a novel and original approach to the problem of polysilicon production. Up until now, there has been no independent research centre (that is, external to the companies that already have this technology) into the refinement of silicon similar to that set out in this project, which in the near future will become a strength for

Spain in the field of silicon refining research, as it will have its own technological and capabilities for continuous innovation.

CENTESIL facilities are located in a building at the Tecno-Getafe site in the Science and Technology Park of the UPM. With 3,000 m² of useful space, the building has several industrial areas, one for the synthesis and distillation of chlorosilanes, another for silicon deposition area and a third one for the crystallization unit and characterisation equipment.

CENTESIL KNOW-HOW

- Deposit reactor laboratory prototype.
- Concept and basic engineering for deposit reactor.
- Prototypes for basic processes in the refinement of chlorosilanes.
- Concept and basic engineering for trichlorosilanes synthesis reactors, distillation columns and gas recirculation system.
- Equipment for the growth of monocrystalline ingots.

IMDEA MATERIALES



Computer-designed image of the definitive headquarters.

IMDEA MATERIALS

IMDEA Materiales is a private foundation that forms part of the IMDEA network (*Institutos Madrileños de Estudios Avanzados*) promoted by the Comunidad de Madrid to drive research and the transfer of technology to the industrial sector in strategic areas. IMDEA Materiales has three main objectives: carry out research excellence into materials science and engineering, transfer technology to the industrial sector to improve competitiveness and attract talented researchers from all over the world to work in an international and multidisciplinary framework.

Activities at IMDEA Materiales began in February 2007. It currently has twenty researchers from nine different nationalities, as well as a management department with wide-ranging experience in the coordination of R+D projects and transfer of technology.

The definitive headquarters of IMDEA Materiales, is a recently constructed building of 19,000 m², which will be located at the Tecno-Getafe Science site in the Technology Park of the UPM. It is a

strategic location, since it will benefit from the available research infrastructures and the synergy created by the proximity of other R+D centres.

The researchers work on the development of materials that include new capacities: multifunctional, hybrid and smart materials

The scientific objectives of IMDEA Materiales are directed towards the design and processing of metallic alloys and composite materials for structural application in sectors such as aerospace, transport and energy generation, in accordance with the interests of the businesses that participate in the patronage of the Foundation (ITP, Grupo Antolín, TOLSA, Aries-Complex and GAMESA). The research includes the development of new manufacturing techniques, the optimisation of already existing materials, the development of materials that include new capacities (multifunctional materials, hybrid

materials, smart (intelligent) materials) and the use of modern simulation techniques in the field of properties prediction and processing (virtual processing and testing).

IMDEA Materiales has four lines of research open at the moment: Advanced Metallic Materials, Composite Materials, Nanomechanics and Simulation in Material Engineering. The research activity in these areas has been framed into 12 research projects with a budget of 2.14 million Euros. This budget is divided into European projects (42%), national projects (40%) and research agreements with businesses (18%). Its objective is to carry out research excellence which will also be useful for improving the technological competitiveness and leadership in businesses. The achievement of these goals has been reflected in the publication of more than twenty research articles in high-impact scientific journals, the application for the first patent and the extension of the collaboration in research projects to companies such as AIRBUS, Rolls-Royce, INTEL and EADS-CASA.

INSTITUTO UNIVERSITARIO DE INVESTIGACIÓN DEL AUTOMÓVIL (INSIA)



UNIVERSITY INSTITUTE FOR AUTOMOBILE RESEARCH

Created in 1993, the *Instituto Universitario de Investigación del Automóvil* (INSIA) is one of the reference R+D+I centres in the transport sector, where R+D+I activities are being carried out, focusing mainly on vehicle safety and transportation environmental impact, postgraduate and specialised training and technological services.

The Institute has the most highly qualified research staff, with more than twenty years' experience in R+D+I projects related to the world of transport, vehicle safety, traffic, and more recently, its environmental impact.

INSIA has carried out relevant studies into accidents, transport, passive safety in buses, coaches and industrial vehicles, biomechanics applied to the protection of occupants and pedestrians in accidents, smart systems and vehicle engineering. It is also authorised as an

official laboratory to carry out trials on the official recognition of vehicles and components under different regulations and directives (buses and coaches, stability, tyres, seats, retention systems) and significant reforms.

Since its creation it has pursued the following objectives:

- To carry out basic and applied research in the general area of automotive transport and its use, with special attention to safety issues.
- To collaborate with the Administration on accident research, drawing up of regulations, rules, studies and action plans, etc., aiming to reduce the number of accidents and their negative consequences.
- To cooperate with vehicle and component manufacturers, coachbuilders and hauliers, offering scientific and technological support through R+D work, advice, trials, certification, etc.

- To set up training activities within the specialisation environment of the Institute.
- To carry out official approval and certification trials related to the safety characteristics of vehicles, their parts and other elements that have an influence on transport safety, as well as fuel consumption and the emission of pollution.

INSIA is located on a 50,000 m² area sited at the Campus Sur of the *Universidad Politécnica de Madrid*. It has two physically separate and independent buildings. The useful area occupied by the laboratories building is approximately 3,000 m², and the research, teaching and administration building occupies 1,700 m².

INSIA has the following laboratories: Vehicles and Components, Pollution Emissions, Calibration of Electro-mechanical Equipment, Passive safety and Instrumentation and Electronics.

CENTRO LÁSER



LASER CENTRE

The *Centro Láser* of the Technical University of Madrid was created in 1998 with the objective of forging links between the University and the industrial environment to promote research, the development and dissemination of the Laser technology applications.

In accordance with this concept, the centre has taken on the following missions:

- Promotion of and participation in technologic R+D+i projects in collaboration with businesses and other research centres, about advanced subjects in which the laser tool provides advantageous solutions.
- Organization and carrying out of activities for the dissemination of laser technology to businesses in the industrial environment.
- Development of practical-theoretical monograph training programs at

different levels, aimed at businesses and research centres' technical staff at Masters and PhD Degree level within the teaching framework of the *ETSI Industriales of the UPM*.

For the development of its activities, the *Centro Láser* of the UPM has the most complete infrastructure at a national level in the field of laser technology. It has numerous power lasers completely robotized for the development of industrial applications, and high intensity systems for the theoretical and experimental study of the laser-material interaction and the development of advanced applications in the treatment of materials.

It also has advanced systems for micro/nano manufacture using pioneering lasers in Spain, through which the development of a significant variety of microsystems becomes possible, and a set of laboratories accredited for the characterization and testing

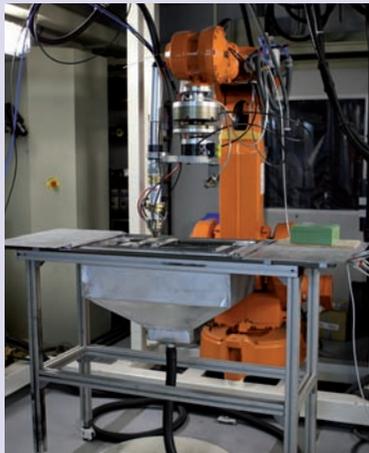
MAIN LINES OF RESEARCH

- Development and instrumentation of power laser industrial applications.
- Development and instrumentation of very high intensity laser applications.
- Development and instrumentation of 2D-3D micro/nano manufacturing processes with laser.
- Development of spectroscopic analysis techniques with laser.
- Development and application of advanced techniques in the characterization of materials.

of materials (confocal and electronic microscopy, FTIR and RAMAN spectrophotometry, trials in mechanical properties, etc.), that allow an accurate evaluation of the manufactured components and the improvements obtained by means of the corresponding laser processes.

The *Centro Láser* has, at the same time, the required potentialities to become an officially recognised centre in Europe, based on its connections at an international level that it has maintained since its founding. In this respect, it actively participates in transnational networks for the transfer in technological knowledge, such as the European Laser Institute and the EULASNET network, while forming part of their boards.

On the other hand, an especially significant aspect of the Laser Centre is its capacity as a training centre, at the level of technical, postgraduate and PhD staff within the framework of UPM both official and own programs. In addition to "Industrial Laser Applications" and "Optical Engineering and Industrial Laser Applications" PhD programs, given by the Department of Applied Physics at the *ETSI Industriales* of the UPM, the centre has promoted, together with other similar institutions of the university environment and that of CSIC, the Official Program of Postgraduate Training in "Laser technology" (Masters Degree in Laser technology).



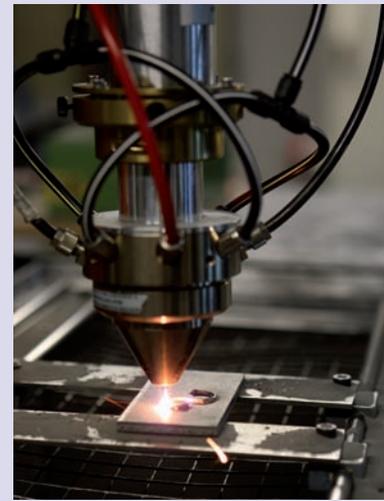
Robotic hybrid laser-arc welding system.



Robotic arm and laser head during the process of surface coating.



Laser surface coating of a tractor axis.



Partial view of the axis system of the laser micro-manufacturing station.

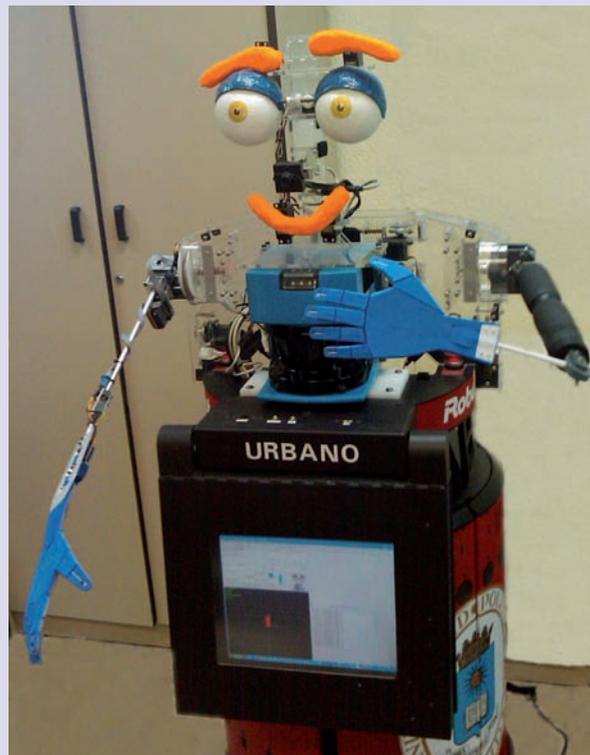
APPLICATION ENVIRONMENTS

- Manufacture and treatment of materials in the aeronautic-aerospace industry.
- Manufacture and treatment of materials for the automobile industry and capital goods.
- Manufacture of MEMS (micro-electromechanical systems) and other components on the micro/nanometric scale based on the use of laser technology, with a high potential for repercussion in the aerospace, transport and biomedicine sectors, among others.
- Micro-manufacture for the photovoltaic solar energy industry.
- Instrumentation for optical sensor and analysis applications based on the use of laser technology, in accordance with the growing demand, on the one hand, of environmental monitoring techniques and, on the other, the integration of advanced detection technologies in different industrial sectors, such as transport.
- Surface cleaning and decontamination with laser.
- Characterization and testing of materials in the field of material transformation, joining and treatment processes with laser and other similar technologies.
- Dissemination and transference of laser technology applications to industry, in collaboration with the main suppliers (national and European) of laser equipment and with other collaborating institutions that make up the HISPLASNET network (Spanish Platform of Laser Science, Technology and Applications), on the basis of the widely representative equipment and infrastructure available.

CENTRO DE AUTOMÁTICA Y ROBÓTICA



Above, map of the location of the Valdelacasa industrial estate, drawn up by the *Ayuntamiento de Alcobendas* (Alcobendas Council). On the right, the *Urbano* robot-guide.



AUTOMATION AND ROBOTICS CENTRE

The origin of the *Centro de Automática y Robótica* lies in the collaboration protocol between the *Consejo Superior de Investigaciones Científicas* (CSIC) and the Technical University of Madrid (UPM) for the setting up of joint scientific and technological centres. Within this protocol the creation of a *Centro Científico Tecnológico Conjunto (CCTC) de Automática y Robótica*, which originally integrated researchers from the *Instituto de Automática Industrial* of the CSIC and teachers from different research groups in the UPM.

The vocation of the researchers is to carry out research mainly applied to offering useful results to society, as well as achieving, through projects in competitive programs at both national and international level, or agreements with industry, resources that allow sustained growth. The transfer of technology to

the industrial sector will be one of its main objectives. This will allow the creation, within its environment, of a network of businesses interested in the development of their activities in these areas.

The Research Groups that initially drive the Centre have more than fifty years experience dedicated to specific research in the fields of Automation and Robotics. Many of these researchers were the instigators of research into these areas in Spain and all of them work exclusively on its development. Their activities will centre on three scientific and technological areas: control and integration of systems, artificial perception and robotics.

The centre will have several buildings and spaces, and its construction is currently being planned, with capacity for a hundred researchers, four hundred fellowship students and around a hundred people for the administration and services.

Their activities will be centred on three scientific and technological areas: control and integration of systems, artificial perception and robotics

ENVISAGED ACTIVITIES

- Scientific and technological research work in automation and robotics.
- Transfer of scientific and technological research results to public and private institutions.
- Drive the creation of technological bodies and businesses.
- Researcher training.
- Training of experts by means of highly specialised courses and postgraduate programs.
- Promotion of a scientific culture in society.
- Inform, assist and advise with regard to science and technology in the areas of automation and robotics to public and private institutions.
- Collaborate in the updating of teachers' knowledge about non-university teachings.

CENTRO DE INVESTIGACIÓN EN MATERIALES ESTRUCTURALES (CIME)

CENTRE FOR RESEARCH INTO STRUCTURAL MATERIALS

This R+D centre was created in 2007 through the integration of the following research groups *Materiales Estructurales Avanzados y Nanomateriales* (MATESAN) (Advanced Structural Materials and Nanomaterials), *Mecánica Computacional* (GMC) (Computational Mechanics), *Polímeros, Caracterización y Aplicaciones* (POLCA) (Polymers, Characterisation and Applications) and *Materiales Híbridos* (MH) (Hybrid Materials).

Its objectives cover the subjects deemed priority for the research into materials within the 7th Framework Program of the European Union: "Generation of new knowledge on high-performance materials for new products and processes, materials based on

knowledge with tailor-made properties, greater reliability in design and simulation, integration of the nano/macromolecular levels into material technology, new nano-materials, biomaterials and hybrid materials, including the design and control of its characteristics".

The Centre has laboratories in several Schools in the UPM, with specialised equipment, which includes machines for mechanical trials, scanning electron microscopes, atomic force microscope, Hopkinson bar. It also has computer equipment and programs for numerical simulation, both commercial and own programs.

Since its creation, the Centre has initiated a trajectory of cohesion of the different member groups. In the medium term it is envisaged that CIME will become a joint centre of the UPM and CSIC, which will enrich the research

capacities and give it greater possibilities to obtain resources.

MAIN LINES OF RESEARCH OF THE CENTRE

- Synthesis, characterization and applications of polymers, compounds and nano-compounds.
- Hybrid materials.
- Particle technology.
- Materials with hierarchical structure.
- Biologically inspired materials.
- Adhesion and adhesives.
- Mechanical characterization of structural materials.
- Numerical simulation of large deformation and dynamic problems.
- Structural integrity.

CENTRO DE ACÚSTICA APLICADA Y EVALUACIÓN NO DESTRUCTIVA

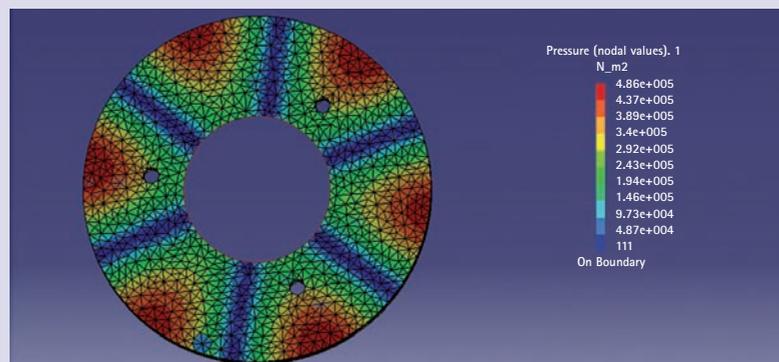
CENTRE FOR APPLIED ACOUSTICS AND NON-DESTRUCTIVE EVALUATION

This Centre is an initiative of the Technical University of Madrid and the *Consejo Superior de Investigaciones Científicas* (Higher Council for Scientific Research), who are in agreement on setting up research excellence groups in different areas of knowledge that allow them to compete at both national and international level. One of these areas is applied acoustics, encompassing the study of applications of mechanical waves both in the audible range and beyond.

Its objective is to deepen knowledge on the generation, propagation, attenuation, detection and processing of physical phenomena which may be applied to acoustics or in the non-destructive evaluation, orienting this knowledge to the development of techniques, sensors and instrumentation to improve the wellbeing of our society.

Its application favours:

- An increase in safety and a reduction in the environmental impact on transport,



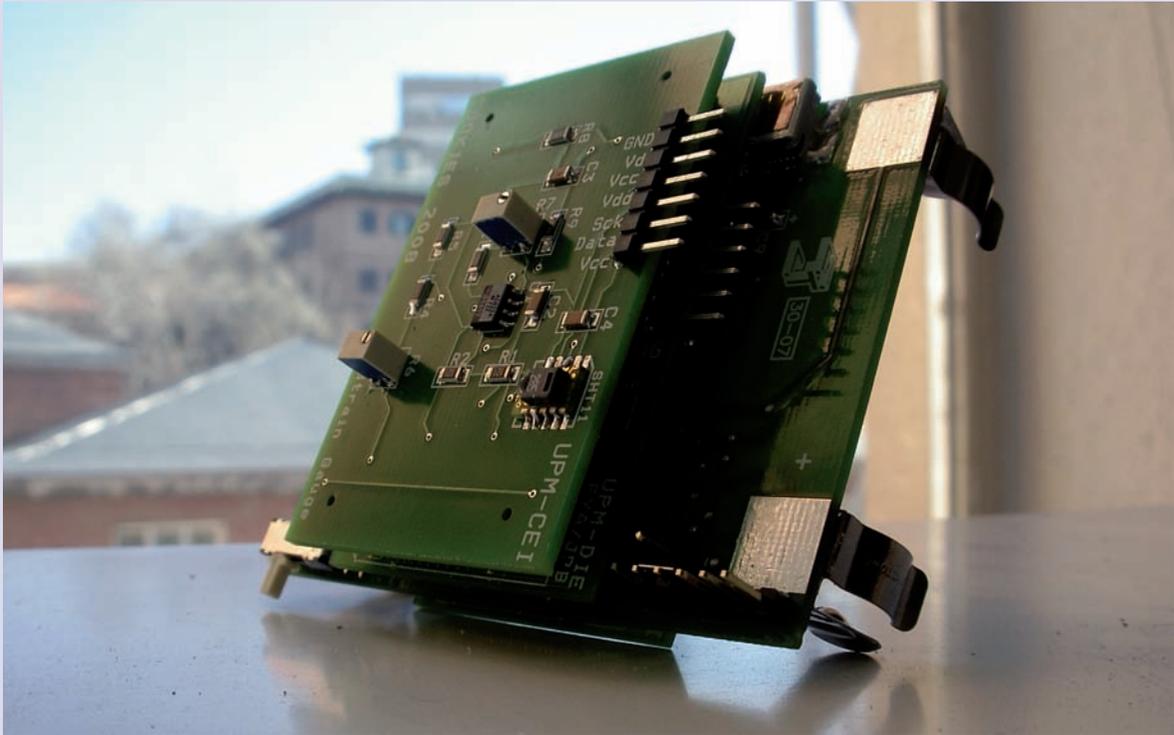
on cities, on infrastructures, as well as on industrial or agrofood processes.

- An improvement in the quality of manufactured products, as well as in the effectiveness of the production processes.
- An improvement in health-related diagnostic devices.
- The maintenance of our cultural heritage (monuments, paintings, sonorous landscapes, etc.), and of the infrastructures in service, increasing their safety and shelf life (bridges, large industrial facilities, buildings, etc.).

- The control of the harmful effects of noise that implies an improvement in the quality of life in urban populations.

Outstanding among the lines of research of the Centre is the evaluation and control of noise, acoustics in building, the development of systems for the non-destructive evaluation of media, material characterization, the development of ultrasonic transducers and systems, electronic instrumentation and virtual instrumentation systems applied to scientific experiments.

CENTRO DE ELECTRÓNICA INDUSTRIAL



Modular nodes for wireless sensor networks (cookies).

CENTRE FOR INDUSTRIAL ELECTRONICS

The main objective of the *Centro de Electrónica Industrial* of the UPM is to create added value centred on industrial electronics creating synergies in two aspects, university and industry. The Centre has three lines of research: power electronics, digital systems and power quality.

In the international university environment it is usual to find very specialised research groups in each of the aforementioned areas, but very few combine experience in the three of them. For example, digital systems groups do not usually take advantage of the act of feeding circuits in a suitable way so as to reduce their consumption (partitioning, dynamic voltage scaling, etc). If the spectrum is extended to include the new trends in environmental intelligence, sensor networks in remote environments, networks-on-chips, etc, it is evident that the integration of electronic instrumentation, communications, analogical and digital electronics and electrical energy allows research projects to be undertaken jointly. This total of capacities, under

the umbrella of industrial electronics, produces an added value that is demonstrated in the activity of the CEI-UPM.

Likewise the transfer of technology to the industrial sector is a constant in the activity of the Centre for Industrial

The Centre has three lines of research: power electronics, digital systems and power quality

Electronics that is not just a university centre isolated from industrial reality. In the last ten years, direct research agreements with more than twenty companies have been carried out. The centre has been working in close collaboration with the following businesses INDRA, CRISA, SENER, BOEING, EADS-CASA, AIRBUS, TECNObit, ALCATEL, FAGOR, ANSOFT, ENPIRION, INTEL, INTERLAB, MTP, the agency, SEDECAL, Red Eléctrica de España and Electricité de France, amongst others.

The CEI has a complete laboratory equipped with the instrumentation necessary for the development of projects from their inception to the prototype phase. It has oscilloscopes, waveform generators, radiofrequency amplifiers, multimeters, impedance analysers, dynamic loads, programmable sources, wattmeters, network waveform recorders, brazing furnaces, equipment for the carrying out of printed circuit wafers, circuit simulators and electronic systems (Simplorer, Saber, Pspice), electrical system simulators (PSS/E, PSCAD), finite element simulators (Maxwell 2D and 3D) and tools for the development of integrated circuits.

In the short term, the Centre will continue with its main activities in the generation of knowledge as regards industrial electronics, through the carrying out of projects, transfer of results to industry, researcher training, dissemination through channels such as congress communications and the publication of articles in prestigious scientific journals, etc.

The UPM Park, an evolving project

The Science and Technology Park project of the UPM, initiated in 2002, will be working at full capacity by 2015. There are currently two operative sites, Campus Sur and Montegancedo. The buildings located in Tecno-Getafe will be working this year, 2009. While the construction works on the centres on the Alcobendas site will begin in the next few months, with its finalization envisaged for 2011.

The UPM Park is an example of a Science and Technology Park promoted by the universities. Its main objective is to facilitate the transfer of knowledge and skills to the productive sectors in society, with the aim of constructing a reference framework in science and technology in which the academic world and productive sector work closely together.

The UPM is intent on creating new R+D+i centres or own R+D+i centres in conjunction with other bodies, establishing stable agreements with business organizations and Public Administrations for the development of R+D+i activities, as well as supporting the creation and financing of spin-offs by means of 'business incubators'.

MONTEGANCEDO

- Biotechnology and Plant Genome Centre (CBGP)
- Aerospace Research and Development Centre (CIDA)
- Integral Smart Building Centre (Domotics) (CeDInt)
- Madrid Supercomputer and Visualisation Centre (CeSViMa)
- IMDEA Software
- Biomedical Technology Centre (CTB)
- Business Centre

TECNO-GETAFE

- Aeronautical Technology Centre
- Industrial Technology Centre
- Technological Centre for Mineral Energy Resources and Advanced Materials
- Technological Centre for Solar Silicon (CENTESIL)
- IMDEA Materials

VALDELACASA

- Automation and Robotics Centre
- Centre for Research into Structural Materials (Cime)
- Centre for Applied Acoustics and Non-Destructive Evaluation
- Centre for Industrial Electronics

CAMPUS SUR

- University Institute for Automobile Research (INSIA)
- Laser Centre



THE PARK IN FIGURES

- 740,000 square meters.
- Six operative research centres, and seven others under construction.
- More than 1,700 researchers.
- In the past six years, more than 660 business ideas as well as 64 businesses have been generated.
- Two working business centres and one under construction.

Data updated in 2009.

UPM Entrepreneurship Program

The aim of the UPM Entrepreneurship Program is to help creating high growth potential companies, through the exploitation of research results and innovative ideas. Thus, the Program is based on four key issues: the business idea, the team, support resources and the business model that defines the feasibility of the project.

Among the services offered in the Program, advice at all of the development phases of the project is included. In order to minimise risks and optimise the business value proposition, three phases have been established in the development of an entrepreneurial project:

- **Phase I:** The team must be able to describe their idea in a brief dossier. Some of the most outstanding aspects

are the definition of potential customers and competitors and also, the competitive advantages and relevant people supporting the project.

- **Phase II:** This stage involves the drawing up of a business plan that demonstrates the opportunity and feasibility of the business project. Market research, marketing plan or financial / economic analysis, are some of the areas to deal with in the design of the plan.
- **Phase III:** At this stage there must be enough information available to make a decision on the following steps and the possible setting up of a business. Should we go on? Communication support, fund-raising or locations are other services provided.

PARQUE CIENTÍFICO Y TECNOLÓGICO DE LA UPM VICERRECTORADO DE INVESTIGACIÓN

Ramiro de Maeztu, 7 - 28040 MADRID. Tel: +34 91 336 36 40 - Fax: 91 336 59 74 - parqueupm@upm.es - www.upm.es



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