campus MONCLOA

la energía de la diversidad

Final Report (2014)

MONCLOA CAMPUS

INTERNATIONAL CAMPUS OF EXCELLENCE

Universities

Complutense and Technical Universities
Madrid

FINAL REPORT

Period: 2010-2014

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Project data: MONCLOA CAMPUS: THE POWER OF DIVERSITY **(Ref. CEI09-0019)**

Type of CEI Global X

Acronym: CEI Moncloa Campus

Coordinating University Complutense University of Madrid

Participating Universities/Cluster Sponsors: COMPLUTENSE UNIVERSITY AND THE TECHNICAL UNIVERSITY OF MADRID

Other CEI sponsors:

La Agencia Estatal de Meteorología (AEMET)

Madrid City Council

Central Lechera Asturiana (CAPSA)

Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT)

Madrid Autonomous Community

Consejo Superior de Investigaciones Científicas (CSIC) (Spanish National Research Council)

Fundación Juan José López Ibor

Fundación madri+d para el Conocimiento

Fundación para la Investigación Biomédica del Hospital Gregorio Marañón (FIBHGM)

Hospital Universitario 12 de Octubre (H12O)

Global Forecasters, S.L.

Hospital Clínico San Carlos (HCSC)

Indra

Instituto de Salud Carlos III (ISCIII)

Instituto del Patrimonio Cultural de España (IPCE)

Instituto Geológico y Minero de España (IGME)

Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA)

Instituto Tecnológico PET

Parque Científico de Madrid (PCM)

Patrimonio Nacional (PN)

University of Colorado Denver

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3

International Campus of Excellence - MONCLOA CAMPUS

Table of contents

1. *Introduction*

The classification of "Campus of International Excellence" (ICE) for the project **Moncloa Campus: The Power of Diversity**, coordinated by the Complutense (UCM) and Polytechnic Universities in Madrid (UPM) was recognised in the resolution of 26 November 2009 by the General Secretary of Universities. In addition to the promoter universities, this project also included teaching bodies and researchers located on the campus of the Ciudad Universitaria. The institutions with which the CEI Moncloa Campus has signed collaboration agreements are listed below:

- Agencia Estatal de Meteorología (AEMET)
- Ayuntamiento de Madrid
- Central Lechera Asturiana (CAPSA)
- Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT)
- Comunidad de Madrid
- Consejo Superior de Investigaciones Científicas (CSIC)
- Fundación Juan José López Ibor
- Fundación madri+d para el Conocimiento
- Fundación para la Investigación Biomédica del Hospital Gregorio Marañón (FIBHGM)
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- Instituto Tecnológico PET
- Parque Científico de Madrid (PCM)
- Patrimonio Nacional (PN)
- University of Colorado Denver

This project, outlined in the Strategic Plan for the Viability and Conversion of the Moncloa Campus into a Campus of International Excellence, was the result of a strategic planning process achieved by clustering the teaching and research bodies located on the Ciudad Universitaria campus in Moncloa. The project was founded through a framework agreement between the coordinating universities and between these universities and the rest of the institutions involved.

The four **strategic areas,** identified by the keywords ***Creating, Sharing, Connecting and Growth,*** determined the **guidelines for the simultaneous actions** that are currently being undertaken to achieve **excellence**. These formed the basis for defining the **strategic objectives** that expressed the desired outcomes to be achieved in order to attain the vision for the future. In turn, these strategic objectives were embodied in **specific or operational objectives** to be accomplished through a series of general, transversal and sector-based **actions**.

The Strategic Plan for conversion to the CEI contained **27 general** and **structural** actions that served as the cornerstones of the project architecture and served to support –thereby raising and enhancing the visibility of the Campus– the five thematic clusters: *Global Change and New Energies, Materials for the Future, Agri-Food and Health, Innovative Medicine, Cultural Heritage and Sustainable Mobility*, all with a strategic plan underway.

As the project develops it has evolved to adapt to the changes in the Chancellor's Office in both universities, leading to closer collaboration between the two institutions and giving impetus to the implementation of the strategic plan.

The Governing Board of the Moncloa Campus have chosen to incorporate the full potential of their universities into this project, beyond the physical concept of the Ciudad Universitaria Moncloa, as originally envisaged in the Strategic Plan. Both universities wished to extend their collaboration with other campuses like Montegancedo or Somosaguas, and thus strategic actions such as the International Centre for Heritage Studies or the Centre for Latin American Studies have set up their operations centres in these campuses.

It has proved impossible to use the building currently housing the Costume Museum as the centre for the activities of the Campus Moncloa, forcing a change in strategy in the distribution of space on the Moncloa Campus. The significant investment required to adapt this building was another factor in the decision-making process. As a result, the services originally planned for the Costume Museum have been distributed around the whole Campus, which enhances their visibility and brings them closer the university community.

Photo: Offices of the CEI Moncloa Campus (Real Jardín Botánico Universitario Alfonso XIII)

During the review period, the following activities have been launched within the transversal actions in the Moncloa Campus Strategic Plan:

- Adaptation of teaching infrastructures to EHEA deployment
- International Post-graduate School at the Campus de Moncloa (EIP)
- Moncloa Campus competitive calls:
  - Call for Moncloa Campus research grants (CAIMON)
  - International talent recruitment programme (PICATA)
- Design of the cluster master plans
- Improvement of data and communications network
- International visitor reception centre (CIVA)
- Campus Recovery Plan: Campus Project
- General accessibility plan
- Actions relating to the museum offer at the Moncloa Campus
- School of Governance
- International Centre for Latin American Studies (CEI-AL)

In terms of the structure of the work areas included within the clusters, each one forms a programme based on the thematic actions defined in their strategic plans.

At the end of November 2011, a new cluster of excellence for research into Sustainable Mobility was proposed and included by the Moncloa Campus Executive Committee after its presentation and acceptance by the Ministry of Education.

The following table summarises the working structure of the clusters, with a more detailed description shown below:

Cluster	Work areas
Global Change and New Energies	▪ E6. Programmes in support of the ITER Project ▪ E8. Creation of a Remote Sensing and Monitoring Laboratory. ▪ E9. Creation of a Laboratory on Climate Change and its Impacts. ▪ E10. Constitution of the Moncloa Natural Hazards Network. ▪ E11. Creation of the Advanced Scientific Instrumentation Laboratory (LICA). ▪ E12. Creation of a Mixed Ex-situ Conservation Unit (UCM-UPM). ▪ E13. Creation of a Programme for Cataloguing, Conserving and Disseminating Biodiversity in the Ciudad Universitaria.
Materials for the Future	▪ F1. Installation and equipping of the ICTS "National Advanced Electron Microscopy Centre (CMA)". ▪ F2. Platform for the Design and Construction of Electromagnetic Sensors and Actuators. ▪ F3. Creation of the Workshop Network for the development of new thin-film materials. ▪ F4. Mechanical Properties Workshop: Durability and Sustainability of Materials.
Agri-food and Health	▪ Creation of the Moncloa Agri-food Corridor (environmental and land-use recovery). ▪ G2. Development of the Consortium for Integrated Agricultural Systems. ▪ G3. International School for Communicable Animal Diseases (EIEAC). ▪ G4. Improvements to the VISAVET Sanitary Vigilance laboratory.
i-Health	▪ Design and synthesis of diagnostic and therapeutic tools ▪ Pre-clinical biomedical imaging platform. Advanced Biomedical Imaging Analysis ▪ Platform for clinical information: System for filing and communicating clinical images and databases ▪ "Living-Lab" Platform
Cultural Heritage	▪ International Centre for Advanced Heritage Studies (CIESP) ▪ Creation of the Science and Technology Laboratory Network for Heritage Conservation ▪ (RedLabPat)
Sustainable Mobility	▪ Electromobility. Models and technologies. ▪ Mobility. Analysis and modelling. ▪ Information and communications systems in transport. ▪ Intermodality. Models and technologies

Work is underway in the following areas of action in the CEI Moncloa Campus Programme:

1. Improvements in teaching and adaptation to the European Higher Education Area
2. Improvements in science and knowledge transfer
3. Transforming the Campus to develop an integrated social model and its interaction with the local environment.

In implementing the strategic plan for conversion to a Campus of International Excellence, Moncloa Campus has closely followed the original project proposal, and carried out the actions for which it has received funding through some of the ministry programmes.

However, it has also embarked on several new initiatives arising from the collaboration dynamics between the participating universities through their mutual involvement in the creation of the Moncloa Campus.

One of these initiatives is UPM's incorporation as a member of the Real Colegio Complutense at Harvard (RCC), which has served to raise awareness of the CEI Moncloa Campus and its importance for the UCM and UPM strategy among Harvard's governing bodies. This negotiation was conducted by prioritising the areas in the CEI. The UPM is represented at the RCC by Professor Páez, who has carried out his functions since April 2040 focusing on the activities in three areas of interest linked to the clusters of the Moncloa Campus:

- Architecture and Cities
- Biomedical Applications
- Renewable Energies

Plans have been made for three encounters and courses between specialised teachers in the UCM and UPM and their opposite numbers in Harvard and MIT. The first of the *areas of interest* – **Architecture and Cities**– has attracted the greatest attention so far, and a work area has been launched in response to the first course scheduled to take place in October.

Continuing with this new line of interest, Moncloa Campus is supporting the initiative developed at the UPM entitled “The City of the Future”, which this new academic year –after being offered for two years at the summer courses in La Granja– is launching a postgraduate programme entitled *Master in City Sciences (MCS),* designed to train the professionals required for current and future urban environments.

Highlights of the achievements of the member organisations of the CEI Moncloa Campus:

The **Moncloa International Campus of Excellence** (CEI Moncloa Campus) is home to the greatest concentration of talent in our country. It represents the coming together of Spain's most important universities with the aim of combining their complementary strengths to forge an international point of scientific reference.

The **CEI Moncloa Campus** runs an integral, unified, sustainable and socially responsible campus, and acts as a catalyst for the cultural life of the city of Madrid.

The **CEI Moncloa Campus** is located in the city of Madrid, although it includes other campuses such as Somosaguas, and the CEI in Montegancedo.

Program for International Talent Recruitment (PICATA)

This represents a commitment to the future by recruiting the most talented young people for research.

It offers pre- and post-doctoral contracts in conditions that are similar to the leading international programs. These projects are co-directed by professors from both universities, which confers an added value on the results.

The content of this research explores areas with a wide-reaching impact, including Parkinson's disease, tuberculosis, food safety and ready-made products, graphenes, the development of two-dimensional magnetic materials, anti-tumour therapy and renewable energies.

Since the program was launched the **CEI Moncloa Campus** had 35 graduates working towards their doctoral thesis, and 36 recent doctoral graduates divided among the six clusters.

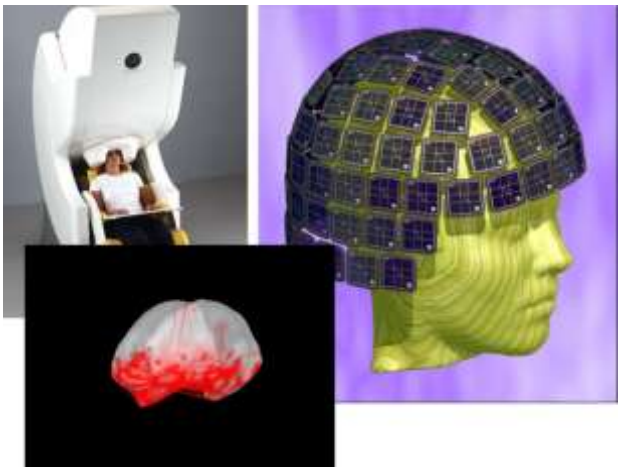
Science infrastructures

The **CEI Moncloa Campus** has provided its researchers with internationally competitive and attractive tools and facilities.

Through the **Moncloa Campus's Call for Research Grants** (CAIMON), nearly 4 million euros has been dedicated to acquiring equipment and infrastructures to assist the research carried out by our scientists. This equipment, and that purchased through the INNOCAMPUS 2010 program, has completed the push for highly competitive scientific installations. Some of the most important resources are described below:

- ✓ **Singular Technical Science Facility for Advanced Electron Microscopy**. This facility has a microscope with an aberration corrector on the condenser lens and cold cathode that makes it unique in Spain. It provides direct images with atomic resolution of the structure of a material, and represents a major leap forward in the development of new materials, particularly in the area of nanomaterials. The facility collaborates with leading institutions such as Oxford, Paris VI, Stockholm, Tsukuba and Oak Ridge National Laboratory.

- ✓ **Cognitive and Computational Neuroscience Laboratory.** This is a unique facility in which a further magnetoencephalography (MEG) apparatus has been added to its electroencephalography equipment (EEG), in what is cutting-edge technology in the field of neuroscience. This equipment creates models which help to understand neurological diseases such as Alzheimer's.



- ✓ **Advanced Scientific Instrumentation Laboratory (LICA).** This laboratory includes instruments with a significant impact on astronomy such as MEGARA, the first instrument capable of observing gas emissions between galaxies.
- ✓ **Living-Lab.** Infrastructure for 3-D visualisation and multimodal interaction capable of recreating the evolution of the real world in a virtual environment. It has multiple applications in the fields of health (surgical training, cognitive therapies), defence (flight simulator), and architecture (accessibility assessment).
- ✓ **Veterinary Healthcare Surveillance Centre (VISAVET).** This centre studies disease-causing microorganisms with an impact on animal production and public health, and verifies that the products we consume are healthy. Its laboratories and animal facilities are unique in Madrid. This Centre has a MALDI TOF/TOF mass spectrometry platform that is the only one of its kind currently installed in Spain.
- ✓ **Agri-food corridor**. Its infrastructures are unique in Madrid. This facility makes this environment one of the leading European axes of R+D+i in sustainable agricultural production, food safety, and animal health and wellbeing.

Academic program.

- ➢ The **International Postgraduate School** (EIP) is the inter-university structure at the **CEI Moncloa Campus** that is responsible for the academic organisation of the activities that lead to the award of university Masters' degrees, its own degrees and lifelong learning. It also arranges extraordinary courses, events, meetings and a range of potential educational activities for the future.
- ➢ As part of academic collaboration the **International School of Infectious Communicable Animal Diseases** (EIEAC) provides technical and scientific training aimed at combating and eradicating infectious diseases in animals. It includes the reference laboratories for the OIE, UE and FAO for African swine fever. In this line of work a collaboration agreement has been signed with the Center for Animal Disease Modeling and Surveillance at the University of California, Davis.

Transfer to society and interaction with its surroundings

- **Cei[innova] conference**. Organised with the aim of highlighting the R+D+i capacities, solutions and services of the **CEI Moncloa Campus**, it also included companies and experts from a range of institutions who shared their current view of the challenges and technological requirements involved in their area of activity.
- **Materialsweek.** Materials week featured a wide range of activities designed to highlight our social presence and the synergies between teaching staff, researchers, students and companies working or collaborating in the materials sector. The events took various formats (lectures, debates, presentation of research lines, demonstrations, courses, visits, etc) aimed primarily at students at different stages of their academic career, companies, researchers and teachers at the **CEI Moncloa Campus** who have some type of relationship with the materials science.

- **Summer courses.** The **CEI Moncloa Campus** also contributes additional value in the sphere of education with courses such as the one on **21st-century astrophysics: the science of the universe** held in El Escorial, or the one entitled **The challenges of the cities of the future** that took place at the Granja de San Ildefonso.

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- ✓ The **University Institute of Automobile Research** (INSIA). This is a reference centre for the automobile industry and transport sector with a national and European scope. It is engaged in an ongoing collaboration with companies in the sector including the Spanish Automobile and Lorry Manufacturers Association (ANFAC). The Spanish Association of Automobile Equipment and Component Manufacturers (SERNAUTO). PSA PEUGEOT CITROËN, Madrid Municipal Transport Corporation (EMT). Madrid Metal Employers Association (AECIM), the Bus and Coach Chassis Company Association (ASCABUS). Association of Paraplegics and the Severely Disabled (ASPAYM). VALVERAUTO, S.A., ALSA.
- ✓ The **Electron Microscopy Centre** resolves technology-based problems for companies such as Repsol, Acerinox, Cepsa, and Lucent Technologies, among others, and works with institutions such as the Prado Museum in the study of Spain's national heritage.
- ✓ The **VISAVET** Centre advises and provides scientific support for companies and government bodies such as Merial Laboratorios S.A., Pfizer S.L.U., Lohmann Animal Health, CZ VETERINARIA S.A. Laboratorios Maymo S.A., Inmunología y Genética Aplicada (INGENASA),

and the Spanish Ministry of the Environment and Rural and Marine Affairs.

2. Work progress

Table I. Description of project actions

Strategic Focus	**SCIENTIFIC IMPROVEMENT**
Project	A5. Moncloa Campus call for Research Grants (CAIMON)
Objectives	To implement a joint call for research grants in the groups taking part in the clusters for the acquisition of scientific equipment to improve research capacity. The aim is also to boost the CEI cluster connectivity through the shared use of resources. The aims of the CAIMON Call, in line with the aims defined in the CEI Moncloa Strategic Plan, are to increase the capacities of the Campus, create the conditions for the optimal use of its scientific and technological infrastructure, create the synergies required to reinforce the Campus, optimize research results transfer to the productive sector and boost the Campus excellence in the thematic areas of the five clusters.

Summary of work completed

By joint resolution of the Complutense University of Madrid and the Technical University of Madrid of 23 March 2011, a call for proposals was announced for the acquisition of scientific-technological equipment and infrastructure for 2011 under the CEI Moncloa.

These grants were complementary actions of acquiring scientific equipment requested strategic programs: Campus of International Excellence Sub B (MICINN) and INNOCAMPUS.

For more information see : http://www.campusmoncloa.es/es/convocatorias/caimon.php).
The Moncloa Campus program has assigned to the CAIMON program almost 4 million euros for the acquisition of equipment and infrastructure for Research Groups or Research Support Centres, and for the inter-university group networks of any institutions on the Moncloa Campus. This funding was complemented by the provision of more than 1.5 million euros from the resources of the research groups which have co-financed the equipment. The Call for Research Grants, which received 55 applications for a total value of over 10 million euros, was assessed scientifically by the ANEP and after a strategic evaluation by independent experts, was decided in December 2011.
The infrastructure and equipment funded are for open use by the whole scientific community of the Moncloa Campus, as per the official joint resolution signed by the Chancellors of the partner universities on 21 May 2013. The resolution was published in: http://www.campusmoncloa.es/data/pdf/gobernanza/Resolucion-Rectoral-Conjunta-20130521.pdf
The availability of and access to the equipment can be consulted on-line on the Moncloa Campus website.
The Table below shows the projects which received funding through this Call:

CLUSTER	TITLE	AMOUNT AWARDED
Innovative Medicine	Improved Confocal Microscopy and Imaging Analysis.	282.922 €
Materials for the Future	Powder Diffractometer with accessory for PDF	214.760 €

	measurement (Atomic Pair distribution function).	
Global Change and New Energies	Ex-situ conservation of animal and plant biodiversity on the CEI Moncloa Campus. Proposal to set up an Inter-university centre for the study of native fauna.	121.044 €
Global Change and New Energies	Guadarrama Monitoring Network Initiative (GUMNET)	318.876 €
Agri-Food and Health	Mass spectrometry platform Maldi Tof/Tof	595.680 €
Innovative Medicine	Incorporation of TAC and new ring of detectors to MICROPET tomograph	165.000 €
Heritage	Incorporation of portable equipment for Energy –dispersive X ray fluorescence (ED XRF) in the Heritage Laboratories Network.	54.588 €
Heritage	Mechanical traction multi-channel georadar system for high resolution large scale geophysical prospection.	118.387 €
Global Change and New Energies	Ex situ conservation of animal and plant biodiversity on the CEI Moncloa Campus. Acquisition and installation of equipment and infrastructure for the conservation, maintenance and study of the biodiversity in the plant germplasm bank.	244.375 €
Materials for the Future	Combined Scanning Electron Microscopy-Cathodoluminescence System(SEM-CL)	250.000 €
Agri-Food and Health	Purchasing equipment for the elemental analysis of C and N in solid and liquid samples for the CAM 212-UPM service laboratory.	113.415,00 €
Innovative Medicine	3D visualization and advanced multimodal interaction infrastructure for CEI Living Lab	296.174 €
Agri-Food and Health	Creation of an interdepartmental laboratory for evaluating techniques and processes to improve the safety, healthiness and quality of foods of animal origin.	155.875.00 €
Materials for the Future	Integral platform for the micro and nano mechanical characterization of materials	120.000 €
Materials for the Future	Direct laser writing system for nanolithography	120.000 €
Materials for the Future	INGENIA: developing the solar cell of the future through a new generation of materials	250.000 €
Materials for the Future	Axial 500kN servo hydraulic dynamic test machine	150.000 €
Global Change and New Energies	Technique for quantitative elemental determination in solids, secondary neutron mass spectrometry (SNMS)	120.000 €
Global Change and New Energies	Capturing and application of 3D information using terrestrial laser to natural resource management, land use planning	80.163 €

Most significant results

The description of the scientific work undertaken is given in the report in the section corresponding to the strategic areas developed by the clusters, where the scientific equipment is an essential complement to the work underway.

Strategic Focus	**SCIENTIFIC IMPROVEMENT**
Project	A9. Program for International Talent Recruitment (PICATA)
Objectives	Recruiting international talent at all levels: Predoctoral grants, post-doctoral contracts and highly qualified technicians. The program is complemented by a subprogram of mobility.

Progress towards goals

The International Program for Talent Recruitment (PICATA) is one of the strategic actions of the Moncloa Campus. Researchers may join research groups at UCM, UPM and / or Partner Entities (CSIC, CIEMAT, INIA, AEMET, etc.) in order to work together. All beneficiaries' work undergoes double supervision, with scientists from at least two institutions from the strategic group of Moncloa Campus. Accordingly, the projects undertaken under this program reinforce the joint research conducted by the CEI Campus Moncloa groups.

Photo: Group of PICATA program beneficiaries at the meeting held in March 2012

This program reinforces the collaboration and integration in the Moncloa Campus and promotes internationalization.

Summary of work completed

In this area of scientific improvement and internationalization, from the human capital perspective, young researchers of academic and scientific excellence have joined through the International Program for Talent Recruitment (PICATA), which is undoubtedly one of the main actions of CEI Moncloa Campus.

The PICATA program has a total budget of about 6 and a half million Euros, divided into four calls for young PhDs, two grants for the completion of doctoral theses and a last tender for highly skilled laboratory technicians. This last call has been financed by the research groups and is intended for large equipment acquired with funds from the CEI Moncloa Campus budget.

The program includes 35 graduates completing their PhD theses, 36 young PhDs and 20 support technicians.

International Calls for Predoctoral Grants are complemented by a Mobility subprogram whereby all Predoctoral grant recipients can enjoy a Predoctoral stay at any university or research centre in any city in the world, for up to three months maximum. The purpose of these grants is to promote the international character of their training and facilitate obtaining European doctorates.

In the last two calls for technicians and doctors in 2014 the main feature is the shared responsibility and 50% co-funding between the CEI Moncloa Campus and the groups that will receive the beneficiaries of the grants. Note that part of the funding for these salaries is obtained through co-funding agreements with private companies given the high interest in the work being conducted.

Details regarding these calls is available on our website:
http://www.campusmoncloa.es/es/convocatorias/picata.php

Most significant results.

The most significant result of the program is the collaboration between groups from the different institutions in the Campus Moncloa project thanks to the work being done by the researchers recruited through this program. Also, from the training viewpoint, Pre-doctoral activity has been enhanced by the fact that the co-directors of the theses tend to complement each other.

Moreover, during the annual meetings organized with all beneficiaries of the PICATA program to review the work they are doing and encourage interaction between them and their research groups, synergies have been created in already well-establish projects.

The 1st PICATA Workshop was held in 2013 and the projects were presented. We have produced a publication with a summary that is available at:

http://www.campusmoncloa.es/data/pdf/noticia/Book-of-abstracts-PICATA.pdf

Internationalization activities

The beneficiaries of the PICATA program have been quite international in many cases, including researchers from other countries and Spanish doctors who have returned after a long stay abroad. They have joined the Campus Moncloa and have provided international research experience and contacts in international reference centres.

Strategic Focus	**SCIENTIFIC IMPROVEMENT**
Project	A6. DRAFTING OF THE CLUSTER MASTER PLANS.
Objectives	Preparation and development of cluster master plans for the purpose of ensuring the strategic objective of connectivity, internationalization and transfer.

Summary of work completed

In 2010 the coordination structures of the clusters were created. The process began with the appointment of Coordinators and Advisory Councils. Cluster Coordinators are members of the campus Board.

To date more than 400 research groups belonging to strategic partners of CEI Moncloa Campus have shown interest in taking part in joint research projects. The Moncloa Campus defines its strategic specialization areas through six strategic clusters: Global Change and New Energies, Materials for the Future, Agri-Food and Health, Innovative Medicine, Heritage and Sustainable Mobility.

A noteworthy factor in this second evaluation period is the consolidation of work developed in the clusters as a force which generates collaborative work in the Moncloa Campus and enhances the power of diversity, as defined by the title of our strategic plan. Moreover, in late 2011 the Moncloa Campus Executive Committee agreed on the incorporation of a new cluster in addition to the initial five clusters. The new cluster specialized in Sustainable Mobility generates new lines of joint work and is strongly supported by the business sector.

While in 2010, progress was made towards the consolidation of clusters, identifying the groups involved in the strategic lines of the Moncloa Campus, defining their objectives and decision making structures through the Advisory Boards of the clusters, during 2011 their work was consolidated and compiled in a document that contains the Master Plans which describe their work strategy.

These master plans may be viewed at the Moncloa Campus website, at the following links:

- Global Change and New Energies Cluster: www.campusmoncloa.es/data/clusters/CG/Cluster-Cambio-Global-y-Nuevas-Energias-Plan-Director.pdf
- Materials for the Future Cluster: www.campusmoncloa.es/data/clusters/MF/Cluster-Materiales-para-el-Futuro-Plan-Director.pdf

Agri-Food and Health Cluster: www.campusmoncloa.es/data/clusters/AH/Cluster-Agroalimentacion-y-Salud-Plan-Director.pdf

- Innovative Medicine Cluster: www.campusmoncloa.es/data/clusters/MI/Cluster-Medicina-Innovadora-Plan-Director.pdf
- Heritage Cluster: www.campusmoncloa.es/data/clusters/P/Cluster-Patrimonio-Plan-Director.pdf
- Sustainable Mobility Cluster: www.campusmoncloa.es/data/clusters/MS/Cluster-Movilidad-Sostenible-Plan-Director.pdf

Governance structures created

In 2010 progress the clusters were created, and the groups involved in the strategic areas of CEI

Moncloa were identified and the objectives defined. Part of the consolidation is based on the decision-making structures created:

- Campus Board Formed by two internationally renowned coordinators (one proposed by each university).
- Advisory Councils of the clusters. Recognized experts from different subject areas of each cluster. They involve not only UCM and UPM researchers, but also prominent members of the Campus partner institutions. Each cluster has been involved in a considerable number of meetings of the Advisory Council to define the strategic aspects.
- Relationship between the Board- Advisory Council and Campus groups. Network structure. Input from groups: Formalizing Expressions of interest (June-July 2010, October-November 2010, April 2011).

Most significant results

Creating structures. Appointment of Coordinators for Clusters and Advisory Councils.

More than 400 research groups from the UCM and UPM have submitted formal expressions of interest in joining the Campus clusters.

Identifying synergies between groups.

Strategic Focus	**SCIENTIFIC IMPROVEMENT**
Project	**Thematic actions of the GLOBAL CHANGE AND NEW ENERGY cluster.** **Actions started:** E6. ITER Project support programs E8. Creation of a Remote Sensing and Monitoring Laboratory E9. Creation of a Climate Change and Impact laboratory E10. Establishment of the Moncloa Natural Hazards Network. E11. Creation of the Advanced Scientific Instrumentation Laboratory (LICA) E12. Creation of a Mixed ex situ Conservation Unit (UCM-UPM). E13. Creation of the Campus Biodiversity Cataloguing, Conservation and Information Program.
Objectives	The Cluster is divided into four strategic areas: a) **Environmental Technology and New Energies**. Aimed at developing new technologies to provide clean energy and to prevent, monitor and mitigate some current environmental problems. b) **Observation of System Earth and Space**. Aimed at preventing and mitigating the impact of climate change and natural disasters, considering that the Iberian Peninsula, its oceanic borders, the north of Africa and the Canary Islands make up a region that is particularly sensitive to these phenomena. Includes support for space missions and the development of instruments in Astrophysics. Actions: *E8, E9, E10, E11* c) **Biodiversity study and conservation**, paying special attention to the Mediterranean and Iberoamerican regions, which currently contain enormous biodiversity reserves (www.biodiversityhotspots.org). Actions: *E12, E13*
Progress towards goals Descriptions can be found on the individual information sheets	

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	E6. Programmes to support ITER Project
Objectives	To support the Technology Programme EFDA (European Fusion Development Agreement with the European Atomic Energy Community, EURATOM), in the area of "Structural Materials Development". Specifically to advance the task of: Development & characterisation of W-V and W-Ti tungsten ODS alloys by Mechanical Alloying (MA) and HIP.

Progress towards objectives

The objective of this action was to integrate the resources of UCM and UPM on Campus, with the participation of CIEMAT, in the field of advanced materials subject to the irradiation of particles from fusion plasma, consolidating knowledge, the use of UCM laser resources and UPM understanding in the search for materials that are capable of filtering and shielding optical components.

The collaboration has been a success with the incorporation of new UPM equipment (SIMS) to CIEMAT for joint use, and devices to manufacture plasmonic nanoparticles in the UCM laser systems.

The equipment has been consolidated with new joint participations in National Plans and International Programmes.

In addition, we have acquired new experimental instruments, Campus equipment of SNMS device (owned and proposed by UPM), located at the CIEMAT Collaboration Laboratory.

Description of the work done.

IFN infrastructure has been significantly expanded with a view to depositing and characterising W-V and W-Ti samples. First, we consolidated the laboratory techniques for deposit of materials by installing new HIPIMS and other *Sputtering* equipment. Also, we acquired equipment to implement quantitative elementary determination of solids with "Secondary Neutron Mass Spectroscopy" (SNMS) and various optical components to conduct optical characterisation on-site. Two PICATA postdoctoral researchers have been hired to work on the project: one devoted to the deposit of thin coatings of Tungsten alloys and implementation of on-site characterisation techniques, and the other one to develop optical characterisation techniques and manufacture thin layers with pulsed laser deposition (PLD), the latter in collaboration with the ultra-rapid spectroscopy CAI at the Complutense University of Madrid.

We have deposited coatings of pure W and nanostructured W with DC and HIPIMS, and studied the influence of sputtering parameters (gas pressure, plasma power,...) on adhesion of samples to substrate, as well as the microstructural properties of the samples. We have achieved nanostructured coatings, with good substrate adhesion, under stress. Characterisation of the mechanical properties of the samples shows their hardness is factor 4 higher than conventional W. Studies have been conducted with Transmission Electron Microscope (TEM) and X-Ray Diffraction (XRD), which showed all samples are phase α-W and polycrystalline. A systematic study was conducted of morphological properties, composition, structure and diffusion characteristics of H on

previously manufactured nanostructured W layers, as well as conventional W samples (*Coarse-grained, CG*), before and after having been implanted with: (i) H at room temperature (RT); (ii) C at RT and H at RT sequentially; (iii) C at RT and H at RT simultaneously; (iv) C at RT and H at 400ºC. Implantation energies were 170 keV for H and 665 keV for C, which corresponds to first wall characteristic energies of Fusion systems, and in particular Inertial Fusion. In conclusion, nano-W structures proved to be stable under the conditions studied, there was no blistering either in the nano-W samples or in the CG, and composition was maintained after implantations. With relation to H performance, we found: (i) retention of H in nano-W samples was dominated by the intrinsic defects of the material (eg. grain edges); (ii) the synergistic effects were very significant in W CG but no in W NANO; (iii) none of the samples analysed showed H retention when implantation was conducted at 400ºC.

As for implementation of optical techniques, we have acquired and assembled two optical devices to (i) measure reflectance and transmittance in small areas (micrometric), and (ii) measure reflectance on-site, during growth of layers. Both techniques are operational and have been used at UPM facilities as well as at several campaigns conducted at UCM, UAM and the University of Crete. Likewise, with the PLD system, we have made deposits of W, Ag and SiO_2 under various conditions of laser intensity, fluence and power. Finally, we have studied the effect of high electronic excitation on various types of metal nanostructures.

Governance structures created

Partners participating in the action

CIEMAT, IMDEA Materials, ETSI Civil Engineering, UAM-CSIC

Supervising Groups at each University UPM: Institute of Nuclear Fusion; UCM: Department of Materials Physics, Faculty of Physics, Ultra-Rapid Laser Centre (CLUR), Faculty of Chemistry

Action Leader: UPM:

Scientific Supervisors: Prof. J. Manuel Perlado (UPM); Prof. Javier Del Río (UCM); Prof. Luis Bañares (UCM)

For the work involved in this Action there has been strong collaboration between the three Campus entities: CIEMAT, UCM and UPM.

Most significant results

A numerical summary of dissemination of results obtained, as well as relevant training aspects, as follows.

All activities refer essentially to the UPM-UCM collaboration. For other collaborations, the following codes have been used: **I**=international participation and **U**=Collaboration with UAM:

Publications in journals included in the SCI: 2012**:** 1 (**I**); 2013: 1 (**I**); 2014: 4 (**I**). Relevant results: theoretical study on Fano resonance on multilayer metal structures published in Nanoscale (IF = 5.9), Nanoscale 5, 209–216 (2013). We also studied the modification of optical properties of silica under irradiation with swift heavy ions; these results were published in the journal Applied Physics

Letters (IF = 3.8) Appl. Phys. Lett. 101, 154103 (2012). Finally, we have experimentally determined the optical properties of Au-Ag alloys and deposited multilayers formed by silica-embedded silver nanoparticles. Both papers were published in Optical Materials Express (IF = 2.6), 4, 403–410 (2014), Opt. Mater. Express 4, 1943–1952 (2014). Study on the accumulation of hydrogen in nanostructured W compared to conventional W. Published in: Journal of Nuclear Materials 453 (2014) 287–295 (IF=2.101). Study of morphology and microstructure according to thickness of pure nanostructured α-W coating. Published in: Applied Surface Science 316 (2014) 1–8 (IF= 2.538)

Publications submitted and under review: 5

Research Projects: National R&D+i Plan: 2 (**I**).

Congress communications and presentations: Guest Lectures: 7 (**I**); Total Communications presented: 18 (**I**).

Courses Delivered: 5 (**I**).

Ongoing Doctoral Theses: 4 (**I**, **U**, **A**).

International Aspects:

Although the action was initially related to the ITER Project, it has a much broader scope in Nuclear Fusion. The study relates to critical materials and techniques in the DEMO systems of Confinement Fusion and laser-based facilities for Inertial Confinement Fusion such as NIF, LMJ, HiPER or LIFE. Participating in the ITER project are the European Union , Russia, United States, Japan, China, South Korea and India. The Project DEMO is based on the Programme EUROFusion of the European Union H2020; NIF is the star project of the USA Laser Inertial Fusion, as is LMJ for France (being used in academia since 2016) and the HiPER and LIFE Programmes are Laser Reactors in Europe and USA, the former being the ESFRI Project whose possible continuity in this line of the European Union is being discussed.

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	E8 Remote Sensing and Monitoring Laboratory
Objectives	The main objective of the Remote Sensing and Monitoring Laboratory is to create a device that is capable of monitoring the surface of the Earth based on space and ground data. Regions of interest: Iberian Peninsula, North Africa and Canary Islands. It includes development of algorithms.

Progress towards objectives

The action continues to develop with the consolidation of a CEI Moncloa Campus Remote Sensing group, based on the specialization in techniques for the study and measurement of deformations of the earth's surface and its many applications, which develops research, and is competitive, holding a leading position in the international arena. Components of the various institutions involved in the CEI Moncloa Campus (UCM, UPM, CSIC, IGME…) and international institutions are being integrated therein.

The main objectives of the Global Change and New Energies Cluster are, among others, to combine the assets of the research groups working in the Moncloa Campus on global change, Earth system,

space, environment and new energies, by providing them with a backbone and a mechanism for joint coordination to optimise resources and their international impact.

The Campus has, among others, CIEMAT, the most important Spanish scientific institution for environmental and energy studies, CSIC, the largest research body in Spain, IGME, whose attachment to the two universities, UCM and UPM, and to the Moncloa Campus, is in itself an essential value added that will be an unquestionable driver in the Cluster.

As part of the activities in the areas of the Earth system, space and new energies, we are considering creating a Remote Sensing Laboratory, connected and coordinated with a twin laboratory the UCM has already deployed in its facilities.

The activities of a Remote Sensing Laboratory require in general, very high consumption of computational resources, both for processing and storage, since they require intensive image processing applications, either fixed or moving, as well as images that are frequently multichannel and with a very high resolution. These resources are provided most adequately and efficiently by means of a supercomputation cluster.

This action is encompassed in large European and international initiatives: IGOS (*Integrated Global Observatory Strategy for monitoring our environment from Earth and Space*), GEOSS (*Global Earth Observation System of Systems), CEOS (Committee on Earth Observation Satellites*), GEM: Global Earthquake Model, GlobVolcano of the ESA, etc.

Description of the work done.

The base used is the existing CSIC-UCM group (integrating one of the universities and a major partner organisation), and remarkable efforts are being made to develop and strengthen collaboration in the fields of action with UPM, other partners of CEI Campus Moncloa and private corporations. The research conducted by the core group has a clearly international nature which we expect to increase within the CEI framework. We have been achieving results in enhancing science-technology collaborations and synergies.

An absolute priority is to develop actions to enhance and increase as much as possible, based on existing or new synergies and collaborations within CEI, the scientific quality of the research conducted, as well as the impact and relevance of the results. We are also beginning to see results in this aspect.

Governance structures created

Partners participating in the action

UPM (ETSI: Telecommunications, Aeronautics, Mining Engineering, Forestry, Agronomy), UCM (Faculties: Chemistry, Physics, Geology, Biology, Mathematics, Pharmacy, Computer Science, Geography and History), CSIC (IGEO Joint Centre, UCM-CSIC), AEMET, IGN, IGME, INIA.

Supervising Groups at each University UPM: School of Aeronautics, UPM-UCM: Joint Institute of Geoscience IGEO, Department of Earth Observation.

Action Leader: UPM:

Scientific Supervisors: Dr. José Fernandez Torres (CSIC-UCM) and Prof. Francisco Javier Elorza

(UPM).

The supercomputing system VIENTO has been acquired and is currently being installed and commissioned.

At an early stage the operating software for image processing and 3D visualization has been defined, and the calls requesting projects for the scientific and technical operation of the infrastructure are being defined.

Most significant results

A numerical summary of dissemination of results obtained, as well as relevant training aspects, as follows. Details are available in Annex I.

All activities refer to the UPM-UCM collaboration and to indicate other collaborations, the following codes have been used: **I**=international participation; **U**=Collaboration with UPM; **A**=Collaboration with other partner entities not CSIC; and **E**=Collaboration with corporations: Publications in journals included in the SCI: 2010**:** 2 (**I**); 2011: 7 (**I**); 2012: 4 (**I**), 1 special edited volume (**I**); 2013: 4 (**I**, **A**) (2 in press). Relevant results: 1 paper in *Geology* (2011) on collapses around the town of Lorca, 1 paper in *Nature Geoscience* (2012) on the earthquake in Lorca, 1 paper published in the Journal of Geophysical Research-Solid Earth (2013) on the eruption of El Hierro.

Publications submitted and under review: 1

Publications in other journals: 2011: 1 (**I**); 2012: 2 (**I**, **A**).

Books, monographs and collective volumes: 2011: 1; 2012: 5 (**I, U**), 1 book published (**I**); 2013: 3 (**I**, **A**)

Research Projects: European Union 7th Framework Programme: 2 (**I**); Space Agencies: 7 (**I**, **E**); National R&D+i Plan: 2 (**I**, **U**, **A**, **E**).

Congress communications and presentations: Guest Lectures: 10 (**I**, **U, A**); Total Communications presented: 40 (**I**, **U**, **A**).

Courses taught: 2 (**I**, **U**, **A**, **E**).

Doctoral theses in progress: 2 (**I**, **U**, **A**, **E**).

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	E9 Creation of the Laboratory for Climate Change and Impacts
Objectives	The main objective is to analyse and model the climate system (atmosphere, oceans, cryosphere, biosphere, and their interaction), and the impact of climate change. The simulations will address various space-time scales, from geological periods to late 21st Century. The Laboratory consists of: A computation cluster, an isotope laboratory focusing on obtaining paleoclimate proxies (laboratory of stable isotopes and a Thermal Ionization Mass Spectrometer).

Description of the work done

1. **EOLO Computing Cluster:**

EOLO is a distributed memory high performance computation system, made up of 40 compute nodes and an advanced NAS storage subsystem for the Cluster File System. The interconnection network for the calculation cluster is InfiniBand, and the one to connect to storage is based on 4 x 10 Gigabit Ethernet links providing 40 Gbps of broadband, 1.9 TB of RAM and 480 actual computation cores. Hard drive capacity is close to 300 TB.

EOLO was acquired to meet the needs of research groups in meteorology, climate and climate change. In these areas, HPC resources are essential to conduct simulations with climate or meteorological models at a regional or global scale. These groups will benefit both from increased computational resources and availability of high storage capacity, thus covering two typical needs of climate / meteorological simulations, in which experiments generate high volume outputs that need to be stored for a long time.

During the initial phase for the study of specifications, acquisition and procurement, we had a large group of researchers, coordinated by Professor Fidel González Rouco, who was the scientific lead of EOLO during this first stage. After setting up the team, a Management Committee was created for the EOLO cluster, with members from UCM and UPM. Given that computation resources involve not only Research Vice-chancellorships, but also the heads of computer resources, the above Management Committee includes representatives of UCM and UPM at CEI Moncloa, a representative of IGEO, a representative of UCM and one from UPM from the Vice-chancellorships responsible for computer resources, and user representatives. This committee is in charge of regulating access to EOLO and of coordinating the distribution of intensive scientific computation requests among the resources available at CEI and its partners. The Management Committee has held several meetings since October 2012. During this phase, an Executive Committee has also been set up, made up of José Manuel Udías (Faculty of Physics of UCM), scientific lead of the team, Jorge Balsa (computer specialist from IGEO) and Jesús Palero (specialist assigned by the UCM CPD as contact for EOLO). EOLO is fully operational with 50 users from 23 groups belonging to CEI Moncloa.

Partners participating in the action

UPM (ETSI: Agronomy, Forestry, CEIGRAM), UCM (Faculties: Physics, Geology, Mathematics, Chemistry, Biology, Pharmacy, Computer Science, Geography and History), CIEMAT, CSIC (IGEO Joint Centre UCM-CSIC), AEMET, INIA.

Supervising Groups at each University UPM-UCM: Joint Institute of Geoscience, Department of Climate Change, UCM: Faculty of Physics, UPM: School of Agronomy.

Action Leader: UCM

2. **Laboratory to obtain paleoclimate proxies:**

Laboratory of Stable Isotopes : Prof. Javier Martín Chivelet (Faculty of Geology, UCM).

The essential objective of this action is to "obtain high resolution models of past and future climate systems, provide new indirect indicators (proxies) of climate variability in the past and generate climate scenarios for the 21st Century, which will allow studying climate impact". The Laboratory of Stable Isotopes is an essential part to achieve this objective. This new laboratory focuses on climate change and geoenvironmental studies, specially aimed at obtaining climate proxies based on different natural materials, including sediments, rocks, speleothems, water, fossils, tree rings, other organic matter, etc. These proxies help reconstruct and analyse recent climate variability in different space and time scales, and they are an essential tool to understand Climate Change, its causes and impact. Moreover, they provide the basis to calibrate climate models, which are required for future projections and, thereby mitigation and resilience policies.

The Laboratory was created when the main analytical equipment was acquired, a high performance and high power mass spectrometer to obtain stable isotope ratios (IRMS). It allows maximum precision to determine H/D, 13C/12C, 15N/14N, 18O/16O, 34S/32S (and other isotope ratios for Si, Ar, Kr, and Xe). It has a dual inlet system for carbonates that allows working with microsamples smaller than 20 micrograms. Specifically, we have acquired a Thermo Fisher MAT 253 with a Thermo Fischer Kiel IV carbonate system.

During the work prior to installation of the equipment, in 2012 and 2013, we visited laboratories with similar characteristics at the Autonomous University of Barcelona, the central services of the University of Barcelona and the University of Minnesota (USA). Likewise, we participated in the "Elementary Isotopic Analysis Workshop" that took place in Barcelona on the 30-31 May, 2013, establishing collaboration relations with the participating organisations.

We have established collaborations with laboratories with similar characteristics in the United States, at the University of Michigan and University of California. Within the CEI Moncloa Campus, we have established new working connections with research groups and laboratories of the Technical University of Madrid (School of Mining and Energy), of the Complutense University (CAIs of

Geological Techniques and Isotopic Geochemistry) and of CIEMAT (Dept. of the Environment), aimed at a collaboration between laboratories focusing on geoenvironmental, paleoclimate and Global Change studies.

It is worth noting that, although with a greater delay than planned, **we have fully achieved the objectives set.**

This laboratory focuses not only on meeting the needs of the CEI Moncloa groups, but also on serving other public research centres and private corporations, which should ensure financing for its maintenance and renewal in future. We expect it to provide regular services as of October 2014.
As part of this project, we have managed to recruit a young scientist (Dr. Laura Domingo Martínez) from the University of California (USA) under a PICATA Postdoctoral Contract.

The creation of a new laboratory based on a technique (Stable Isotopes) which is currently in high demand in the field of geoenvironmental, paleoclimate, and other studies, is a remarkable infrastructure milestone that meets a significant need long demanded by researchers. The microsampling system attached to the IRMS, indicated for microsamples to analyse carbon and oxygen isotopes, gives it enormous national and international specificity.

Isotopic Geochronology and Geochemistry CAI: Thermal Ionization Mass Spectrometer Prof. Carmen Galindo (Geochronology CAI, UCM)

The Isotopic Geochronology and Geochemistry CAI has helped many research projects obtain results. This service is possible to a great extent, due to the acquisition of the new mass spectrometer Phoenix HCT040 and design and implementation of the new Clean Room in the Laboratory, both acquired with CEI funds. All of this has helped improve performance regarding precision, accuracy, delivery time of results and resolution of occasional technical problems.

The Isotopic Geochronology and Geochemistry CAI also conducts an educational task, by allowing third-year students to access the Laboratory to learn, reinforcing their knowledge about the techniques used here, and subsequently analyse samples of interest for their science projects.

During the academic year, the Geochronology CAI obtained the Quality Certificate ISO 9001. We have also updated the CAI website, including the two elements acquired with CEI funds (TIMS Phoenix and the Clean Room), which has given it more visibility and quality.

Photo: EOLO control screen

The EOLO cluster has been installed and is operational at the Data Processing Centre (CPD) of the UCM in the Moncloa Campus. In August 2013, usage level was over 90%, most of the time devoted to climate simulations with the CESM1.2 (Community Earth System Model) and the Whole Atmosphere Community Climate Model (WACCM). As of 20th September 2014, EOLO is being used by 50 researchers in 23 research groups in CEI Moncloa.

3. Project *Guadarrama Monitoring Network* (GuMNet):

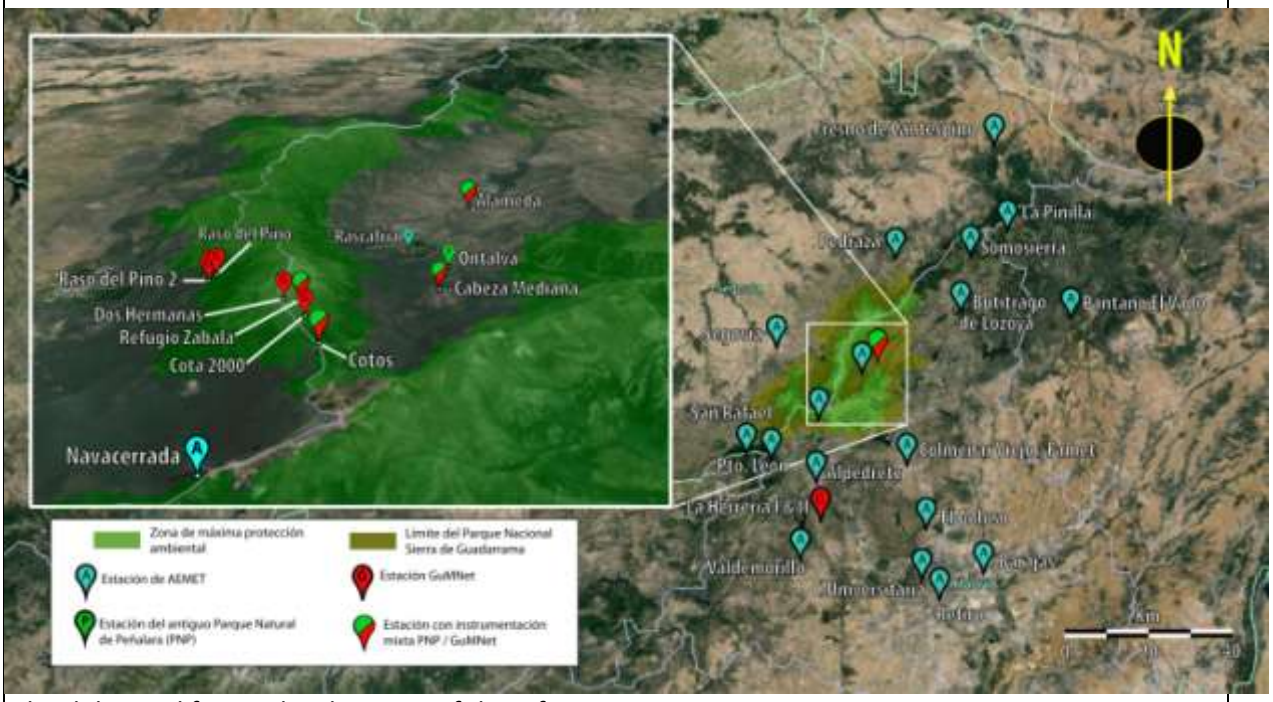
The GuMNet Project is an initiative financed with funds of the Campus of International Excellence: Moncloa Campus and it is being carried out in collaboration with the Complutense University of Madrid, the Technical University of Madrid, CIEMAT (Centre for Energy, Environmental and Technological Research), AEMET (National Meteorology Agency) and the National Park of Sierra de Guadarrama (PNSG).

Photo: Sierra de Guadarrama

The instruments to be installed are divided into three categories. The first one is related to the study of the subsoil, something which only the best global change observatories have. The state of the subsoil will be monitored by inserting sensors at various depths: up to two meters to record humidity and up to 20 metres for temperature. The infrastructure established by the GuMNet will provide data to characterise the meteorological and climate status of the PNSG. This information will be useful to manage the PNSG and develop protocols to improve its operations, protection and safety. It will be useful for research groups and students interested in examining the environment and ecosystems of the PNSG as they will be able to develop new experimental methods and models; also, citizens going to the Sierra will have high quality meteorological and environmental information. The GuMNet vision is to develop a Global Change Observatory, promoting the development of the atmosphere and subsoil network, bringing together the huge potential for the scientific, educational and social dimensions.

The GuMNet instruments are the continuation of the infrastructure developed for more than a decade at the Peñalara National Park, expanded with relation to sites, and atmosphere and subsoil instruments. It will also include the AEMET stations around the Sierra de Guadarrama
GuMNet will be an information management system, monitoring the status of the atmosphere and subsoil in the Madrid mountains: a Meteorological and Climate Observatory of Global Change.

The tender, divided into four parts, was awarded on 27 February 2014. Since then, project development has focused on: a) installation of equipment; and b) promotion of actions to ensure



durability and future development of the infrastructure.

The future plan for this infrastructure project is to consolidate all of these groups in a research consortium or unit (JRU) for various aspects of mountain meteorology and climate, global change, etc.

The future sustainability of the infrastructure depends on obtaining financing from the various calls for infrastructure and research. The participating groups have presented a Network research and maintenance proposal to National Parks (GuMNet-GO!) and they are currently considering submitting a proposal to the national project call (GuMNet-Flux). The possibility is being discussed of including GuMNet in the National Park Global Change Monitoring Network or promoting sustainability and future maintenance from therein.

Integration with UPM has been highly successful. The CEIGRAM Group, which includes several researchers (Ana Tarquis, Esperanza Luque, Ines Minguez, Alberto Garrido), is contributing very significantly to the development of the project. One of the scientific orientations of this group are research issues related to soil and pasture evolution. The Group is collaborating, for example, with others in UCM and CIEMAT to develop a technical report for treatment and storage of soil and subsoil samples during this infrastructure installation phase. **In order to meet the scientific needs of the highest number of research groups.** This group is currently participating, together with CIEMAT, in the development of a project proposal for the national call, GUMNET-FLUX.

-**Internationalisation:**

GuMNet will be a relevant infrastructure internationally both due the uniqueness of its equipment and design and because it is focused on high mountains. The internationalisation aspects are still limited, since the action began this year **(February 2014)** and efforts have focused on infrastructure

installation and sustainability.

GuMNet plans to join the ICOS network for monitoring CO2 and other international subsoil (IHFC) and high mountain **(CRIOPERU)** observation networks.

Most significant results

Implementation of EOLO has already had an impact on achievement by some CEI Moncloa groups of European projects that will be carried out with EOLO support. These include:

MULCLIVAR Project (CGL-2012 -38923-C02-01), with national financing, coordinated by María Belén Rodríguez Fonseca at UCM and M. Inés Mínguez Tudela at UPM. European Project PREFACE (Enhancing PREdiction oF Tropical Atlantic ClimatE & its impact)

EU Framework 7 cooperative project (ENV 2013), coordinated at UCM by María Belén Rodríguez Fonseca. Also "Simulation and analysis of key Periods in the Quaternary: Towards advancing understanding of proxy Reconstructions and model Simulations, CGL2011-29672-C02-01(MINECO). Principal investigator: Volker Rath (UCM). Mechanisms and variability of troposphere-stratosphere coupling (CGL2012-34221, MINECO) coordinated by David Barriopedro Cepero (UCM). "Interaction between atmospheric boundary layer and fog in stable environments: observational study and numerical simulations" (CGL2012-37416-C04-02).

Other results in the Science Annex attached to this report.

Scope	Teaching Improvement / Scientific Improvement / Transfer / Comprehensive Social Campus
Action	E10: Moncloa Natural Hazards Network.
Objectives	To develop and innovate new technologies to study the causes of natural hazards. We will promote natural hazard modelling studies and develop early warning systems.

Description of the work done.

1. Western Mediterranean Seismic Network

Improvement of the Western Mediterranean (WM, ROA/UCM) seismic network by acquiring 4 broadband seismic stations, with speed and acceleration records and 3 ocean bottom seismographs (Ocean Bottom System, OBS). We studied the characteristics of current market instruments, their suitability for the WM network objectives and in particular, maintenance of the network's homogeneity. This point is crucially important to integrate observations from the new equipment into the existing database. Also, this is necessary to ensure maintenance and control of new equipment. This task has been conducted in collaboration with the Royal Naval Institute and Observatory (ROA).

The Western Mediterranean (WM) network set up jointly by the Complutense University of

Madrid and the Royal Naval Institute and Observatory (ROA) of San Fernando, Cadiz, is a product of the collaboration between the two institutions. This collaboration dates back to the 70s, when the Deep Seismic Profile programme was initiated within the Geodynamics Project. Between 1973 and 1982, a series of campaigns were carried out with the participation of researchers from UCM and ROA, as well as other, not only national, but also international institutions (France, Switzerland, Germany, etc.). The experiments consisted of sea explosions conducted by the Navy, recorded on land. Thanks to these campaigns, it was possible to obtain the first detailed models of the lithosphere in the Iberian Peninsula and the Canary Islands.

In 1996, a permanent broadband seismic station was installed jointly between ROA and UCM, with the collaboration of GFZ (GeoForschung Zentrum, Potsdam, Germany) in the Cerro de San Cristobal (Cadiz), which was called SFUC. This station was the origin of the ROA/UCM network, currently the WM network and which before the inclusion of new equipment, was comprised of 12 seismic stations, of which only 3 had simultaneous speed and accelerations records.

The four seismic stations were comprised of a Streckeisen STS2.5 speed sensor, an ES-T EpiSensor acceleration sensor, and a Q3330HR data acquisition system. These instruments allow recording seismic signals by speed (seismograms) and acceleration (accelerograms) continuously, with a sampling rate of 100 samples/s and a dynamic range of 32 dB. Having the acceleration and speed records installed at the same site prevents saturation issues, which is common in speed records when there is a high magnitude earthquake nearby, as well as increasing the number of nearby field records essential for a detailed study of seismic risks.

Three of these units have been installed in these locations (Figure 1):

SFS (San Fernando, Cádiz) 36.677ºN 6.175W
CHAS (Chafarinas Islands) 35.150ºN 2.42ºW
ARNO (Arenosillo, Huelva) 37.089ºN 6.733ºW

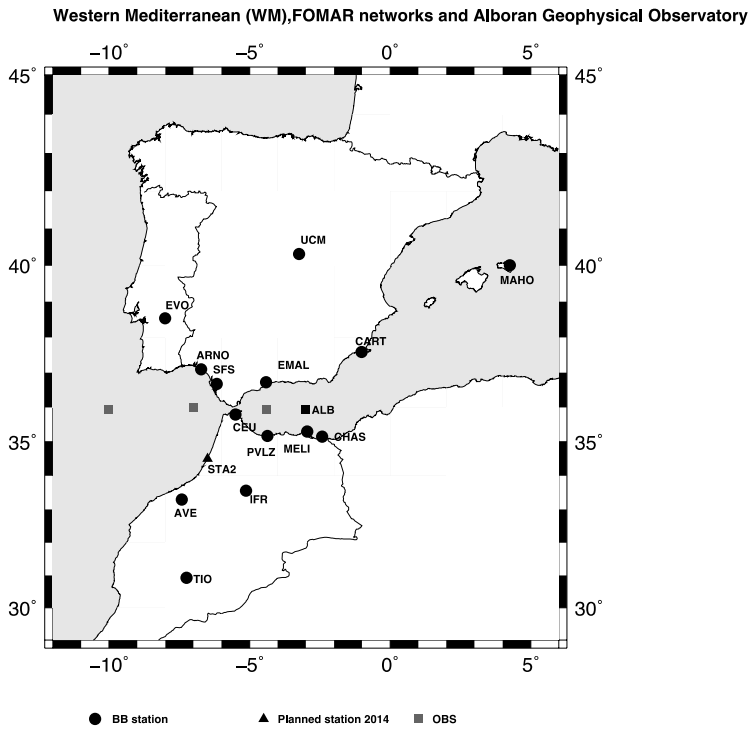


Figure 1

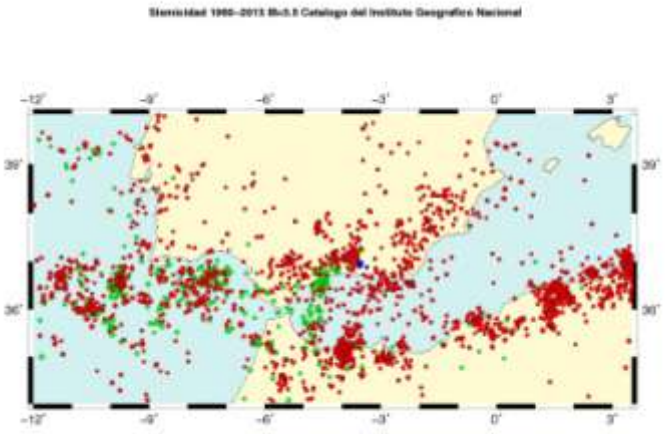
SFS Station. The equipment installed in this station had become obsolete since it was the first station set up (SFUC) in 1996, later changing its name to SFS. Established in the ROA premises, it is a key station to study earthquakes in Cape St. Vincent and the Gulf of Cadiz, an area where there have been large earthquakes, such as the one in Lisbon 1755 (Imax=X) and St. Vincent in 1969 (Ms=8.1), which have also generated tsunamis.

CHAS Station. Installed in the Chafarinas Islands, north of Africa, it is a key station to study earthquakes in the Alboran Sea and the south of Spain. It is of special interest to study the intermediate-depth seismicity in this area, which could cause potentially harmful earthquakes such as the one in Malaga of 1680 (Imax=IX-X). In the Chafarinas Islands there was a seismic station between 2001 and 2004 during development of the project TEDESE, subsidised by the Ministry of Science and Technology and coordinated by UCM. The equipment was on loan from the GeoForschung Zentrum, Potsdam, therefore when the project was finished it had to be returned, and the site has had no new instruments since then.

ARNO Station. Installed in the Experimentation Centre of Arenosillo of the National Institute of Aerospace Technology, it covers the major lack of seismic stations in this area, since the stations of the National Geographic Institute (IGN) in the zone are further north. Therefore this deficit has now been corrected with the ARNO station. This site is essential as SFS for large earthquakes in the Gulf of Cadiz and the Cape of St. Vincent.

The fourth unit is called Master, located in ROA, and its mission is to be able to replace any of the existing ones in the WM stations in the event of a breakdown in any of them.

Acquisition and integration in the FOMAR network of 3 **ocean-bottom seismic stations (OBS).**



The WM network has allowed considerably improving the study of the generation and occurrence of earthquakes in the Iberian-Maghrebi region. However, given the seismicity of this area, with an abundance of hypocentres at sea, which generate large earthquakes such as the one of 1969 west of Cape St. Vincent (Ms=8.1) or the large earthquake in Lisbon of 1755 (Figure 2), in 2005 it was decided that ocean-bottom seismometers (OBS) had to be installed to complete the WM network geometry. In September 2009, ROA installed the Geophysical Observatory of the Alboran Island (Figure 1), with the participation of UCM. In April 2011, the FOMAR network was installed, comprised of 3 semi-permanent OBS in the Gulf of Cadiz and the Alboran Sea. These units were bought with funds from an MEC infrastructure project with the participation of UCM researchers. The instruments are of the German brand KUM and they are anchored to the seabed for 6 months. After this time, the instruments are recovered to download data, serviced, and then anchored again.

The three units acquired under the INNOCAMPUS 2010 programme are three OBS-Lobsters with the same characteristics and type as those in the FOMAR network which, given their design, can be anchored in depths of up to 6000m, guaranteeing their functionality in areas where major earthquakes could take place. The three units have been anchored (Figure 3) in the following locations

OBS1 36.60ºN, 6.37ºW
OBS2 36.60ºN, 6.38ºW
OBS3 36.58ºN, 6.41ºW

Due to the characteristics of these units and unlike those on land, these anchorings are temporary, for 6-month periods that could be prolonged to 8 months, after which they are recovered, and others are anchored or the location is moved depending on the data registered, thus covering a much larger area.

The data recorded by these stations (on land and sea) is included in the **Western Mediterranean Seismic Databank**.
The WM stations transmit data in real time to three data centres: Department of Geophysics and Meteorology at the Faculty of Physics in UCM, ROA and GeoForschung Zentrum, Potsdam, where they are stored in three different servers (Milne II for UCM). This way it is possible to access data simultaneously to the occurrence of an earthquake. In the case of the Earthquake Early Warning Systems (EEWS), it is an essential requirement. UCM coordinates the project ALERT-ES CGL2010-19803-C03 (in which ROA also participates) with the objective of studying the viability of an EEWS for the SW of Iberia, and a new project has been requested to implement an EEWS in the MINECO call, which is in the evaluation phase. In this

regard, the infrastructure acquired is of major importance for a possible EEWS in the area.

Figure 3

The speed and acceleration records received are stored in Milne II in binary miniseed format. Dataless header files have been designed to be able to recover the information on the instrument. Monitoring of seismic signal reception is in real time through a monitor installed in the corridor of the Department of Geophysics and Meteorology of the Faculty of Physics at UCM. This type of monitoring allows students to have direct access to this information and observe seismograms in real time when there is an earthquake, therefore this instrument is useful for research and also for teaching, combining theory and practice, which is something very necessary in Spanish universities.

The scientific-technological relevance of the objectives set is evident, and they have been achieved above the 100% set. Basically:

1.- Capacity of the WM network has been increased, with 3 more seismic stations and a "Master" station that will minimise interruptions in the reception of information in real time since there are now replacement instruments.
2.- The network FOMAR has been increased 100%, by going from 3 OBS to 6 OBS, which allows increasing the area covered in future sea campaigns and minimising the time for replacement of anchored equipment.
3.- This new infrastructure is of vital importance for the EEWS being developed by UCM in collaboration with ROA, since it allows concentrating the land stations with the installation of ARNO and CHAS and obtain information on the hypocentres with epicentres at sea by duplicating the capacity of the FOMAR network.
4.- With this infrastructure, UCM is able to undertake studies on the edge of knowledge on the generation and occurrence of earthquakes such as EEWS, reaching a world-class level few research institutions currently have.

To undertake all of this project it has been crucial not only to have the participation of ROA, but also of the Spanish Navy, which is in charge not only of anchoring the OBS, providing the project researchers with means that would be difficult for us to access otherwise, such as boats, divers, etc., but also for installation of stations on land. For example, for the station set up on the Chafarinas Islands, it is necessary to travel by helicopter or boat, means of

transport that UCM obviously does not have.

This action has achieved to:

- Reinforce and improve the existing collaboration between UCM and ROA, as well as with the Spanish Navy.
- Improve existing infrastructures. The WM network has gone from having 12 stations to 15, as well as a "Master" station that will help minimise downtime at a station when it breaks down. The FOMAR network (OBS) has doubled its capacity, going from having 3 OBS to 6 OBS.
- Availability of this new infrastructure has aroused the interest of the business world. Two companies have contacted UCM to conduct detailed seismicity studies in areas with hypocentres at sea (Strait of Gibraltar, and the area of the CASTOR platform, Castellón). In the first case, the contract is being processed.

2. Early Warning System

Portable seismic network comprised of 4 seismometers that will allow not only conducting emergency detection and location campaigns of aftershocks related to special interest events, but also to conduct microseismicity campaigns to study the geological behaviour of specific segments of faults (identification of aseismic creep, seismicity gaps, etc.).

During the month of May 2014, we received the detection equipment of the seismic network that is part of the Disaster Early Warning System. This system has four Trillium broadband sensors with remote mass centering, four Centauro digitizers, four power batteries, solar panel, suppliers, rectifiers and all the necessary cabling. This equipment has been designed to be installed in field campaigns and detect and locate seismic activity with a high resolution. The following Figure shows details of one of the assembly diagrams designed for the learning tasks described below.

Likewise, a video tutorial has been made on the assembly of the equipment that will be posted on the Internet in order to provide teaching and communication materials that had not existed before for this type of equipment.

At the moment, the equipment is ready to be used in seismic phenomena monitoring and surveillance campaigns. Given the limited time elapsed since the equipment was received, it has not yet been possible to deploy it on the field. The equipment has been tested for operation and remote transmission of data via modem.

Within the objectives of the initial phase prior to the first measurement campaigns, there are three worth highlighting:

-Train the research team on use of the system and data processing

-Organise a course on data processing open to students and researchers of the CEI

-Inform the media about implementation of this seismic detection system.

The three objectives above have been met or are being met under the work plan defined. The research team in the group requesting the acquisition has received 10 hours of training from the provider. This training is particularly important since the sensor and digitizer are state of-the-art and have hardly been used in our country before now. As for the training offer, we have agreed with the Director of the National Seismic Network, Mr. Emilio Carreño that two specialists in seismic data instruments and processing from the National

Geographic Institute will deliver a course on processing of seismic data within the Doctoral programme of the Faculty of Geology. At present, the course programme design is being completed and it will be taught for two weeks in late September/ early October 2014. Finally, as for awareness, we have participated in the filming of a RTVE (Spanish Public Television) programme for Channel 2 to disseminate the work of geologists in society. During this filming we highlighted the acquisition and creation by CEI Moncloa of this early warning system and its importance to conduct research on seismic risks in Spain.

The plans for future tasks have analysed the points for the possible installation of stations around the Fault of Alhama in Murcia, located in the southeast of the Andalusian mountain range which was responsible for the destructive earthquake in Lorca. One of the milestones of this network is to deploy it along this fault in order to determine its microseismicity characteristics. In the event of an earthquake of a significant magnitude, capable of generating aftershocks, the stations would be installed around the source in order to monitor the phenomenon during the following days and weeks. The deployment would be conducted in coordination with the National Seismic Network and the Andalusian Institute of Geophysics that already have stations in the region, in order to establish synergies and increase the quality of data acquisition.

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	**E11. Laboratory of Advanced Scientific Instrumentation (LICA)**
Objectives	To create and maintain a laboratory devoted to the design, development and integration of all types of astronomical instrumentation for large installations on land as well as space missions. Optimisation for high energy, optical and near-infrared (cryogenics) areas. Development and optimisation of algorithms for astronomical and space data simulation, processing and analysis. Development of software related to instrument control. Development of tools to work with the Spanish and European Virtual Observatory, as well as the future Astrophysical Software Laboratory. The group is responsible for the data reduction chains of the instruments EMIR and FRIDA for the GTC.

Description of the work done

The study of the impact of global change and natural risks requires the use of networks of sensors measuring various parameters (soil humidity, temperature, etc.) that are easy to install and low consumption. Only with adequate monitoring is it possible to develop natural disaster evolution models and early warning systems. On the other hand, the demand is growing for advanced instrumentation specially designed to be used in satellites and airplanes, for example, to measure light pollution directly or based on the effects of night sky brightening.

The group of Astronomical Instrumentation at the Moncloa Campus (http://guaix.fis.ucm.es/) leads design, development and construction of the instrument MEGARA for the 10m Gran Telescopio Canarias: High spectral resolution fibre-based integral field multi-object optical spectrograph. Budget around 6 million euros.

Astrophysics is an area of enormous development, both scientific and experimental, with high company involvement, a great capacity to attract resources and huge return for society.

Large science projects in Astrophysics are associated to leading edge developments (with budgets of several M€) in large astronomical facilities both on Earth and space. Given the enormous possibilities of the international market in this field (new instruments for GTC, ESO, space missions, European giant telescope E-ELT), it is not enough with the centres that had been developing astronomical instrumentation in Spain to date (IAC, INTA). Taking advantage of this new niche in R&D, Astrophysics in the Moncloa Campus is making remarkable progress, playing a very significant role (and in some cases leading) major R&D projects to develop astronomical instrumentation for large scientific projects. The development of these instruments has generated the need to design, test, integrate and check various optical, mechanical and engineering modules. It is therefore essential to have the material and human resources necessary to guarantee undertaking of these activities.

Interaction between physicists, engineers, mathematicians and IT specialists is an enormous advance for development of this Laboratory.

Most significant results

In Spring 2014 there were two vital milestones for development of the instrument MEGARA. On 28 April 2014, a contract for the final design, for 1,640,000 euros, was signed between UCM and Gran Telescopio de Canarias (GRANTECAN). On 5 May 2014, UCM and GRANTECAN signed a contract to build and deliver the instrument at the end of 2016, for a total of 2,846,000 euros. The total project amounts to 4.5 million euros.

The MEGARA project has been a real breakthrough, taking over the LICA capacities completely until the start of 2017. However, LICA continues serving other institutions. Proof of this is that since its recent creation, LICA has joined the CAI of Physical Techniques and various contracts have been signed to provide services to private companies.

Longer-term, the group of Astronomical Instrumentation at the Moncloa Campus has joined the international consortium to develop an optical multi-object spectrograph (MOSAIC) for the future European giant telescope E-ELT. This project was started in 2014 with a not fixed budget of 60 million euros, but it will not be completed until 2020. Finally, LICA is a member of the R&D "SpaceTec" network of the Community of Madrid to develop space mission instruments.

Internationalisation activities

Internationalisation of LICA is very high. The reason being that development of large astronomical instruments requires complex international consortia. In the case of LICA, MEGARA has significant participation from the Mexican Institute for Astrophysics, Optics and Electronics (INAOE), with whom a bilateral agreement has been signed. In MOSAIC, UCM participates in a consortium of over 10 European institutions led by the Observatory of Paris, Durham University (UK), Rutherford Appleton Laboratory (UK), Laboratory of Astrophysics of Marseille (France), Astron (Netherlands), National Observatory of Brazil, and others.

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	E12 Creation of a Joint Unit for ex situ Conservation.
Objectives	Ex situ conservation is an essential activity against the loss of biodiversity in natural habitats. The aim is to encourage the development of cutting-edge research in the Moncloa Campus taking advantage of existing UCM-UPM-INIA groups already working collaboratively on this topic.

Progress towards objectives

Ex situ breeding centre for native fauna: construction of an insectary (in process). This structure is aimed to the study and conservation of indigenous animal species and their host plants. The facility will be fitted with different areas that allow breeding small animals and the plants they feed on, with their various ecological requirements (areas of irrigated and unirrigated plants, ponds, etc.). The goal is to use the site to study or experiment with said species. The facilities will be available to any interested research teams, who will contribute to their maintenance with projects that are in progress. It is also intended that the facility should focus on general dissemination of the biodiversity present at CEI-Moncloa, with special emphasis on native species or endangered species, and with an emphasis on plant-animal interactions. Accordingly, the facilities will also be designed so they can be visited occasionally, especially on doors open days, science weeks and other outreach events.

Plant Germplasm Bank: The facilities allow conservation and maintenance of the plant material, making possible the study and monitoring of seed viability in the medium and long term, insect-plant interactions and possible supply of seeds or plants to the research group co-responsible, the determination of appropriate conservation conditions and the possibility of providing research material based on availability.

Scientific objectives: The scientific objectives are framed within the context of the Global Change and New Energies Cluster and directly correspond with the E12 Actions "Creating a Joint Unit (UCM-UPM) for *ex situ* Conservation" and E13 "Creating a program for Cataloguing, Conservation and Dissemination of Biodiversity in the University Campus" contained in the Moncloa Campus document, which were supported by UCM and UPM groups who initially expressed interest in joining the CEI Moncloa.

Installing a research greenhouse at the Royal Botanic Gardens Alfonso XIII.

Description of the work done.

The Greenhouse has been installed in the Royal Botanic Gardens Alfonso XIII and will activate the research area of Study and Conservation of Biodiversity.
The installation allows planting in soil or benches for ex situ conservation and for experimentation. It is further provided with an isolated compartment for transgenic plants and programmable automatic irrigation and temperature and light control as well as artificial light to vary the photoperiod.
The infrastructure will allow ***ex-situ*** **conservation** of animal and plant species under conditions suitable for their growth and survival, enabling research on the monitoring and recovery of endangered species. The ultimate goal is to create a research centre specializing in **recovery** of species of plants and animals using endangered plant species from the *Plant Germplasm Bank* - UPM. The medium-term objective is to use this laboratory for the restoration of biodiversity firstly in the University Campus, and then in the city of Madrid. It is important to emphasize here the significance of the role of biodiversity conservation in **urban environments** through organic gardening and sustainable urbanism, as recommended in the 10th Meeting of the Parties to the *Convention on Biological Diversity*, held in Nagoya, Japan (URBIO 2010; see Agenda 21*).*
The growing interest in environmental issues and greater sensitivity to the conservation of the species have been reflected in both the *Convention on Biological Diversity* (UN, 1992), and the *Law on Natural Heritage and Biodiversity* (BOE 42 / 2007) that, in particular, promote the establishment of facilities for the study and *ex situ* conservation of species, preferably in the country of origin. The *Inter-University Centre for the Study of Native Fauna* is needed to progress in biodiversity reconstruction from the *Plant Germplasm Bank* of the UPM, and allows **breeding and *ex situ*** conservation of these species. This centre will be a ground-breaking facility developing activities that contribute to the **conservation of wild species present in the CEI - Moncloa** in Madrid, which also promotes **awareness of the value of the biodiversity** we live within this **urban or semi-urban environment**. The creation of this infrastructure will allow the groups involved, and those interested, to develop research in a very controlled environment where, as in a greenhouse, it is possible to regulate many of the factors that affect animals and plants with which they interact. This type of site where the environmental conditions and the structure of communities of organisms can be manipulated has been requested repeatedly in various scientific forums in order to promote manipulative experiments, almost impossible to tackle in natural conditions. Therefore, we believe it to be a **necessary laboratory** which, in addition to its return applied in the field of restoration, may help establish ongoing projects and initiate new lines of work in a field of scientific study of biodiversity that still has few facilities of this kind.
Regarding the Germplasm Bank, equipment and infrastructure comprises long-term seed conservation Chambers including the Plant Germplasm Bank of the UPM, which conserve endemic and endangered species, as well as species from the Cruciferae family. Such conservation cameras have a supplementary generator, security systems and an annexed mini-laboratory to prepare samples for storage.
These facilities are available to research teams according to their possibilities and may also be visited on open days, science weeks and other specialized outreach events.
Plant material (food plants) will be provided as far as possible for the joint applicant's project for the "ex situ" conservation project for animal biodiversity.

Most significant results

We have also participated in the action**: Terrestrial laser 3D data capture (LIDAR)**

The researcher hired by the PICATA program (Richard Williams) is developing a new line of research on geographic distribution on a small spatial scale (landscape) of the risk of infection by parasites in wild birds. The project combines parasitological diagnosis techniques developed by the UCM team with techniques for mapping natural processes developed by the UPM group, and will use the infrastructure (terrestrial laser) granted in research that will combine the specialties of the groups involved with development of niche models (R. Williams' specialty) for the prediction of the distribution of the risk of infection. This line of research will be impressive in the different fields of knowledge (disease ecology and physical geography) due to its resolution capacity (never before has there been a study of these characteristics in bird populations) and its potential contribution to better understand the dynamics of disease transmission in wild populations.

Activities related to the CEI of both UCM research groups that support the project.

Biology and Vertebrates Conservation Group (Research Group UCM 910577)

http://www.ucm.es/info/zoo/bcv/inicio.html

Activities related to the CEI Moncloa: http://www.ucm.es/info/seguimientofauna/ Currently this page is being relocated to the new servers provided by the new website environment of the Complutense University.

The overall objective of these activities continues to be the study of the biology of bird populations within the framework of standardized programs of long-term studies. Once again, this program has been very successful.

The three long-term bird monitoring programs remain in operation. Both scientific bird tagging station in the Royal Botanic Gardens Alfonso XIII of UCM, and the population of passerine bird nest boxes around the entire campus and four batteries of nesting boxes for swifts on the 9th floor of the main building of the Biology Faculty have operated throughout the academic year 2012-2013. The banding station has operated continuously on a biweekly basis. Nest boxes have also been checked and the results published. There have been a total of 47 field days. Since the start of the project a total of 100 different people belonging to all levels of the university community have been involved in some phase of the project and distributed as follows: 67 4-year degree students, 12 bachelor's degree undergraduates, 10 master students, 6 graduates and other 5 members of the educational community. The degree of involvement in the activities has been higher than in the previous season each participating in an average of 6 conferences.

Regarding the scientific tagging in the Royal Botanic Gardens Alfonso XIII station a total of 946 birds have been captured up to the end of June 2013 (608 tags and 168 recoveries) of 48 species. A total of 177 nest boxes for passerines and 43 for swifts have been controlled. 295 eggs have been laid and the birth of 204 chicks has been confirmed, of which 167 have been tagged.

The website which was launched during the 2011-2012 academic year is currently being migrated to the new servers at the UCM (www.ucm.es/info/seguimientofauna/). It reports on activities, calendars, the actual results of each of the programs and the integration of the activities within the Wildlife Monitoring Program of the UCM Moncloa campus. It has not been possible to determine the number of visits but the university community has been aware of its existence and the Research Vice-Chancellor has shown interest in the program and has suggested its dissemination through the website of the Campus of International Excellence CEI.

Furthering the Project on Innovation and Improvement of the Educational Quality: Monitoring bird populations on the Moncloa campus -UCM developed during the 2011-2012 academic year. A new project has been launched entitled Virtual catalogue of Wildlife of the CEI-Moncloa Campus of the UCM. It was granted 700 Euros and its main objective is to promote the knowledge and study of wildlife in the CEI - Moncloa Campus of the UCM within the framework of the implementation of a virtual wildlife catalogue following standardized methodologies. There will be specific tabs for the most representative species to be incorporated into the website to be used by the entire university community.

Scientific results have led to two master's dissertations carried out partly thanks to the data obtained in this project and three communications to the next Iberian Ornithological Congress to be held in Vitoria next December.

Biological and Biodiversity of Arthropods Group (Research Group UCM 921632)

http://escalera.bio.ucm.es/usuarios/bba/

Wildlife Monitoring Project at the CEI- Moncloa Campus
(http://www.ucm.es/info/seguimientofauna/index.html)**:** is being developed by teaching staff and students of the Zoology and Physical Anthropology Department of the Faculty of Biology, UCM. The main objective of this project is to encourage the biological study of the animal populations present at the CEI- Moncloa Campus. It arises from an interest in understanding the biodiversity found in an urban environment near to our centre and it is proposed as a preliminary step leading to future research projects regarding the monitoring and recovery of potential endangered species. With regards to entomofauna, two main activities have been carried out:

Development of an entomofauna census at the CEI- Moncloa Campus: to understand the entomological diversity present in the urban and suburban surroundings in which the CEI-Moncloa Campus is found, a long-term census program has been undertaken, to observe and monitor the populations of daytime Lepidoptera and ants, continuing during the current year, 2013. This program aims to fulfil three main objectives: a) to help to understand the identity of the species present at the CEI-Moncloa Campus; b) to provide information about the population densities of the species; and, c) to examine the population trends of these species over time. In practice, this program follows a methodology similar to (or slightly modified in the case of ants) to that of the *UK Butterfly Monitoring Scheme* (UKBMS), and consists in following a route on foot, at a constant speed, which crosses diverse zones with different ground use across the Campus, repeated periodically, counting the species and individual numbers of butterfly and ant which the observer comes across. There is currently a list with observed and potential species at the CEI- Moncloa Campus and, amongst other results after

two years of continuous sampling, we highlight the observation of four species of daytime butterflies which had not previously been noted at the Campus, confirmation of the presence of an invasive exotic species of butterfly on the campus (Cacyreus marshalli (Butler, 1898)) and the likely disappearance from the CEI-Moncloa Campus in the order of twenty species of daytime butterfly in the last 15-20 years. These results will be presented at the *1st Congress of the Society for Urban Ecology*, which will be held in Berlin (25-27 July 2013).

Development of entomofauna inventories for the CEI-Moncloa Campus: with the involvement of students, we have continued with an inventory of the entomofauna found at the CEI-Moncloa Campus, primarily directed at a number of groups of arthropods: ants, daytime butterflies, Odonata, spiders, Microhymenoptera and beetles. A number of different sources of information have been used: a) ad-hoc sampling carried out on the Campus; b) data obtained from the census undertaken on the Campus (for butterflies and ants); c) review of specimens from the collections at the Museum of Entomology at the Faculty of Biological Sciences, Universidad Complutense de Madrid – UCME; and, d) registries extracted from bibliographic references. During 2013, we have continued to carry out excursions around the Campus aimed at the observation and identification of active individuals; for this purpose, a number of students have been trained in the use of different sampling methods and in the identification of species from the various groups. A database for each group present at the CEI-Moncloa Campus is being developed, which will allow for the progressive creation of a global inventory of these species.

II Biodiversity Testing at the CEI Moncloa Campus: on 19 April 2013, the II Biodiversity Testing at the CEI Moncloa Campus was hosted at the Faculty of Biological Sciences (Universidad Complutense de Madrid), organized by the *Arthropod Biology and Biodiversity and Vertebrate Biology and Conservation* Research Groups (Department of Zoology and Physical Anthropology, UCM). A number of different institutions collaborated in this event, such as the Ministry of Agriculture, Food and Environment (http://www.magrama.gob.es/es/), the Spanish Association of Entomology (http://www.entomologica.es/), the Félix Rodríguez de la Fuente Foundation (http://www.felixrodriguezdelafuente.com/), the Real Sociedad Española de Historia Natural (http://rshn.geo.ucm.es/), and the SEO/Birdlife (http://www.seo.org/). The event was open to all fans of nature and photography, and was primarily aimed at Bachelors (4-year and full degree) students in Biology, with the purpose of contributing to the knowledge of the biological diversity that lives with us at the Campus of International Excellence at Moncloa. A Testing is a naturalist pursuit which consists in taking the maximum number of photographs of the biodiversity of a particular area to subsequently upload them to the *Virtual Biodiversity* site (http://www.biodiversidadvirtual.org), with the aim of identifying the species photographed and add to the knowledge of biodiversity for scientific, teaching and conservation purposes.

Establishment of a BV Point at the CEI-Moncloa Campus: since the month of June, 2012, the Department of Zoology and Physical Anthropology at the Complutense University of Madrid, agreed with the *Virtual Biodiversity* platform (http://www.biodiversidadvirtual.org) to create a la *BV Point* at the CEI-Moncloa Campus. This commits the department to establish in the near future an information point for its visitors concerning the Biodiversity present at the Campus. The benefits of the establishment of a BV Point on the Campus will be as follows: a) inspire greater curiosity from their visit to visitors and students; b) make them participants in a national project and database; c) widen knowledge regarding the overall biological diversity of the Campus; d) establish a new aspect to socialization and social and participatory dynamics with visitors and students with zero cost, contributing to a great project. During this

last year, collaboration has consisted in the contribution of photographs of the biodiversity of the campus, to add to the inventories of known species there.

Day of cleaning and of ecological report at the CEI-Moncloa Campus: with the purpose of contributing to the a good state of conservation for biodiversity at the campus, cooperating in the collection of rubbish on campus and of ecological reporting (in the latter case, in identifying and communicating to those responsible, information regarding those areas which should be cleaned in greater detail or recovered from a neglected or degraded state), a Day of Cleaning was organised on 22 February 2013. One of the ultimate aims of this event was for the different team members (staff as well as students using the campus) to better understand the wealth of species and habitats present here, their physical location and, specially, the state of conservation of these areas. We believed an added value was achieved; by making the team members participants, as users of the campus, in the maintenance of adequate conditions for health and care, people may see the benefits (health, comfort, etc.) of working in an environment with greater biodiversity.

Use of human, material and financial resources:

The installation of the Greenhouse has been financed with a charge to Project CEI2009, Sub-program B. The cost has amounted to 330,493.83 Euros.

The Germoplasm Bank is another of the selected projects selected on the CAIMON program which obtain financing of 244,375 Euros, with a charge to the CEI2009 Program.

The teams participating in the guidelines linked to the Faculty of Biology at UCM (*Biology and Biodiversity of Arthropods*-UCM 921632 and *Biology and Conservation of Vertebrates*-UCM 910577) and to the School of Agronomy Engineers at UPM (*Biodiversity and Conservation of Plant Genetic Resources and Integrated Management of Plagues*) are four representatives of the teams from CEI-Moncloa that have been working for a number of years on aspects related to the conservation of biodiversity, plant-animal interactions and *ex situ* conservation of different organisms.

Linked to the Germoplasm Bank projects are:

- UPM Research Group: “Biodiversity and conservation of Plant Genetic Resources”. Lead researcher: Jesús María Ortiz Marcide.
- UCM Research Group: “Biology and Biodiversity of Arthropods”. (UCM 921632). Group co-directors: María Dolores Martínez Ibáñez and Raimundo Outerelo Domínguez.
- UCM Research Group: “Biology and Conservation of Vertebrates”. (UCM 910577). Group co-directors: José Luis Tellería and Javier Pérez-Tris.
- UCM Research Group: “Molecular Systematics of Fungi and Plants (SYSTEMOL)”. Group director: Ana María Crespo de las Casas.
- Centre for Plant Genetic Resources (CRF) (INIA). Director: Luis Ayerbe Mateo-Sagasta.

Strategic Area	**SCIENTIFIC IMPROVEMENT**

Action	E13 Creating a program for Cataloguing, Conservation and Dissemination of Biodiversity in the University Campus
Objectives	To maintain for research and teaching purposes the UCM and UPM herbaria and collections, to continue with their incorporation into the international project coordinated by GBIF-Spain (Global Biodiversity Information Facility; http://www.gbif.es/) and to create with this material and with the botanical gardens located on the University Campus a training schedule (with web catalogues) for university students in our community and secondary education institutions of the Community of Madrid.

Progress towards objectives

Projects:

- Biodiversity Interpretation Centre of CEI Moncloa Campus, starting point and interpretation of the schedules, including workshops.
- Design of the Moncloa Campus Biodiversity Schedule including visits to:
  - Vertebrates Museum, Biology, UCM
  - Entomology Museum, Biology, UCM
  - Herbarium, Biology, UCM
  - Arboretum, Forestry, UPM
  - Fish Farms, Forestry, UPM
  - Royal Botanic Gardens Alfonso XIII, UCM
  - Geology Museum, UCM
- Improvements to the collections and museums (Herbarium, Vertebrates Museum and Entomology Museum).
- Installation of a Bio-Geological Clock and outdoor Typhlological Museum.

Description of the work done.

Design of the interpretation centre of the Campus Biodiversity. This action involves the coordination between various UCM and UPM centres, with scientific collections, useful to develop public awareness campaigns among students and the general public. The Royal Botanic Gardens Alfonso XIII has designed a specific action in one of the buildings within the complex, and includes an exhibition space and workshop with a sample of the variety of natural collections Moncloa Campus. An innovative and ambitious design has been chosen for the interpretation centre, using expository criteria and highly innovative technological resources. The action has been complemented with a FECYT project in the context of calls for grants for scientific dissemination which resulted in the installation of a Bio-Geological clock and outdoor Typhlological museum with resin models of different species throughout the life of the planet.

Figure Resin model of Opabinia.

- Refurbishment works on the Vertebrates Museum, Biology, UCM. Exhibition spaces were adapted in the annex building, where the exhibition collections are deposited. Four independent spaces were created: two 20-square metre rooms, the graduate hall and the assembly hall (approx. 30 square metres) and changing rooms (approx. 100 square meters).

- Improvement in the Entomology Collection, Biology, UCM. The Entomology collection of the Faculty of Biological Sciences is mainly for scientific use and stores specimens (many of them type-specimens used for the identification of a new species) resulting from the research work of the professors of the Department of Zoology. The specimens are stored in a 150 square metre hall (approx.) which required the installation of a cooling system, as a preventive conservation mechanism that would prevent the invasion of entomophagous pests. Traditional conservation methods used chemicals (paradichlorobenzene) that have proved toxic to people working in this environment and harmful to the environment and, therefore, have been replaced by physical methods (cooling).
- Improvements in the PCI of the Herbarium. The MACB Herbarium (included in the official list of university herbaria) has two workspaces: an area for the administrative and scientific processing of new entries and a storage area for the specimens (specimens are stored on sheets of folded paper, that envelope the dried plants). The latter is a space of 150 square metres (approx.) and has a powerful air conditioning system that prevents pest activity, but did not have a fire safety system to ensure the safety of the collection (and the building), being highly flammable materials.

Governance structures created

Joint Committee for the coordination and preparation of Biodiversity Schedules

Most significant results

Renovation and improvement works were performed at the Museum of Comparative Anatomy of Vertebrates, with numerous school visits and participation in the second annual Summer Campus, organized by FECYT. A booklet was distributed to Campus participants.

Participation as an External partner in the Wildlife Monitoring Project Moncloa Campus -UCM (http://www.ucm.es/info/seguimientofauna/PROFESORES.html).

Use of human, material and financial resources:

The Interpretation Centre has been renovated thanks to a grant of € 200,000 obtained through the Strengthening 2011 program, currently being conducted, with the opening scheduled for the month of October 2013. The bio-geologic clock and the Typhlological museum is a FECYT project amounting € 19,000. The renovation of the museum is funded from the CEI2009 project for a total of about € 92,881.
Major deviations in progress towards objectives: The Project progresses as planned.

Strategic Focus	**SCIENTIFIC IMPROVEMENT**
Project	**Actions for the MATERIALS FOR THE FUTURE Cluster:** F1 Installation and completion of the Advanced Electronic Microscopy Centre (CMA). F2 Platform for the Design and Construction of Electromagnetic sensors and actuators. F3. Creation of the Workshop Network for the development of new thin film materials. F4 Mechanical Properties Workshop: Durability and Sustainability of Materials.
Objectives	This cluster aims to develop a network structure for the research groups in the fields of structural and advanced functional materials from the UCM and UPM. These groups are experts in the synthesis and structural and physicochemical characterisation of these materials and the determination of their structure-property relationships. These groups' research lines cover some of the hottest topics in Materials Science and Technology, including metallic, ceramic, magnetic and conducting materials, biomaterials and cement-based materials.

Summary of work completed

Each line of action of the cluster is described on a separate information sheet.

Two editions of MaterialsWeek have been organized and the 2015 edition is currently being planned. MaterialsWeek is a forum where scientists, students and firms in the field can come together. The aim of this action is dissemination and transfer of knowledge.

MATERIALSWEEK

Activities for Scientific Dissemination and Connection with Society

The strategy followed in the Materials for the Future Cluster for Scientific Dissemination and Connection with Society is based on several areas, corresponding to the objectives initially set in the lines of action of the Master Plan:

1. Fostering of scientific culture and innovation in Society.
2. Fostering of creativity and scientific vocation among university and pre-university students.
3. Science, job and business fairs disseminating the results obtained at CEI Moncloa Campus.
4. Fostering of networking and synergy between researchers, teachers, students and companies.
5. New methods for student learning, motivation and participation.
6. Increased University-Business collaboration

7. Internationalisation.

The activities listed below include the most cross-functional, innovative and original ones conducted. This is by no means exhaustive and does not include initiatives traditionally carried out in our Campus, such as the Researchers' Night, the Science Week, Job Fairs in Schools and Faculties.

1. FECYMAT: Forum of Companies, Materials Science and Technology.
2. -Workshop on Materials for Nuclear Energy (activity which takes place entirely in English)
3. Student competitions.
4. Technology Exhibition organised by participating companies. Visits to Laboratories, Research Centres and Museums.
5. Volunteer work.
6. Theatre.
7. International projection of the Materials for the Future Cluster.
8. International Seminars on the Frontiers of Materials Science.
9. Inter-university Master on Materials Engineering (entirely in English).

To enhance the international focus of the event, all actions were bilingual (Spanish-English unless otherwise indicated, in which case they are entirely in English). The rationale for this initiative is that both in science and in technology, it is essential to acquire this competence (universities request that their graduates have a level B2 of English) and this encourages its use and justifies its need. Seven of the actions proposed were organized at the UPM's School of Civil Engineering (except for the website, the volunteers and the visits to the laboratories, for obvious reasons). This School, located in the heart of the Moncloa Campus, has excellent communications with the rest of the scientific and academic community, and the city centre, which makes it a point of reference for students and researchers at the Complutense and Technical Universities.

On the other hand, the School of Civil Engineering has enough large spaces, rooms and classrooms to house all the activities proposed here (including an auditorium seating 700), as well as being the site where the Degree and Master of Materials Engineering of the UPM is taught. It is also only about 500 metres from the building where the Degree of Materials Engineering of the UCM (Faculty of Physical Science) is taught.

Citizen support of Science can only arise from interest and curiosity about learning new ideas and technologies, something innate in humans. This is achieved through mutual knowledge and implies debate and discussion on diverse topics, in plain and understandable language, yet not empty of contents. With this project, we have aimed to collaborate in the promotion of a scientific culture in Spain, seeking a connection between citizens and generators of knowledge. To build this bridge for awareness and proximity between the two sides involved, at the Materials for the Future Cluster of the CEI Moncloa Campus we intend to generate various types of gatherings between teachers, researchers, students, citizens and companies, based on the field of Science and Materials Engineering. Therefore, we consider that the activities should focus not only on a physical space, but also a timeline that allows greater publicity impact and a higher possibility of participant interaction, to achieve an atmosphere and critical mass favouring meeting the objectives set. Thus, eight of the ten events listed took place during a short period of time (three days, 28, 29 and 30 April, 2014), during what we called Materials Week. Here we shared experiences, knowledge, technology and ideas. We consider this is a key effort that should be encouraged in our Campus, especially taking into account the current situation that leads to lack of motivation in society as a whole; so it has not been an isolated event, but rather is intended to last and the 2015 edition is already being worked on.

The Materials Week wishes to provide a ray of light, hope and optimism for a future which we believe, most sincerely, will be much better than what we can imagine now. Therefore, what is better than trying to show how we are building this future at the CEI Moncloa Campus? During the Materials Week, various types of events are carried out simultaneously: conferences, debates, demonstrations, open door days, competitions… in Spanish and English. These activities are aimed primarily at young people and they feature companies, technologists, researchers and teachers. Concentrating a high number of specialists and students, they generate a dynamic learning space.

However, it also attracts the attention of the general population, and of other universities, institutions and companies. This science education and information project is based on traditional mechanisms but with innovative approaches that encourage learning among participants, shown as a way to improve the current economic and social situation. Within the immense scientific variety of our Campus, we have focused on Materials Science and Engineering for various reasons:

a) This is the most cross-functional discipline of all those existing on the Campus.
b) It is also one of the least-known. The materials revolution is a silent one that has changed our world without our realising it, taking us stealthily from leather shoes to those made of composite materials.
c) This is one of the most transforming areas from a social, cultural, scientific and technological viewpoint.
d) It is very close to us and it can be ***touched and shown*** easily with no need for prior knowledge or major installations.
e) The Community of Madrid concentrates over 30% of the Materials research and technology of Spain.
f) Our country, and in particular this Campus, is an international reference in the area of Materials.

Below is a description of the activities conducted to date, however, given that in many cases this initiative is ongoing, we have also included what we have planned for the future.

ACTIONS

ACTION 1 FECYMAT: FORUM OF MATERIALS SCIENCE AND TECHNOLOGY. *(This action is filmed in its entirety and webcast with free access).*

At the Materials for the Future Cluster we wish to enhance the social presence of the CEI Moncloa Campus and synergy between research groups and lines, students and companies. Therefore, the main action during the Materials Week is the Business, Materials Science and Technology Forum (FECYTMAT). We want this Forum to be a meeting point for citizens, companies, professionals, students, graduates, teachers and researchers, so that they can share and disseminate experiences, knowledge, technology and ideas, contributing to scientific education and stimulating the creative, critical and entrepreneurial spirit of the attendees. In short, the aim is to create the breeding ground to favour a range of benefits, from young people finding jobs, to setting up research projects or spin-offs through University-Company collaborations, or simply, talking directly with knowledge generators. With this aim, we alternate informative presentations on the most innovative lines of research groups, with company presentations, in order to achieve higher interaction of both worlds and provide attendees with a closer and more comprehensive overview. Therefore, this activity is the ***core event*** of the whole Materials Week, serving as the backbone for all other activities.

FECYTMAT begins with the opening conference of the Materials Week (delivered by Dr. Blanca Losada in 2014 - (Distribution Director from Electricidad de Gas Natural Fenosa), followed by a debate with a panel of experts from the industry, administration, science and technology. The rest of the program has the following format: on the afternoon of the first day, during all of the second day and on the morning of the third, there are several sessions with monographic conferences, which in 2014 addressed topics such as Materials for Defence, Construction Materials, Food Materials, and Glass and Ceramic Materials. Each one of these monographic sessions includes multidisciplinary presentations that provide an enriching view of each field, and each block lasts around four hours.

Throughout the Materials Week, there are simultaneous breaks in all the activities, so that all participants may enjoy some light refreshment (coffee, tea, soft drinks and a snack) in the hall on the first floor of the School of Civil Engineering. This turns this large hall, which must be crossed to access all the other activities, into the ***meeting point***. In this hall there are also the booths of the companies in the Technology Exhibition, exhibiting the works submitted to the Photography Competition and where all the videos submitted to the various competitions are continuously shown on a screen. These breaks are an excuse to encourage the meeting between participants and specialists, and with the collaboration of students in the last years of the Materials Engineering Degree of both universities, to break the barrier hindering communication between strangers from very diverse backgrounds. Here they can all chat in a relaxed atmosphere, over coffee, on the activities carried out and they can address speakers

with any questions or things they are curious about.

ACTION 2 WORKSHOP ON NANOTECHNOLOGY AND NANOMATERIALS. *(This action is filmed in its entirety and webcast with free access).*

The Workshop is comprised of three sessions. In each one there will be two specialists on the monographic topic of the session who deliver an informative talk on the same. After the presentations, there is a round table with, aside from the speakers, a specialised science journalist from the large media and one or two students from the Materials Engineering Degree in our universities, for a debate with the audience. The topic changes every year, depending on the interests detected when it is organised. In any case, it takes place entirely in English. This activity is of special interest for bilingual schools of the Community of Madrid (which are growing in number), as it allows pre-university students to practice their skills in this language while receiving information and scientific education by the main actors. The results of the 2014 edition were most satisfactory and for 2015 we already have reservations for participants.

ACTION 3 COMPETITIONS *(This action is filmed in its entirety and webcast with free access).*

Materialise your ideas! That is the motto of our competitions. With this motto we wish to stimulate creativity, curiosity, imagination, knowledge, entrepreneurship and scientific and technological vocation among the young, but also among those not so young. Through fun and easy activities, and with the reward of modest but significant prizes, we will be able to achieve all of these objectives. Six different competitions have been proposed covering different areas of scientific reasoning and its technological application, so that according to the skills and competences of each participant, they can go for one competition or another, or all of them simultaneously. Competitions take place during three days, so they do not overlap and it is possible to participate in or attend all of them, at will. The prizes initially proposed for each category are: first prize of €300 and two second prizes of €100 each. This activity was experimentally carried out during the Materials Week 2014 and it was very successful.

3.1 Scientific Dissemination

Participants must disclose some of the research conducted in the Materials for the Future Cluster in an entertaining, fun and ingenious manner. Participants must communicate their message in a way that is understood by all of society. The objective of this competition is to foster dissemination of Materials Science and Engineering through new channels to approach society, and what better way to do so than with the young, in a language that is close to them. Participation may be individual or collective and a video in English is presented with a maximum duration of three minutes. The videos generated are posted on the website. In addition, a text is submitted, in English or Spanish, of less than one thousand words, explaining the purpose of the video and what it explains. The works selected by the jury are presented by the authors during the Materials Week, in Spanish or English, in a maximum of seven minutes, for which they can use visual aids.

3.2 MacroWorld Photography

Photography contest of the mesoscopic and the macroscopic world where participation may be individual or collective. The jury shall assess the contribution to dissemination of scientific research conducted in the Materials for the Future Cluster and the photographs are presented in digital format to be exhibited on-line. The photographs must have a title in Spanish and in English, and be accompanied by an explanatory text in Spanish and English of less than one hundred words.

3.3 MicroWorld Photography

Photography contest of the microscopic world where participation may be individual or collective. The jury shall assess the contribution to dissemination of scientific research conducted in the Materials for the Future Cluster and the photographs are presented in digital format to be exhibited on-line. The photographs must have a title in Spanish and in English, and be accompanied by an explanatory text in Spanish and English of less than one hundred words.

3.4 Talent Show

This is an attractive competition in which the young show their abilities (magic, music, monologues, performance,...) outside the classroom, stimulating their creativity and making them lose their fear of speaking in public (which is excessive in Spanish society). It takes place at the Auditorium of the School of Civil Engineering and participation can be individual or collective. Performances cannot be degrading, sexist, racist, or against any civic criteria expected in our society, and they can be in Spanish and/or English. This is a relaxed event where the audience, students and teachers can mingle and interact.

3.5 Materials games Gymkhana.

One way for students to discover how much they know about the world of materials is asking them, but in this case instead of taking an exam we have decided to ask questions in traditional games such as Trivial, Monopoly, playing cards, etc. by modifying and adapting them to the world of Materials. The competition consists of playing five games: Materiapolis, Trivimaterial, Granta Materials Cards, etc. where points are obtained according to whether one is the winner, second, third, etc. in each one. There is a first qualifying round, and winners go on to the qualifying finals, with the final taking place on the last day of the Materials Week in the morning. The organisation reserves the right to create groups of participants if there is a very high number of entries. During the 2013 edition there were close to sixty participants, and it was one of the activities with the highest demand.

3.6 Creativity, Entrepreneurship and Innovation.

The contest is aimed at pre-university and university (undergraduate, graduate and doctorate) youths, individually or in groups. Creativity, entrepreneurship and inventiveness must be focused on the field of Materials Science and Engineering. For example, you can submit the development of a new material, an experiment, improvement of an existing product, development of a company… whatever, as long as it is original, innovative and imaginative. Participation may be individual or collective and a video in English is presented

with a maximum duration of three minutes. The videos are posted on the website. In addition, a text is submitted, in English or Spanish, of less than one thousand words, explaining the purpose of the video and what it describes. The works selected by the jury are presented by the authors during the Materials Week, in Spanish or English, in a maximum of seven minutes, for which they can use visual aids. The Jury shall take into account the new idea as well as how it is structured and disclosed. The purpose of this is to:

- Encourage a critical spirit aimed at creativity.
- Stimulate creativity, entrepreneurship and development of ideas among the young.
- Encourage autonomous and team work and the use of idea generation techniques.

ACTION 4 TECHNOLOGY EXHIBITION.

The Company Exhibition takes place in booths in order to allow students, specialists and companies to be in direct contact with the latest technological advances in production, analysis and characterisation of materials. Various companies, leaders in instruments for the field of Materials Science and Engineering, present their latest equipment and offer free demonstrations. There are also informative talks and mini-courses for anyone interested in learning more details about the technologies and machines displayed.

In collaboration with CSIC, and in addition to the above, in the 2014 edition, the exhibition *A Walk Through Nanoworld* was installed on the ground floor hall of the School of Civil Engineering. The purpose of this exhibition is to show the general public a selection of images selected as finalists in the 2007 and 2009 editions of the International Contest of SPM Microscopy Images, organised by CSIC and the Autonomous University of Madrid. The images show various "nanolandscapes" populated by atoms, molecules, carbon nanotubes, nanoparticles and other nanostructures, allowing us to see the real actors of nanotechnology, the new paradigm of knowledge that shall bring about the industrial revolution of the 21st Century.

ACTION 5 VISITS TO LABORATORIES, RESEARCH CENTRES AND MUSEUMS.

The main objective of the visits is to provide a tour of the places where knowledge is generated, with the possibility of chatting with researchers while ***looking and touching***. The Moncloa Campus has a network of international centres of research excellence (ISOM, National Centre of Electron Microscopy…), as well as the most extensive network of scientific museums of all the Spanish university campuses. Many of them are unknown, but have real gems that help understand the role of scientific and technological development in the history of Spain. This activity is primarily aimed at pre-university schools to complement what is being taught in class by teachers, and stimulate scientific and technical vocations. We contact schools directly, especially those associated to the two universities, and we offer them the possibility of full packages, in which the visit to some of our facilities is followed by participation in one of the other actions described. This way we provide participants with a more comprehensive experience, and the cost of this type of field trip for the school is optimised.

ACTION 6 VOLUNTEER WORK.

A way of involving students at our universities in this project is to make them feel key players of the same, and what better way than to have them collaborate directly in its organisation and dissemination. Their help is essential to make this initiative a reality, so we encourage them to collaborate, letting them know that just a few hours of their time means a lot to us. This way they can personally discover that on Campus there is a very rich life beyond the classrooms, and not necessarily that of the mad scientist made popular in Hollywood films. In the 2013 edition we had over thirty volunteers.

ACTION 7 THEATRE PERFORMANCE

The Theatre is a perfect meeting point between Science and Humanities, which we do not want to leave out of the field of science and technology. In the 2014 edition the group Teatro en Canal, of the School of Civil Engineering (UPM), we were entertained with a play whose plot sought to establish a dialogue between Science and Society, serving as an enjoyable and entertaining connection with the rest of the actions of the Materials Week.

Providing this showcase is a reward for the efforts of students of technical and scientific careers to combine their specialised education with humanities. In the 2014 edition we conducted a pilot of this experience with nearly four hundred attendees.

ACTION 8 INTERNATIONAL PROJECTION OF THE MATERIALS FOR THE FUTURE CLUSTER

Achieving international projection of scientific, technological or business activities in our Cluster, and therefore of the CEI Moncloa Campus and our country, is a must in a globalised world. That is why we have developed a very attractive and modern website showing all our work. It includes the over forty hours of videos generated every year throughout the Materials Week, with a twofold objective: i) to be able to show the international community our achievements and potential, as well as open the door to new collaborations, projects and attract talent for our classrooms and laboratories; ii) continue our work for dissemination and scientific education beyond the space and time of the Materials Week. Since the material is accessible for free and permanently, it can be used by teachers at different levels, associations, institutions and individuals for continuing education. One of the objectives of this action is to provide all the information available on the Materials Week website both in Spanish and English in order to achieve greater international projection.

ACTION 9 INTERNATIONAL PROJECTION OF THE MATERIALS FOR THE FUTURE CLUSTER

International Seminars on Materials Science Boundaries (www.mater.upm.es/seminarios.asp) have a weekly periodicity and their objective is to serve as a meeting point for sharing and disseminating current and relevant issues in the area of Materials Science and Engineering; with a broad vision that ranges from biological materials to functional materials, and purely technological applications. They are participated voluntarily by relevant teachers, researchers, companies and technologists of Universities, Companies and Research Centres, both national and international.

They have multiple objectives: learn about what other researchers are doing, explore new ways of collaboration or simply learn something new. The Seminars are held every Monday

from 9:30 to 10:30 a.m. The expected duration for the talk is about 45-50 minutes, leaving 10-15 minutes at the end for Q&A.

As for the audience, it is very diverse: from students of engineering and science degrees, to senior researchers and master and doctorate students.

The speakers are filmed in order to provide, for free, maximum dissemination of the talks and the knowledge presented. As a result, the ***research of the speakers is webcast to over 60 countries***, and some videos have had over 40,000 visits. In total, we have received ***over 400,000 visits to our space in YouTube-UPM***.

We believe that we can be very satisfied with this activity, as it has turned us into a national and an international reference on scientific communications in the field of Materials Science and Engineering.

ACTION 10 INTER-UNIVERSITY MASTER IN MATERIALS ENGINEERING

A university without research is a bad university, but a university without education is not even a university. We could not leave aside in our approach education and its actors: students. They are the raison d'être of our institutions, and for them both universities have developed syllabuses for the Degree in Materials Engineering. Joining the two degrees might be a good idea, but for now it is not feasible for various reasons, many of them administrative. What we can do is try to offer our students a joint Master in Materials Engineering of the CEI Moncloa Campus.

Coordinating the efforts and interests of two large universities, with at times differing cultures and interests, can be complicated. Academic year 2013-14 saw the start in the UPM of the Master in Materials Engineering. Its main characteristics are:

1. Duration: one year (72 ECTS)
2. Studies taught entirely in English (in fact the students requested that all subjects be taught in English).
3. Four specialities (functional, biological, for energy and structural materials) which include the main lines of research of the Cluster.
4. Attracting international students, with students from China and Saudi Arabia participating. At the time of writing this report, registration for the 2014-15 course is still open, however based on the pre-enrollment figures (a total of 62) we have several foreign students and many who were previously in other Spanish universities.
5. Teacher participation from both universities, from the research centres attached to the Campus (CSIC and CIEMAT) and international teachers. Of special note is the participation of Dr. Mihael Rieth from KIT (Germany). He is the coordinator of the European Fusion program and his course had about 100 participants.

Officially the Master is attached to the UPM, because for administrative reasons we have been unable to include the UCM and make it an inter-university degree. Currently all of our efforts are dedicated to having a joint Master's in the 2015-16 academic year, although there are many obstacles and different points of view that must be overcome. In the meantime, participation by non-UPM staff is significant: 25% UCM, 50% UPM and 25 % teachers from other institutions (mostly CSIC and CIEMAT). However, the recent inclusion of firms is an

important step and is valued greatly by students.

Proof of the firm commitment of the two universities with this Joint Master is that in July 2013 we invested €25,000 + VAT to acquire a four year licence for software for Materials Selection (from Granta Design). This has been used widely in the 2013-14 school year, in both Master and undergraduate programs, by teachers and students of both universities. Furthermore, this type of software allows teaching based on case studies and methodologies that are closer to students.

2. OBJECTIVES

The main objective of this project is to consolidate the scientific dissemination efforts in the field of Materials Science and Engineering that, in its institutional role, is to be expected from any public university, and to link it with the specific work of research and teaching conducted at the Complutense and Technical Universities of Madrid through their faculties, schools, research centres and institutes, and more specifically through their more than one hundred renowned research groups. This gives us a critical mass with enormous potential (to which should be added the contribution of researchers of entities attached to the Campus such as CIEMAT and CSIC) concentrated in a small geographical area. It should be noted that many of these researchers and teachers are international leaders in their respective fields of work, with significant relations with the most reputable international science and technology centres. All of this science potential is organised in the Materials for the Future Cluster, the strategic area of the Moncloa Campus of International Excellence led by the Universities.

The Materials Week was designed with the following specific objectives:

1. Generate a participatory, consistent and rigorous resource with a high visual impact that is attractive for all types of audiences: modern, innovative, educational, and using new technologies.

2. Raise awareness on the importance of Materials Science and Engineering, explaining the concept and providing illustrative examples, close to visitors and inspired on what we do at the Moncloa Campus.

3. Introduce participants to the magic of materials and their present and future applications, from the conception of the idea up to its industrial production.

4. Create a space devoted to the reception and guidance of visitors, their education, enhancement of critical spirit, creativity, innovation, free and critical thinking,...

5. Internationally project the image of the CEI Moncloa Campus and of Spain as a science and technology reference in Materials Science and Engineering. Increase interaction between the scientific world, innovation and organised civil society, encouraging public participation in science and technology.

6. Develop innovative and provocative formats and channels to promote a scientific culture.

7. Promote knowledge of science, technology and innovation in society, consolidating their public image as an activity that generates wealth, development, well-being and quality of life.

8. **Encourage scientific vocation**, by increasing grassroots scientific culture.

9. **Foster a critical spirit**, which is the foundation of the scientific method, to build freer and more aware citizens.

A specific result of the project proposed is integration of various actions for scientific communications in a central physical space within the University that is easily recognisable; thus consolidating the educational and entertaining role of Science and Engineering, and bringing the University's research and academic efforts closer to the general population.

This project intends to bring the wealth, cross-functionality and multidisciplinarity of Materials Science and Engineering to our target audience, through its contribution to social, cultural and economic development of Humanity. For this we follow a current and modern vision, not a historiographic one. This has the advantage of being close to the latest advances, and the disadvantage of losing the historical continuity of contributions. Nonetheless, the latter can be discovered by the recipient by unravelling the historical thread of discoveries that have led to the present situation, which endows the approach with added value. Therefore, any consideration of the proposal shall place emphasis on disseminating the most important and recent results from the Moncloa Campus as described by their actors: ***the scientists, specialists and technologists.*** The presentation and detailed explanation of the contributions, many of them absolute universal references, should contribute to greater awareness among citizens on materials science and technology, their study and value. Also, it shall encourage the onset and development of scientific, technological and entrepreneurial vocations, at a time when they are scarce but extraordinarily necessary in our country.

A positive collateral effect of the activity proposed is the creation of a breeding ground in a space-time where researchers and companies can present their work and studies, establish contacts and collaborations, interact with young students and graduates for Senior Projects and Master Projects, Doctoral Theses, Internships and job opportunities. Additionally, this initiative will help show Spanish society, and using the Internet we can also show the whole world, the great competitiveness and capability of this sector, that so often goes unnoticed due to its routine nature, where we play a very significant role globally: we are the ninth scientific power in the field of materials and we have multinational companies that export to most developed and emerging countries.

3. LEVEL OF INNOVATION AND SCIENTIFIC-TECHNICAL RELEVANCE OF THE ACTIVITY

The proposal is not based on a display of possibilities that is overwhelming for our visitors; it aims to show in a direct, simple and entertaining manner, the potential of Materials Science and Engineering at the Moncloa Campus and its ability to transform our society.

Without underestimating the usefulness of computer communications, we wish to bring the objects of our study closer to the population (whether in the university or not). Their beauty,

complexity, innovation, usefulness and presence in our everyday life cannot be perceived at a distance. This is why we bring together in a limited physical space (the School of Civil Engineering) all the activities proposed, except for the visits to laboratories, museums and research centres. Thus, there will be simultaneous competitions, guided tours, conferences, exhibitions, debates, demonstrations, booths, cultural activities, etc. so that visiting the Materials Week becomes a comprehensive experience captivating visitors from every nook and cranny. We shall reinforce the bonds between researchers, scientists, teachers, technologists, business owners, students and the general public, by bringing them together in the same space-time. This is why we have breaks between the sessions of the various activities where we offer some small refreshment (mid-morning and mid-afternoon). This serves as an excuse to encourage the meeting of attendees, and with the collaboration of students in the last years of the Materials Engineering Degree of both universities, to break the barrier hindering communication between strangers from very diverse backgrounds. They shall all be able to chat in a relaxed atmosphere, while having a coffee or tea, on the activities carried out and specialists shall be available for questions or clarifications. This meeting point (hall on the first floor of the School of Civil Engineering), must be crossed to access all other activities, and it is surrounded by the booths of the Technology Exhibition companies, the photographs of the Photography Exhibition, and all the videos submitted to various competitions, continuously being shown on a screen.

This arrangement also makes visits from schools especially interesting, both for students and schools and teachers. Given the increasing difficulty of raising funds for student trips, it is necessary to optimise them. If instead of visiting a single activity we offer the possibility of complementing several events and link them, it is an added incentive for all, providing a more comprehensive and motivating experience. In the 2014 edition of Materials Week, we tried out this proposal with sixty sixth form students from the British Council School with amazingly positive results. So much so, that the head of the school has asked to book a repeat visit in 2015.

Although the project's philosophy does not consider radical methodological innovation with respect to the usual communication channels, it does provide a unique opportunity to try out new formulas and formats integrating very diverse activities that can, however, establish major synergies.

In addition, all the actions described include preparation of digital materials (by being filmed) that can be accessed remotely on the Internet. In the 2014 edition of Materials Week, we filmed over thirty hours of videos of the various activities carried out, and all the material generated is currently being edited. Once done, it shall be classified and catalogued so it may be accessed on the Internet (in our own websites and in social networks).

4. TARGET AUDIENCE

The primary audience of this action is the university community linked to any of the education or research centres included in the Moncloa Campus, as well as any attached entities, pre-university schools in the area of Madrid, and any person interested. The project has a clear inter-institutional vocation, especially when considering the preexisting close

collaboration between UPM and UCM, within the Moncloa Campus of International Excellence Program of the Ministry of Education, Culture and Sports.

Since university students (and, by extension, the rest of the university community: administration and support staff and teachers and researchers) are those that will benefit the most due to their proximity to this action, the Campus must and wants to extend its scope of influence to other social groups. This project is particularly sensitive towards teachers and students preparing to enter university. Contact with the centres attached to the two universities is regular, with frequent informative visits to the schools, and their students visit us for events such as the Science Week or Researchers' Night. These kinds of initiatives are always very welcome and in past years, they have always filled up.

Aimed essentially at university and pre-university students, this project also welcomes other audience profiles: on the one hand, non-specialised and family audiences that may find in this environment -close and well communicated- a space for scientific leisure, and on the other, a space for scientific information. Furthermore, this activity can be especially attractive for members of the ***University for Seniors*** of the UCM (or other similar initiatives); this audience has enormous intellectual curiosity which, in science, can be met with communication programs such as the one proposed here. In this regard, we shall make a special effort to contact and inform associations of friends of science and senior citizen associations.

Finally, addressing various actions towards audiences with disabilities will facilitate access to scientific information by a group generally neglected in Scientific Dissemination projects. For this purpose, we shall seek the support of associations of people with disabilities and specialists in our Campus.

5. STRATEGY AND COMMUNICATION PLAN

The communication strategy for the activities includes the usual media in the university community:

- The Materials Week web page: (http://www.campusmoncloa.es/es/eventos/materialsweek/), which is continuously updated,
- Usual electronic communication channels: email, social networks, newsletter, etc.
- Information points through university, school, research centre websites, both of the Moncloa Campus and associated entities.
- University newspapers, radios, and televisions, in particular those linked to the Faculty of Communications and the specialities of Sound and Image in Telecommunications Engineering. Media coverage was widespread in the 2014 edition. Of special note was the emission of the Spanish National Radio program "España, vuelta y vuelta" that was broadcast from the School of Civil Engineering during MaterialsWeek.

Regarding the general public, the initiatives developed shall be communicated to the local and regional institutions in our geography to attract schools, secondary schools (especially those associated to the two universities), cultural associations, etc., linked to the guided tours offered by both universities.

Finally, as a complement, the Moncloa Campus has its own International Office of

Communications, while the participating universities each have Communications Departments and Scientific Dissemination Units, available for this project for direct contact with the media and local communication networks.

6. COLLABORATION, INTERDISCIPLINARITY, AND INTERNATIONALISATION

The project submitted brings together in the same space-time point, under the coordination of the UPM and UCM Research Vice Rectors, several centres, schools, faculties and technology institutes and the over one hundred research groups present in the Materials Cluster of the Moncloa Campus. They shall conduct their scientific activities in the area of Materials Science and Engineering firmly committed to transferring their work to society, and in particular to the business world and the young in order to encourage their vocation.

The objective of the CEI Moncloa Campus is also to link this initiative to other research centres, companies and groups (not only from UCM or UPM) related to the world of materials, thus increasing dissemination and awareness among the university community and society in general of the efforts made by these two universities to enhance knowledge of Materials Science and Engineering. Given that the region of Madrid concentrates over 30% of the materials research groups in Spain, and a significant proportion of the most advanced companies in the sector, we are one of the main European poles in the field of materials. All of these centres and companies will therefore be able to use the time-space environment created by the Materials Week to show their work and research. However, we want to go further and make it the breeding ground to establish networks and collaborations among them, contact young students and graduates for Senior and Master Projects, Doctoral Theses, Internships and job opportunities. Additionally, this initiative will help show Spanish society the high competitiveness of this sector, where we hold a prominent position in the world: we are the ninth scientific power in the field of materials and we have multinational companies exporting all over the world.

Our objective, as Materials for the Future Cluster of the CEI Moncloa Campus, is ambitious and we aim to become a European, and an international, reference in the field of materials, so that the annual organisation of the Materials Week allows not only favouring scientific dissemination locally, but also contributes to creating and spreading the Brand Spain as State policy, the efficacy of which lies in long-term, local actions with a global projection. Proof of this is that this year we have had participants from various Spanish universities, various papers submitted to the competitions from Latin America, and visits to our website from over twenty countries.

The objective is to improve the image of our country, both internally and beyond our borders, for benefit of the common good. In a global world, a positive country image is an asset that helps endorse a State's international position in politics, economics, culture, social affairs, science and technology.

In short, improving our country's image as a leader in the field of Materials Science and Technology will support our projection internally as well as abroad. We hope that with this we can, humbly, contribute to increasing exports by our manufacturers, attract new

investments in our companies and universities, foreign students and researchers interested in joining the Spanish Science and Technology system. We also want to help achieve internationalisation of our companies in a niche in which Spain is and can be highly competitive.

Finally, we should highlight the firm and unswerving commitment of the universities participating in this proposal with equal rights and integration of those members of the university community living with disabilities for raising awareness among the general public (and in particular, the young) on education without barriers. Specifically, the Moncloa Campus, in collaboration with ONCE and the Ministry of Education, is promoting a university free from any type of barrier, that guarantees equal opportunities and non-discrimination of people with disabilities to access, stay and advance in the university community.

Although the activities proposed are aimed at the general public, all of them will take into special account people with any type of disability. This includes placing special emphasis on how new materials can help resolve different types of temporary or permanent disabilities. Specifically, we shall request technical assistance from associations of different types of disabilities, as well as support for communications, dissemination and fostering of various actions.

7. FUTURE PROJECT SUSTAINABILITY

The events planned shall be enhanced in future with new proposals arising from the experience acquired and suggested by research groups in the universities comprising the CEI Moncloa Campus and its attached entities, which include major corporations. Through the Management Committee of the Materials for the Future Cluster of the CEI Moncloa Campus, the group of researchers, associated corporations and scientific associations shall be called upon to design initiatives for the Materials Week, thus enhancing communications of our research efforts.

The actions with a higher impact, conferences and tours of research centres and institutes, addressed not only to the university community but also to children and youths, are assured thanks to the prior experience of the two universities and their networking with pre-university schools, which guarantees their success.

The main sources of funding that guarantee the viability, sustainability and financial autonomy of the project in the medium and long-term are based on three core elements:

1. **Self-funding**, from the regular budgets of the two Universities through the CEI Moncloa Campus project.
2. **Corporate sponsorship** through their participation in FECYTMAT and the Technology Exhibition. In the 2014 edition, there were nine participating companies with varying contributions.
3. **Patronage from public and private foundations.** We will strive to contact scientific associations in the field of materials (there are nearly ten in our country), foundations with a strong scientific dissemination vocation (Areces, BBVA, Santander, etc.) in order to enter into multiannual contracts supporting this initiative. In the 2014 edition we had the support of SOCIEMAT (the Spanish Materials Society) and we expect their support to

be even greater as awareness of the Materials Week increases.

4. **Crowdfunding and private donations.** This is a collective cooperation option, carried out by people who set up a network to raise funds or other resources, usually web-based, to finance work and initiatives of other individuals or organisations. We believe this can be very significant for our future viability and furthermore it can gauge the level of satisfaction of participants. In the 2014 edition this channel was opened through our website.

With all of the above actions we believe continuity of the initiative shall not depend only on competitive sources of financing, so we can assure independent medium and long-term continuity of the Materials Week.

8. MECHANISMS TO EVALUATE IMPACT AND QUALITATIVE AND QUANTITATIVE IMPACT

The impact of the project submitted can be evaluated with quantitative and qualitative criteria. We propose the following plan to measure the impact:

1. **Visits to the website at three different periods.**
   a) three months before the event
   b) during the event
   c) six months after the event.
2. **Registrations to events through the website.**
3. **Number of visitors to each event**: number of visitors received directly, number of on-site visitors
4. **Number of corporations sponsoring the event**
5. **Number of corporations collaborating in the event**
6. **Number of papers submitted to the various competitions**
7. **Quality of the papers awarded prizes in the various competitions**
8. **Satisfaction surveys of visitor groups**, as well as setting up a permanent channel for discussion through the usual social networks for possible suggestions and improvements.
9. **Satisfaction surveys of selected opinion groups.** After the event, of selected groups such as teachers, schools, student delegates and representatives, etc. they will be sent surveys on their satisfaction level and possible suggestions for improvement.
10. **Presence in the media.** We compile all mentions of the Materials Week in the press, radio, television, Internet and any other news mass media.

In the 2014 edition of the Materials Week, in order to test the viability of the initiative, we developed a program with no mass publicity aimed at schoolchildren, scientists and university students, and it

gathered nearly one thousand attendees. Our estimate is that with a communications program for centres, associations and institutions, and for our own university students, complemented with a richer offer of activities such as those included in this proposal, we can reach a number of visitors exceeding 2,000 people on site, and over one hundred thousand visits to our website in 2014.

Strategic Area	SCIENTIFIC IMPROVEMENT
Action	F1. Installation and equipping of the ICTS "National Centre for Advanced Electron Microscopy"

Summary of the work to date

The study of the structural complexity of today's materials demands increasingly sophisticated equipment. To understand the relationship between a material's structure and its properties –both structural and functional– requires high-resolution electron microscopes that provide images with atomic resolution in order to analyse lighter elements, while simultaneously producing high-resolution maps of its chemical analysis and electronic characteristics, with the adequate spatial resolution. To respond to this need, aberration-corrected lenses have been developed in recent years which –when correctly configured and fitted to a particular electron microscope– provide a direct image of the structure and its chemical composition, and information on its electronic properties with atomic resolution. In these conditions, electron microscopes with an acceleration potential of 200-300 kV equipped with a cold FEG and a spherical aberration corrector allow resolutions as high as 0.05 nm, representing a giant leap forward in the development of new materials, and particularly in the field of nanomaterials.

The National Centre for Electron Microscopy therefore continues to install, develop and calibrate the new equipment. The first action was the acquisition of the JEOL JEM 2100 transmission microscope through the SUB-PROGRAMME B PROJECT CEB09-0013, “CAMPUS OF INTERNATIONAL EXCELLENCE”. This equipment is now fully operational and available to the national and international scientific community. This is a highly versatile microscope that enables information to be obtained routinely at an intermediate resolution. Characterisation in this type of microscope is a prior step to the use of the high resolution microscope ARM 200cF.

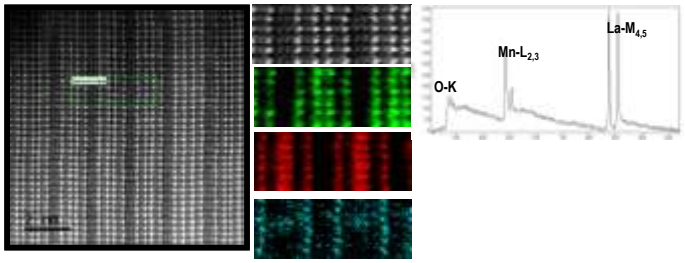
The ARM 200cF was installed in two stages. The first stage was funded by the Moncloa Campus of Excellence and by a public tender awarded to the company IZASA in November 2011, and consisted of installing the microscope and the necessary docks for the remaining analytical accessories. The second phase was by public tender granted to the company IZASA and funded by a collaboration agreement between FGUCM and MINECO in June 2012, and involved the installation of all the microscope's analytical accessories (GIF-QuantumER^{TM} and Oxford INCA-350 spectrometers). The microscope has five different detectors (JEOL HAADF, JEOL LAADF, JEOL BF, GATAN DF and GATAN BF) for use in STEM mode, and the installation was completed during this second phase. Additionally, in order to correct the problems observed during installation, a noise canceller and a magnetic field canceller were also added.

The assembly and alignment of the ARM200 microscope was done directly by JEOL France; the GIF-QuantumERTM spectrometer was installed by GATAN France; and the spectrometer Oxford INCA-350 was installed by IZASA. The cold field emission gun (CFEG) –and consequently its installation and revision– have always been under the direct supervision of the central office of JEOL in Tokyo (Japan).

The figure shows the ARM 200 cFEG electron microscope with an aberration corrector on the condenser lens and equipped with a GIF-QuantumER spectrometer for analysis by EELS spectroscopy and energy-dispersive X-ray. The system is designed to exploit the characteristics of the cold FEG and is equipped with a 2K X 2K camera. It includes all the computer hardware necessary for its operation. Once all the resolution and calibration tests have been completed, the equipment will be available for use by the scientific community from May 2013.

This last year saw completion of the installation and calibration of the JEOL JEM-ARM200F aberration-corrected microscope. The microscope is fitted with an aberration corrector on the cold FEG condenser lens which can operate with accelerating voltages of 200, 120 and 80 kV, and provides analytical information with a spatial resolution of 0.078 nm. A second microscope with a spatial resolution of 0.05 nm and an aberration-corrected lens will be installed during 2014.

During the second semester of 2012, the team members attended training courses on the different techniques in order to respond to the instrumental problems and technical requirements necessary to ensure the best possible working conditions. To resolve the problems of stability detected, a noise canceller and a magnetic field compensator were installed to ensure the optimal quality of the images and the EELS maps with atomic resolution. The spectrometer was also configured for the shorter camera lengths needed to obtain atomic resolution at 200 kV, 120 and 80 kV.



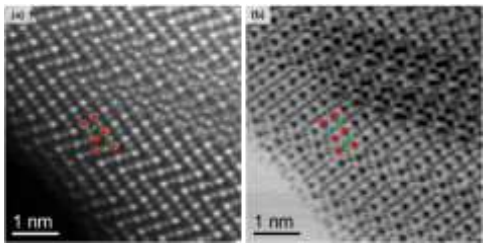
This figure shows a HAADF (high angle annular dark field) of a mixed oxide of Mn with a complex composition used to calibrate the microscope in the conditions described: 200 k, EELS spectrum obtained on an area of 46 nm^2 (marked in green on the HAADF image) and chemical maps extracted from the signals La-$M_{4,5}$ (green) Mn-$L_{2,3}$ (red) and O (blue) of the sum of the spectra.

Diagram of the ARM200 microscope with examples of the different possibilities for imaging and analysis at atomic resolution

The main advances and the new challenges deriving from the use of the new equipment, in terms of the original aims of the project, are as follows:

Image and spectroscopy of light and metal-oxygen elements

The combined use of HAADF and ABF techniques makes it possible to resolve atomic columns of heavy and light elements in different transition metal oxide with a complex composition and small particle size. The figure shows the HAADF and ABF images of a mixed oxygen-deficient manganese oxide.



Detection of isolated atoms using EELS spectroscopy

The possibility of using an extremely fine beam allows atomic resolution elemental mapping by EELS and the analysis of the oxidation states of different cations using a Quantum GIF spectrometer. The figure shows the HAADF image of a nanoparticle alongside the chemical maps of the different elements. The different states of oxidation of the transition metal oxide are also indicated.

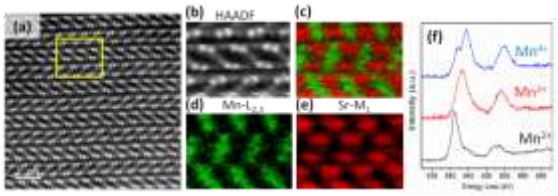
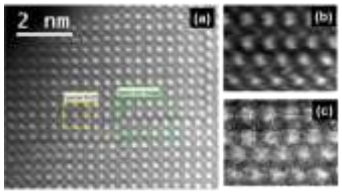


Image and spectroscopy of isolated defects

Identifying defects at the local level is important for understanding the behaviour of materials. The image shows a plan of defects isolated in a mixed oxide matrix.



Most significant results:
Different examples of atomic resolution in functional materials are given below by way of illustration:

Atomic resolution images have been obtained of different carbon materials: graphene, graphene oxide and reduced graphene oxide. Reduced graphene oxide is prepared by reducing graphene oxide using chemical methods, and offers a less costly alternative for producing graphene in large quantities. It is therefore crucial to determine whether the

material prepared in this way maintains the same properties as graphene obtained through the exfoliation of graphite.

One of the major milestones within the sphere of communications materials was fibre optic. The addition of dopants such as lanthanide elements affects the properties of the fibre. Once again, their location is fundamental to understanding its behaviour. Images have been obtained in the microscope with the aberration corrector on the condenser lens where erbium atoms have been located in the amorphous matrix of the fibre.

Images obtained in mixed-valence perovskite manganites with colossal magnetorresistence enable the location of the different states of oxidation of the Mn and the surrounding atoms according to the void attractor and phase separation model.

Various conferences have been scheduled to highlight the analytical capacities of the new technique, delivered by international experts:
"Applications of Aberration-Corrected Transmission Electron Microscopy with Focus on BiGFeO3 Thin Films" Dr. Marta Rosell (EMPA, Switzerland).
"Fine structures of nanomaterials studied by SEM and TEM" Prof. Osamu Terasaki (University of Stockholm, Sweden).
Training courses have been given on the use of electron microscopes, and particularly for the one recently acquired through these funds. In 2012 and 2013 Dr. J. García (ICTS, UCM) gave a course entitled "Characterisation of materials by electron diffraction and high-resolution electron microscopy", attended by over a dozen students in each year from the universities of Barcelona, Cadiz, Basque Country, Complutense and the Materials Science Institute in Madrid.
In addition, the 2013 summer programme run by the Head of Science and Technology at ICTS included the course entitled "Atomic resolution: a revolution in electron microscopy" delivered by ten international experts in the use of high-resolution techniques.

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	F2. Platform for the design and construction of electromagnetic sensors and actuators.
Objectives	The aim is to develop sensors with applications for medicine, radar and railway technology and to favour the incorporation of research in companies in the sector.

Description of the work to date.

Acquisition of an X-ray diffraction machine. The X-ray diffractometer that has been acquired is a basic tool for the structural characterisation of any type of material and is an essential piece of equipment for the ISOM and its Technology Centre (Spanish Singular Scientific-Technical Facility), given that one of its main activities is growing new semiconductor compounds with high crystalline quality in the form of epitaxial multilayers and nanostructures by MBE (molecular beam epitaxy) for optoelectronic devices and magnetic sheets for sensors.

Acquisition of an incident beam model with X-ray lens. The aim is to develop new thin-film and nanostructure materials for sensors and semiconductor devices for nanoelectronics. The characterisation is based on the combined use of high-resolution microscopy techniques from the STEM-EELS ICTS on this Campus, and X-ray diffraction and absorption spectroscopies and polarised neutrons, in addition to magnetic and transport measures. The aim is to exploit the phenomena that appear in the interfaces between complex oxides to manufacture devices with new functionalities. The facilities of the ICTS ISOM on this campus will be used in nanomanufacturing processes.

These actions have been led by the UPM. The equipment acquired will be used by researchers at the UPM and the UCM.

Image of the new diffractometer

Acquisition of a field emission scanning electron microscope. The FESEM is a basic tool for the characterisation of any type of material and is an essential piece of equipment for the ISOM and its Technology Centre (Spanish Singular Scientific-Technical Facility) given that one of its main activities is growing new semiconductor compounds with high crystalline quality in the form of epitaxial multilayers and nanostructures by MBE (molecular beam epitaxy) for optoelectronic devices and magnetic sheets for sensors. The FESEM enables their morphology

to be studied and calculates their dimensions with a great degree of accuracy due to the fact that its high resolution (2 nm) allows measurements to be made at the nanometric scale (10-9m).

Acquisition of a cathodoluminescence module. The aim is to develop new thin-film and nanostructure materials for sensors and semiconductor devices. The characterisation is based on the one hand on analysing the structure and morphology with high resolution X-ray equipment (HRXRD) and FESEM, and on the other, on its optical properties. This last method uses photoluminescence (PL) and cathodoluminescence (CL). By combining CL with SEM it is possible to see locally –at the nanometric scale– the luminescence of areas of interest. This complements the available PL technique, which currently only enables luminescence to be observed in the entire sample.

The SEM (left) and CL module (right)

Most significant results

Acquisition of the FESEM-CL has enriched the ISOM's infrastructure, extending and improving the range of services offered by the ICTS (Singular Scientific and Technological Infrastructure), and allowing researchers to study a wide range of device-ready nanostructures, including InAs/GaAs and InGaN quantum dots (QDs) and group III-nitride nanocolumns. One of the current research lines involves the growth of ordered arrays of InGaN nanocolumns to produce efficient, phosphor-free white light (nanoLEDS). The same structure is used in the latest multi-junction solar cells.

In addition, the presence of another Electronic Microscopy ICTS in the Campus of International Excellence (UCM) has enabled us to broaden the range of complementary technology services for the analysis of structural, chemical and optical properties. In this way, the new FESEM-CL system has allowed both the ICTS and the Campus of International Excellence to work together.

The ISOM undertakes many different research projects in which the FESEM-CL is a major component, among them:

- ''Substrate nanopatterning by e-beam lithography to growth ordered arrays of III-Nitride nanodetectors: application to IR detectors, emitters, and new Solar Cells''.

Organisation: EU. Code: SNB09, PIEF-GA-2009-253085 (2011-2013). PI: Enrique Calleja Pardo.

- ''Células solares de heterounión de InGaN y alta eficiencia crecidas por MBE''. Organisation: International Action coordinated with Japán, Ministry of Science and Innovation. Code: PLE2009-0023 (2009-2012). PI: Enrique Calleja Pardo.
- ''Smart Nanostructured Semiconductors for Energy-Saving Light Solutions (SMASH)''. Organisation: EU. Code: Nº 228999, FP7-NMP-2008-LARGE-2 (2009-2012). PI: Enrique Calleja Pardo.
- ''High quality Material and intrinsic Properties of InN and indium rich Nitride Alloys (The Rainbow ITN)''. Organisation: EU. Code: 213238- PITN-GA-2008-213238 (2008-2012). PI: Miguel Ángel Sánchez.
- ''III-Nitrides alloys and plasmonic effects for high efficiency Solar Cells fabricated by MBE on Silicon and GaN substrates''. Organisation: Ministry of Science and Innovation. Code: MAT2011-26703. 2012-2014. PI: Miguel Ángel Sánchez-García.
- ''Nanodispositivos eficientes de luz clásica y cuántica (Q&CLight) ‘’. Organisation: Madrid Autonomous Community. Code: CAM P2009/ESP-1503 (2010-2013). PI: Enrique Calleja Pardo.
- ''High frequency Resonators on AlN/Diamond structures, ReADi''. Organisation: Ministry of Science and Innovation. Code: TEC2010-19511 (2010-2013). PI: Fernando Calle Gómez.
- “III-V nanowires for third generation solar cells”, ERA.Net RUS. Organisation: UE, Pilot Joint Call for Collaborative S&T Projects. Application: May 31, 2011. PI: Enrique Calleja Pardo.
- “3D GaN for High Efficiency Solid State Lighting (GECCO)”. Organisation: EU. Code: Nº 280694-2. FP7-NMP-2011-SMALL-5, NMP-2011-2.2-3 Materials for Solid State Lighting. 2012-2014. PI: Enrique Calleja Pardo.

Strategic Focus	**SCIENTIFIC IMPROVEMENT**
Project	F3. Creation of the Workshop Network for the development of new thin film materials.
Objectives	Aimed at the development of new thin film materials for the development of sensors and devices for nanoelectronics.

Progress towards goals

- Refurbishment of the laboratories situated in the west wing of the UCM's Faculty of Physical Sciences.
- Modernisation of the UCM's Physical Techniques CAI (Research Support Centre).

Note: instruments for the Institute Of Optoelectronics Systems and Microtechnology (ISOM) described in the previous project also affect this project.

Summary of work completed.

Modernisation of the UCM's Physical Techniques CAI: additional infrastructure for the laboratories, electric air compressor, needle valve rotameter, power outlets, water pressure relief valve, block and tackle and frame for condenser, power line protectors.

Refurbishment of the laboratories situated in the west wing of the UCM's Faculty of Physical Sciences. Certification of the Physics west wing (OHL): Certification no. 12, corresponding to the month of May 2009. Project management of the Physics west wing (Instituto Técnico de Materiales y construcciones): Project management, execution and health and safety coordination of the conservation, consolidation, modernisation and restoration of the west wing of the UCM's Faculty of Physical Sciences.

The project is organised by the UCM.

Strategic Focus	SCIENTIFIC IMPROVEMENT
Project	F4. Mechanical Properties Workshop: Durability and Sustainability of Materials.
Objectives	The aim of the project is to modernise and extend the facilities in the University College of Civil Engineering by incorporating a mechanical testing centre equipped with the best and most versatile instruments for experimental analysis of structures and the assessment and characterisation of construction systems and materials. The project enables researchers to advance in the understanding of the mechanical behaviour of advanced materials, nanomaterials and coatings by means of the in situ analysis of their micro- and nanometric behaviour. This will allow researchers to understanding and associate the macroscopic mechanical behaviour of materials with their microstructure and composition at different scales.

Summary of work completed

A nano- and micro-mechanical testing machine has been installed for characterising the mechanical behaviour of advanced materials, nanomaterials and coatings using a high-resolution field emission scanning microscope.

This project affects the research, technological development and advanced teaching in the field of the mechanical properties of materials, mainly at a macroscopic and mesoscopic scale, with particular emphasis on surface behaviour. It will focus on the characterisation, modelling and, if possible, advanced design of composites, alloys and compounds of particular interest today, such as ceramics and polymers. Although the main focus will be on structural materials, and specifically on studying the evolution of construction materials (cement-based, metals, ceramics, fibres and resins), research will also be conducted on certain functional materials.

Advances will be made in the scientific and technical understanding of the life cycle of construction materials that can contribute to sustainable development by producing environmentally friendly products and require less energy consumption during the production, manufacturing and use stages. Use of construction materials made from recycled materials and urban waste products. Study of the complete life cycle of materials (from the raw material stage, through manufacturing, use, repair, elimination and recycling), focussing on production and absorption of CO2 and energy consumption.

The Comprehensive and Self-Contained System for Conducting Mechanical Tests under Dynamic Conditions is a state of the art mechanical testing machine capable of applying dynamic tensile and compressive loads of up to 1,200 kN. It is housed in a specially outfitted installation in the School of Civil Engineering. This School is an international leader in its field and is supported by the experience of the Department of Materials Science, which specializes in fracture behaviour characterization for all kinds of materials. This system consists of

several complementary pieces of equipment that must be set up to work together as a whole according to the technical specifications. The main features of the system are:

- State of the art hydraulic testing machine for performing static and dynamic mechanical testing with a maximum capacity of 1200 kN.
- Hydraulic power units to supply enough oil flow to operate the machine described in item 1. The oil flow must be greater than 250 litres per minute at a nominal pressure of 210 bars.
- Cooling system for the hydraulic pump (item 2), capable of operating from -5 to +43 ° C.
- Hydraulic clamps, capable of up to 1,000 kN for tensile testing of different materials. Due to the inertia of the systems under dynamic conditions, the clamps should weigh as little as possible, but less than 500 kg each.

The main applications of this team will focus on the mechanical characterization of structural materials, but it can also be used to study functional and biological materials, and in structural characterization. This system will be available to the different research groups that make up the Moncloa Campus and many others related to this field. This will be a strategic commitment to the future quality and excellence of the Campus by providing it with capabilities that few centres devoted to the structural characterization of materials currently have.

Strategic Focus	**SCIENTIFIC IMPROVEMENT**
Project	**AGRI-FOOD AND HEALTH Cluster** G1. Activities of the Moncloa Agri-food Corridor. G2. Development of the Consortium for Integrated Agricultural Systems. G3. International School for Communicable Animal Diseases (EIEAC). G4. Improvements to the VISAVET Sanitary Vigilance laboratory.
Objectives	The Agri-Food and Health Cluster (A&S) proposal encompasses the activities undertaken by the Complutense University of Madrid (UCM), the Technical University of Madrid (UPM) and partner organisations (including the National Institute for Agricultural Research and Experimentation - INIA) involving the development and implementation of new technologies for generating agricultural and livestock products, processing these products for the purpose of producing safe, health, good quality food for both human and animal consumption using sustainable techniques and systems and respecting animal welfare standards. The MISSION of the Cluster is to transmit knowledge, developments and sustainable solutions for safe, quality food production. The strategic objectives of the A&S Cluster are: • To design a new, comprehensive, effective management model. • To build and improve shared and multiuse infrastructures. • To lead the field in: - Specialised training - Research - Anticipation, detection and assessment of risks - Providing prompt solutions to specific problems • Internationalisation. • To promote business opportunities. The Cluster is divided into four strategic areas: • Animal breeding and health: nutrition, health and welfare applied to livestock and aquaculture. • Plant propagation: sustainable cultivation and management, including at-risk agricultural resources. • Agricultural technologies: advanced technologies for quality, safety and traceability. • Food hygiene and safety: cultivation of safe, healthy foodstuffs.
Progress towards goals Start-up of projects: G1 Activities of the Moncloa Agri-food Corridor G2. Development of the Consortium for Integrated Agricultural Systems. G3 International School for Communicable Animal Diseases (EIEAC) G4 Improvements to the VISAVET Sanitary Vigilance laboratory.	

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	G1 Activities of the Moncloa Agri-food Corridor
Objectives	Creation, environmental restoration and spatial planning of the Moncloa Agri-Food Corridor.

Progress made towards objectives

The creation of the CEI Moncloa Platform for Mass Spectrometry MALDITOF/TOF, including staff recruitment for the use of this platform.

UPM and UCM organization and participation in the Summer Courses of El Escorial 2014, with the preparation and coordination of the course entitled " TECHNOLOGIES APPLIED TO FOOD QUALITY AND SAFETY"

Coordination of the Official Master Degree on Animal Production and Health from the Polytechnic University of Madrid (UPM) and the Complutense University of Madrid (UCM).

Rabbit breeding facilities: new investments in facilities for common use in research

Creation of the Interdepartmental Laboratory for the evaluation of techniques and processes to improve the safety, health and quality of foods of animal origin.

Laboratory of Instrumental Analytical Techniques

Description of work completed.

The idea of creating a model of joint management for the facilities of the technical college of Agricultural Engineering (UPM) and the Faculty of Veterinary Science (UCM) is one of the strategic objectives of the Health and Agri-food Cluster of the Campus of International Excellence CEI-Moncloa.

One of the most important actions of this agri-food corridor has been the installation of the mass spectrometry platform **MALDI TOF/TOF**, which includes MALDI-BIOTYPER, MALDI Imaging and LC-MALDI systems at the VISAVET Centre (www.vigilanciasanitaria.es). In order to optimize team performance, the VISAVET centre set up the VISAVET-BRUKER-Mass Spectrometry Service (VISAVET-BRUKER) in December 2013 which has a multidisciplinary team of professionals (five veterinarians, one biologist, one chemical engineer and two laboratory technicians) in the systems that form the MALDI TOF/TOF platform.

Following the protocol established for the concession the MALDI TOF/TOF Platform, on 22 May 2014 a meeting for researchers supporting the petition for this platform was called, as well as for Department or Centre Directors with research groups belonging to CEI Campus Moncloa

with a potential interest in platform applications. The purpose of the meeting was to report on the conditions of use of equipment, rates and service request protocol. Additionally, the 'User Guide Microbial Identification by MALDI Biotyper' was sent to all researchers convened in order to receive feedback and suggestions for improvement in the service offered.

Bearing in mind that this cutting-edge technology requires a constant update on the applications offered by the MALDI TOF/TOF platform, a series of courses and training placements have been conducted in order to improve the service provided. Finally, in order to promote the transfer of knowledge and research based on mass spectrometry in the field of microbiology, the first VISAVET-Bruker prize was awarded for the best communication of mass spectrometry at the Tenth Group Meeting specialized in Molecular Microbiology held in Segovia (9-11 June 2014); this prize was awarded by the Spanish Society for Microbiology (SEM).

Another task performed this year was the organization of the course entitled "TECHNOLOGIES APPLIED TO FOOD QUALITY AND SAFETY" included in the Summer Courses of El Escorial 2014, organized by the Complutense University of Madrid. These courses are indeed each year an ideal scenario for discussion and an excellent opportunity for intellectual exploration and cultural enrichment through the University's academic and scientific resources. The directors of this course were Margarita Ruiz Altisent PhD. (UPM) and Lucas Domínguez Rodríguez PhD (UCM) (http://www.vigilanciasanitaria.es/es/tecnologias-aplicadas-a-la-calidad-y-seguridad-alimentarias/31=115/). The course was organized by experts from the Polytechnic and Complutense Universities of Madrid, and with the collaboration of various public and private partner entities, as well as international experts. The joint work of scientists from both institutions enhanced the approach of the subjects approached from interdisciplinary fields of knowledge.

During the 2013-2014 academic year, the first edition of the **Official Master Degree on Animal Production and Health** of the Polytechnic University of Madrid (UPM) and the Complutense University of Madrid (UCM) took place with a total of 19 students. Its main objective is that students may acquire advanced multidisciplinary training in the field of Animal Production and Health. Training will be focused on the development of scientific research in these areas and also on practice. Postgraduates may complete their research training with the completion of a dissertation or, become employed as qualified professionals. The aim is that they learn to contribute significant knowledge to society, contributing to its transformation and competitiveness, and to work both independently and as a team, always based on the values of ethical responsibility.

Most significant results

On the other hand, the gradual adjustment of the facilities and services offered by the facility should result in obtaining increased funding for European calls for the development of research projects.

The VISAVET-Bruker Service aims to increase the ability to perform competitive research in all CEI members, and other research centres, thereby fulfilling one of the main objectives promoting the acquisition of this platform. The VISAVET-Bruker Service was consolidated in

July this year with the signing of a Framework Agreement for cooperation between the University Complutense and Bruker Daltonik GMBH (Bremen, Germany) in a ceremony held at the Complutense Summer Courses 2014 (El Escorial, Madrid). This agreement allows us to maximize the future viability of this equipment, to implement training plans in mass spectrometry and to achieve international projection for future action in the field of international education and for the purpose of attracting talent. Both institutions are currently working on the preparation of an agreement setting out the specific terms of the proposed collaboration. Unfortunately, the company Bruker Daltonik GMBH is currently undergoing a restructuring process that has slowed down the process in this regard. The VISAVET-Bruker service combines three tasks:

- Providing service to the various research groups requesting use of the MALDI TOF/TOF platform, through the VISAVET-Bruker Service website (http://vigilanciasanitaria.es/es/visavet/unidades/servicio-visavet-bruker-de-espectrometria-de-masas/). During the first months, collaborations have established with various institutions in the Agri-Food and Health Cluster (CEI Campus Moncloa) and other centres, such as the University of Extremadura, Gran Canaria, INIA or MAGRAMA.

- Providing a learning space for students and researchers interested in exploring the applications the MALDI TOF / TOF platform.

- Developing new lines of research focused on the application of the MALDI TOF / TOF technique in the area of Agribusiness and Health. The MALDI TOF/TOF platform has expanded the expertise of researchers belonging to the Agribusiness and Health Cluster (CEI Moncloa Campus) which is reflected in the number of projects requested and granted, such as that of the Ministry of Economy and Competitiveness ("MALDI TOF CAMPLYOBACTER: genotyping and molecular characterization AGL2012-39028 C03-01 Sub-program of Non-Oriented Fundamental Research Projects 2012".

The most significant results of organizing the Summer courses of El Escorial include the information to the general public, businesses and governments on how the application of new technologies in the area of agri-food is allowing an improvement in the quality and the safety of the food we eat. The participation of private companies in these acts showed their concern for improving the quality of the products that the consumer demands and their interest in learning about new technologies (including MALDI) in the field of agri-food and health. Students' responses to surveys have shown how concerned they are, while the quality and proximity of the course speakers are other reasons suggesting that the course will again take place in next year's summer courses.

The creation of the official university Master Degree in Animal Production and Health is one of the examples of integral cooperation between UPM and UCM, and this master has proved to be well-received in the university community with a 50% increase in enrolments.

Finally, internationalization is expected to increase with the dissemination of the potential of the facilities and the feasibility of the projects.

The new rabbit breeding facilities have been rebuilt in order to adapt to the regulations concerning the care and handling of experimental animals in the Agri-food Corridor.

The new common laboratories for evaluation of techniques and processes to improve safety,

health and quality of food of animal origin, and the Laboratory of Instrumental Analytical Techniques are a milestone in the capabilities of the cluster in the Agri-Food Corridor Departments. They have opened up new possibilities for new projects and results and are at the service of cluster components. These facilities have led to substantial environmental improvements in that area.

With regard to postgraduate courses, three research Masters have been secured, organized by groups belonging to the cluster and three new doctorates have been approved under the new regulations.

Collaborations between the cluster groups are reflected in numerous publications.

Strategic Focus	**SCIENTIFIC IMPROVEMENT**
Project	G2. Development of the Consortium for Integrated Agricultural Systems.
Objectives	Development of the consortium of agriculture systems to increase farming system productivity by improving the use of natural resources, balancing economic and environmental sustainability and reducing the pressure on ecosystems.

Progress towards goals

The scientific scope of the project falls within this activity. Both established research lines and the role of the Agri-Food Corridor as the focus of the cluster have been consolidated.

Summary of work completed.

- The UCM/UPM partnership continues to generate published papers, presentations in international congresses and research projects, the most important of which is the "Multiscale Climate variability. Agricultural and Economic Impacts (since 1 January 2013). Subproject I: ODYN: Ocean Influence, Predictability, Dynamics and Impacts. Subproject II: ACER-Agro: Integrated Assessment of Climatic Hazards and Economic Risks: Adapting Agricultural Systems in Spain" project included in the National R&D&I Plan.

  The stakeholders in this project are the Spanish National Agrarian Insurance Organisation (ENESA) and Agroseguro S.L. Collaboration extends to doctoral theses undertaken jointly by researchers from both universities. The project also bridges the activities of the Global Change and New Energies clusters (research into climatic variability and change).

- CEIGRAM (Research Centre for the Management of Agricultural and Environmental Risks) has developed a joint project with the Sustainable Agriculture Technology Platform in which researchers from Ag Systems, Economy and Animal Production have participated. The project has generated a number of published papers, including "Indicadores de la Sostenibilidad de la agricultura y ganadería Españolas" (1980-2009), published by the Cajamar Foundation Sustainable Agriculture Platform. The project has been presented in several forums, including: Gestión de Riesgos Agrarios y Ambientales, MAGRAMA, 25 June 2013.

- Collaboration with other cluster groups (Agrisost-Newgam) is ongoing, and seminars on common research topic have been organised.

- The European project: "Effects of climate change on air pollution impacts and response strategies for European ecosystems. (ECLAIRE)" has been accepted and funded by FP7-ENV-2011. Timeframe: 2011 - 2015. This project also strengthens ties with the Global Change Cluster. The COAPA and GECA groups participate in the project.

- The project funded by the National Plan: Uso potencial de la fertilización nitrogenada para mitigar los efectos del ozono en cultivos agrícolas. Sponsored by: Ministry of

Economy and Competitiveness (MINECO). Timeframe: 2013-2015, in which the GECA group (CIEMAT - Centre for Energy, Environment and Technology Research) has participated.

- The TAPAS (Agri-environmental Technology for Sustainable Agriculture) master's program is still under way and has obtained the TAPAS doctorate program Mención hacia la Excelencia (Quality label towards excellence).

Most significant results

The Agri-Food Corridor has been consolidated as the cluster's centre for interaction.

Core projects allow activities to be added, such is the case with CEIGRAM (Research Centre for the Management of Agricultural and Environmental Risks). This R&D+i centre based in the UPM welcomes researchers from the Veterinary Science Faculty as associate members, many of whom belong to VISAVET and actively participate in seminar or activities jointly funded by CEIGRAM or ENESA.

Various research articles from the AGRISOST program have been published, some involving inter-group collaboration.

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Project	**G3. International School for Communicable Animal Diseases (EIEAC)**
Objectives	The results expected from the creation of the International School are: a. The creation of a top quality, standardised, EU-equivalent training program based on the organisation and operation of reference laboratories. b. The creation of the infrastructure required to broaden the scope of the School and create an international school focussing on key topics in the agri-food sector, taught by experts in each relevant field. c. Inter-institutional cooperation to guarantee that the knowledge taught is contributed by the best experts in the field.

Progress towards goals

The activities of the EIEAC, so far, include:

Training course in the theory, practice and legal aspects of diagnosing bovine tuberculosis

The course aims to train veterinary professionals involved in conducting bovine tuberculosis field tests, in compliance with the provisions of the National Program for the Eradication of Bovine Tuberculosis, approved for joint EU funding by Decision 2011/807/EU.

The course is organised by the VISAVET-UCM Health Surveillance Centre, the Ministry of Agriculture, Food and the Environment (MAGRAMA) and the different autonomous communities, and is taught over 3 or 4 days (32 teaching hours), from Monday to Wednesday, including theory and practice. The course is held at different locations, depending on the geographic origin of the students enrolled.

Teachers include experts from the EU-RL for Bovine Tuberculosis, the VISAVET-UCM Centre, different veterinary sciences faculties, the Research Institute for Hunting Resources (IREC), the Research Centre for Animal Health (CRESA), the MAGRAMA and the autonomous communities.

From 2012 to date twenty one courses have been held across Spain, for a total of 700 veterinarians, and at the beginning of 2015 10 additional courses are planned.

Online course on Infectious Diseases in Swine

Online course organised by the Viral Immunology and Preventive Medicine Service (SUAT) of the VISAVET-UCM Centre.

BIOSLab Training Platform for Biosafety in Laboratories and Animal facilities

BIOSLab was created as part of a project of Innovation and Improvement of the Educational Quality at the Complutense University of Madrid. The aim of the project is the creation of an online platform for continuing education for biosafety in laboratories and animal facilities for students of health sciences. The ultimate goal was to gain knowledge in key issues such as regulations for handling biological agents, necessary equipment and facilities, or protocols.

(http://www.vigilanciasanitaria.es/es/bioslab/proyecto-bioslab.php).

African Swine Fever technology transfer courses

The functions and duties of the ASR reference laboratory laid out in European Council Directive 2002/60/EC, 20 June 2002, specify that: "[the reference laboratory must] make the necessary arrangements for training or re-training experts in laboratory diagnosis with a view to harmonising diagnostic techniques".

Accordingly, the CISA-INIA, in its capacity as the European reference laboratory for ASF (EURL-SWF), provides national reference laboratories and animal health laboratories with scientific and technical assistance in the form of continuing professional development courses. The aim of

these course is to achieve the technology transfer of SWF diagnostic techniques established by the OIE and the EU in order to harmonise SWF diagnostic methods world-wide.
The training courses include practical exercises combined with lectures aimed at giving a general overview of the disease, including its history, epidemiology, control, and general SWF diagnostic techniques, with particular emphasis on laboratory techniques. At the end of the course, students receive the course material in digital format, including copies of the lectures, results of the laboratory activities, standard operational procedures (SOP) and all the SWF reference bibliography.

Bovine Tuberculosis Technology Transfer Course

One of the functions of the European Reference Laboratory for Bovine Tuberculosis (EU-RL) is assisting the National Reference Laboratories in order to provide technical support and standardize techniques across Europe. During the past year we have received personnel from Portugal and Greece. In addition, the EU-RL has organized a total of 9 comparative studies between the different Member States in order to align, streamline and standardize the available laboratory diagnostic techniques.

Training placement for researchers

The EiEAC's activities are particularly relevant nowadays for many Mediterranean, Latin American and developing countries.

For this reason, most of the researchers attending specialist training courses at the EIEAC come from these countries. Over the last year 5 researchers from Tunisia, Kuwait and Latin America have participated in extended training programs in VISAVET, and there were 10 shorter visits by people from other countries.

Description of the projects completed and the role of each partner

The International School for Communicable Animal Diseases (EIEAC) is one of the activities included in the initial CEI Campus Moncloa project, within the Agri-Food and Health Cluster. The aim of the School was to provide top quality, specialised, standardised, EU-equivalent training in infectious communicable diseases.

The EIEAC provides technical and scientific training on an international level, focussed on eradicating infectious, communicable (mainly zoonotic) diseases in animals, including the relevant health, legal and logistic aspects.

The EiEAC's activities continue to be relevant for many Mediterranean, Latin American and developing countries. Nevertheless, there has hitherto been insufficient training in these diseases for various reasons: in most developed countries they are considered exotic diseases; the risk of animal to human transmission; the difficulties involved in housing infected animals; and the need for special facilities and specialised diagnostic techniques. Furthermore, the creation of an international school will sow the seed for the development of an International Agri-Food School, supported by leading experts in the field.

Most important results

The EIEAC is linked to the EU and OIE reference laboratories, which in itself guarantees internationalisation:

- EU-RL for bovine tuberculosis
- EU-RL for African swine fever
- OIE reference laboratory for African swine fever

OIE reference laboratory for African horse sickness

The demand for specialized training at the level of laboratory and field techniques for the control and eradication of diseases has become apparent. The EU will probably establish a set of minimum skills required by official EU veterinaries that will be expected to have knowledge of all communicable diseases under control and eradication programs. For example, in its reports the Bovine Tuberculosis Task Force suggested that training courses be created for veterinarians who would participate in campaigns to eradicate Bovine Tuberculosis in Spain. The EU-RL has been involved in the training of these veterinarians and has laid the groundwork for the internationalization of this course not only for Europe but also developing countries, for whom the training could prove crucial. From the point of view of the Campus of International Excellence the project makes use of an existing building to stage a more broad-ranging training activity, thus increasing the likelihood of a successful outcome.

Strategic Area	SCIENTIFIC IMPROVEMENT
Action	**Actions planned within the I-HEALTH Cluster.** I. Design and synthesis of diagnostic and therapeutic tools II. Pre-clinical platform for biomedical imaging. Advanced Biomedical Imaging Analysis III. Platform for clinical information: System for filing and communicating clinical images and databases IV. "Living-Lab" Platform
Objectives	The cluster aims to take advantage of the singularity of having on Campus Biomedical Sciences, the hospitals linked to the Faculty of Medicine, and experts in health-oriented applications of information and communication technologies. This connection allows covering from the most basic aspects of biomedical research to practical implementation and validation using clinical trials and tests.
Progress towards objectives Evolution of each action is explained in the separate forms below.	

Strategic Area	SCIENTIFIC IMPROVEMENT
Action	I. Design and synthesis of diagnostic and therapeutic tools

Objectives

To provide a service for the design and synthesis of diagnostic and therapeutic tools, bringing together the proven experience of several research groups in this area.

Summary of work completed

For this action, several sections have been set up to gather teams which are currently scattered and independent in Campus, with centralised management for their operation and organisation in order to provide a wide portfolio of services.

Medical Chemistry Section: Services of computational chemistry (identifying targets and selecting compounds), synthesis (HPLC, mass spectrometers,... to prepare, purify and characterise molecules) and high performance screening (structural studies, computational methodologies and in vitro screening of compound libraries to identify bioactive molecules).

Advanced pharmaceutical technology development section: Design and preparation of customised pharmaceutical technologies for development of advanced diagnostic and therapeutic systems for drug delivery (nanoconjugates and nanoparticles for medical imaging techniques; conjugation and inclusion of molecules in nanoparticles/liposomes; biofunctionalization for vectorization, etc...).

Gene transfer, transgenesis and pluripotent cell technology section: Technology resource to develop therapeutic tools based on viral vectors for gene transfer, development of cell lines and

knock-out/in transgenic animals and management and handling of pluripotent cells.

Coordinator: Aurelio G. Csaky.

One of the priority actions carried out is the creation of a laboratory to develop new radioactive tracers with contrast properties in molecular imaging by positron emission tomography (PET). In the case of PET tracers, the laboratory conducts cold synthesis and pharmacological studies of new molecules. The phase to incorporate the radioactive isotope is conducted at the facilities of the **PET Technology Institute**, where synthesis yield and tracer purity is determined. Next, in vivo biodistribution is analysed with micro-PET imaging of small animals.

The group has been established at the **UCM Multidisciplinary Institute** (they moved in 2012) and it maintains regular interaction with the **PET Technology Institute** and the **UCM-PET Centre for Research Assistance**, both located here, with the necessary radioactive facilities to execute this project.

Most significant results:

In the line of research being conducted, we have implemented synthesis of a set of molecules that have shown important properties for enzyme inhibition (BACE), aggregation-deaggregation of amyloid peptide and inhibition of free radicals, characteristics of interest for the development of new therapies that could help treat neurodegenerative diseases in general, and Alzheimer's Disease, in particular.

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	II. Pre-clinical platform for biomedical imaging. Advanced Biomedical Imaging Analysis (LA2IB)

Objectives

This line shall be provided with **laboratories with surgical areas** to conduct monitored animal surgery and recovery. It shall offer established models of prevalent diseases (cancer, cardiovascular disease and stroke, neurodegenerative diseases, inflammatory diseases, infectious diseases) and develop new models in close collaboration with the Genomics and Proteomics CAI. These services shall be available to users to find pathogenic mechanisms, identify and validate molecular and imaging markers, identify and validate therapeutic targets, new therapies and biopharmaceutical systems.

Its platform shall be located in an environment next to the **Biomedical Imaging Laboratories** for follow-up and monitoring of models, and to validate new nanomagnetic markers and radioactive tracers. Also, the **LA2IB** shall make its knowledge available to users. This Laboratory shall help users prepare experiments, use radiopharmaceuticals efficiently and interpret images quantitatively, by developing or optimising software and hardware tools for each specific user need in order to get the most out of the increasingly complex molecular imaging equipment on Campus.

Progress towards objectives

Thanks to CEI financing, some of the refurbishment detailed in the Animal Facilities CAI have already been carried out.

With regard to the **Biomedical Imaging Laboratory** (LA2IB), we will acquire with CEI funds (equipment has already been tendered and we are waiting to receive it in the various centres) a series of equipment that will enhance not only quantitatively but also qualitatively, provision by the Research Assistance Centres (CAI) of: animal facilities, MRI, brain mapping, cognitive and computational neuroscience and cytometry and fluorescence microscopy laboratory.

Description of work completed:

Coordinators: I Lizasoain, A Santos

UCM Animal Facilities CAI

The Animal Facilities CAI is registered under nº EX08-UCS in the Community of Madrid. Thanks to CEI funding, this Centre meets all legal requirements contemplated in Law 32/2007, of 7th November, for the Care of Animals, their Use, Transport, Experimentation and Sacrifice (BOE 268, 8th November 2007) and the new Royal Decree 53/2013, of 1st February establishing basic applicable regulations for the protection of animals used for experimentation and other scientific purposes, including teaching (BOE nº 34, 8th February 2013).

1.- ***Refurbishment of the Medicine Unit.***

This work has consisted of fitting out an area ceded by the Faculty located next to the current Animal Facilities CAI. The space has been prepared to create an area with operating theatres and an area (isolated and soundproofed) destined mainly to study behaviour in experimental animals, specifically rodents (rats and mice).

2.- ***Refurbishment of Biology Unit***

Improve the quality of the facilities and meet all legal requirements regarding the use of experimentation animals.

UCM - NMR CAI

The infrastructure acquired has improved and complement the services available in this CAI. The Magnetic Resonance CAI had only one mid-field Magnetic Resonance Imaging unit (4.7 Tesla) to cover the various needs of the lines of work conducted in this cluster. Usage of this equipment is close to saturation. Under these conditions, the Magnetic Resonance CAI could no longer meet the demand for developing the lines of the Campus of International Excellence submitted by the various groups, therefore this new unit was crucial.

The Resonance Imaging equipment is simple, of low field (1 Tesla) and permanent magnet, with reduced operating and maintenance costs, high productivity and providing reproducible and quality results for studies with small animals. It will be fully functional in the last quarter of 2013. Nationwide, there is no other similar equipment in other entities. This equipment also fits in perfectly with the i-Health Cluster (i-Medicine and i-Maging). Also, work areas belonging to other Clusters, such as Materials for the Future, Agri-Food and Health and Global Change and New Energies, shall also benefit. There is a significant and growing need for Magnetic Resonance Imaging equipment that can resolve the various questions being addressed by these areas.

UCM Brain Mapping CAI

The infrastructure acquired (to be installed in the 4th quarter of 2013) by our Research Assistance Centre (CAI), shall improve and complement the services of the micro-PET equipment already installed in 2006 (PR70/05-14317 and MEC UCMA05-33-049) with an X-ray micro-CT and a new ring of PET detectors. The demand for studies with the current micro-PET service from the various research groups and biotechnology companies has increased, partly due to the existing framework agreement between UCM and the PET Technology Institute www.petmadrid.com, a pioneering company in Spain in the production of PET radiotracers and attached to the CEI.

This equipment is included in the i-Maging line of work of the CEI innovative medicine cluster and is directly involved in the CEI action for creation of the Biomedical Imaging Platform and, indirectly, with the actions of the Advanced Pre-Clinical Development Platform, of the New Nanomagnetic Markers and PET Tracers Laboratory and the Advanced Imaging Analysis Laboratory.

Cognitive and Computational Neuroscience Laboratory

The UCM-UPM Cognitive and Computational Neuroscience Laboratory (http://www.ctb.upm.es) has Magnetoencephalography (MEG) and Electroencephalography (EEG) equipment used in functional resonance studies, MEG and EEG of healthy young and older individuals and patients with cognitive impairment such as Alzheimer's disease, psychiatric problems and strokes.

With CEI funds, we have moved an isolated room that shields the external magnetic field. This move was essential for UCM and UPM to be able to set up the above mixed laboratory to study the human brain. This is now allowing us to serve not only multiple regional, national and international researchers, but also hospitals in various areas in Spain who refer their patients to us for studies with this unique infrastructure.
Thanks to having installed this cognitive and computational neuroscience laboratory, we have had an extraordinary impact worldwide, not only on the number of publications in first quartile journals, but also on the number of international collaborations with countries in 3 continents and participation in international projects such as the Human Brain Project.

Cytometry and Fluorescence Microscopy CAI

The Cytometry and Fluorescence Microscopy CAI is part of the Spanish Network of Advanced Optical Microscopy (REMOA) and the Network of Laboratories of the Community of Madrid, both with an international projection. In future, the Centre shall join the European Network for Biological Imaging (EuroBioImaging, EMBL).

The main objective of the action funded by the CEI was to provide scientific and technical support to the lines of research, primarily in the Innovative Medicine Cluster (cancer, stem cells, cardiovascular diseases, neurological and psychiatric disorders and autoimmune, inflammatory and infectious diseases), as well as those in other disciplines such as Agri-Food or Biomaterials. The specific objectives were: i) meet the growing demand for confocal laser microscopy and its various applications (multicolour microscopy, colocalization, multidimensional analysis, in vitro work with live cells, ii) increase the number of services devoted to multiphoton laser microscopy with the current equipment, thanks to being able to conduct some of the present microscopy studies in new equipment, iii) include new confocal laser applications, specifically the space-time analysis of fluorescent molecules with FCS, iv) incorporate new technologies based on optical fluorescence microscopy: stereology and v) implement image processing and analysis services, by incorporating powerful computer hardware and software (Imaris, FluoView, Metamorph), in order to provide researchers/users with final results of CAI equipment conducted by highly qualified scientific-technical CAI staff

Use of human, material and financial resources:

UCM Animal Facilities CAI

The Animal Facilities CAI is registered under nº EX08-UCS in the Community of Madrid. Thanks to CEI funding, this Centre meets all legal requirements (see section above).

1.- ***Refurbishment of the Medicine Unit.***

The work done included: i) creation of an access area only for behavioural studies with soundproofed spaces and individual control of light cycles (necessary for observation and audiovisual recording under animal perception conditions, for example, at night) ii) creation of 2 operating theatres for handling animals, and iii) installation of equipment for video recording and a computer data processing system with common software. With other non-CEI funds, the laboratories have been fitted with all necessary furnishings and equipment.

2.- ***Refurbishment of Biology Unit***

The work proposed includes: i) repair of walls (Epoxy paint, wall-floor connections), floor renovation (vinyl), sinks, etc... and ii) renovation and soundproofing of behaviour room.

UCM - NMR CAI

The infrastructure acquired will improve and complement the services available in this CAI. The Resonance Imaging equipment is simple, of low field (1 Tesla) and permanent magnet, with reduced operating and maintenance costs, high productivity and providing reproducible and

quality results for studies with small animals. It will be fully functional in the last quarter of 2013. Nationwide, there is no other similar equipment in other entities.

UCM Brain Mapping CAI

The infrastructure acquired (to be installed in the 4th quarter of 2013) by our Research Assistance Centre (CAI), shall improve and complement the services of the micro-PET equipment already installed in 2006 (PR70/05-14317 and MEC UCMA05-33-049). This consists of an X-ray micro-CT unit and a new ring of PET detectors that makes our system a hybrid PET/CT scanner capable of obtaining anatomical (CT) and functional (PET) images almost simultaneously, which assures co-recording and subsequent merging of the various tomographic images obtained. We have also increased the visual field of the micro-PET camera and implemented software for acquisition and reconstruction of the PET system matrix taking into account interaction with gamma rays on the glass and correction of gamma ray reduction on animal bodies with information obtained with the CT. All of this entails a significant reduction in acquisition times (by also increasing PET system sensitivity from 2.1% to 5%), therefore improving the machine's productivity.

Cognitive and Computational Neuroscience Laboratory

The UCM-UPM cognitive and computational neuroscience laboratory (http://www.ctb.upm.es/) has Magnetoencephalography (MEG) and Electroencephalography (EEG) equipment. With CEI funds, we have moved this equipment to an isolated room that shields the external magnetic field, and which is necessary to record brain magnetic fields. Thus, UCM contributed to setting up this laboratory with this isolated room and UPM with the newly acquired Magnetoencephalography equipment. The brain magnetic field is 10^{-15} Tesla and ambient magnetic field is several orders of magnitude higher than this field, therefore, without this room, brain activity could not be recorded. This room has the ability to divert the field and therefore record brain magnetic field with no interference.

Cytometry and Fluorescence Microscopy CAI

The Centre has 5 technicians on staff (4 with Higher Degrees and 1 Specialist Technician) who are highly specialised and adequately trained on the new equipment and techniques. Additionally, they will take training courses delivered by the companies awarded the contracts. The Centre has additional equipment for implementation and daily operation of this proposal (laboratory, microscopy and flow cytometry) to support the technical improvements proposed. The Centre is part of the UCM network of Research Assistance Centres and it has revenue from the work conducted by the UCM's research groups, public research bodies (OPIs) and private corporations, with fees approved by the UCM Social Board. It also has financial resources from the UCM Research Service, basically for maintenance contracts with manufacturers or their representatives. Other Centre resources come from the CAM (Community of Madrid) program of excellence groups, as part of the S2010/BMD-2420 project as a laboratory in the CellCAM Network.

With CEI funds, the Cytometry and Fluorescence Microscopy CAI has obtained the following equipment: confocal laser microscopy system, FluoView1200 (Olympus) with Correlation Spectroscopy (FCS, PicoQuant), stereological microscopy system (NewCast, VisioFarm, Olympus) and two off-line workstations for processing and analysing images (HP WorkStations, Imaris, Olympus FluoView).

Strategic Area	SCIENTIFIC IMPROVEMENT
Action	III. Platform for clinical information: System for filing and communicating clinical images and databases

Objectives

Clinical information network with PACS (Picture Archiving and Communication Systems) and online spaces for clinical database files (biobanks, clinical cases, integrated electronic clinical records) for research purposes, meta-analysis and teaching. Space with additional use for telemedicine, digital prescriptions, demographic research and public health, and coordination with reference hospitals.

ICT design, medical signal processing, health information systems, medical applications in ambient intelligence (AmI).

Progress towards objectives

This will be comprised of 3 closely related services.

- **Biobank and Clinical Record Management Platform**: This platform aims to implement a computerised management network of biobanks and clinical records for improved awareness and use on Campus. Use of this platform shall improve healthcare and biomedical research.
- **Biomarker Validation and Identification Platform**. A platform is offered comprised of clinical groups in referred hospitals to identify and/or validate new biomarkers in the pathologies described.
- **Clinical Trial and Pharmacovigilance Platform**. The fact there are 3 large hospitals associated to the UCM allows conducting clinical trials with a sufficient number of patients. Molecular and imaging biomarkers allow selecting patient populations or subpopulations with a specific disease to be recruited for various clinical trials, which means not only reducing the size and duration of clinical trials, but also improved patient control and, in short, improved healthcare for the general population.

1. 12 de Octubre Hospital Research Institute (i+12). Clinical Research Support Unit.

(http://imas12.h12o.es/index.php/servicios-de-apoyo/investigacion-clinica).

2. San Carlos Health Research Institute (IdISSC)
(http://www.madrid.org/cs/Satellite?pagename=HospitalClinicoSanCarlos/Page/HCLN_home)
3. Gregorio Marañón Hospital Foundation for Biomedical Research. (http://fibhgm.hggm.es/)

Description of work conducted:

Coordinator: José Luis de Pablos
We have continued holding meetings with the above entities to implement a joint database of

clinical groups involved in this priority line and that belong to the CEI Moncloa: **Centre of Biomedical Technology** -CTB- Campus Montegancedo (Francisco del Pozo, Director CTB), **Madrid-MIT M+Visión Project** Community of Madrid (Luis Sánchez Álvarez, Managing Director ACAP), **Vice Deanship of Research** UCM Faculty of Medicine (Francisco Pérez-Vizcaíno, Vice Dean of Research), **San Carlos Health Research Institute –**IdISSC- (Elena Urcelay, Science Director IdISSC), **12 de Octubre Research Institute** -i+12- (Jesús Fernández Crespo, Director i+12), **Gregorio Marañón Health Research Institute** -IiSGM- (Rafael Bañares, Director of IiSGM).

On the 13th June 2012, we held the first CEINNOVA Innovation Conference, with the participation of the abovementioned groups. Also, we have signed the following agreements directly related to this strategic line: Agreement between CEI Moncloa and **Madrid-MIT M+Visión** (29-04-2012) and UCM-UPM Agreement with the **University of Colorado** (7-05-2011).

Most significant results:
This objective is highly complex as many centres from various entities are involved, and at least the conditions for this collaboration are being laid.

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	IV. Large infrastructure for 3D viewing and advanced multimodal interaction in the Living-Lab of the Moncloa Campus of International Excellence.

Objectives

The infrastructure is appropriate for conducting research of the groups involved in the two universities, and the university community in general. Below is a summary of the various lines of research being started with the support of the 3D viewing and advanced multimodal interaction infrastructure, establishing synergies between UPM and UCM. These lines of research are closely related to the line of work of the Innovative Medicine Cluster: Personalised Health (p-Health), aimed at consistent and coordinated integration of bio and nanotechnology, ubiquitous computing, ambient intelligence, self-adaptive multimodal interface and artificial intelligence for health and improved quality of life. Specifically, the objectives focus on action H7 of the Innovative Medicine Cluster and Consolidation of the Living-Lab, increasing its capabilities to achieve the expected impact on the Campus of Excellence.

Progress towards objectives
The action carried out consisted of purchasing and installing a 3D viewing and advanced multimodal interaction infrastructure for the Living-Lab at the Moncloa Campus of International Excellence.

The equipment included an immersive system that allows showing high quality and real-time three-dimensional graphics. The system provides the option of LSHAPE projection which consists of a double projection system, front and floor, with main user position feedback in real time so the virtual reality system presents the right information through the graphic system. This way, the user's position and viewpoint are updated in the virtual world, allowing total immersion. This information is obtained with a Positioning System and several advanced multimodal interaction media.

The system is run on hardware capable of generating 3D graphics and images, surround sound, virtual world evolution, user interaction and synchronization of all system elements. Another twin computer helps develop projects, as simulation cannot be provided simultaneously with

development.

The strengths and distinguishing elements of this infrastructure are the various types of user interaction through the camera tracking system, wireless gloves, Kinect support and voice recognition. Due to the necessary synchronism of the various systems, it will be possible to evaluate and study complex situations such as prevention of risk situations and non-conscious emotional and cognitive states.

The 3D viewing infrastructure can be connected to the Living-Lab (with sensors and actuators distributed throughout the house) creating a link between 3D viewing, virtual environment and real environment, thus expanding the benefits provided by the Living-Lab and the 3D viewing and advanced multimodal interaction infrastructure. This will allow, among other things, obtaining an immersive advanced multimodal interaction 3D viewing room, where users can interact in a virtual world connected to real space where different scenarios can be modelled (an accessible digital home, an operating theatre, an office, etc.) and product and service prototypes can be developed quickly for developing simulation and training systems. In turn, with this new equipment, in the main room of the Living-Lab, different simulation scenarios can be reproduced as well as validation of the products and services proposed, and the environment can be changed according to interactions defined in the virtual environment.

This connection makes real and virtual simulation possible of different training scenarios, allowing a more finely tuned study of all the cases of use and scenarios to be developed, thanks to recording of events with cameras, microphones, sensors and actuators in the Living Lab.

Aside from the multiple properties technically offered by the above infrastructure, including it in the Living Lab allows developing the following applications for the fields of e-health and personalised health (p-health):

- Clinical psychology (study of behaviours, treatment of phobias)
- Medical training and planning (3D medical images, surgery simulation: endoscopy, laparoscopy or endovascular navigation, role-play activities)
- Patient rehabilitation with the so-called "serious games"
- Applications for defence (flight simulators, military training, car simulators, accident and terrorist attack simulation)
- Energy efficiency architecture and simulation (adaptation and experimenting with spaces created, virtual tours of historical monuments)
- AAL (Ambient Assisted Living aimed at people with reduced mobility and the elderly with movement difficulties)
- Follow-up of chronic diseases (diabetes, Parkinson's, heart failure, coronary heart disease)
- Evaluation of impact of stereoscopic systems on human vision
- Support of independent living for people in a completely assisted and natural environment including a pond with fish, real and simulated pets, natural plants, simulation of context and moods, etc.

Thanks to the rapid prototypes and personalisation of the health services (p-health), there is evidence of the following advantages for acquiring and installing the 3D viewing and advanced multimodal interaction infrastructure in the Living Lab, justifying the need for the action:

- Cost and time savings: as opposed to building other Living Labs, different virtual and test environments can be created in various areas of interest inside a single structure.

- Reproducibility: once the environment has been created, appropriate for certain types of users, it can be reproduced quickly and cost-effectively.
- Safety: the AAL services and environments can be evaluated and tested in a safe and controlled manner.
- Verifiability and experimental testing of new interaction paradigms, environments and intelligent system reactions.
- Accessibility: the infrastructure provides a single solution to monitor movement of wheelchair users, whether electric or manual, allowing use by a larger population spectrum.

This solution is not currently available in any entity of the Moncloa Campus of Excellence, nor do we know of anything similar in any other Spanish university. It is presented as a ten times more cost-effective solution than a virtual reality cave, but with similar immersion properties thanks to the projection on the floor, as well as the advantages abovementioned.

Description of work conducted:

"Living-Lab" Platform (Coordinator Mª Teresa Arredondo).

The 3D viewing and advanced multimodal interaction infrastructure for the CEI Moncloa Campus Living-Lab has been connected to the Living-Lab (with sensors and actuators distributed throughout the house) creating a link between 3D viewing, virtual environment and real environment, thus expanding the benefits provided by the Living-Lab and the 3D viewing and advanced multimodal interaction infrastructure. This has allowed, among other things, obtaining an immersive advanced multimodal interaction 3D viewing room, where users can interact in a virtual world connected to real space where different scenarios can be modelled (an accessible digital home, an operating theatre, an office, etc.) and product and service prototypes can be developed quickly for developing simulation and training systems.

Aside from the multiple benefits technically provided by the infrastructure, including it in the Living Lab has allowed increasing the quality of the research processes in the following applications in the field of e-health and personalised health (p-health): i) Clinical psychology (study of behaviours, treatment of phobias), ii) Medical training and planning (3D medical images, surgery simulation: endoscopy, laparoscopy or endovascular navigation, role-play activities), iii) Patient rehabilitation with the so-called "serious games", iv) Applications for defence (flight simulators, military training, car simulators, accident and terrorist attack simulation), v) Energy efficiency architecture and simulation (adaptation and experimenting with spaces created, virtual tours of historical monuments), vi) AAL (Ambient Assisted Living aimed at people with reduced mobility and the elderly with movement difficulties), vii) Follow-up of chronic diseases (diabetes, Parkinson's, heart failure, coronary heart disease), viii) Evaluation of impact of stereoscopic systems on human vision, and ix) Support of independent living for people in a completely assisted and natural environment including a pond with fish, real and simulated pets, natural plants, simulation of context and moods, etc.

The following research groups have participated in the action:

Life Supporting Technologies Group (UPM):

- Design and development of intelligent systems to help citizens have a better quality of life.
- Develop, validate and evaluate systems based on Ambient Intelligence, AmI

system architectures, context and ambient control, system adaptability, sensors...
- Develop, validate and evaluate User Interaction systems, accessibility, adaptability, high usability interface, natural interaction, behaviour modelling, etc.
- Develop, validate and evaluate Ambient Assisted Living (AAL) services
- Develop, validate and evaluate services based on ubiquitous computing

Through the use of immersive 3D viewing systems, different techniques for real time user interaction shall be evaluated. This will be possible thanks to the rapid prototyping for ambient intelligence and different types of user control systems.

Creation and Psychosocial and Cultural Effects of Audiovisual Discourse (UCM) Group:

- Develop training materials to enhance and teach communication skills that healthcare professionals (physicians, nurses, social workers, psychologists...) must implement every day in their work (giving bad news, interaction with patients and their families, conflict resolution...)
- Development and implementation of disease prevention programs and, essentially, drug and alcohol use. Also, development of education programs for health and promotion of healthy habits, especially addressed to a young target audience and using information and communication technology.
- Proposal and implementation of communication plans in risk situations and crisis management (epidemics, natural disasters, clinical errors, eating disorders, etc.) through simulations and training in 3D environments

Applied Vision Group (UCM):

- Evaluate aspects of binocular visual function such as breadth of motor fusion, stereopsis (binocular disparity) and depth thresholds.
- Investigate the effect of artificially restricting vision and efficacy of different treatments and optical visual aids aimed at patients with vision alterations.
- Measure eye movements and gaze positions, electrooculogram and electroencephalogram activity in human subjects interacting with and navigating in a virtual reality environment with 3D viewing. This allows monitoring neurological and eye dysfunctions in various vision and attention disorders or evaluating, for example, eye movements before an imminent collision in driving simulations.
- Evaluate mobility and collisions with obstacles in the elderly or patients with low vision, as this avoids difficulties and hazards of falls and actual collisions. This would help to study sensory processing strategies (how and when a virtual obstacle is identified when walking) and guide development of new visual aids.

Biomedical Imaging Technology Group (UPM):

- Processing of functional and molecular images: application of image processing techniques to obtain functional and molecular quantitative information based on biomedical imaging.

Biomedical Technology Centre (UPM):

- Simulation, virtual reality and image-guided technologies for training and planning in minimally invasive surgery.
- Technology for personal and ubiquitous healthcare of chronic, disabled or fragile patients. Ambient intelligence for monitoring and mining knowledge, lab-on-a-chip, sensor networks, interoperability...

Most significant results:

The infrastructure presented is currently being used for development and evaluation of various prototypes within the following European projects:

- European Project VAALID (Accessibility and Usability Validation Framework for AAL Interaction Design Process), comprised of various author tools to create assisted ambient (AAL) 3D spaces. These spaces can be saved in a library that allows rapid design of prototypes. Although this project is finished, the results are being transformed into a prototype applicable to the new 3D viewing and advanced multimodal interaction infrastructure for the Living Lab on the Moncloa Campus of International Excellence.
- European Project VERITAS (Virtual and Augmented Environments and Realistic User Interactions to Achieve Embedded Accessibility Design). Its main objective is to provide support for all phases of design, development and validation of assistive technologies with virtual reality simulations and iterative testing. This process is applied to various areas: automotive, automation, intelligent environments, work sites, personal care, well-being and entertainment. The results shall be evaluated in the 3D viewing infrastructure.
- European Project UniversAAL (UNIVERsal open platform and reference Specification for Ambient Assisted Living). Its objective is to implement an open and standard platform that allows developing AAL solutions simply and cost-effectively. The various components of the platform are currently being installed in the Living Lab, connecting them to its sensors and actuators. Once installation has been completed, they will be connected to a 3D simulation of the Living Lab allowing the link between 3D viewing, virtual environment and real environment.
- European Project PERFORM (A soPhisticatEd multi-paRametric system FOR the continuous effective assessment and Monitoring of motor status in Parkinson's disease and other neurodegenerative diseases progression and optimizing patients' quality of life). Among the neurodegenerative diseases that entail motor disorders, the objectives of the PERFORM project are monitoring and efficient management of patients. Although this project is completed, it has been found that Parkinson's patients can walk on their own using virtual reality (VR) tools, in spite of their movement disorder, therefore research is continuing within the framework developed in the PERFORM project applying the infrastructure movement recognition tools and virtual reality projections. Virtual reality environments have shown to be an efficient measure for neuro-rehabilitation of patients affected by Parkinson's syndrome.
- European Project CogWatch (Cognitive Rehabilitation of Apraxia and Action Disorganisation Syndrome) has the objective of improving rehabilitation of stroke patients by creating a tool to carry out rehabilitation at home. The infrastructure's movement recognition tools are being used for its development.

Aside from the abovementioned European projects for which the infrastructure presented is being used, we expect that in upcoming editions of Horizon 2020, topics shall be proposed for which the 3D viewing infrastructure shall provide remarkable added value, thereby reinforcing its position within the consortium of European projects and increasing the success of the proposals submitted.

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	**CULTURAL HERITAGE CLUSTER** • International Centre for Advanced Studies on Cultural Heritage (CIESPC). • Moncloa Network of Laboratories for Science and Technology of Heritage Conservation (RedLabPat).
Objectives	a) Thought: development of doctrine, principles, criteria and own techniques to serve as references to other institutions. b) Management: a set of synergies between universities, research groups and the various institutions involved to promote multidisciplinary work in the field of Heritage

Progress made towards objectives

- Redefinition of the Heritage Cluster through the use of the adjective 'Cultural', to consider 'the whole human legacy of movable and immovable tangible artefacts and intangible attributes inherited from the past, decided to be worth protecting as our cultural identity, and declared to be our heritage'. By this definition, National Heritage property, declared and protected as such and linked (or potentially linked) to our Cultural Heritage assets, will be considered within this Cluster.
- Analysis of the file content of the 168 Research Groups which had expressed an interest in forming part of the original Heritage Cluster.
- Review of the information on the 16 laboratories which may form part of the RedLabPat, the strategic Cluster area.
- Design and planning of the inter-university Master in Cultural Heritage Management envisaged to start in 2014-2015.
- Technological equipment for the CIESPC, including computers, software, hardware, three-dimensional modeling equipment and other services needed for a highly specialized research space.
- Improved collaboration between private firms and the research organization, with a focus on reaching specific agreements to provide services, especially in the field of new technologies, as well as cultural heritage consulting services for large companies.

Description of work completed and role of participants

The Cultural Heritage Cluster includes different heritage-related research and postgraduate teaching features of both universities: research groups, centres and institutes, departments, postgraduate programs, industry-sponsored Chairs, laboratories and museums. It takes full advantage of the unique presence on the Campus of teaching centres for Architecture, Fine Arts, Geography and History, along with research groups and laboratories for Heritage Science and Technology, to develop a global interdisciplinary approach to all areas related to the discovery, restoration, conservation and enhancement of our Cultural Heritage. It has the previous commitment of the *Instituto del Patrimonio Cultural Español (IPCE), Patrimonio Nacional,* CIEMAT, CSIC, and has made initial contacts with the *Academia de Bellas Artes* and *Academia de la Historia*.

As well as implementing the two actions described below, the Cluster coordinators have encouraged the search for joint project funding sources through national and international programs, with the proposals listed below presented and pending approval: These include:

- PACUE (Comprehensive strategy for the assessment and management of cultural landscapes associated with energy transformation): This research project is part of the National R&D+I plan and includes researchers from the School of Architecture and Civil Engineering at the UPM and the department of Ecology at the UCM. The electric company ENDESA has joined the project and it is hoped that a university Chair will be created within the framework of CIESPC in the near future. Similarly, the Spanish Foundation for Science and Technology (FECYT) together with the Fundación ENDESA, funded the exhibition "Paisajes Culturales de la Energía" (Cultural Landscapes of Energy), which took place in May in the 'Arquería de Nuevos Ministerios' exhibition hall, which was of interest for national and international journals. In addition, the project was recognized by the Secretary of State for Culture, which decided to change one of its training courses at the National School of Heritage to include the subject, with the involvement of the researchers working on the project.
- Assessment of the rural Heritage of Public Works (VAPROP): Researchers from different fields from both the UPM and the UCM are collaborating on the project. This project, which is focused on what new technologies can offer in the field of rural heritage recognition, has developed an application for smartphones and its results were presented at the FITUR tourism fair and at other national and international meetings. The project is funded with funds from the Ministry of Environment.
- PHI Network Project: The project PHI Patrimonio Histórico + Cultural Iberoamericano proposes the development of an innovative global information system, based on the capabilities of the university and constantly updated. The aim is to create a platform that will permit a better understanding of the strategic value of heritage and to allow for more efficient management of this shared heritage to assist in the organization of the available spaces. It is useful for various reasons and at many different levels. The project includes collaboration between the UPM's School of Architecture and various faculties at the UCM (Geography and History, Fine Arts…). The project is financed by various public and private entities such as ACS or the Fundación Carolina.
- Action COST "In search of transcultural memory in Europe (ISTME)": - COST "In search of transcultural memory in Europe (ISTME)" CIESPC researchers from the UPM and UCM participate in this project that explores the construction of the European territory from the standpoint of it cultural heritage, through theoretical and practical research.

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	INTERNATIONAL CENTRE FOR HERITAGE STUDIES (CIESPC).
Objectives	1. To promote research themes focused on basic or knowledge-based research into Cultural Heritage Management and applied research. 2. To boost relationships with other national and international centres through research projects and participation in specialist courses. 3. To promote cooperation with industry and the wider public, to facilitate transfer and dissemination.

Description of work completed and role of participants:

The CIESPC is an advanced scientific and technical study centre which promotes, implements and publicises research and training activities within the following scientific and technological areas applied to Heritage:

- Application of technologies for the conservation of cultural property.
- Theory and intervention criteria of architectural and urban heritage.
- Advanced methods of analysis and evaluation of architectural, territorial and landscape heritage.
- Cultural Heritage reference and storage strategies.
- Management of cultural property.
- Intangible Heritage Studies.
- Laboratory of Digital Manufacturing.

Specific objectives of the Centre included in the general goals are:

- The analysis, study, development and dissemination of theories, methods and techniques applied to the protection of cultural heritage and to its protection, conservation, management, research and dissemination.
- The implementation of programs, plans, reports, assessments, projects and activities in the fields of research, documentation, protection, intervention and communication of cultural property.
- The integration, coordination and systematization of information and documentation on heritage, in order to contribute to the study and understanding of cultural property.
- Technical assistance and specialized services to businesses and government in the field of Cultural Heritage.
- Promoting cooperation with industry, developing services and mechanisms for the required technology transfer.
- Collaboration and cooperation agreements with other public authorities, and public and private entities, necessary for the performance of its functions, both nationally and internationally.
- Promoting and organizing training and development plans for specialized staff,

including own degrees, courses, seminars, conferences and other similar activities in the various fields of Cultural Heritage, in collaboration with both public and private entities.

- Participating in national and international organizations and associations related to its purposes.
- Participating in European and international research and mobility programs.
- Any other functions that contribute to the fulfilment of CIESPC's mission.

The facilities of the CIESPC include a Laboratory for small-scale digital fabrication: **Fab Lab Madrid / CoLaboratorio.** This is a digital fabrication laboratory linked to the international FabLab network created by MIT in 2000, which currently has 90 active and 31 planned laboratories. Its aims are the digital fabrication of parts and rapid prototypes and collaborative research between industry and architectural projects. Spain has 5 active Fab Labs (Barcelona, Bermeo, León, Sevilla and Valldaura) and 4 projected including the FAB LAB in the UPM School of Architecture.

The CIESP is located in a new building in the extended Business Centre on the Montegancedo Campus. Its location facilitates collaboration with the *Centro de Domótica Integral* (CeDInt) and it has already set up the contacts needed for future cooperation in research projects taking advantage of the complementary nature of the themes and tools handled by each centre. Also underway is the acquisition of equipment and infrastructure to enable the implementation of the research projects currently in development phase mentioned above. As the main working area is the application of new technologies to the study, dissemination and enhancement of Heritage, it has the software and hardware needed to apply these new technologies (GIS, GIM, augmented reality, modelling and 3D printing).

As for the relationship with society and transfer, CIESPC offers a catalogue of unified and integrated services including services required by private businesses and government bodies in services of information, analysis, training or treatment of cultural property, among others. The service catalogue is summarized in: documentation services, including digitization, technical assistance in documentation and information for cultural heritage and digital mapping; Intervention services, including imaging examination techniques, condition diagnosis and proposed treatment, valuation reports, master plans and projects of cultural property; scientific analysis service, including chemical, tectonic, environmental, spatial, structural analyses among others.; training services.

Internationalization activities.

Participation in networks is one of the main instruments of European cooperation, information management and resourcing that CIESPC considers essential in its internationalization strategy.

The CIESPC intends to join the network of European reference R + D + i centres in the field of the protection of cultural heritage as well as thematic networks of the various disciplines.

This action is essential in the interests of researchers, as it increases the capacity of access to European knowledge and EU institutions. Firstly with regard to European funding, and secondly, regarding information and participation in the various policies implemented by the EU.

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	MONCLOA SCIENCE AND TECHNOLOGY LABORATORIES NETWORK FOR HERITAGE STUDIES (RedLabPat)
Aim	To create a laboratory network capable of implementing study techniques in Cultural Heritage.

Description of work completed:

The motive for creating this network in the CEI-Moncloa was the need to boost the analytical capacity of the UCM and UPM in Heritage Sciences. Its main aim is to offer a specialized service to both the research groups in the CEI and other research institutions and to the business sector. Both the UCM and UPM have scientific and technical infrastructures which are not always made available to the wider public. This newly created network has enabled these resources to emerge and their inclusion through the different laboratories which wholly or partly carry out studies in Heritage Sciences. This approach has led to the inclusion of 15 laboratories in the network enabling a specialized multidisciplinary overview of different problems related to heritage conservation and enhancement. 8 of these laboratories are in the UCM and 5 in the UPM. This network also includes a joint UCM/ UPM laboratory for Dating in Heritage Sciences (DACIPA), recently set up on the Moncloa Campus, one of the objectives of the CEI-Moncloa (P4). Other collaborative institutions mentioned above also participate in the network.

After an analysis of the available resources and infrastructure, the laboratory proceeded to acquire the equipment to enable it to extend and improve the services offered. This includes accelerated aging testing chambers to facilitate a better understanding of the useful life of materials and their behaviour in aggressive environments. This data will enable appropriate treatments to be selected to reduce deterioration of the movable and immovable heritage. The acquisition of these chambers complements those already in place in various laboratories in the Network and will allow a more complete service offer. Other planned acquisitions include equipment for high resolution infrared imaging, to obtain high definition 150 cm area images with no angular distortion. This acquisition means a great advance in the scientific and technical study of art works and the information it provides is of significant interest to art curators, restorers and historians.

Aims of RedLabPat

1. The creation of a network to share and distribute resources with a view to undertaking specialised technological work aimed at the conservation of our heritage with a vision which is not only multidisciplinary but above all interdisciplinary.

2. To improve the quality and competitiveness of the laboratories which constitute it, defining analytical protocols and methods of intervention and developing new techniques for the conservation of heritage.

3. To support research in the field of Heritage Sciences, and promote lines of research and cooperation with public and private companies, regarding measures for conservation, restoration and raising the profile of heritage, with special emphasis on comprehensive programmes.

The development of the network has involved a series of stages. The first ran from December 2010 to February 2011 and consisted of a detailed review of information concerning the research groups which had expressed interest in joining the CEI Moncloa Campus Cultural Heritage Cluster. Those which had their own laboratories (funded by research projects, contracts, etc.) were identified and invited to an introductory meeting in March 2011. After this first contact some groups from UCM and UPM expressed their interest in forming part of the network, placing the equipment and infrastructures of their laboratories at its service. RedLabPat was finally constituted in June 2012 and was presented at the CEIINOVA conference held on 13 June 2012 organised by CEI Moncloa Campus.

To date 17 laboratories have joined, nine of them belonging to UCM and seven to UPM, while one is a combined CSIC-UCM centre. Each of these laboratories is linked to a recognised research group except the research support centres (CAI) for Archaeometry and Archaeological Analysis and for Geological Techniques, which report to the UCM, and the laboratory belonging to the Marqués de Valdecilla Library Conservation and Restoration Department, which reports to the UCM library. Membership of the network is open to new laboratories which wish to join.

The laboratories belonging to RedLabPat are listed below.

- Applied Chemistry Laboratory. Research group (UCM-930420): Heritage documentation, conservation and restoration techniques. Faculty of Fine Arts

- Petrophysics Laboratory. Research group (UCM-921349): Petrology applied to Heritage Conservation. Its Quality Management System is certified according to the UNE-EN-ISO 9001:2008 standard. It is a member of the Madrid Community's Laboratory Network (RedLab no. 217). Geoscience Institute (IGEO). UCM-CSIC combined centre. Geological Sciences Faculty

- Georeferencing Laboratory. Research group (UCM-910596): Ionosphere and global navigation satellite system (GNSS) study group. Physics and Mathematics Faculties

- BIOCRIPT Laboratory. Research group (UCM-910801): Biodiversity and taxonomy of cryptogamic plants. Faculty of Biological Science.

- Raman Spectroscopy Chemistry and Physics Laboratory. Research group (UCM-910481): High pressure. Determination of spectroscopic and thermodynamic parameters. Chemical Sciences Faculty

- Entomology Laboratory. Research group (UCM-921632): Biology and biodiversity of arthropods. Biological Sciences Faculty

- Photometry and Colour Laboratory Group (UCM-910006): Complutense Applied Optics Group. Faculty of Optics and Optometry

- UCM Historical Library Conservation and Restoration Department Laboratory. Marques de Valdecilla Historical Library

- Archaeometrical and Archaeological Research Support Centre (CAI) Faculty of Geography and History

- Research Support Centre for Geological Techniques. Geological Sciences Faculty

- Biomolecular Stratigraphy Laboratory. UPM Research group: Environmental Studies. Higher

Technical School of Mining, Madrid

- Technology of Geographical Information Laboratory (LatinGEO). UPM Research group: MERCATOR information technology. Higher Technical School of Topography, Geodesy and Cartography.

- Structures Laboratory. UPM group. Department of Building Structures. Higher Technical School of Architecture

- EUITF Laboratory. UPM Research group: Construction with wood. Higher Technical School of Forest Engineers

- Biodeterioration Laboratory. UPM Research group: BIO-MAT. Bioengineering and Biomaterials. Higher Technical School of Industrial Engineers,

- Testing Laboratory. UPM Research group: Architectural Heritage Analysis and Intervention (AIPA). Higher Technical School of Architecture

- Laboratory of Acoustics and Vibration Applied to Building, the Environment and Town Planning. Laboratory certified as ENAC nº 688/LE1477. Member of the Madrid Community Laboratory Network (registration no. 266). UPM Research group: Architectural acoustics. Higher Technical School of Architecture

Cooperation between these laboratories is reflected in the following activities:

- Participation in Summer Science Campuses.

Organised by: FECYT, "Campus Moncloa" (UCM-UPM) Campus of International Excellence. Heritage Cluster and Ministry of Education.

Participating Laboratories: Applied Chemistry Laboratory. Research group (UCM-930420): Heritage documentation, conservation and restoration techniques. Fine Arts Faculty and Petrophysics Laboratory. Research group (UCM-921349): Petrology applied to Heritage Conservation.

Length of course: 100 hrs.

Editions: 2011 and 2012

- Participation in Projects for Educational Innovation and Improvements in Teaching Quality (PIMCD)

Title of project: Interactive and Innovative Practices Applied to the Conservation and Restoration of Heritage (Project no. 219)

Organised by: UCM Vice-rectorate for Quality

Participating Laboratories: Applied Chemistry Laboratory. Research group (UCM-930420): Heritage Documentation, Conservation and Restoration Techniques. Fine Arts Faculty and Petrophysics Laboratory. Research group (UCM-921349): Petrology Applied to Heritage Conservation.

Duration of course: 2013

- Participation in Call for R&D Activities among Community of Madrid Research Groups in

Technology 2013

Title of project: Geomaterials (Ref: P2013/MIT-2914)

Participating Laboratories: Applied Chemistry Laboratory. Research group (UCM-930420): Heritage Documentation, Conservation and Restoration Techniques. Fine Arts Faculty and Petrophysics Laboratory. Research group (UCM-921349): Petrology Applied to Heritage Conservation.

Other Research Groups belonging to RedLabPat: Research group (UCM-921349): Petrology applied to Heritage Conservation. UPM Research group: Architectural Heritage Analysis and Intervention (AIPA).

Duration: The project has been preselected and is now in the second stage of assessment.

EXISTING RedLabPat EQUIPMENT

All the laboratories belonging to RedLabPat have their own equipment to carry out research and provide external services. The equipment initially held by the network was valued at €3,200,000. A range of equipment has since been incorporated via public tenders. A number of laboratories in the network jointly supported the acquisition of equipment through the CEI-Moncloa programme for the acquisition of scientific and technical equipment and improvement of infrastructures (CAIMON), which was concluded satisfactorily in February 2012. The following equipment was purchased via the programme:

- Portable unit for energy-dispersive X-ray fluorescence (EDXFRX), to determine the chemical characterisation of materials and product alteration. Being portable, the unit can be easily transferred to archaeological sites, museums, archives, libraries, etc. It was purchased in October 2013 and is kept at the Petrophysics Laboratory. Geological Sciences Faculty

- Multi-channel georadar with mechanical traction to determine the archaeological characteristics of large areas. Purchased in 2013 and stored at the Archaeometrical and Archaeological Analysis Research Support Centre in the Geography and History Faculty

Equipment purchased by CEI Campus Moncloa to reinforce RedLabPat resources:

MICRODRONE MD4-200 UNMANNED AERIAL VEHICLE. Purchase of an unmanned aerial vehicle (UAV) for the Heritage Science and Technology Laboratory Network (RedLabPat) for the spatial analysis and 3D modelling of heritage sites (archaeological sites, large scale heritage features, high locations, etc.). This is a non-invasive device that can be used to study heritage sites. Among the many applications of UAVs we would emphasise the following: studying the state of conservation of heritage elements, the study of hard-to-access heritage sites, documentation on heritage features, 3D modelling of hard-to-access heritage sites, aerial photography, the creation of digital elevation models, aerial mapping of archaeological sites, archaeological studies and the mapping of archaeological sites. UAVs have only been applied in scientific research very recently. Indeed, very few institutions have devices of this kind. They include: Leibniz Universität Hannover, Universität Bonn, University of Warmia and Mazury in Olsztyn, University of Applied Sciences Frankfurt am Main, National Oceanic and Atmospheric Administration (NOAA), German Aerospace Center (DLR), and European Aeronautic Defence and Space Company (EADS). The purchase of this type of equipment would place the Complutense University of Madrid at the

forefront in this type of technology.

Compared with other technological options, the cost of using and maintaining UAVs is very low. They can be used in locations which are inaccessible for helicopters or planes. Their small size and the fact that they run on batteries allow them to operate almost silently and they do not cause air turbulence that might damage heritage features. This is a very valuable non-invasive device for the study of heritage sites.

Current models can function in very demanding climatic conditions, they are water- and dust-resistant and can operate at temperatures ranging from -20° C to +50° C. They are normally controlled by GPS, which gives the added benefit of allowing immediate automatic geo-referencing of the data obtained.

Location of the equipment: Room S225-B, Mathematics Faculty.

GNSS TOPCON GR5 SYSTEM. The purchase of a sub-centimetre precision GNSS system has many applications in the field of Archaeology, especially the following:

1) Precision topography of archaeological sites. While traditional methods that used theodolites, total stations, etc. were complex, lengthy and costly to deploy, the GNSS system allows the production of very high quality topographical information in a very short time. The precision of the Global Navigation Satellite System derives from the fact that it can receive signals not only from the American GPS system, but also from the Soviet GLONASS system and the new augmentation systems, such as the European EGNOS and American WAAS systems, and it is being prepared for the future Galileo system. The imperative need to determine the precise location of structures and other elements found at any archaeological site makes the use of this equipment essential for the preparation of preliminary documentation and the conduct of field work in archaeology.

2) Georeferencing of data obtained using georadar methods. The purchase by the Campus of Excellence of a Multi-channel Stream X GPR system, funded by another programme, makes it necessary to combine this methodology with the **topographical location of georadar paths**. The GPS antenna and data capture have thus been coupled to the georadar system, so that the work area can be documented with maximum precision.

3) Georeferencing of specific points in archaeological sites. As well as determining the three coordinates (X, Y, Z) of the elements one wishes to document in a site, their positioning can be combined with aerial photography using photogrammetric cameras, to produce a 3D elevation of structures that have been excavated. The presence of a UAV Microdrone MD4-200 in the Georeferencing Laboratory of the UCM Mathematics Faculty (which is also a member of RedLabPat, working jointly with the research support centre for Archaeometry) makes it possible to provide **photogrammetry services for archaeological projects using unmanned aerial vehicles**.

Location of the equipment: Archaeometrical and Archaeological Analysis Research Support Centre (CAI) Faculty of Geography and History, Complutense University of Madrid

MICROSCOPY EQUIPMENT USING NIKON ECLIPSE CI-L DIGITAL MICROPHOTOGRAPHY WITH IEEE1394B DS-U3 CONTROL UNIT, CPU I3 AND 24" HP KD911AT TFT SCREEN AND TISSUELYSER

LT MECHANICAL DISRUPTOR

The photographic equipment currently owned by the BIOCRIPT Laboratory is partly obsolete and it has no digital microphotography equipment. To improve the quality of the work carried out and facilitate the inclusion of images in research projects and papers it was desirable to purchase new equipment with better specifications, which would cater for digital microphotography, and a monitor for viewing images.

One of the laboratory's lines of work is genetic analysis, which involves identifying samples which are very small or at an early stage of development, these being very difficult to examine using the methods conventionally applied in Botany. A mechanical disruptor is essential to carry out this type of analysis satisfactorily.

Location of the equipment: BIOCRIPT Laboratory, 4th floor, UCM Faculty of Biology annex

LUMINESCENCE EMISSION EQUIPMENT FOR ALTERATION OF XXL+ ENVIRONMENT

Many of the processes for conserving and restoring fixed and mobile heritage elements involve the use of commercial products whose exact composition and long-term behaviour are not known. They thus need to be subjected to appropriate tests to determine their effectiveness. Using accelerated artificial ageing tests we try to simulate the conditions these products will encounter during their working life. The variables normally tested are temperature, humidity, light, cycles of rain and polluting gases, acting individually or in combination.

When examining binding substances, fixatives, water repellent and cleaning agents which are to be used on inorganic materials such as stone, metal, ceramics and wall facings in outdoor locations, it is fundamental to study the combined action of light, humidity and direct rain.

The ATLAS-Xenotest SUNTEST XXL+ meets these requirements, as it enables one to examine these variables individually or in combination. The equipment also provides for the use of special filters to simulate indoor lighting conditions; tests for artificial ageing thus have a closer relationship to the natural ageing materials will undergo in settings such as a museum.

Currently ageing tests of this kind are prioritised as a quality control system for products proposed for the conservation and restoration of a wide range of works of art and fixed and mobile heritage assets.

Location of the equipment: Applied Chemistry Laboratory. 1st floor, Fine Arts Faculty

UPDATING OF SOFTWARE AND INCORPORATION OF ELECTRONIC AIR CONTROL TO MONITOR GASES IN GAS CHROMATOGRAPHY

The Faculty of Fine Arts Laboratory for Chemistry Applied to Conservation and Restoration, which belongs to the Science Laboratory Network for Heritage Conservation (RedLabPat), has a gas chromatography unit, some of whose components need to be improved to enhance its performance and effectiveness. Specifically, the use of an automatic injector calls for the incorporation of an air-controlled electronic system to transfer the energy needed to move the injector's gears.

An update of the gas chromatography equipment's software is also needed, which involves purchasing the Total Chrom 6.3.2 package.

AUTOMATIC INJECTOR FOR GAS CHROMATOGRAPHY EQUIPMENT

The Faculty of Fine Arts Laboratory for Chemistry Applied to Conservation and Restoration, which belongs to the Science Laboratory Network for Heritage Conservation, has a gas chromatography unit and the other equipment needed to prepare micro-samples (extraction and derivatization). However, the sample prepared previously in the column of the unit has to be introduced manually, using a micro-syringe, which makes the time needed to complete the work excessively long. It should be borne in mind that the sample is retained inside the column until it passes through the detector for 20 to 40 minutes and another sample cannot be introduced until the first sample has emerged from the column. The operator consequently needs to monitor the progress of the chromatogram constantly in order to introduce the other samples to be analysed.

This disadvantage can be offset by the use of an automatic injector which allows the process to be carried out automatically without the need for the operator to be present. This makes it possible to analyse a great number of samples, as the equipment can be programmed to function outside normal working hours, leading to greater efficiency in the work of the laboratory.

MASS SPECTROMETRY EQUIPMENT

The precision analysis of complex compounds, such as the binding agents and varnish used in traditional painting, calls for a combination of different analytical techniques. For example, gas chromatography (GC) allows us to separate the different esters from the fatty acids composing the drying oils used in oil painting, but it suffers from the limitation of not being able to identify them accurately. Mass spectrometry (MS) is an analytical technique which can identify organic structures accurately but it cannot deal adequately with complex compounds.

One way to deal with this type of difficulty is to couple a gas chromatography unit to a mass spectrometry system. In this way the GC system's enormous capacity for separating components is combined with the MS unit's sensitivity and ability to provide structural information. Both techniques can function with very small samples (of the order of ng) and identification can be carried out in real time, i.e. the components of the mixture are identified as they pass from the chromatography column.

The Fine Arts Faculty Applied Chemistry Laboratory has chromatography equipment with a flame ionization detector (FID), which detects the components of the mixture as they flow from the chromatography column, but it cannot identify their chemical composition. The only way to solve this problem is to work with patterns and control working conditions very strictly. This provides an approximate result for the chemical composition but it does not allow us to determine the composition of the samples analysed with any precision and the procedure is limited to previously identified patterns.

The purchase of a mass spectrometry unit to be coupled to the gas chromatography equipment which is already available would overcome these limitations and would thus improve the quality of our analyses, extending the range of cases that could be dealt with.

MASS SPECTROMETRY LIBRARY

The information obtained via mass spectrometry is in the form of a spectrum which appears as a

bar chart, each bar corresponding to an ion. The information provided indicates the m/z ratio (where m is the mass of the ion and z is its charge) and the relative intensity of each signal. Interpreting the signals is not easy and establishing their relationship with the compound that has generated them is complicated. It is thus necessary to compare each of the signals in the spectrum obtained with a reference library of patterns. The results obtained can then be interpreted more quickly with greater confidence in the validity of the conclusions.

Location of the equipment: Applied Chemistry Laboratory. 1st floor, Fine Arts Faculty

3D PRINTER

The use of 3D scanners and printers is becoming increasingly common in the conservation and restoration of cultural assets. They replace the methods used traditionally to make 3D copies or reconstructions, such as silicone or plaster, which have to come into direct contact with the original object. This method means that some items cannot be reproduced, as silicone can alter important aspects of their appearance, such as colour or shine. 3D technologies, on the other hand, enable one to carry out the procedure without damaging the original piece, as its surface is not touched. This is particularly important when the work to be restored, copied or studied is fragile or not well conserved. In such cases, scanning objects in order to produce a positive image using a 3D printer allows us to obtain high quality reproductions which can be used to study certain characteristics of items of cultural importance.

To obtain such high quality facsimiles involves previously scanning the original object with a 3D scanner. The files generated for each piece can then be used in a second stage to reproduce the object using a 3D printer. When the item has been printed or reconstructed a mould can be made, it being unnecessary to touch the original. The definitive reproduction can then be made using the resin, additives and pigments that have been chosen.

In view of the possibilities described above, the use of 3D technologies in heritage conservation and restoration and in Fine Arts has become increasingly common and some of the leading international museums have 3D lasers and printers. This is also the case with the main companies responsible for heritage conservation and those concerned with design or the production of sculpture.

The Fine Arts Faculty already has a 3D scanner, which is being used by members of the UCM-930420 research group (Techniques of Heritage Documentation, Conservation and Restoration) and the UCM-294 research group (Art, Science and Nature) for scanning three-dimensional objects. Both groups belong to the CEI Moncloa Campus Heritage Cluster. The proposal to purchase a 3D printer would thus allow us to extend the performance of the equipment already available and obtain pieces from which facsimiles of original items could be made.

The Sicnova Projet 1200 3D printer is a high-resolution model which includes a UV curing unit. With it one can obtain small, high resolution pieces quickly, making it ideal for the production of high quality facsimiles. Its purchase will be of interest to research groups working on subjects related to the study of Heritage, its Conservation and Restoration, creative art and the field of Palaeontology. It will also be useful to groups working in the area of industrial design, making it possible to obtain 3D prototypes from computer-generated models. There are, moreover, benefits for the Health Sciences, where the use of 3D printers to make implants and prostheses

is being studied.

Location of the equipment: Room S-16. Basement floor. Faculty of Fine Arts.

HIGH RESOLUTION GEOELECTRIC PROSPECTING UNIT APPLIED TO HERITAGE

Centimetre-scale high resolution geoelectric prospecting unit using resistance measurements which enables us to determine moisture content in porous media, monitoring the resistance of materials used in heritage items by passing an electric current through them.

This method is used mainly for architectural and archaeological heritage and for the conservation of mural paintings to detect damp areas where the substrate may become detached. Another important application is in determining how faults develop and how materials are altered in cultural heritage items and in geological heritage sites where the formation of tafoni, bees' nests and hollows is closely related to the presence of different levels of moisture. It thus has a wide range of uses in research into processes and causes and a very direct application in the conservation of heritage, which is of great interest to the companies in the sector.

This type of equipment does not exist elsewhere in Spain, as geoelectric units are mainly used for large scale geophysical prospecting but not for centimetre-scale high resolution prospecting, which is of special interest for studies related to cultural and geological heritage.

The equipment is stored at the Institute of Geoscience Petrophysics Laboratory (UCM-CSIC).

CLIMATIC CHAMBER WITH TWO INDEPENDENT LINES FOR TESTING CARBONATION AND SULPHATION

The acquisition of a climatic chamber which enables us to control temperature, humidity and CO_2 and SO_2 concentrations is of great interest for research into heritage conservation. The materials traditionally used for heritage items undergo deterioration because of the effects of the climate conditions in which they are located, this process being accentuated through atmospheric pollution by gases such as CO_2 and, above all, SO_2, which lead to damage caused by carbonation and sulphation. Many types of material, including stone, ceramics and metal, suffer deterioration because of these gases. Our architectural and archaeological heritage may be exposed to outdoor (façades of buildings, sculptures) or indoor (works of art or paintings in museums, cathedrals, caves, etc.) conditions and in the short, medium and long term this exposure can lead to pulverisation, fissures, corrosion, dissolution, or the formation of black coating, which it is important for us to be aware of before these objects are exposed to certain atmospheric conditions.

The chamber purchased caters for these three parameters and will allow us to model the effects of temperature, humidity and the major pollutants leading to the deterioration of materials, in order to establish appropriate measures to deal with the problem.

This also has a major application in the use of new products and materials to use in restoration work and even in new construction work, allowing one to introduce the most durable materials for aggressive environmental conditions. It also has an important use when establishing the most suitable conditions for the application of treatments to consolidate and protect these materials,

as their effectiveness may be influenced by the atmospheric conditions in which they are used.

The acquisition of this equipment allows us to conduct accelerated ageing tests for freezing-thawing, humidity-drying, thermal shock, carbonation and the effects of atmospheric pollution. It is an item of great value, enabling us to conduct various tests which are in great demand in heritage conservation studies by public bodies and by the companies in the sector.

Determining the behaviour of materials tested under different atmospheric conditions would enable us to quantify their long-term and short-term durability and establish their life cycle with a view to selecting the most suitable materials and products for each type of environment.

An important aspect is the use of this chamber to analyse the effectiveness of new treatments to consolidate and protect materials using nanotechnology. The effects of the carbonation process in nanoparticles of calcium and magnesium hydroxide varies according to atmospheric conditions and the mineralogical transformations occurring in the presence of CO_2 and its concentration are also different. Knowledge of these factors is of great interest when planning different heritage conservation measures.

The chamber is also useful for studying carbonation processes occurring in our natural and geological heritage, such as the formation of speleothems in caves. The ability to control relative humidity, temperature and CO_2 pressure in experimental studies would enable us to determine under what conditions one type of speleothem or another is precipitated, which is significant in paleo-climatic studies, as one can then deduce what climate changes occurred in the past and create predictive models.

The chamber is of interest for environmental geochemistry, as one can investigate CO_2 and SO_2 capture by certain materials and the capture of heavy metals according to atmospheric conditions.

The experimental work that can be carried out with this climate chamber to monitor polluting gases can provide valuable insights into the behaviour of materials on the macro-, micro- and nano-scale. These are of great interest in many fields of science and industry as the results can lead to patents, the creation of new products, the modelling of climate change, and financial savings because of the better selection of materials and products according to their durability in the atmospheric conditions to which they will be exposed.

Location of the equipment: Petrophysics Laboratory. IGEO. UCM-CSIC Combined Centre. Geological Sciences Faculty

Renewing the existing infrastructure in the Geological Techniques Research Support Centre and adapting it to Earth and Heritage Sciences

The main aim of this bid is to tackle the study and characterization of materials from any source from a multidisciplinary and global viewpoint, with special emphasis on geological materials and heritage. In some cases new equipment was needed (X-ray fluorescence equipment and fusion robot for the production of beads for X-ray fluorescence) and in others existing equipment such as the Mass Spectrometer with ICP ionization source had to be fully replaced or partially renewed via the purchase of accessories, such as the retrodispersion and cathodoluminescence detector for the scanning electron microscope, accessories for the liquid chromatography unit recently purchased by the centre, and new microwave reactors. The TOPAS software application

has also been purchased with 10 licences for quantitative studies of X-ray diffraction diagrams.

The research support centre currently receives samples from practically all the UCM Centres for Experimental and Health Sciences (Geology, Biology, Chemistry, Physics, Medicine, Pharmacy and Veterinary Science, among others), from other research support centres such as those for Archaeometry and Geochronology, and from other centres forming part of CEI Moncloa, such as the schools in the Technical University, centres belonging to the CSIC (ICTAN, CENIM, etc.), as well as a number of Spanish universities (Valencia, UNED, Salamanca, Castilla-La Mancha) and companies in various fields (ADIF, Repsol, etc.).

All the equipment is kept at the Research Support Centre for Geological Techniques, in one of the two laboratories in which the relevant techniques are applied: the Geochemical and Environmental Analysis Laboratory and the Geological Materials and Geotechnical Laboratory

Bruker Aurora ELITE Inductively Coupled Plasma Mass Spectrometer (ICP-MS)

This equipment replaces the Varian RedTop (Prototype) unit purchased in 2004, which does not meet the requirements for the type of sample and the applications currently demanded of the centre. Progress in ICP-MS technology in recent years has been exponential compared to other techniques, with improvements in ease of use, better performance and easier maintenance. This technique, which has become almost indispensable for the analysis of heavy metals at low levels of concentration, is applicable to nearly all types of sample for trace analysis in: geological samples, new materials, nano-particles, water (surface, subterranean and sea water and water for consumption), foodstuffs, vegetable and animal samples (blood, urine, entrails) with applications in geology, biology, heritage, environmental and forensic science, etc. The equipment can optionally be connected to a high performance liquid chromatograph (HPLC) unit, which is necessary for metal speciation analysis, requests for which are beginning to reach the centre. It will also be possible in the future to connect the unit to a laser ablation system, a tool which is very necessary for the analysis of solid samples in fields as diverse as geology, heritage, the environment or forensic analysis.

The company supplying the equipment has also agreed to include heating and air conditioning in the centre's white room and to a reduction in part of the cost of maintenance, etc.

This technique is not available in any other research support centre at the UCM and when it is operative it will be possible to meet the demands of a large number of researchers in a wide variety of fields, especially in applications related to Earth and Heritage Sciences.

Bruker S2 Ranger Energy Dispersive X-ray Fluorescence (EDXRF) unit.

Together with X-ray diffraction and electron microscopy (techniques which are already available at the centre), X-ray fluorescence is the research technique most extensively used in the characterization of geological samples and materials sciences. The possibility of the centre offering chemical analysis of solid samples using XRF constitutes a substantial and very necessary improvement in the service provided by the CAI to the wide range of users who see the centre as a reference laboratory for the analysis of samples in the fields of Earth and Heritage Sciences. This equipment complements the most accurate and precise techniques for chemical analysis currently available at the centre (ICP-OES and ICP-MS), allowing it to offer a much wider range of chemical analyses. It also allows us to analyse solid samples directly without digesting them,

greatly simplifying the preparation of samples and saving a considerable amount of time.

Katanax X-ray Fluorescence Bead Preparation Equipment

The preparation of beads is necessary for quantitative analysis using X-ray fluorescence or ICP spectrometry. Hitherto it was only possible to use compressed pastilles, which gave semi-quantitative results. The use of beads in the preparation of samples for XRF provides more uniform samples, leading to a substantial reduction in analytical errors. It is essential to minimize errors in the analysis of heterogeneous substances such as geological samples, heritage items and materials in general, which are constantly being analysed in the centre.

The possibility of obtaining solutions of such fused substances enables us to analyse them using other techniques available in the centre, such as ICP spectrometry (ICP-OES and ICP-MS). These fusions are important in the case of heterogeneous samples and samples that require fusion because of their nature (e.g. slag) or because of the parameters to be analysed (e.g. silica in silicates).

Purchase of a Chroma CL2 retrodispersion electron detector and cathodoluminescence system to update and maximise the performance of the JEOL JSM-820 scanning electron microscope.

The update and performance improvement approved will lead to a renewal of existing scanning electron microscope technology, donated by the Ministry of Defence in 2010. With the additions and improvements made, this equipment meets the requirements for the sampling and other applications called for in the centre.

The technical specifications cover the facilities provided by the microscope (detector of secondary electrons and EDX) and offer improvements with the retrodispersion electron detector, allowing us to obtain compositional images, and colour cathodoluminescence, which offers a new analytical technique in the microscopy service available to users. The most important features of the equipment are the following:

Compositional images can be obtained from the detection of the retrodispersion electron signals. These images are fundamental for studies using scanning electron microscopy with geological samples and materials, whether they are fragments or specimens such as fine layers (a type of sample we cannot analyse adequately at present in the centre, although they are used commonly in Geology). At present the centre is experiencing heavy demand for retrodispersion electron analysis by users of the microscope, as they need to correlate data obtained using existing detectors with the information obtained from compositional images to characterize samples correctly. Images can be obtained from the detection of the cathodoluminescence signal using the Chroma CL2 cathodoluminescence system, which allows us to generate cathodoluminescence images in full colour. The use of this new detector with the microscope will allow us to offer a fundamental new research technique in Geology, Mineralogy, Materials Science and Semiconductor Engineering, as it will be possible to examine the internal structures of semiconductors, rocks, ceramics, glass, etc. with a view to obtaining information about their composition, growth and quality.

With the configuration we now have a broad spectrum service is guaranteed, as befits a centre supporting research of this kind. The range includes geological samples and heritage material, together with samples related to Materials Science and the Life Sciences.

The accessories were installed in the microscope unit in June 2014. The retrodispersion detector has been operational since it was installed and training in cathodoluminescence will be available from September.

Ancillary equipment to update and maximise the performance of systems for the preparation and chemical analysis of geological samples

The accessories purchased from Gomensoro will allow us to provide a quality service in line with the needs of researchers and other users, especially in the field of Earth and Heritage Sciences.

For the preparation of samples the centre has a Milestone ETHOS 1600 high-pressure microwave digester oven and for the digestion of natural samples we have purchased a complete set of digesters.

For the analysis of anions the centre had a Metrohm 881 IC pro Ionic Chromatograph and in this round of applications we have acquired a conductivity detector, rotor and dosing unit, plus the software needed to use them, with a view to improving the analysis of geological samples.

For the chemical analysis of metals the centre had a Spectro Arcos Optical Emission Spectrometer with an ICP (ICP-OES) excitation source and in this round we have acquired the accessories needed to work with hydrofluoric acid, in which geological samples can be digested. We have thus purchased a complete cyclonic system and an ultrasonic nebulizer, accessories which will allow us to increase the sensitivity of the technique and considerably reduce the time needed to carry out analyses and deliver results.

The accessories were installed in the relevant equipment in June 2014 and training in their use will be offered in July and September.

TOPAS software.

This software is needed for qualitative and quantitative analysis using the Rietveld crystalline and amorphous phase X-ray diffraction method. It has been installed on all the computers that already had the DRX EVA Plus software. 10 licences have been purchased, 5 of them for remote use.

In the second half of September training for users will be provided by Francesc Girard from the Rovira y Virgili University, who is a specialist in the technique.

Results

The Research Support Centre for Archaeometry and Archaeological Analysis has focused its activity on updating and maximizing the performance of Multi-channel 3D Georadar applications with antennas using frequencies of 200 and 600 MHz, with which one can locate anomalies that cannot be detected with single channel equipment, covering large areas in a short time. With GPR SLICE software we can obtain 3D blocks and 2D or Slice sections, and horizontal sections, at different depths, so that results can be interpreted and understood more easily. We have continued to use conventional single-channel georadar with antennas working at 250, 500 and 1000 MHz, in sites where their use was more appropriate. We have also acquired a Differential GPS to produce high-precision topography. As well as being a useful tool in itself, it has provided precise georeferencing of georadar procedures, so that the areas of prospection are perfectly referenced in the cartography of archaeological sites.

The acquisition and adjustment of multi-channel georadar and the relevant software and training in their use involve a high level of specialisation, it being one of the few units of this type currently operating in Spain. The differential GPS unit is latest generation and has provided fundamental support in the development of geophysical prospection.

ACTIVITIES CARRIED OUT BY THE ARCHAEOMETRY AND ARCHAEOLOGICAL ANALYSIS RESEARCH SUPPORT GROUP IN 2014

1- Attendance at Congresses and Scientific Conferences

- Invitation to attend the meeting on *"Revalorización de zonas arqueológicas mediante técnicas no destructivas"*. Organized by the Instituto de Arqueología de Mérida (CSIC) as part of the activities of the Extremadura-Alentejo Cross-border Research Network (Riteca), which has ERDF funding.

2- Acquisition of a GNSS precision topography system and training in its use

- The acquisition of the TOPCON GRS system by the UCM Campus of Excellence for the Archaeometry Research Support Group has involved appropriate training. The high-precision GNSS system is easy to use, either by itself for topography and site referencing or, as has been the case up to now, linked to the Multi-channel Georadar unit to reference its movements.

Course in the use of the Topcon GR5 GPS in the Complutense University

3- Course in handling drones and pilot's licence for documentation via Orthophotography

- The acquisition of a drone by the UCM Campus of Excellence for the Astronomy and Geodesy Departmental Section has enabled us to extend the use of this equipment to archaeological applications, such as the photogrammetric documentation of sites and monuments. To this end the Section arranged for the centre's technical specialist Javier Vallés Iriso to attend a course on

the handling of drones.

- The new regulations for piloting drones involve obtaining a pilot's licence for this particular type of work. Mr Vallés Iriso has completed the compulsory training and in early October he will take the exam to qualify him for handling these devices.

4- <u>Application of georadar to subsoil prospection in archaeological sites and its topographical referencing.</u>

- "Poblado de la Edad del Hierro del Cerro de la Mesa (Toledo). Activity corresponding to Project HAR2011-25191 of the National R&D Plan (MINECO). Lead researcher: Dr Juan Pereira Sieso (University of Castilla-La Mancha).

Application of 2D Georadar to the Cerro de la Mesa (Toledo) site and of the 600 MHz multi-channel Georadar antenna in the Visigoth necropolis at Ermita de la Vega (Guadalajara)

- Plot where the dolmen at Entretérminos (Madrid) was located. Service contracted by "RENO Arqueología" with the permission of the Madrid Autonomous Community.

- Roman camp at La Hinojosa (Guadalajara). Activity corresponding to the Plan for Archaeological Measures in Castilla-La Mancha 2014. Lead researcher: Emilio Gamo Pazos (Complutense University of Madrid).

- Celtiberian settlement at Los Rodiles and Visigoth necropolis at Ermita de la Vega (Cubillejo de la Sierra, Guadalajara). Activity corresponding to the Plan for Archaeological Measures in Castilla-La Mancha 2014. Lead researcher: Dr Maria Luisa Cerdeño Serrano (Complutense University of Madrid).

- Iberian period settlement and necropolis at Jutia (Albacete). Activity corresponding to the Plan for Archaeological Measures in Castilla-La Mancha 2014. Lead researcher: Dr Susana González Reyero (Institute of History. CSIC).

- Roman settlement at Sisapo (La Bienvenida, Ciudad Real). Activity corresponding to Project HAR2012-34422 of the National R&D Plan (MINECO). Lead researcher: Dr Mar Zarzalejos Prieto (UNED).

- Visigoth necropolis at Arroyo de La Pila (Almadén, Ciudad Real).). Activity corresponding to Project HAR2012-34422 of the National R&D Plan (MINECO). Lead researcher: Dr Mar Zarzalejos Prieto (UNED).

Application of multi-channel georadar with 200 MHz antenna and differential GPS in the area of the dolmen at Entretérminos (Madrid)

Action	Actions planned within the Sustainable Mobility Cluster: • Electromobility. Models and Technologies. • Mobility. Analysis and modelling. • Information and Communication Systems in Transport. • Intermodality. Models and Technology

Objectives

The Sustainable Mobility Cluster aims to set up **research themes** in current areas in the development of more advanced, ecological, safe and accessible transport systems. The Moncloa Campus has important resources and research groups available in most transport related areas,

in the different modes of transport, and in their integration into the transport system, in terms of their efficiency, socio-economic and environmental impact, or telecommunications. The extensive history of the work in this area of the partner universities in the Moncloa Campus also includes having stable collaborative agreements with all the relevant companies in the industrial sector covering infrastructure, vehicles and energy services and transport technology.
Progress made towards objectives In September 2011, the Executive Committee of the Moncloa Campus agreed to include the activity of the new Sustainable Mobility Cluster in the Strategic Plan for Conversion to Campus of Excellence of the Moncloa Campus. This was launched following the proposal made by the cluster members from the *Instituto Universitario de Investigación del Automóvil* (INSIA) in the UPM affiliated to the *Escuela Técnica Superior de Ingenieros Industriales* and groups from the UCM.
Description of work completed and role of participants: Explanations are available in the individual action files.

Strategic Area	**SCIENTIFIC IMPROVEMENT**		
Action	**Partnership agreement between the TRANSyT Centre for Transport Research (UPM) and the Research Group "Transport, Infrastructure and Territory"(UCM)**		
Cluster	Sustainable Mobility		
Action Areas	Scientific Improvement / Transfer		
Partners	UPM, UCM	**Other entities**	
Start Date	June 2012	**End date**	2017
Location	*Escuela de Ingenieros de Caminos, Canales y Puertos* [*School of Civil Engineeringt*] (UPM) and *Faculty of Geography and History* (UCM)		
Person(s) Responsible for Action	Andrés Monzón de Cáceres (UPM) and Javier Gutiérrez Puebla (UCM)		
Contact Data (mail/tel...)	UPM: 91 336 5373 andres.monzon@upm.es UCM: 91 394 5949 javiergutierrez@ghis.ucm.es		
Contact person for service request or webpage where applicable	http://www.transyt.upm.es http://www.ucm.es/tit		
Infrastructure involved	The TRANSyT library, mobility and transport databases and meeting room are available to the partners. The Research Group "Transport, Infrastructure and Territory" mobility and transport databases are available to the partners.		
Action Description and Rationale	The general aim of the agreement is to regulate the collaboration between the two groups, to facilitate the development of joint activities within the framework of the Sustainable Mobility Cluster.		

Objectives:	- To participate in national and international R&D projects and programs. - To generate Doctoral Theses

International Aspects:
The two partners are members of international research networks. In 2013 the project "INSIGHT. Innovative Policy Modelling and Governance Tools for Sustainable Post-Crisis Urban Development" received funding from the EC 7th Framework Program

Results:

R&D projects with the collaboration of more than one group in the Cluster:

Project Title: INSIGHT. Innovative Policy Modelling and Governance Tools for Sustainable Post-Crisis Urban Development
Funding: EC 7th Framework Program
Project dates: 2013 - 2016
Cluster Participants include: *TRANSYT (UPM)* and *Grupo Transportes, Infraestructuras y Territorio (UCM).*

Project Title: Spillover Effects of transport infrastructure (SPILLTRANS)
Funding: MICINN. *Plan Nacional de I+D+I*
Project dates: 2012-2014.
Cluster Participants include: TRANSYT (UPM) and *Grupo de Economía del Transporte y las Infraestructuras* (UCM).

Project Title: TRANSBICI – Behaviour and modelling of cyclist demand: transition to a cyclable city
Funding: MICINN. *Plan Nacional de I+D+I*
Project dates: 2011-2013.
Cluster Participants include: TRANSYT (UPM) and *Grupo de Economía del Transporte y las Infraestructuras* (UCM).

Project Title: HABIT. Habit and Inertia in mode choice behaviour: a data panel for Madrid.
Funding: MICINN*. Plan Nacional de I+D+I*
Project dates: 2011-2013.
Cluster Participants include: TRANSYT (UPM) and *Grupo de Economía del Transporte y las Infraestructuras* (UCM).

Project Title: DESTINO Developing methodologies to evaluate the economic impact of transport systems through interregional input-output tables
Funding: Ministerio de Fomento *(Convocatoria 2008).*
Project dates: 2009-2012.
Cluster Participants include: TRANSYT (UPM) and *Grupo de Economía del Transporte y las Infraestructuras* (UCM).

Project Title: TRANSPORTRADE
Funding: Comunidad de Madrid (*Convocatoria Redes de investigación 2007*)
Project dates: 2008-2012.
Cluster Participants include: TRANSYT (UPM) and *Grupo de Economía del Transporte y las Infraestructuras* (UCM).

Strategic Area	**SCIENTIFIC IMPROVEMENT**
Action	Actions carried out by INSIA
Cluster	Sustainable Mobility Cluster (CMS)
Action areas	Research, technological development, postgraduate teaching
Location	CAMPUS SUR UPM. INSIA.
Person responsible for action	Francisco Aparicio Izquierdo
Contact Data (mail/tel...)	francisco.aparicio@upm.es / 913365304
Contact person for service request or webpage where applicable	José María López Martínez Josemaria.lopez@upm.es
Infrastructure involved	**TEST BANK FOR HYBRID ELECTRIC CONFIGURATIONS**
Action description and rationale:	Design of hybrid traction configurations for heavy duty vehicles using software simulation tools requires validation of models in a test bank. This test bank allows components to be tested separately or as a complete system, optimizing energy flows and therefore the real application in the vehicle. This method allows the correction of design faults before the solutions adopted are implemented in the real vehicle. To our knowledge there are no other similar test banks currently in use in Spain as heavy duty vehicle hybridization is still at a very early stage. The rationale for this action is: • The need to validate design and development and thus establish the technological concepts and criteria to enable progress in future developments linked to electric and hybrid vehicles in an urban context. • To quantify the environmental impact of the mobility of this type of vehicles in an urban environment through testing and to cover safety-related legal aspects.

Objectives:

- To research into the applications of specific technologies to hybrid propulsion with heat engine and with electric only propulsion.
- To develop or contribute to developing hybrid and electric vehicles for special uses.
- To contribute to the drawing up of new international rules and regulations applicable to these vehicles.
- To offer training for engineers and other professionals involved in new technologies and vehicle use.

Use of human, material and economic resources:

- All the resources are made available from the partner universities' own resources.

International aspects: Information on the work of the testing bank within the international groups in this knowledge area with INSIA staff participation. ERMES, HDH, ECTRI. Participation in European projects.
Expected impact: Taking into account the growing importance of the demonstrators, tests, etc. and heavy duty vehicles in the future H2020, this test bank may lead to increased participation in European level projects. Reinforcement of the INSIA research area related to new propulsion systems. Increased company demand for tests on hybrid and electric propulsion systems for heavy duty vehicles. Contribution to the improvement and optimization of the systems and components involved. Increased understanding of new propulsion systems applied to heavy duty vehicles.
Related publications citing CEI Campus Moncloa: -

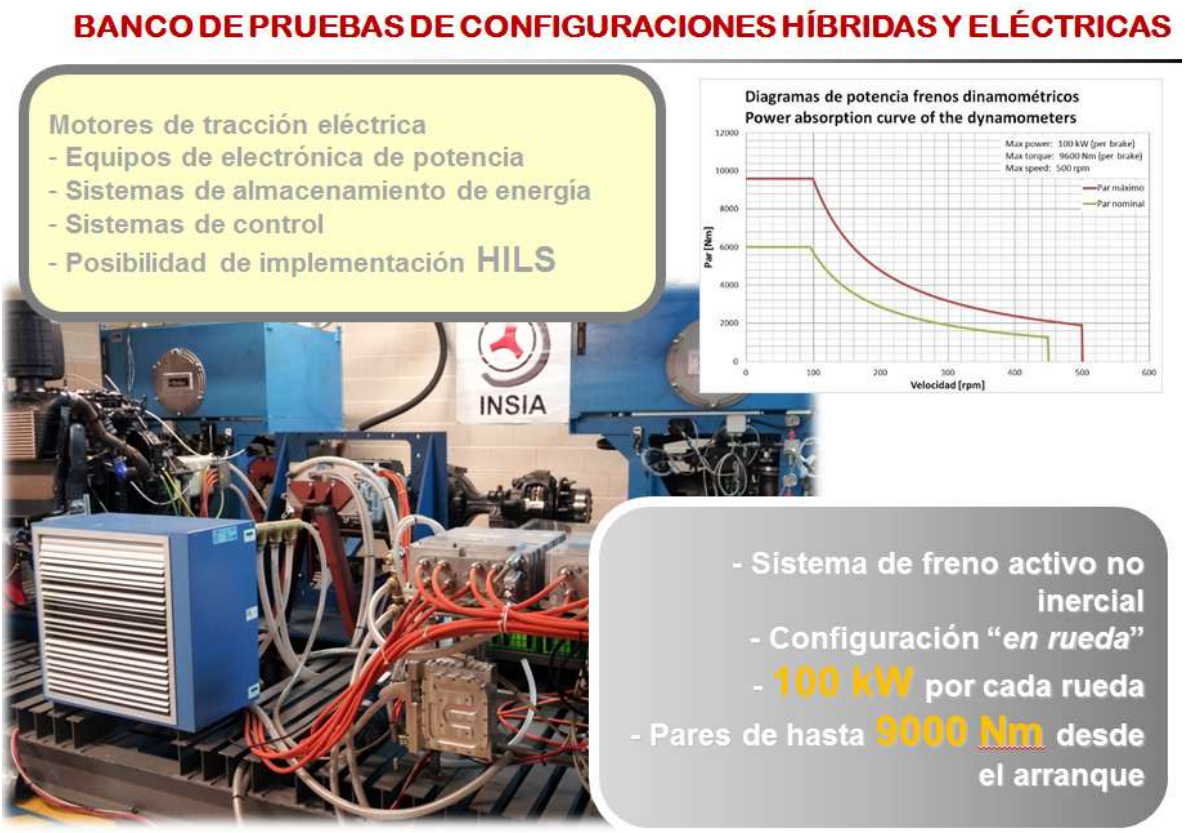


Figure 1 Characteristics of the test bank and general overview

Strategic Area	**SCIENTIFIC IMPROVEMENT**		
Action	Actions implemented by Visual Telecommunication Applications Group in the Technological Support Network for Mobility Control, Management and Traceability.		
Cluster	Sustainable Mobility (CMS)		
Action Areas	Research, technological development and transfer, and postgraduate teaching		
Partners	UPM, UCM, CSIC	**Others**	
Start date	2012	**End Date**	N/A
Location	E.T.S.I. de Telecomunicación (UPM)		
Person Responsible for Action	José Manuel Menéndez		
Contact Data (mail/tel...)	jmm@gatv.ssr.upm.es		
Contact person for service request or webpage where applicable	Nuria Sánchez (nsa@gatv.ssr.upm.es) Juan Torres (jta@gatv.ssr.upm.es)		
Infrastructure involved	- Cooperative service provision platform with capacity to integrate new types of sensorization, advanced processing and communications starting with the latest developments in the field of Intelligent Transport Systems. - Intermodal transport management platform for smart cities. - Mobility monitoring system for urban and interurban routes via Computer Vision and LIDAR systems		

Objectives:

- To carry out transversally based quality research into areas including sensorization, intelligent processing and communications for other actions. This aim includes:
  - Use of new devices for infrastructure sensorization (motes, lighting sensors…) and development of the corresponding algorithms.
  - Design of communications architecture and interface implementation to allow reliable data transfer between different entities in the same cooperative system.
  - Advances in data fusion and behavioural analysis areas: sensor networks and intelligent processing.

- To promote cooperative systems and the potential impact of services based on this technology on the area of efficient, safe, sustainable and accessible mobility.
- To carry out quality research and technological innovation from an integral and transversal viewpoint in the area of inter- or multi-modal transport; to achieve optimization and sustainability in different transport modes, to improve energy efficiency and reduce emissions and environmental impact. This aim includes:
  - Developing citizen service provision systems which boost intermodality and efficient consumption of natural resources, promoting the use of electric vehicles and reducing congestion.

- Developing technology transfer activities in the above areas.

- Developing post graduate activities: Quality Master and Doctoral programs.

Use of human, material and economic resources:

- Technical coordination for the real deployment of 7 cooperative services in different environments (motorways in Spain, Portugal, Germany and Greece) within the framework of the FOTsis European project. Some of these aim to improve various mobility related aspects in sections with high density traffic.
- Subcontract in the INNPRONTA Ciudad 2020 project to carry out design and development tasks for:
    - A Virtual Intermodal Centre for monitoring mobility in smart cities.
    - Services intended for city dwellers using *smartphones* and on-board devices for information exchange with the city manager. These services include an intermodal eco-preferred route planner and include the use of bicycles, public transport and electric vehicles.
    - Monitoring tool for particular infrastructure points using Computer Vision in relation to traffic parameters, detection of available parking spaces, incident detection, monitoring pedestrian crossings and cycle lanes.
- Developing a smartphone application within the HABIT project (Habit and Inertia in mode choice behaviour: a data panel for Madrid).
- Contributing to the proposed 'Master in Sustainable Mobility' with 60 credits for research.
- Active participation in the TG Mobility in ECTRI (European Conference of Transport Research Institutes), with attendance at various meetings organized in Brussels.
- Preparation of a proposal for the Call FP7-SST-2013-RTD-1 – OPTICITIES (Optimise Citizen Mobility and Freight Management in Urban Environments) designed to develop and implement new information services for users of any intermodal transport network and other supporting goods transport activities. Consortium Agreement initiated on approval. Expected project start date: October 2013. The technical coordination of the project, once it is underway, will correspond to the GATV.
- Active participation in national and international standardization bodies: i.e. standardization groups (AENOR CTN159, CEN TC278 WG1 [ISO TC204 WG5], CEN TC278 WG15, CEN TC278 WG16 [ISO TC204 WG18], ETSI ITS)
- Continuation of the tasks associated with the WePark project, development and testing of systems for the automatic detection of available parking spaces in controlled environments. The implementation involves the application of advanced techniques for image processing and integration of contextual information.
- Participation in the dissemination activities proposed in the DECOMOBIL project, intended to provide support and knowledge acquired in new types of sensorization, advanced processing, communications and HMI interface development with a view to safer and more intelligent mobility.

International Aspects:

Our participation in various European projects related to the Action Aims, in the HUMANIST Virtual Centre of Excellence created from the network of excellence (NoE) with same name, in various groups for European level standardization and in ECTRI Technical Groups, ensures the visibility of the results generated by the research activity undertaken within the Visual Telecommunication Applications Group (GATV) in the UPM.

Expected impact:

- Recognition of the GATV members as experts in cooperative systems designed to improve mobility in cities and reinforcement of the group research activity in the Intelligent Transport Systems (ITS) and Smart Cities sector.
- Participation in new national and European projects to guarantee the financial sustainability of the research group.

Strategic Area	**SCIENTIFIC IMPROVEMENT**		
Action	Application of research results to improve efficiency, safety, sustainability and accessibility of mobility in transport.		
Cluster	Mobility Cluster		
Action Areas	Teaching improvement/ Scientific improvement/ Transfer/ Integrated Social Campus		
Partners	UPM, UCM	**Others**	
Start Date	2012	**End Date**	2013
Location	Faculty of Physics, Optics Department,		
Person Responsible for Action	Eusebio Bernabeu Martínez		
Contact Data (mail/tel...)	ebernabeu@fis.ucm.es/+34 91 394 45 53		
Contact Person for service request or webpage where applicable	Eusebio Bernabeu Martínez *www.**ucm**.es/info/**aocg**/*		
Infrastructure involved	Faculty of Physics. Faculty of Optics and Optometry		
Action Description and Rationale:	The Complutense Group for Applied Optics (AOCG/UCM) is a recognised research group in the UCM Department of Optics. Its action framework is research in applied optics with emphasis on instrumentation, metrology and precision optics. The main action areas are sectors including machine tools, mobility, safety, emergencies and defence.		

Objectives:

- To implement a technological support network for other actions.
- To engage in high quality research.
- To research into improvements in mobility in terms of safety, efficiency, sustainability and accessibility.
- To encourage technological transfer activities in the above areas.
- To implement the Master in Sustainable Mobility

International aspects:

- Tourism of Things for Smart Destination
  - Contract type: INNPACTO-2012: "ToT" IPT-2012-0563-1000
  - Funding Source: Ministerio de Ciencia e Innovación
  - Participants: EZENTIS, DYLVIAN, FERROVIAL, WINHOTEL, PRODIGY CONSULTORES, BANKOI, CICTOURGUNE and UCM
  - Duration: 2012 - 2015
  - Lead Researcher: Eusebio Bernabeu
- Development of strategic research and engineering roadmaps in Systems of Systems Engineering and related case studies
  - Contract type: Grant agreement no: 288274
  - Funding Source: EU (European Union)
  - Participants: Steinbeis Innovation gGmbH, Karlsruher Institut fur Technologie, Commissariat à l'énergie atomique et aux energies, IFM Education and consultancy services alternatives, Fraunhofer-Gesellschaft zur foerderung der angewandten forshung E.V. Prodigy Consultores, UCM.
  - Duration: 2011 - 2013
  - Lead Researcher: Eusebio Bernabeu

Expected impact:

Institutional collaboration with the Ayuntamiento de Palma de Mallorca within the framework of the project INNPACTO-2012: "ToT" IPT-2012-0563-1000 for the use of CMOS cameras to control mobility of pedestrians in built up areas and vehicular traffic in critical situations.

PROJECTS

Contract/Project Title: Grabación y Lectura de Encóderes Anulares "FORE"

Contract type: IPT-020000-2010-9

Funding Source: Ministerio de Ciencia e Innovación

Participants: RofinBaaselEspaña,S.L.,FagorAutomation,Sdad.Coop.Ltda., UCM

Duration: 2010 -2013

Lead Researcher: EusebioBernabeuMartínez

Contract/Project Title: PhotonicsTransceiver

Contract type: Art. 83 LOU

Funding Source: Ministerio de Ciencia e Innovación

Participants: Alter, ESA, UCM

Duration: 2010 - 2013

Lead Researcher: Eusebio Bernabeu Martínez

Contract/Project Title: Photonic transceiver for secure space communications

Contract type: Art. 83 LOU

Funding Source: Tecnológica Ingeniería, Calidad y Ensayos, S.A.

Participants: Alter technology, UCM, Lidax, ICFO, UPV-ITEAM, Emxys, ThalesAlenia

Duration: 01/05/2008 - 01/09/2013

Lead Researcher: Prof. Eusebio Bernabeu

Contract/Project Title: EffiCity

Contract type: INNPACTO EFFICITY IPT-440000-2010-16

Funding Source: Ministerio de Innovación y Ciencia

Participants: MaatgNozzle. SL, I2Cat, Indal, Ekoplc, UCM.
Duration: 2010 - 2013
Lead Researcher: Eusebio Bernabeu
Development of strategic research and engineering roadmaps in Systems of Systems Engineering and related case studies"
Contract type: Grant agreement no: 288274
Funding Source: EU (EuropeanUnion)
Participants: Steinbeis Innovation gGmbH, KarlsruherInstitutfuerTechnologie, Commissariat al energieatomique et aux energies, IFM Education and consultancy services alternatives, Fraunhofer-Gesellschaftzurfoerderung der angewandtenforshung E.V ProdigyConsultores, UCM.
Duration: 2011 - 2013
Lead Researcher: Eusebio Bernabeu
Project Title: **Asesoría en la construcción de superficies progresivas con superficies polinómicas**
Funding Source:IndizenOpticalTechnologies
Duration: 1/1/2010-31/12/2014
Lead Researcher: D.José Alonso Fernández, Juan Antonio Quiroga Mellado
Project Title: **Tourism of Things for Smart Destination"**
Contract type: INNPACTO-2012: "ToT" IPT-2012-0563-1000
Funding Source: Ministerio de Ciencia e Innovación
Participants: EZENTIS, DYLVIAN, FERROVIAL, WINHOTEL, PRODIGY CONSULTORES, BANKOI, CICTOURGUNE, UCM
Duration: 2012 - 2015
Lead Researcher: Eusebio Bernabeu
Project Title: **Desarrollo de sistema submarino autónomo, (UAV, Autonomous Underwater Vehicle) para detección temprana de vertidos en líneas submarinas.**
Contract type: INNPACTO AUV IPT-2012-0157-31000
Funding Source: Ministerio de Ciencia e Innovación
Participants: CEPSA, IXION, UCM
Duration: 2010 - 2013
Lead Researcher: Gonzalo Pajares Mantinsanz
Project Title: **Vialidad de sensores basados en tecnología de fibras ópticas para la detección de fugas de hidrocarburos en tuberías enterradas y /o submarinas"**
Contract type: ART 83 LOU
Funding Source: Compañía Española de Petróleos S.A. (CEPSA)
Participants: CEPSA, UCM
Duration: 2010 - 2013
Lead Researcher: Gonzalo Pajares Mantinsanz
Project Title: **Grabador fotolitográfico de elementos ópticos difractivos con moduladores espaciales de luz**
Funding Source: Ministerio de Ciencia e Innovación
Duration: 01/01/2012-31/12/2014
Lead Researcher: Luis Miguel Sánchez Brea
Project Title: **Computación científica con Python para módulos de evaluación continua en asignaturas de ciencias aplicadas.**

Funding Source: Universidad Complutense de Madrid
Duration: 01/10/2012-31/11/2013
Lead Researcher: Luis Miguel Sánchez Brea

Strategic Area	**TEACHING IMPROVEMENT AND ADAPTATION TO EUROPEAN HIGHER EDUCATION AREA**
Action	A2. ADAPTATION OF TEACHING INFRASTRUCTURE TO EHEA DEPLOYMENT
Objectives	To adapt teaching facilities to face the new challenges of the EHEA and the internationalization of the Campus by: 1. Adapting classrooms, areas and furnishings to provide more flexible mobile learning areas to facilitate student –teacher interaction. 2. Incorporating new teaching tools and networking to enable online access to teaching material and class work. 3. Setting up multimedia classrooms enabling real time online teaching and establishing a teaching network between the Campus institutions and other Spanish and international universities.

Progress towards objectives

All the actions described in the aims are already underway

Description of work carried out. Governance structures created

a) Campus Virtual.

With the aim of updating the MOODLE educational platform, the most used on the Virtual Campus (UCM), Version 1.9 was updated to Version 2.6 during the academic year 2013-2014. This new version offers improved possibilities for collaborative and group work, allows file drag and drop and more user-friendly management of each teacher's whole course load.

To facilitate teacher use of the platform, Virtual Campus Coordinators and other trainers have been trained in each Faculty, so that they in turn can train the teachers in all the Faculties and Centres. In addition, a new Videoconference service (*Big Blue Button*) has been implemented, which can be added to each of the courses taught using this virtual platform. The advantage of this new system is the self-management of the videoconferences by the teacher in question, as this add-on facility is available as another block, and allows teaching sessions to be recorded and used for a wider audience and/or transcribed as required.

b) Distance learning classroom:

- The installation and roll out of the *Aula de Telepresencia-1* in the central Campus building (Edificio Jardín Botánico), with the material required to record and upload master classes, tutorials, seminars, generate multimedia content for the open learning campus and use video conferencing. The equipment includes:
    - Interactive projector, hybrid surface 16:10 format whiteboard for projection and

writing, rack and table connection boxes, wall-mounted SONY EVI camera with ¼"color CCD image sensor.

- Computer for teacher, with keyboard and wireless mouse with laser sensor.
- Computer for capture devices, HD/SD capture device, VGA-DVI capture device, production and live streaming software, 8x8 VGA and audio stereo matrix switcher, cordless microphone system, flexible microphone, 3-input stereo mixer, 2 compact HiFi loudspeakers, audio mixer, control system, rack.
- Rack and wall installation, connection boxes, cables and all other elements required.

- Installation of *Aula de Telepresencia-2* in the auditorium in the UCM Chancellor's Office to record and upload master classes, tutorials, seminars and generate multimedia content material for the *Campus Virtual* etc. The corresponding equipment includes:
  - 3 wall-mounted robot cameras
  - Laptop with camera and software, memory card, dazzle DVD recorder.
  - Installation and cabling required for the equipment and network access points.
- Acquisition of portable material to enable videoconferencing and streaming or live video broadcasting, standard quality, which can be used in the distance learning classrooms or other areas of the campus as required:
  - Laptop, HSDS capture device, VGA DVI capture device, broadcasting software
  - Hand held and lapel microphone, boom, closed headphones, camera tripod with case, 9"LCD monitor, case with 3 quartz lights and tripod

  The portable equipment is kept in the Faculty of Education.
- Acquisition of portable equipment for high video recording and viewing for use in the distance learning classrooms or as required in other university areas:
  - Canon 14x optical zoom HD digital camcorder, tripod adapter, charger with 2 batteries, memory card and carrying case
  - HD video and audio recorder
  -

c) Massive Open Online Courses (MOOC)

The MOOC Implementation Strategy was started in November 2013. Among other actions, the Digital Content Production Unit was set up in 2014, with its main functions the editing and postproduction of digital learning units from its site in the Jardin Botánico building where the mobile recording equipment and the whole sound system are located.

The Call for MOOC 2014 was published in July 2014, inviting innovative teaching project proposals for MOOC. In this Call, one of the participative modes for support funding was a) *Apoyo Campus de Excelencia Internacional de Moncloa (CEI)*. The aim is to boost or reinforce teams from this University (UCM) and the UPM to devise MOOC where the learning goals are preferably related to one of the thematic clusters of the Campus : Global Change and New Energies, Materials for the Future, Agri-Food and Health, Innovative Medicine, Cultural Heritage, and Sustainable Mobility.

a) Actions in areas including the Library, Multimedia, on-line Campus Virtual and Area Management and the implementation of a Collaborative Environment.
The Library is a support service for learning, teaching and research in the University, and uses appropriate software tools to manage and update information on all library books and document collections, and to manage user loans. Among all the Library management programs, the catalogue search facility is of particular importance, to ensure that all users can access the resources available. To ensure this, given the increasing demand, a new server was acquired to improve response times and update the Millenium Library management software to the latest version to improve catalogue and indexing performance.

During 2012 the equipment needed to improve the services as described above was acquired and installed and is currently providing the services as planned. .

Most significant results

- The Virtual Campus, after the MOODLE platform update, has maintained the same growth rate as in previous years. In the academic year 2013-2014 there were 5318 online courses available and by October 2014 this number had already risen to 5991 online courses in MOODLE 2.9. The number of online courses on the SAKAI platform also increased to 356.
- The *Aula de telepresencia 1* offers its services to 6595 teaching and research staff on the Moncloa Campus, and may be booked by any university teacher or administrative staff. The devices are controlled by a wireless touch screen with a user friendly menu which allows the movement of the teacher in the classroom and the independent use of the equipment.
- The *Aula de telepresencia 2,* has enabled more than 50 sessions where some 200 hours of activities have been recorded and streamed.
- From October 2013 to September 2014, the Streaming service has covered 15 institutional events and 38 non-institutional ones, allowing the university community to disseminate academic activities but also relevant debates on university life.
- To date, 4 pilot MOOC have been run and another 6 are underway. In addition, the results of the Call for MOOC show 10 high quality courses selected, including two within the support framework *Apoyo al Campus de Excelencia de Moncloa*, involving teachers from the UCM and UPM.
- Improved performance of the applications and user response time.
- New infrastructure for installing the research website *Portal del Investigador*, Academic Management and on -line Administration.

Strategic Area	**TEACHING IMPROVEMENT AND ADAPTING TO THE EUROPEAN HIGHER EDUCATION AREA**
Action	A7. IMPROVING THE DATA NETWORK AND COMMUNICATIONS

Objectives	To provide improved accessibility and broadband to enable the production of new services and applications for the university community and the integration in new R&D initiatives at a national and international level.

Progress towards objectives

In April 2013, the Chancellors of the three public universities in the Ciudad Universitaria **–José Carrillo** (Complutense), **Carlos Conde** (Technical University) and **Juan A. Gimeno** (UNED) **–** signed an agreement by which the three universities would share the use of the optic fibre installation and cables of each one, so that each institution would be able to extend its own academic communication network efficiently and economically. The agreement signed was to include the UNED in the project.

Granting mutual rights to use communications infrastructure means a **significant saving for each of the three institutions** with centres and services scattered and mixed in adjacent areas in the Ciudad Universitaria: they thus agree to the regulated use of existing and future installations independently of which university these belong to. The agreement means an **important improvement in the speed and capacity of the academic and scientific communications network used by university staff with connection to REDiMADRID, the Madrid region's high capacity network,** and also to the national RedIRIS network; both these networks allow 10 Gb connections, an essential requisite for some of the ambitious R&D projects which are underway in the three universities.

In terms of the actions in areas of network infrastructure and security, this description can be subdivided into three action areas:

1. Enterasys security console. The new user license has been in operation since late August 2012, with maintenance renewal.
2. Acquisition of Palo Alto firewall. The new equipment is installed and operative since February 2013.
3. Laying of fibre optic cables:
    - Connection with the Museo del Traje (Costume Museum): The work was completed in 2012 and the connection has been available since then.
    - Updating of the fibre backbone in various buildings (Faculty of Physics, Biology-Geology, Philology, Edificio de Alumnos and Colegios Mayores) to allow future 10Gb connection. Completed 2012.
    - Connection to the Rediris Nova point located in the CIEMAT. Finished in 2012, this is waiting for RediMadrid to activate the connection nodes.

Most significant results

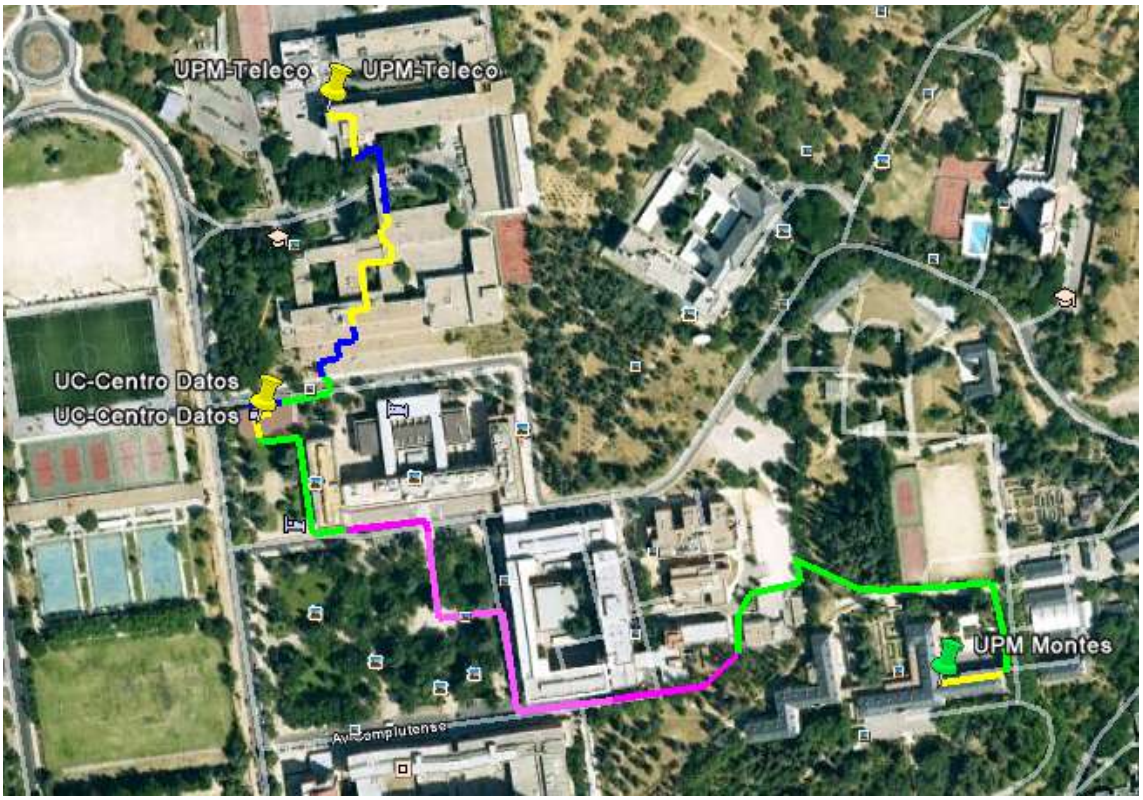
- Protection from attacks and other security problems in servers and work stations. Average 1000 attacks logged per month.
- Improved broadband management allowing greater granularity in policy definition.
- Eliminating points of failure in old non-maintained equipment.
- New simpler and more secure SSL VPN which allows its use to be extended to students and enables the use of scientific software licenses and provides the university

community with access to off-campus bibliographic resources.

- Network connection from the Museo del Traje building enabled since October 2012.
- Connection of UCM network to 10G fibre.

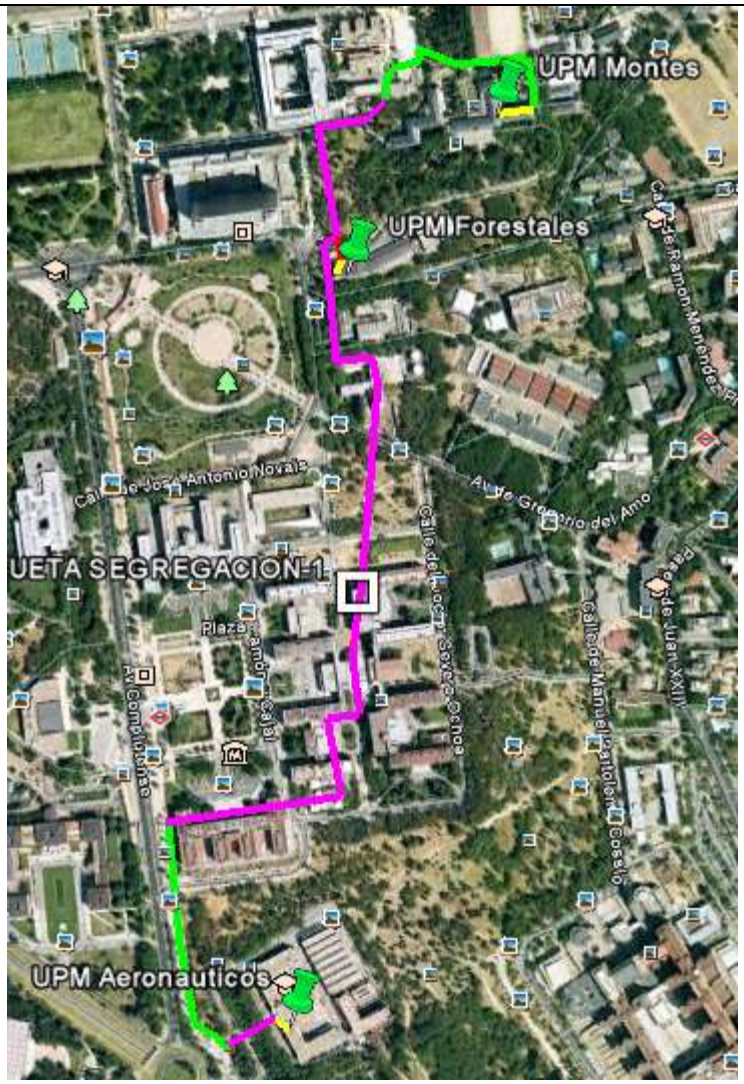
The graphics below show the optic fibre route between the UPM facilities

Section 1: ETSI Telecomunicaciones-ETSI Montes



This section runs from the Escuela Técnica Superior de Ingenieros de Telecomunicaciones to the Escuela Técnica Superior de Ingenieros de Montes passing through the Data Centre. A 64 single-mode optical fibre cable was installed in this section because of the different types of cable installations.

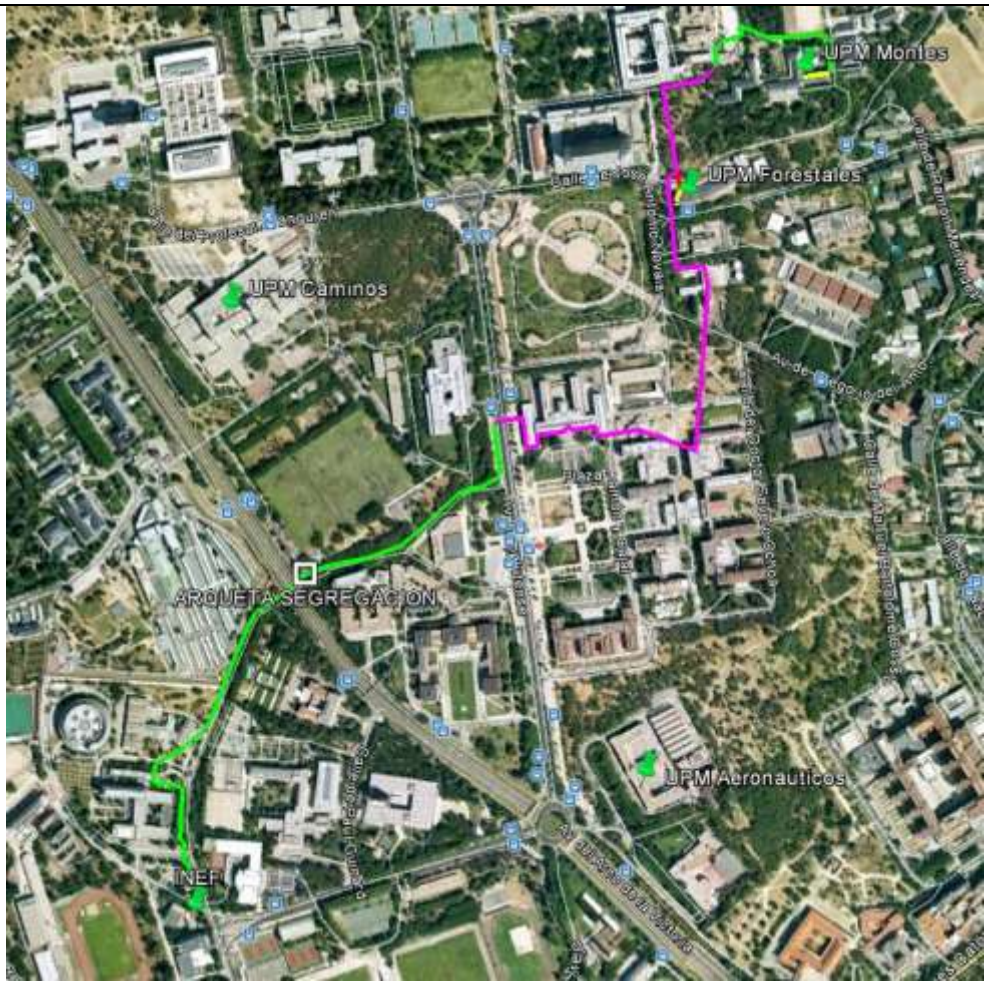
Section 2: ETSI Montes- ETSI Aeronauticos



This section runs from the Escuela Técnica Superior de Ingenieros de Montes to the Escuela Técnica Superior de Ingenieros Aeronáutico. A 64 single-mode optical fibre cable was installed in this section because of the different types of cable installations.

The 6 mts. of new underground cabling in sub-section 47, were carried out to join up the existing underground cabling and the gallery of the ETSI Aeronáuticos. The construction of an 80 x80 manhole was also needed as well as access for the new cabling to the manhole and gallery.

Section 3: ETSI Montes- ETS de Arquitectura



This section in fact runs from the INEF passing through the Escuela Técnica Superior de Arquitectura to the *arqueta de segregación-1*. A 64 single-mode optical fibre cable was installed in this section because of the different types of cable installations.

The 8 mts. of new underground cabling in sub-.section 52, were laid to join the existing underground cabling in sub-section 50 to sub-section 53. The construction of an 80 x80 manhole was also needed as well as access for the new cabling to the gallery.

Strategic Area	**TEACHING IMPROVEMENT AND ADAPTATION TO THE EUROPEAN HIGHER EDUCATION AREA**
Action	A3 and A4. INTERNATIONAL POSTGRADUATE SCHOOL CAMPUS OF MONCLOA (EIP-MONCLOA)
Objectives	Creation and implementation of an International Postgraduate School CEI Campus Moncloa with the goal of making the campus an international benchmark in training. The specific objectives are: 1) promoting the development of interuniversity master's degrees, particularly between UCM and UPM, rationalizing the two universities' offers with better use of resources; 2) increasing the number of foreign students in master's programs; 3) promoting the exchange of students and teachers with other national and international universities, as well as increasing the number of foreign teachers working on the Campus

Description of work completed

The EIP is a university structure dependent on both universities in charge of the academic organization of the activities involved in university master's degrees, own degrees, continuing education and the organization of special courses, seminars, meetings and all other training activities envisaged in the future. This school formally exists since 21 May 2013, with the signing of a protocol by both universities to set it up; masters courses and other studies will commence during 2014-2015.

The EIP integrates UCM and UPM academic bodies which are competent in this type of education and it is responsible for their promotion, as well as for encouraging inter-university actions and collaboration and the participation of public and private institutions and companies.

The EIP aims to play a key role in the construction of training and teaching activities of the CEI Moncloa Campus, which should be in close connection with the R & D campus on the one hand, and with society in which it is integrated and which it serves, on the other.

The lines directing the activity of the school are based on teaching and research activities of all members of both universities forming the CEI Moncloa Campus, as well as its collaboration with partner organizations, institutions and companies that guarantee social projection of the campus activities in terms of the development and consolidation of human capital at CEI campus Moncloa.

As for the criteria for admission to EIP-Moncloa studies the following have been considered:

Source: The proposal of master's courses must come primarily from the Professors of the various schools and faculties of the two universities or clusters of CEI and should always have the approval of schools and faculties involved in them.

Excellence: Measures by National and Foreign Evaluation Agencies. Requirements for student acceptance and teachers' CVs.

Internationalization: Origin and / or trajectory of students and teachers, international interest in the content, working language, etc.
Effective use of the campus: Campus synergies should be exploited, which in particular implies the involvement of faculty and staff from both universities (UCM / UPM and other partner institutions), and infrastructure and resources of both should be used (classrooms, workshops, laboratories).

Relations outside the campus: It is also essential to have the support and participation of businesses, organizations and foundations outside the campus to provide not only financing (in the form of agreements, collaborations or contracts) or know-how and expertise, but also essential contacts with the business world and society in general and the projection of students' professional future.
Content: They must display novelty (interdisciplinarity, opportunity, emerging technologies, new uses of existing technologies, future projection). Exploitation of niches not yet occupied at the UCM, UPM, national and international levels.
Methodology: Innovation should not only be in content but in methodology, technology, modularity, coaching, etc. to make the offer attractive to potential students.
Temporal projection: Vocation of continuity over time and the possibility of extension to PhD if appropriate, etc.

Demand: It is essential that the proposed degrees should present grounded expectations about real demand, both for pre-registration and effective enrolment; the latter should in no case be below 20 students.
The EIP has established its headquarters on the ground floor of the Multipurpose Building 2 belonging to the Complutense University of Madrid. On this ground floor, spaces allocated to the school are the following: a first hall (SI) of 172.25 m2 with the main entrance and common areas with access to the restrooms, and other units whose use is still to be determined, adjacent to a patio of 167.7 m2; a second area (SII) of 37 m2, which will house the working area or collective offices and the main hall (SIII) of 292.50 m2, with the classrooms, meeting room and some offices; and finally an auditorium (SA) of 307 m2. It is currently under construction, which will not prevent the masters courses offered in this academic year to start in the Colleges and Schools promoting them.
The UCM-UPM Joint Masters already integrated into the EIP-Moncloa framework and taught since the 2013-2014 academic year are:

- Master's Degree in Animal Production and Health.
- Master's Degree in Computational Statistical Processing of Information.
- *Máster Erasmus Mundus: Nuclear Fusion Science and Engineering Physics.*

Moreover various academic committees have been organized; they are formed by members of different UCM and UPM faculties and schools and are responsible for the design of new masters that meet the EIP-Moncloa criteria and that could be offered for the 2015-2016 academic year.
Those in charge of organizing the following masters are noteworthy:

- Interuniversity Masters in Cultural Heritage Management of the 21st century: management and research. A committee composed of specialists in Cultural Heritage Management, both the UCM and the UPM have been holding meetings to agree on and design the academic character of this new Master, with the intention of it starting during

2015 -2016. To date, it has been connected with various departments (32 in total), which based on the specialization, projects and publications of its members, may participate in teaching. Currently the approval documents of each of the 16 Boards of the Faculties or Centres with respect to their participation in the Master are available. The Master degree report will soon be submitted to the ANECA, as well as the UCM / UPM Agreement for its implementation.

- University Master's Degree in Disaster Management (pending approval by ANECA).
- Interuniversity Master's Degree in Strategy and Technology for Development: Cooperation in a Changing World.
- Interuniversity Master's Degree in Management of High Mountain Areas.
- Interuniversity Master's Degree in Materials Engineering.

In addition, CEI clusters continue to work on the design of other official master courses tailored to the specialization of each of their areas, which may also be integrated into the EIP-Moncloa.
Before starting EIP activities, joint educational activities have been carried out during the summer courses of the Complutense and Politécnica universities in 2012, 2013 and 2014.

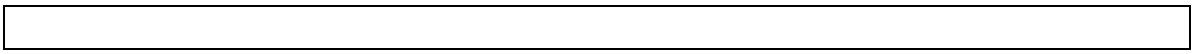
This is the list of the courses resulting from this collaboration:

- Satellite observation and natural hazards
- 21st century Astrophysics: the science of the universe
- The Challenges of Cities of the Future
- The crossroads of energy: Energy of the Future.
- Iberoamerican Cultural Historical Heritage
- Progress in biomedical imaging: from the laboratory to the clinic
-
- The course was sponsored by the CEI Moncloa (UCM / UPM) and other entities collaborated, such as CNIC; Madrid-MIT M + Vision Consortium; CIBER-BBN; RETICS (ISCIII); Consorcio Comunidad de Madrid I2M2.
- The course consisted of a review of the latest progress in biomedical imaging in three fields of biomedicine: cardiovascular disease (myocardial infarction, fibrosis, pulmonary hypertension), brain pathology (stroke, diseases related to memory processes) and vascular inflammation (atherogenesis, immunity).
- It was attended by a total of 50 people, including students and teachers.
- Technologies applied to food quality and safety
- Extreme events in a changing climate
- The cities we want

For the 2014-2015 academic year, the EIP has published a call for grants for associated studies. The call, which will be resolved shortly, has an allocation of about € 175,000 that will cover the tuition fees of the successful students.

Previously, Campus Moncloa was part of the sponsorship for the ninth call of the Sino Spanish program of scholarships for students from China, aimed at students from technical universities for postgraduate stays at the UPM during the academic year 2013/2014.

Thanks to these grants, 13 Chinese students enjoyed their academic year at different UPM schools.



Strategic Area	**TEACHING IMPROVEMENT AND ADAPTATION TO EUROPEAN HIGHER EDUCATION AREA**
Action	A8. Improvement of the María Zambrano Library (BMZ)
Objectives	Since the BMZ opened in 2011 work has continued on the facilities to increase services offered to users

Progress towards objectives

The re-inauguration of the BMZ, planned for October 2013, after the second phase of CEI Actions, represents a real milestone for the CEI Moncloa Campus. The space made available to the public to date in the BMZ has allowed:

- Improved student/study space ratio for the Law and Philology Faculties which both have large student numbers. As well as this, it has meant a significant increase in the study spaces on offer in the UCM libraries and in general terms on the Moncloa Campus as a whole, offering direct service to the university community of around 65,000 students and more than 5,000 teachers and researchers.

- The BMZ will be the library of reference on the Moncloa Campus, and in terms of surface area and provision of study spaces is the largest university library in Spain and one of the most important in Europe.
- The improvements in the library service are outstanding. Concentrating the main part of the collections in highest demand in both Faculties into the BMZ allows these to be made available in spacious areas with easy user access, while the rest of the collections still in their original locations are those less requested by users, therefore meaning a reduced staff workload. This selection of library stocks, arranged for easy user access, plus the implementation of a user friendly, efficient self issue/return facility, guarantee a quality service and are a considerable improvement over the previous situation.

- It also means a significant improvement in special extended seasonal opening hours on the Moncloa Campus. Since it was opened in February 2011, the BMZ has played a major role in the policy of extended library opening hours on the Moncloa Campus during exam periods. This had been repeatedly requested by students and is achieving increasingly improved satisfaction ratings in user surveys due to the comfortable and spacious facilities. These results are expected to improve considerably after the Actions implemented in the Project Phase 2.
- Two-fold impact on improved teaching and research. First, the spaces freed in the original teaching centres can now be re-used by these Faculties for teaching and research. Secondly, the improved offer in the BMZ itself of study spaces and areas adapted to different needs will have very positive repercussions on learning and research and will encourage library use. Recent studies show that students who use libraries obtain better academic results and have a lower dropout rate (http://www.jisc.ac.uk/publications/browsetypes/reports.aspx). It has also been shown that the students who are prize-winners at the end of their degree course are among the most active library users.
-

Description of work carried out and role of the partners.

The Moncloa Campus includes the UCM Library, the largest in Spain, with around 3.000.000 volumes, the second most important historical collection after the Biblioteca Nacional and digital collections comparable to other top ranking world-class university libraries. One of the Strategic Actions of the Moncloa Campus has been the creation and implementation of the María Zambrano Library (BMZ), a new library facility intended to concentrate library stock previously scattered in different locations (collections from the Law Faculty Library and the Philology Faculty Library in Faculty Buildings A and B) to allow a reallocation of space for teaching and research in the Faculties of Law, Philology, Geography and History. The BMZ offers its services to all the

surrounding teaching centres, including various UCM Faculties and UPM Schools including the School of Civil Engineering (Escuela Técnica de Ingenieros de Caminos, Canales y Puertos). The design of the BMZ is configured as an advanced Resources Centre for Teaching and Research (CRAI). Its freely accessible rooms, with their perfectly finished architectonic features and a surface area of around 8.000 m² with a capacity of 2.200 study spaces adapted to different needs (group work, study, research and reading), completely justify its use as a library area without further delay, even though the overall original plan for the BMZ has not been fully implemented. This included plans to create, under the Philology and Law buildings, large research rooms, meeting rooms and work areas and for large scale stacks with the potential capacity for housing all UCM library stocks.

The Actions carried out to date for the opening and improvement of the BMZ within the CEI framework were in two phases:

First phase

The first Action, included in CEI 2009, was implemented in late 2010 /early 2011:

- Acquisition of furnishings for the entrance hall, group workroom, much in demand as a result of the implementation of the EHEA, and one of the two large reading rooms, intended for the Philology Dept Library Collection, with the creation of 1500 study spaces and shelving for more than 90,000 volumes.
- Provision of 46 computers.
- Implementation of wifi infrastructure for 100 laptops.

This enabled the inauguration of the library in February 2011. The entrance hall and group work room were designed for shared use of BMZ partner libraries. The entrance hall includes a large exhibition space which housed several successful exhibitions and cultural events during the *Semana de la Ciencia* and the *Semana Complutense de las Letras.*

Second phase

The CEI 2009 and 2010 envisaged additional Actions, carried out in 2013 and which include:

- Acquiring new furniture for opening to the public for the first time the other large reading room (Sala Rafael Ureña), intended to house the Law Library Collection. This meant the number of study spaces in the BMZ increased to a total of around 2200.
- Moving the collections from the reading room of the Law Dept Library (15,000 volumes) and of the high demand items from the Philology Library (60,500 volumes) to their respective new Reading Rooms.
- Implementing a modern radiofrequency system (RFID) to manage the stocks, loans and security of the collections.
- Reinforcing the electrical and IT infrastructures and the wifi connection in the BMZ.

Most significant results

- Increased number of study spaces used on the Campus.
- Improved number of study spaces/student ratio on Campus.
- Improved efficiency of the user and lending services in the partner libraries.
- Recovery of areas currently used by library services for teaching and research.
- More efficient deployment of user help resources.
- More efficient extended library opening library hours.

International aspects:

- The BMZ will become a university library of reference in Spain and on the international scene, offering facilities and services similar to the best European university libraries.
- The offer of study spaces for researchers reinforces the existing availability in other libraries on the Moncloa Campus and provides appropriate study and research areas for international students and researchers, whose numbers have already increased and are expected to continue to grow as a result of the internationalization efforts of the UCM and UPM, with the backing of the CEI.

Area	**TEACHING IMPROVEMENT AND ADAPTATION TO EUROPEAN HIGHER EDUCATION AREA**
Project	A26 SCHOOL OF GOVERNMENT
Objectives	Two primary objectives: First, to connect with the tradition of the most prestigious schools of government in order to update course materials and teaching approach to align them with the current demands of society. Second, to combine the excellent work done at the CEI Moncloa, mainly in the field of technology, with the potential of the UCM and UPM in the public management field, with particular emphasis on technology management.

Progress towards goals

- The protocol creating the School of Government (SG) was signed during the meeting of the Governing Council of 21 May 2013. This protocol appointed a joint commission to define the syllabus and set up the School of Government.

  Members from the UPM: Vice-Chancellor for Academic Planning and Doctorate Studies Jorge Pérez Martínez, or his delegate - University Professor - School of Telecommunications Engineering, and Antonio Hidalgo Nuchera - University Professor - School of Industrial Engineering.

  Members from the UCM: Vice-Chancellor for Postgraduate Studies and Continuing Professional Development María Esther del Campo García, or her delegate. University Professor. Faculty of Political Sciences and Sociology. Director of the University Institute of International Studies (ICEI), and Emilio Cerdá Tena. University Professor. Faculty of Political Sciences and Sociology. The Director of the International School of Postgraduate Studies, Antonio Dobado, is also a member of the commission.

- The preliminary report on the creation of the SG, “CEI Campus Moncloa School of Government: Strategic Decisions", was prepared.

Description of the projects completed and the role of each partner

Building on the document that laid the foundation for the School of Government of the UCM-UPM Campus of International Excellence, which was approved by the Ministry during the 2010 call for proposals, the commission created to set up the SG held a number of board meetings and encounters with various national and regional organisations, and commissioned a study on the leading European and US Schools of Government. Based on these, the Commission took a number of strategic decisions relating to the final profile of the project. These decisions, though not yet fully implemented, are summarised below:

I. PROFILE OF THE SCHOOL

The SG will essentially be an academic institution dedicated to training professionals for

leadership roles and public management in the broadest, most current, sense. A number of research lines, consultancy and technical assistance (terms of reference - ToR) activities will also be implemented, together with surveys, studies and dissemination activities - in short, a series of activities aimed at developing the ability of the School to help improve public life, while opening additional funding channels. The School will not, in principle, cater for students wishing to prepare for public service exams, although the possibility of participating in the continuing professional training of public servants attached to different government offices with *ad hoc* or more general courses cannot be ruled out. In this regard, the SG does not intend to follow the European model, where such schools come under government control and are an extension of the administration. However, given our starting point, neither can we adopt the US model, in which SGs are very much market- and civil society-oriented. Inevitably, the School's initial funding and resources will be provided by public institutions (mainly the UCM and the UPM), although our long-term aim is to become self-funding. This would enable the School to work on demand, invoicing both public and private organisations or individuals, and cooperating with different government offices that are, after all, the source of both potential academic staff and funding, and of professionals looking for the kind of training the School can offer.

The main objectives of the SG can be summarised as follows:

- To offer comprehensive, top level, multidisciplinary training that is of great practical value in the sphere of top management positions in public and private institutions, and in the preparation, assessment and implementation of policies, infrastructures and public services.
- To drive research, studies and projects involving the most relevant problems encountered in these areas.
- To disseminate the most relevant results of research conducted both in the SG and in other excellence centres.
- To be recognised as a meeting place and forum for discussing the most pressing problems in these areas.

II. THEMATIC AREAS

In a world of head-long privatisation dominated by the concept of curtailing government influence, a growing number of public assets, services, spaces, etc., are coming under private or public/private management. As a result, many aspects of public governance fall beyond the scope of the administration as a whole (state, autonomous community, community, or local) and have to include the activities of private companies or other civil society associations. Globalisation has also meant that national autonomy and the development of national policies is increasingly conditioned by variables controlled beyond national borders, meaning that public management must include the need to manage the impact that such external pressures have on domestic affairs. Knowledge and technology are held to be the main assets of any advanced society, and determine its structure and its social, political and economy dynamism. As such, particular attention must be paid to these elements when providing state-of-the-art training in public management This is what we mean when we say that the main theme of the SG is public management in the broadest, most current, sense. Based on this idea, on the strong points of both universities and the findings of the study on leading SGs, we have initially divided public management in five thematic areas

The SG's priority thematic areas are:

- *Political management, public management and public policies*
- *Knowledge society and governance*
- *International economy and development*
- *Technology, innovation and enterprise management*

These thematic areas will focus on sectorial policies in which both universities specialise, such as energy, telecommunications, urban planning and housing, the environment and rural affairs, social policies, research and development (R&D), transport, etc.

III. ORGANISATION MODEL

In view of the complexity of the project, the organisation model must be open and flexible, capable of adapting to and consolidating its activities in a context dominated by increasingly rapid social, economic and political change. In addition to a management team and administrative staff that must be directly linked to the CEI School of Postgraduate Studies, the SG will be organised into four or five main teaching and research units. These will either correspond to each of its thematic areas or to the list of strategic programs offered (masters or other qualifications), and based on these, each will implement its interdisciplinary activities, its relationship with the departmental structure and with the different centres established in each university, and will recruit and manage their academic staff.

The first issue to clarify in terms of academic staff is their relationship with the academic structure of both universities (centres, department, institutes, etc.). Initially, the SG will engage the services of lecturers and professors attached to either university, although in the long-term it will gradually build up a core, full-time academic staff that will be complemented by visiting lecturers or out-sourced teachers. In all cases, the academic staff of the SG will be recruited according to the rules of the centre, and the teaching, research and consultancy requirements to be fulfilled.

IV. TRAINING PROGRAMS

Because of its profile, the SG will offer courses aimed at professionalising the many different aspects and forms of public management in government, and exploring the different ways in which these can be approached. Accordingly, the core academic catalogue will consist of a few interconnected multidisciplinary *master's* (between one and three) aligned with the excellence criteria of *Erasmus Mundus* (namely, strict acceptance requirements, 120 credits, international students, partly taught in English, etc.) that implement in a flexible way the aforementioned thematic areas.

Other types of courses are also planned, including:

- *Mid-Career programs*, lasting less than one year, that systematise in a highly concentrated and practical manner the basic content of the above master's. These could take the form of proprietary degree courses.
- *Executive programs*, of variable duration (from two days to several months) that would mainly focus on broadening or updating the existing skills of professionals working in different spheres related to public policies and policy management, including innovation and technology management in a globalised world. These could take the form of tailor-made courses for certain public or private institutions.
- *Specialisation programs* that, though in some cases are part of a master's course, will also be available as a separate program.

In any event, all forms of teaching must prioritise flexibility to ensure that high standards and professionalism come together to enable each student to personalise their study program. Another general feature will be a basic, applied teaching approach: the final objective does not depend on the amount or depth of the knowledge transmitted, but on teaching a broad range of skills and resources. Case studies could be the preferred teaching approach. Finally, we consider that e-learning should be used essentially to complement classroom teaching and to help transmit knowledge.

V. STUDENTS

The course will be designed, generally speaking, with two types of students in mind.

- Postgraduate students, possibly with some work experience in the public sector, seeking the training required for these types of jobs.
- Professionals already employed in the public sector who wish to update their knowledge base or skills.

The SG will consider entering into agreements with institutions or organisations for whom *ad hoc* executive course can be designed. The student profile, however, will be further defined by the requirements established for each course on offer.

VI. RESEARCH, CONSULTANCY AND TECHNICAL ADVICE

The comparative analysis of leading schools of government worldwide has shown that all complement their teaching activity with research and the transfer of knowledge to the public and private sectors. The SG, therefore, will give excellence research groups from both universities the chance to channel their public management-based research, studies and projects through the School. The SG, in turn, will benefit from the prestige of such academics and researchers,

Research, mainly in its applied form, will take the form of funded research projects relating to the key thematic areas of the School. Consultancy and technical advice services will be offered within the framework of decision-making processes in both public administrations and private organisations. Likewise, specialised advisory services related to the formulation, implementation and evaluation of public policies will also be offered.

VII. DISSEMINATION

We consider it necessary to gradually introduce the technical tools and organisational structures needed to publish studies and research conducted both by the SG and by third parties. This will also provide a means of consolidating the SG as a meeting point for debating the most pressing issues relating to the topics taught in the School. These activities will include series of conferences and seminars that will be a part of the School's annual program of activities, and an attractive webpage.

VIII. SOCIAL RESPONSIBILITY

The overriding goal of the School of Government is to train students to become fully accomplished professionals, capable of working anywhere in the world, with a highly developed sense of their own responsibilities as both citizens and professionals. The SG aims to help drive and promote social responsibility in companies and organisations.

Our ongoing challenge lies in conducting quality research to build a body of knowledge relevant

to CSR, thereby enriching social debate on these issues and providing the kind of education that will help individuals create and manage companies capable of generating economic wealth that is in turn reinvested in social and environmental improvement.

We must, therefore, approach our contribution from this perspective: to develop the kind of knowledge that forms a well-grounded, solidarity-based commitment to justice and the human development of society.

IX. FUNDING

The SG is made possible by funding received through different grants awarded to the Campus of International Excellence and from contributions made by both universities that, for the time being, also include facilities, resources and academic staff. Our long-term goal, however, is to be practically self-sufficient, based on three fundamental sources of funds:

- Course fees paid directly by students or by their employer. Our executive and specialisation programs should be particularly lucrative.
- Public and private funding, either in return for specific research (article 83 of the Universities Act), or for the organisation of specific courses. It is important for the SG itself to instigate and manage research projects and the corresponding budget, although this does not preclude providing incentives for the researchers involved.
- Donations for creating university chairs or specific programs.

In order to benefit from these funding sources the SG, by creating a reputation for efficiency and high standards, must become a guarantee of quality. To achieve this it is essential to have good professionals who are committed to the School; students who feel valued, challenged, respected and supported; and sponsors convinced that joining their name to that of the School is a good investment. We have also considered the possibility of creating, from the start of the project, a Unit focussed entirely on obtaining funding by developing and complementing the above channels.

Most significant departures from the scheduled course of the project

There have been no significant departures from the objective and schedule. There has, however, been a certain delay in reaching the second objective. This, though, is not only justified, but even in the best interests of the projects, since the best criteria for associating, selecting and implementing what both universities and other CEI-Moncloa centres can contribute to the SG must be based on a well-defined project that has been tested against other excellence SGs and backed by the institutions consulted.

Proposal for corrective measures

Focus more on the search for partners and sponsors, and in establishing agreements with other SGs worldwide.

Field	**TEACHING IMPROVEMENT AND ADAPTATION TO EUROPEAN HIGHER EDUCATION AREA**
Project	A27 INTERNATIONAL CENTRE FOR LATIN AMERICAN STUDIES (CEI-AL)
Objectives	The aim of the project is to create an International Excellence Centre that will set new standards for the development, transmission and management of knowledge relating to Latin America and become an internationalisation and knowledge transfer tool for the CEI-Moncloa. It is hoped that the Centre will inspire and motivate both universities to further improve research and postgraduate teaching of Latin American topics.

Progress towards goals

- The protocol creating the Centre for Latin Amercian Studies was signed during the meeting of the Governing Council of 21 May 2013. This protocol appointed a joint commission to define the syllabus and set up the CEI-AL.

Members from the UPM: Vice-Chancellor for Academic Planning and Doctorate Studies Jorge Pérez Martínez, or his delegate. University Professor. Department of Economy and Agricultural Social Sciences. School of Agricultural Engineers, and Carlos Mataix Aldeanueva. Tenured University Lecturer. Director of the Centre for Development Cooperation of the Technical University of Madrid (UPM). School of Industrial Engineering.

Members from the UCM: Vice-Chancellor for Postgraduate Studies and Continuing Professional Development, María Esther del Campo García, or her delegate. University Professor. Faculty of Political Sciences and Sociology. Director of the University Institute of International Studies (ICEI), and Heriberto Cairo Carou. University Professor. Dean of the Faculty of Political Sciences and Sociology. The Director of the International School of Postgraduate Studies, Antonio Dobado, is also a member of the commission.

- The preliminary report on the creation of the CEI-AL was prepared. "International Centre for Latin American Studies: Strategic decisions".

- The first CEI-AL seminar ""Una mirada hacia América Latina" (Focus on Latin America) was held on 18 June 2013 in the Paraninfo hall of the main building of the UPM.

Description of the projects completed and the role of each partner

The Centre for Latin American Studies (CEI-AL) is part of the Moncloa Campus of International Excellence (CEI) formed by Madrid's Complutense (UCM) and Technical (UPM) universities. The aim of the Centre is to become an academic centre of reference for all issues relating to Latin American societies. Both universities have a long tradition of Latin American studies and many

top-level professors and researchers.

The CEI-AL hopes to achieve a level of academic excellence through its research, teaching, and both area-specific and case studies. In the area of research, the Centre will establish systematic cooperation mechanisms with institutions and companies operating in or with Latin America as a means of ensuring that much of the research conducted will both contribute to the teaching activities and have a practical analytical application.

Collaboration with top level Latin American teaching staff, researchers and research centres.

The Centre will establish permanent research and researcher training collaboration agreements with leading Latin American centres and with Latin American study centres of high standing in other countries. Depending on the available resources, the Centre with attempt to attract the best Latin American academics and other experts in the field of Latin American studies.

Multidisciplinary centre

Today's societies are becoming increasingly complex, as are their most pressing issues. The CEI-AL, therefore, will take a multidisciplinary approach to topics addressed in the teaching, research and studies areas. This decision is based as much on methodological convictions - complex subjects require a broad-ranged approach - as on the firm belief that such an approach will maximise the synergies arising from the collaboration between the two universities in which the Centre is based, one of which specialises, *inter alia*, in Humanities and Social Sciences, and the other in Applied Sciences. In today's world, many problems must be approached simultaneously from both fields of knowledge. Consider, for example, the economic, biological, social and political problems facing the traditional agricultural methods used by native populations in Latin America; or the issue of climate change, sustainable development, or the diversification of energy sources in this region.

Core activities: doctorate programs, research, and the preparation of reports and studies.

The core activity of the Centre will consist of a top quality, highly flexible, modular doctorate program focussing on a concise series of Latin American issues. The doctorate program is also linked to the topics that will form the focus of the Centre's research lines, in which both academic staff and doctorate students will participate. The research undertaken during the doctorate program will contribute towards the reports and studies conducted by the multidisciplinary teams. Other *ad hoc* postgraduate courses linked to both the core doctorate programs and demand from both public and private institutions will also be offered, as explained in section 4 of this document. The following 4 subjects will form the core of the Centre's teaching activity, and are in turn divided into different topics that include, but are not limited to, the following:

- ***Democracy and government reform***
    - Cultural differences and social inequalities.
    - Political integration of indigenous peoples and ethnic identity processes.
    - Traditional societies and their response to modernity and postmodernity. Racial intermingling and global culture.

- Cultural heritage. Latin American culture and thought in the 21st century.

- ***Science and technology for Development***
  - Information technologies for development.
  - Renewable energies.
  - Biotechnology and development.
  - Regional and urban planning.
- ***Sustainable development***
  - Agriculture and development.
  - Climate change.
  - Biodiversity.
  - Sustainable management of natural resources and global economy.
  - Mining and development.
- ***Globalisation and integration***
  - Democratic security.
  - Supranational integration processes.
  - North-South and South-South relations.
  - Cross-border migration.
  - The Euro-American arena.

Organisation model

In view of the complexity of the project, the organisation model must be open and flexible, capable of adapting to and consolidating its activities in a context dominated by increasingly rapid social, economic and political change. In addition to a management team and administrative staff that must be directly linked to the CEI's School of Postgraduate Studies, the CEI-AL will be organised into four or five main teaching and research units. These will either correspond to each of its thematic areas or to the list of strategic programs offered (masters or other qualifications), and based on these, each will implement its interdisciplinary activities, its relationship with the departmental structure and with the different centres established in each university, and will recruit and manage their academic staff.

The first issue to clarify in terms of academic staff is their relationship with the academic structure of both universities (centres, department, institutes, etc.). Initially, the CEI-AL will engage the services of lecturers and professors attached to either university, although in the long-term it will gradually build up a core, full-time academic staff that will be complemented by visiting lecturers or out-sourced teachers. In all cases, the academic staff of the Centre will be recruited according to the rules of the centre, and the teaching, research and consultancy requirements to be fulfilled.

1. **Training programs**

Because of its profile, the CEI-AL will focus on courses related to the development, transmission

and management of knowledge rooted in Latin America. Accordingly, the core academic catalogue will consist of a few interconnected multidisciplinary *master's* (between one and three) aligned with the excellence criteria of *Erasmus Mundus* (namely, strict acceptance requirements, 120 credits, international students, partly taught in English, etc.) that implement in a flexible way the aforementioned thematic areas.

Other types of courses are also planned, including:

- *Mid-Career programs*, lasting less than one year, that systematise in a highly concentrated and practical manner the basic content of the above master's. These could take the form of proprietary degree courses.
- *Executive programs*, of variable duration (from two days to several months) that would mainly focus on broadening or updating the existing skills of professionals working in Latin America in different spheres. These could take the form of tailor-made courses for certain public or private institutions.
- *Specialisation programs* that, though in some cases part of a master's course, will also be available as a separate program.

In any event, all forms of teaching must prioritise flexibility to ensure that high standards and professionalism come together to enable each student to personalise their study program. Another general feature will be a basic, applied teaching approach: the final objective does not depend on the amount or depth of the knowledge transmitted, but on teaching a broad range of skills and resources. Case studies could be the preferred teaching approach. Finally, we consider that e-learning should be used essentially to complement classroom teaching and to help transmit knowledge.

Students

The course will be designed, generally speaking, with two types of students in mind.

- Graduate students wishing to specialise in one of the research fields pursued in the Centre.
- Professionals already employed in the region who wish to update their knowledge base or skills.

The CEI-AL will consider entering into agreements with institutions or organisations for whom *ad hoc* executive course can be designed. The student profile, however, will be further defined by the requirements established for each course on offer.

2. **Research, Consultancy and Technical Advice**

A comparative analysis of leading Latin American research centres worldwide has shown that all complement their teaching activity with research and the transfer of knowledge to the public and private sectors. The CEI-AL, therefore, will give excellence research groups from both universities the chance to channel their Latin America-based research, studies and projects through the Centre. The Centre, in turn, will benefit from the prestige of such academics and researchers,

Research, mainly in its applied form, will take the form of funded research projects relating to the key thematic areas of the Centre. Consultancy and technical advice services will be offered within the framework of decision-making processes in both public administrations and private organisations. Specialised consultancy services related to the Centre's core subjects will also be offered.

3. **Dissemination**

We consider it necessary to gradually introduce the technical tools and organisational structures needed to publish studies and research conducted both by the CEI-AL and by third parties. This will also provide a means of consolidating the Centre as a meeting point for debating the most pressing issues relating to Latin America. These activities will include series of conferences and seminars that will be a part of the Centre's annual program of activities, and an attractive webpage.

4. **Social responsibility**

The overriding goal of the CEI-AL is to train students to become fully accomplished professionals, capable of working anywhere in the world, with a highly developed sense of their own responsibilities as both citizens and professionals. The Centre aims to help drive and promote social responsibility in companies and organisations.

Our ongoing challenge lies in conducting quality research to build a body of knowledge relevant to Latin America, thereby enriching social debate on these issues and providing the kind of education that will help individuals create and manage companies capable of generating economic wealth that is in turn reinvested in social and environmental improvement.

We must, therefore, approach our contribution from this perspective: to develop the kind of knowledge that forms a well-grounded, solidarity-based commitment to justice and the human development of society.

5. **Funding**

The CEI-AL is made possible by funding received through different grants awarded to the Campus of International Excellence and from contributions made by both universities which, for the time being, also include facilities, resources and academic staff. Our long-term goal, however, is to be practically self-sufficient, based on three fundamental sources of funds:

- Course fees paid directly by students or by their employer. Our executive and specialisation programs should be particularly lucrative.
- Public and private funding, either in return for specific research (article 83 of the Universities Act), or for the organisation of specific courses. It is important for the CEI-AL itself to instigate and manage research projects and the corresponding budget, although this does not preclude providing incentives for the researchers involved.
- Donations for creating university chairs or specific programs.

In order to benefit from these funding sources the CEI-AL, by creating a reputation for efficiency and high standards, must become a guarantee of quality. To achieve this it is essential to have good professionals who are committed to the Centre; students who feel valued, challenged, respected and supported; and sponsors convinced that joining their name to that of the Centre is a good investment. We have also considered the possibility of creating, from the start of the project, a Unit focussed entirely on obtaining funding by developing and complementing the above channels.

CEI-AL seminar: "Focus on Latin America"

The seminar was attended by leading experts from influential Latin American institutions during the morning session, together with representatives from major Spanish companies with ties to Latin America. The sessions were organised around the following round tables:

ROUND TABLE: "Demands from Latin America: An institutional outlook"

Moderator: Rosa Conde (Centre for Constitutional and Political Studies)

Ramón Santos (Adviser to the Secretary of State for International Cooperation and Latin America)

Javier Quintana (Director of the International Latin American Foundation for Public Administration and Public Policies)

Ignacio Corlazzoli (Inter-American Development Bank)

Rafael Garranzo (Cooperation Director for Latin America and the Caribbean at the Spanish Agency for International Development Cooperation)

ROUND TABLE: "Spanish companies in Latin America: university-business synergies"

Moderator: Marisa Ramos (Conference of Ministers of Justice of Latin American Countries)

Emma Fernández (Director General, Indra)

Antonio Merino (Director of Environmental Study and Analysis, Repsol)

Arancha Díaz-Lladó (Director of Public Affairs, Telefónica Latin America)

Rafael Pérez (Managing Director, Global Strategic Accounts, International Organisations at Microsoft Corporation)

Most important results

The founding bodies were created.

The document defining the characteristics of the Centre, its doctorate and research program was prepared. This document will be used to present the Centre and seek additional sources of

funding, to recruit top-level teachers and attract future doctorate and master's students.
Use of human, material and economic resources Provisionally, the International Centre for Latin American Studies has been housed in the Finca Mas Ferré, ICEI building, Somosaguas Campus, UCM. Both the work of those involved and the material and economic resources have been mainly dedicated to establishing contacts and holding meetings with national and foreign institutions and in creating and organising the meeting of the agreement monitoring committee and the executive committee,

Strategic Area	**TRANSFORMING THE CAMPUS TO DEVELOP AN INTEGRATED SOCIAL MODEL AND INTERACTION WITH ITS LOCAL ENVIRONMENT**
Action	A10. International Visitors Reception Centre (CIVA) http://www.campusmoncloa.es/es/servicios/
Objectives	To set up a 'one stop' International Reception Centre for students and researchers arriving on Campus, offering information and possible solutions to their queries related to settling into the Campus.

Progress towards objectives

Design for the International Visitors Reception Centre.

Implementing the Project: Moncloa Campus Accommodation

Description of work carried out

Providing an integrated help desk for international students and researchers, offering the following services:

Before their arrival, they are offered information, advice and assistance with the official bodies responsible for the administrative aspects of recognition of academic qualifications, access regulations and information on obtaining an entry visa, where applicable, to facilitate the completion of all the entry requirements for the student or researcher arriving in the CEI.

On arrival in Spain, they are offered information and advice on available accommodation, managed by us through rented accommodation, university residences, partner residences or other options of interest.

To facilitate their stay in Spain, information is offered on legislation issues and administrative procedures and related paperwork.

To ensure their successful integration into the CEI, information is provided on the educational and research institutions which form part of the CEI.

Finally, with a view to facilitating recognition of studies completed in the CEI, a service is offered for the collection of the degree certificate or course diploma obtained, its legalization and forwarding to their home address.

In academic year 2013-2014 there were 13,028 international students enrolled in the UCM and UPM. This is an 85% increase over three academic years.
The number of international students accepted by the CEI Moncloa makes it essential to improve reception and integration services for these students on Campus and highlights the importance and relevance of the creation of the International Visitors Reception Centre.

Most significant results

International Visitors Reception Centre (CIVA)

With the Centre set up and running since January 2013, once the necessary work had been completed to provide suitable office space and technical facilities, international students now have a specialized reception centre available to facilitate their arrival on the CEI Moncloa Campus.

In the CIVA they can find a portfolio of services which attempt to satisfy their needs before, during and after their stay and provide them with specialist staff to answer their queries.

The new premises ensure:

Easy access by public transport.

Easy to find central Campus location, with clear signage.

Multiple help desk modes: face to face, by phone, by email and website, ensuring the best possible service.

Users have four computers available for internet access and most common software applications.

Accommodation Office

This office has become a reference point on Campus for finding accommodation. As a result of the different types of information and contact available (in person, Webpage, email and phone) the number of users has continued to grow with currently around 4000 requests for information per year.

Other points to note are that since January 2013, the Help Desk has handled 5562 face to face enquiries from Campus members; 984 by phone and email; there have been 70,174 Webpage visits, 809 messages on Facebook, with 615 followers, and 809 tweets on Twitter, with 456 followers.

Most significant results

International Visitor and Welcome Centre (CIVA)

Its effective operation started in January 2013, after completing the required adjustments regarding space and techniques; international students have a special welcome centre at the CEI Campus Moncloa.

At CIVA students will find a catalogue of services that aims to meet their needs before, during and after their stay, as well as specialized staff.

The new facilities will allow:

Easy access from all major public transportation.

A quick location, thanks to its central location within the Campus and street signage.

Multiple forms of assistance: in person, by phone, email and Web-specific, which will allow a better and more comprehensive service.

Users have available four computers for public use for access to the Internet and to the most standard office applications.

Accommodation Office

It has become a benchmark for the Campus when providing accommodation. Thanks to the various forms of information and contact (in person, own Website, email and phone) the number of users served has continued to grow and now stands at an average of 4,000 information requests per year.

In the academic year 2013-2014, 8,626 requests have been attended to, with 92,660 hits on its website, representing an increase of 55% and 32% respectively over the previous period.

Strategic area	**TRANSFORMATION OF THE CAMPUS FOR THE CREATION OF AN INTEGRAL SOCIAL MODEL AND ITS INTERACTION WITH ITS TERRITORY**
Action	**A12.** International Office for Communication and Knowledge Promotion of the Campus (OICD)
Objectives	To set up an office to coordinate and manage the Campus's communications activities towards the exterior and the activities for disseminating the knowledge generated on the campus, with the following specific missions: Promotion of the Campus's international profile. Coordination of the dissemination of its scientific output. Congress organization. Encounters with Nobel laureates. Campus radio and television (in relation with action A23)

Description of work completed.

- First Conference of the Moncloa Campus 23-25 February 2011.
- Visit by the Nobel prize-winner: Carlo Rubbia (Nobel Prize for Physics in 1984). *Institute for Advanced Sustainability Studies, Potsdam, Germany, CERN, Geneva, Switzerland.*
- Design and development of the Campus Moncloa website www.campusmoncloa.es
- Cei[nnova] conference held on 13 June 2011.
- Informative conferences on participation in EU projects.
- Scientific Outreach Awards CEI Campus Moncloa.
- Spirit encouragement Activities: Ambassadors for science and Researchers' Night.
- *MaterialsWeek (http://www.campusmoncloa.es/es/eventos/materialsweek/)* held on 26, 29 and 30 April 2013.
- Dissemination of scientific results through Redescubre (http://www.ucm.es/red.escubre) and Tribuna Complutense.

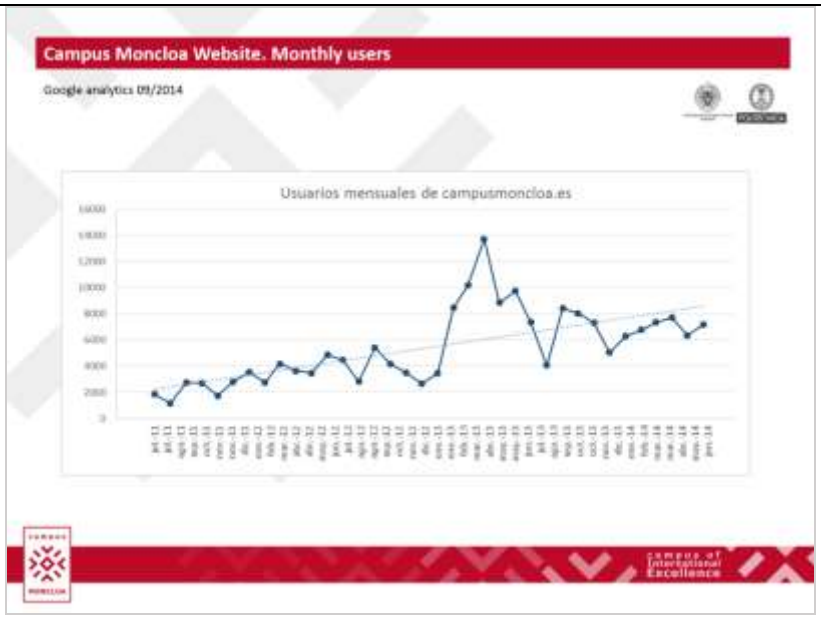
Website of the CEI Moncloa Campus: http://www.campusmoncloa.es

The website of the Moncloa Campus showcases the activity carried out on the Campus. It is the communications channel for interacting with potential or current users, namely students, researchers and institutions interested in the research activity that takes place at the Moncloa Campus.

Although it is true that at its launch the website was somewhat insubstantial, this lack of content has been gradually resolved in recent months, as can be seen in the following graph which shows a steady increase in the number of visits to the Campus website.


Campus Moncloa Website. Monthly page views
Google analytics 09/2014
Páginas visitadas mensuales de campusmoncloa.es
Campus of International Excellence


Campus Moncloa Website. Monthly visits
Google analytics 09/2014
Visitas mensuales a campusmoncloa.es
Campus of International Excellence



The peaks of activity coincide with the opening of electronic applications for postdoctoral grants and the registration period for the scientific communication competition organized for researchers at the Moncloa Campus. Finally the dip observed in August corresponds to the reduction in the activity of the Moncloa Campus at that time due to the suspension of a number of functions and the closing of the Complutense and Polytechnic universities that make up the Campus.

Activities and dissemination of research results.

Since the start of the CEI Moncloa project, particular emphasis has been placed on disseminating the scientific results of the researchers who form part of the Campus. To this end, Rocío Oña, contact manager of the CEI website, has worked in collaboration with others to repackage these scientific results into journalistic articles that are accessible to audiences of all kinds, and to translate them into English for the purpose of raising the international profile of the campus. These articles have been published on the CEI website and on the websites of both the universities, and thanks to the combined efforts of both institutions they have in several instances had considerable impact in the communications media. This dissemination activity continues today.

Compilation of all the news about the CEI: http://www.campusmoncloa.es/es/noticias/

Communication 2.0: Facebook and Twitter

The need to find new ways to communicate and to reach the university community and the general public gave rise to the CEI's entry in the social networks through Facebook (232 likes) and Twitter (553 followers). These communications tools have made it possible to spread word of the events that taking place within the framework of the CEI Moncloa Campus. It has also helped to set up an interaction between researchers and social networks users who are interested in the scientific results produced on the campus.

First Moncloa Campus Course on 23-25 February 2011.

From 23 to 25 February 2011, the First CEI Moncloa Scientific Course was held in the Assembly Hall of the Dentistry Faculty at the UCM. The primary objective of this course was to present the lines of action of the Moncloa Campus in R+D+i before the scientific and university community

and to society in general, and to highlight the most important and ground-breaking research within the themed areas in the scientific clusters for which the Campus of Excellence has defined a strategy for the advancement of knowledge.

The course included six plenary sessions that were open to the public in which researchers of renowned international prestige gave talks on cutting-edge scientific topics in the fields of Agri-food and Health, Global Change and New Energies, Materials for the Future, Innovative Medicine, and Heritage. The guest speakers were Professor Paolo Bonato (Harvard Medical School, Harvard-MIT; Professor Víctor M. Orera Clemente (Materials Science Institute of Aragon, Saragossa University), Professor Ricardo García Herrera (President of the AEMET), Professor Malcolm Mitchell (Scottish Agricultural College - SAC), Professor Javier García Fernández (Professor of Constitutional Law. Ministry of Defence).

In parallel, each cluster organised specialised sessions designed to reinforce already existing collaborations and to seek new synergies between the different research groups in the two universities and the associated institutions.

Finally, in the closing act of the course, on the 25th at 11:30 am the Nobel Laureate for Physics, Professor Carlo Rubbia gave a talk on *Innovative energies for a sustainable development.*

The courses are available on the website of the CEI Moncloa Campus:

http://www.campusmoncloa.es/es/media/video/

In 2011, this office continued to manage the activities of dissemination and awareness-raising of the Moncloa Campus. Some of the highlights of these activities include:

Innovation Day [cei]nnova at the Moncloa Campus.

Last June 13, 2012 the [cei]nnova Innovation Course of the Moncloa Campus took place in the Faculty of Medicine of the UCM. It had a predominantly business-oriented focus and was designed to serve as a meeting point between companies and the groups that work in the clusters in the Moncloa Campus. The event served as an opportunity to highlight the R&D+i capacities, solutions and services of the Moncloa Campus, while companies and experts from a range of institutions shared their current view of the challenges and technological requirements involved in their area of activity.

The event was attended by almost 400 participants who took part in sessions in the different themed clusters.

More information: http://www.campusmoncloa.es/es/eventos/jornada-innovacion

Informative courses on participation in EU projects.

Activities to encourage the scientific spirit such as the "Science Ambassadors" and Science Week projects, participation in Researchers' Night and the 1st Biodiversity Testing initiative at the CEI Moncloa

Campus, which resulted in the identification of a butterfly previously thought to be extinct.

Event for the presentation of the Agri-food and Health cluster.

The event took place on 15 December 2012 in the School of Agricultural Engineering and featured the participation of the groups involved in the cluster. The proceedings included the presentation of the Agri-food Corridor project, the strategic lines of the cluster, and possible sources of funding for research in this field, with particular emphasis on EU programs.

CEI Moncloa Campus Scientific Dissemination Awards.

Between 20 March and 30 April various works in the areas of photography, video and news were collected together in order to promote the culture of dissemination among the researchers of the Moncloa Campus. The prize-winning works have been published on our website. You can see them at:

http://www.campusmoncloa.es/es/convocatorias/premios-divulgacion-cientifica/

In addition to the prize money, the winners were invited to take part in the 3rd Course on Science Journalism and Dissemination organized by the OTRI at the UCM in collaboration with the UCC+i of the UPM.

Materials Week at the CEI Moncloa Campus

Organized by the Materials for the Future cluster, the activities took place on 26, 29 and 30 April 2013 in the ETS Engineering Faculty. The objective of Materials Week was to reinforce the cluster's social presence, and to explore the synergies between the teaching staff, researchers, students and companies in the field of materials science and engineering. The various events arranged were a chance to share experiences, knowledge, technologies and ideas that will contribute to excellence among the members of the CEI Moncloa Campus, and serve to benefit citizens as a whole.

A range of parallel events took place in Materials Week, including lectures, debates, the presentation of lines of research on companies, a workshop on nanomaterials and nanotechnology, demonstrations, courses, visits, open-doors events, specialized photography contests, innovation, video, talent shows, etc. in Spanish and English. These activities were aimed primarily at students with a range of academic qualifications, as well as companies, researchers and teaching staff.

More information at: http://www.campusmoncloa.es/es/eventos/materialsweek/

RED.ESCUBRE

The digital newsletter **RED.ESCUBRE** was launched to raise awareness of scientific activity. This is a project organised by the UCM's Communications Office in collaboration with the university's Research Department in order to disseminate the scientific and cultural activity that takes place on the campus, thereby raising its profile and reinforcing the cohesion between its centres.

RED.ESCUBRE is a bimonthly publication appearing on the website of the Complutense University which already has over 700 subscribers, each of whom receive the issue by e-mail. In addition to its internal distribution, **RED.ESCUBRE** also circulates in institutional circles with links to science –the Ministry of Education, Department of Education, the Education Committee of the Madrid Assembly– and also among journalists specializing in the field of science.

Five issues of **RED.ESCUBRE** were published in 2012, featuring scientific articles which showcase

the quality of the research work currently being done.

More information at: http://www.ucm.es/red.escubre

Tribuna Complutense

This is a bimonthly publication by the UCM which throughout the academic year 2012-2013 included reports highlighting the activities of the multiple actors responsible for the CEI Moncloa Campus.

SYMPOSIUM "UNIVERSITY EDUCATION IN CULTURAL HERITAGE MANAGEMENT (Forun-GPC)"

The Spanish Institute of Cultural Heritage was the venue on the 17th, 18th and 19th of September at which this symposium was held, having one main objective: to share experiences with those who coordinate Masters in Cultural Heritage Management in different universities worldwide, in order to address with more knowledge the challenges posed by the new UCM / UPM Master. A platform has also been created for professionals in order to exchange experiences and make contacts.

Representatives of 22 universities attended, 10 of them being national, as well as UNESCO and the Council of Europe

During the presentation sessions and especially in the discussion, the major role of the economic situation became clear, being internationally and nationally very different, with universities such as those from Northern Europe, offering high quality masters, without registration fees and with few students, with a strong selection system, while others, such as Spanish universities, involving very expensive enrolment fees and hardly any student selection requirements as minimum number of students required is very high.

The "professionalizing" vocation of most existing Masters, as opposed to the main research objective of the new UCM / UPM Master was also clear. And, of course, it was found that the problems that affect our masters have much in common with those affecting others on other subjects, such as intellectual property of dissertations, the actual application and practical use thereof, labour conflicts in external practices, etc.

The last day was devoted to the presentation of the "International Network on Cultural Heritage Management: higher education and research (RED-GPC)," an initiative that arises in connection with the future master's degree. It aims to bring together universities with master's degrees in Cultural Heritage Management on a platform for the exchange of knowledge, research and people. Most considered this a positive initiative and their willingness to join.

Since this was the first time a symposium of this kind was held in the world, there is a strong determination to publish the results in a possible specific series of the CEI Moncloa Cultural Heritage Cluster.

UNI2XSALUD event, an initiative of the Cluster of Innovative Medicine of Moncloa Campus of International Excellence.

The event will take place on the campus of Moncloa (Madrid, Ciudad Universitaria) during spring 2015.

The goal that both universities pursue with this activity is to promote awareness of the health problems in developing countries and the integration of research, innovation and development

of new activities in the field of health among the university community.

The event will make a simple blood test available to the Campus students; by providing a few drops of blood, they will find out about important biomarkers for their health and thereby improve the prevention of non-communicable diseases of increasing incidence in our environment such as cardiovascular diseases, and thus control risk factors and promote individual and community responsibility for healthy living habits. This voluntary act strives to go beyond our borders and promote reflection on the health of those living in countries with low health coverage.

Therefore, the event promotes two health cooperation projects conducted by the UCM and the UPM in two African countries, namely Mozambique and Ghana, entitled:

- Project MalariaSpot, proof of concept in the *Manica Health Research Center* in Mozambique.

- Project for the prevention of malaria and zoonosis transmissible in the Northern Region of Ghana.

This initiative reflects the commitment of both universities in promoting health awareness in prevention of relevant diseases in a global context, through the application of academic research in vulnerable areas where basic needs are not being met.

Most significant results

Improvement in the visibility and communication of the CEI Moncloa Campus.

Proposal for corrective actions:

Although the original idea was to set up a communications office for the Moncloa Campus, finally the management of the CEI opted to appoint Braulio Calleja, Coordinator of the UCM Department of Communication, as the director of the CEI's communications activities, thereby combining the press and communications offices of both universities in the task of raising awareness of the campus. The joint work of the communications offices of both institutions improves and unifies the work done by both institutions in the sphere of action of the CEI Moncloa Campus.

Strategic area	**TRANSFORMATION OF THE CAMPUS FOR THE CREATION OF AN INTEGRAL SOCIAL MODEL AND ITS INTERACTION WITH ITS TERRITORY**
Action	A13. CAMPUS RECOVERY PLAN: PROJECT CAMPUS
Objectives	1. Recover green and wooded spaces in areas of public use. Design a system of clearly defined and prioritized footpaths and install urban furniture. Alfonso XIII Royal University Botanical Gardens 2. Regulate motorised traffic and aboveground parking: Sustainable Mobility Plan of the University City (PMUS) ○ Reduce aboveground parking and encourage the use of the underground car park existing on the university premises. ○ Reinforce public transport. ○ Increase pedestrian and cycle mobility. ○ Improve accessibility. ○ Determine street ownership, in most cases poorly defined at present. ○ Reduce environmental and noise pollution. ○ Implement a mobility office to integrate sustainable mobility in the campus's urban planning policies. 3. Implement of system of bike stations for on-campus transport and lay out a bike lane connecting the various university centres. Reduce through traffic and the use of private vehicles on the campus.

Progress towards the objectives.

- PMUS mobility plan completed.
- Completion of the recovery of green spaces and improvements to the Alfonso XIII Royal University Botanical Gardens.

Description of the work carried out.

1. Recovery of green and wooded spaces in areas of public use on the campus.

The geographic scope of the International Campus of Excellence is delimited by the perimeter of the Madrid University City where the CEI Moncloa is located, and also coincides with scope of the University City Urban Planning Consortium. This consortium was created to protect, conserve, and simultaneously highlight the importance of the main environmental and scenic sites in the University City, and comprises the Complutense and Polytechnic universities, the UNED distance learning university, and the Madrid City Council. The Consortium is responsible for applying the Special Plan for the University, whose objectives include the recovery of the urban, architectural and environmental features of the site, and particularly its relationship with the existing and future system of green spaces; the protection of the site and its architectural and scenic heritage; and –as a connecting element– the establishment of channels to facilitate its integration with the city.

As part of the Moncloa Campus, the old Royal Trail that leads through the University City was opened to the public. The Royal Trail is a pedestrian pathway 2.7 kilometres long between the Puente de los Franceses bridge and Sinesio Delgado street that represents the restoration of a natural environment in an example of joint collaboration between the Madrid City Council and

the three universities whose teaching and research work takes place in the University City. This action combines progress and economic development with respect for nature, and provides new green spaces for members of the university and citizens.

Recovery of green and wooded spaces in areas for public use on the campus: November 2011 saw the completion of the work to refurbish the landscaped areas and the installation of urban furniture in the emblematic Plaza Ramón y Cajal square.

The aims of the UCM's **Alfonso XIII Royal University Botanical Gardens** are to play a key role in training future graduates, and to support research and environmental education. In addition, today –when over 20% of European flora is on the red list of threatened species– we should not overlook the role of this kind of facility as a means of conservation and as a gene pool, and to guarantee the study and possible reintroduction of some of these species in their natural environment.

Moreover, as with every landscaped area in an urban environment, it is also worth mentioning the aesthetic and architectural aspects that contribute to creating a harmonious space which serves as a stimulus for simple contemplation, observation and study. A Botanical Garden is considered essential in all universities whose activities include subjects related to Plant Biology, and a number of these facilities have been built in Europe in recent years. A Botanical Garden is probably one of the most pleasant and efficient means of promoting the precise dissemination of science that the University can offer its students and society as a whole.

The following actions are currently underway:

- Extension of the plant collection.
- Extension of pedestrian footpaths and minor infrastructures.
- Maintenance and improvement of supports.

2. Regulation of motor traffic and aboveground parking.

As this is part of the actions promoted by the CEI, an agreement was signed in 2010 between the University City Urban Planning Consortium –as the body responsible for acting on the University City Campus– and the Regional Transport Consortium (CRT), aimed at the ***"Creation of a Sustainable Mobility Plan for the University City Campus in Madrid. Moncloa"***

From the technical point of view, this agreement states that the action plan will be drawn up by the CRT, which will consider the scope of execution and its specific set of problems. It also establishes the maximum funding limit for the study –set at €200,000– of which the Campus of Excellence will be responsible for 30% of the total.

The action consists of the following phrases:

- Collecting information on fieldwork
- Analysis and diagnostic of the current situation and process
- Determining objectives, benchmarking and compiling action questions
- Assessing and collecting questions
- Final document on the Mobility Plan

Justification: the fact that the Moncloa Campus has been a Property of Cultural Interest since 1999 means that any action aimed at its improvement is in itself of interest.

A point worth noting is that the use of private vehicles has increased in the area of the University City, despite the high rate of use of public transport. An example of this is the more than 100,000 car journeys recorded during work days, to which must be added the pressure of the through traffic on the A-6 motorway. This traffic situation gives rise to problems of congestion and parking which need to be corrected.

3. **Implementation of a system of bicycle stations on the campus and layout of a lane to link the various university centres**

During 2010 the bike-loan system was awarded on the University City campus. For the correct application of this system, there is a bike lane which runs mainly through the centre of the University City to bring the system closer to the various university buildings.

Most significant results

- With regard to the development and implementation of the PMUS: the action has a twofold impact; on the campus itself, and on the users. As mentioned above, the campus has been listed since 1999 as a Property of Cultural Interest, and therefore traffic, the excessive use of private vehicles and poor parking have led to a deterioration which must now be rectified. The PMUS will regulate all those issues and give on-campus mobility a dimension of sustainability that is essential today. This result would in itself justify the implementation of an action designed to enhance the value of a unique environment.

  However it will also have an additional impact on users of the Campus, a place frequented on a daily basis not only by the students and workers in the universities, but also by the staff of all the other institutions located in the University City, as well as by many of the inhabitants of the city of Madrid, within whose boundaries it is located. This suggests that the PMUS would bring an evident benefit to a considerable number of people who in one way or another would come into regular contact with this environment.

  The fact that the Moncloa campus has an important international dimension with a high number of annual visitors from all over the world exponentially increases the impact of this action.
- Opening of the Royal Trail.
- Refurbishment of the Plaza de Ramón y Cajal square
- Improvements in the RJB Alfonso XIII.
- Bike loan system.

Strategic area	**TRANSFORMATION OF THE CAMPUS FOR THE CREATION OF AN INTEGRAL SOCIAL MODEL AND ITS INTERACTION WITH ITS TERRITORY**
Action	A15. GENERAL ACCESSIBILITY PLAN
Objectives	To improve accessibility in all its dimensions, both in exterior spaces and in the buildings and their facilities, and in all the different areas of activity of the campus. Its actions will be applied transversely and incorporate –through to 2012– a system of global accessibility management through the **UNE 170001, 1-2 certification processes**, for the purpose of obtaining the aforementioned certification. It will also include extending measures to support people with disabilities to the whole campus, endorsed by the approval of a Campus regulation on this point. This program includes the already existing Accessibility Plan, whose overall cost is 7 million euros and is co-financed by the Madrid Regional Government.

Progress towards the objectives

Improvement in the accessibility to different premises in the Moncloa Campos and the adaptation of two rooms for the severely disabled in the Colegio Mayor Santa Teresa de Jesús student residence.

Description of the work carried out

Through the 2010 and 2011 Reinforcement programs, the Madrid Complutense University signed two agreements with the Ministry of Education and the ONCE Foundation whereby actions for accessibility and have been implemented in range of university facilities, the most important of which were the works to improve accessibility in the C.M. Santa Teresa de Jesús student residence. These actions were designed to guarantee universal accessibility for people with disabilities through the construction and refurbishment of university accommodation.

In addition, these agreements made possible the acquisition of IT and technical material adapted for both the visually and hearing disabled. The material was installed in the libraries at the Information Science and Economics faculties, the latter on the Somosaguas Campus. The Optics Faculty has been improved by the installation of signage to the Optical Clinic, a tactile paving guide and audio loop indicator for the deaf, as –in addition to teaching– the premises are used to provide healthcare services, the patients of which frequently have reduced visual capacity.

Most significant results

Organisation of agreements with the Ministry of Education and the ONCE, and implementation and completion of the financed projects.

Area	Integrated social campus/ Interaction with the environment
Action	**A16.** Moncloa Campus University Residence (RUMON)
Objectives	Refurbishment of the UCM's current Colegio Mayor Antonio de Nebrija as a university residence, providing a different model to other student residences. To facilitate and encourage the incorporation of talent.

Description of the work to date

The Colegios Mayores (university residences) owned by the UCM have been an essential part of the Ciudad Universitaria from almost its earliest beginnings, and one of its underlying foundations: one of the key aspects of the original university project (along with the academic, administrative and management elements) outlined in the 1929 Plan was the construction of residences for faculty members and students, to be known as the Colegios Mayores.

The buildings that are today the Colegios Mayores of Ximénez de Cisneros, Antonio de Nebrija and Diego de Covarrubias (in 1943 the students from the former Residencia de Estudiantes were moved here) were built after the Spanish Civil War. The complex won various awards and prizes for its architectural design. The Colegio Mayor Teresa de Jesús was a later addition (this was the descendent of the residence for young ladies established in 1915 and incorporated into the Ciudad Universitaria in 1975), as was the Colegio Mayor Santa María de Europa, founded in 1947. In view of their history, these residences are buildings with high maintenance costs, and some are also covered by the maximum urban planning protection.

The project for the Moncloa Campus of Excellence recognises that the possibility of offering the accommodation and environment for study and teaching provided by the Colegios Mayores is a key factor in its competitiveness, in addition to encouraging the mobility of faculty members and students and reinforcing the European model of integrated learning.

The age of the buildings and the scarcity of resources in our public universities points to the need to invest in the Colegios Mayores, which have been integrated into the Campus of Excellence project with immediate results for the Complutense University and the other universities on the campus. This same factor –their age– means that not all the buildings are accessible for people with disabilities. However, we have made some inroads in this area as part of this project, and others designed to achieve the same objective.

The five Colegios Mayores are in differing states of conservation and maintenance, and only one of them has been entirely refurbished. This is a prime example of the importance of the condition of the facilities provided for accommodation to the students' perception of their university, as well as that of the families who entrust the education of their offspring to our university. Although the public university itself –and particularly the Universidad Complutense– is favourably rated, there is still some way to go in implementing a model for the future, through a major modernisation to take us into the coming decades with a guarantee of success that will underpin the values of today with the tradition and prestige of the UCM.

The Colegios Mayores perform an essential service for the UCM and the Campus as a whole, as demonstrated by the increasing numbers of students in the UPM and other public universities

who opt to live in their facilities every year. They are also a significant economic asset, if –as has been the case in the last two academic years– they have a high or even full level of occupation, as is the case at present. In recent years we have also noted an increased demand for accommodation by students or postgraduate students on international exchange programmes, in addition to teachers.

Some potentially usable spaces in our Colegios Mayores are currently not in use due to the recent impossibility of maintaining their facilities in perfect condition. We cite here the potential for converting the third pavilion of the CM Antonio de Nebrija. On the other hand, progress has been made in the design of a common service area for the four Colegios Mayores on the Moncloa Campus thanks to the investment in the Campus of International Excellence project.

Gradually, and with improvements in the state of the facilities, the university community itself is also beginning to revise its perception of the usefulness of the Colegios Mayores, both as a student accommodation and also as part of the quality public service provided by the university. On this point we should highlight their key role as a venue for cultural and sporting events for the whole of the university community; for courses, seminars and lectures to supplement learning by students and teachers throughout the academic year; and for congresses and professional and educational encounters in the summer holidays.

With a view to the future, an essential goal is to give greater emphasis to the internationalisation of the universities, and particularly public universities, with the UCM at their head. The aspirations of a Campus of Excellence like Madrid-Moncloa must include the offer of the wide range of services that can be found in all the most prestigious universities in the world. A model of student residences and Colegios Mayores such as is available at the Complutense University in Madrid –refurbished and updated to maintain their modernity and competitiveness– is therefore absolutely essential.

Most significant results

With the improvements in the facilities of the Colegios Mayores we have achieved 100% occupation in registration for the current academic year 2014-2015, with demand for places outstripping supply.

Over 65% of the residents are enrolled in the faculties of the UCM, while 22% are students of the polytechnic schools.

Strategic Area	**TRANSFORMATION OF THE CAMPUS TO DEVELOP A COMPREHENSIVE SOCIAL MODEL AND ITS INTERACTION WITH ITS WIDER ENVIRONMENT**
Title of Action	**A24. Implementation of the museum project: Creation of a Management and Storage area in the Complutense Art Centre.**

Objectives:

Convert the c art c (Complutense Art Centre) into a space that helps to catalyse and regenerate the historical, urban, environmental and cultural value of the Complutense University of Madrid

campus.
Exhibit the artistic treasures in Complutense's Museums and Collections as historical examples of immense cultural heritage in a collection that is permanent, dynamic and open to researchers and participation by the public.
Establish a leading facility for creative innovation and socio-cultural integration with an ongoing dialogue between creators and the public.

Description of the action and justification of the need for the action:

Creating a home for the UCM's permanent collection requires a museum project to be implemented that defines the content and the form for exhibiting the works.

For this project it was necessary to adapt or buy the museum material needed to exhibit the selected works. This material includes display cabinets, stands, information panels and other items needed to create a versatile and modern exhibition space in which to display UCM's historical, artistic, scientific and technical heritage.

At the same time, it was necessary to adapt an area as a place where the Museum Management Unit could work since this unit will be responsible for managing the collection on display and supervising, in compliance with UCM's Regulations on Historical Heritage Museums, the management of UCM's museums and collections.

A storage area has been created in which to store the technical elements from the room and to act as temporary storage for exhibition material.

As a complement to the entire project, an area has also been established as a restoration workshop for the works displayed in the room.

Use of human, material and financial resources:
This project has been funded entirely through being charged to the CEI 2009 budget.
The work to adapt the areas has been carried out, completing the museum management area which includes the storage and restoration areas.
The furniture for the storage area has already been delivered, as has all the computer equipment.
The network cabling for the installation of the computer stations has yet to be completed.
Also pending is the transfer, from the current location, of the office furniture in the Cultural Technical Unit, which currently occupies the unit, to create up to six workstations.
Work has already started on the museum project. It is expected to be completed during December.

International aspects:
The creation of this exhibition space will improve the visibility of the collections in the international environment of university museums, especially through UMAC (University Museum and Collections, ICOM Section, with formal links to UNESCO, which deals specifically with University Museums).
The graphics related to the exhibition will be created in Spanish and English to improve awareness about it.

Expected impact:
The creation of a permanent exhibition featuring Complutense University's historical, artistic, scientific and technical heritage, in a space suitable for that, will provide the University with a platform for the research and dissemination of its heritage, offering exhibition and conservation

conditions comparable to the best found in public and private institutions in Madrid. This will give a big boost to awareness of the importance and richness of the university's collections, which will enhance the research and the educational roles of the collections and the search for financial resources for their maintenance.

Title of Action	**A24. Implementation of the museum project: Preparing spaces for the Complutense Veterinary Museum**

Objectives:

- Consolidate a heritage restoration project started in 2006, bringing together UCM's entire veterinary heritage into a single exhibition.
- Exhibit, with the appropriate conservation and security guarantees, the museum's extraordinary collections, among which we can highlight the collection of nineteenth-century anatomical waxes and Dr. Auzoux's papier-mâché models, with examples that are unique in the world.
- Create a leading facility for research, teaching and socio-cultural integration, making it easier to handle the high demand for visits to the Faculty of Veterinary Medicine's collections.

Description of the action and justification of the need for the action:

Before opening the Complutense Veterinary Museum, some work is needed first to adapt the space adjoining it to complete the security measures and create an area for the storage and treatment of museum pieces.

This work involves cleaning and panelling a room attached to the museum, installing a water intake to facilitate the conservation work on the pieces and installing a surveillance camera security system connected to Complutense University's general security system.

Use of human, material and financial resources:

The project is funded entirely by Moncloa CEI.
The area in question has been panelled to create storage and restoration space.
Security cameras suitable for the surveillance of the museum are being installed.
The installation of the water intake in the storage-restoration space is pending.

International aspects:

The creation of this exhibition space will improve the visibility of the collections in the international environment of university museums, through UMAC (University Museum and Collections, ICOM Section, with formal links to UNESCO, which deals specifically with University Museums).
The graphics related to the exhibition will be created in Spanish and English to improve awareness about it.

Expected impact:

Creating a permanent exhibition with the Faculty of Veterinary Medicine's collection will allow the Complutense Veterinary Museum to be opened in the near future.

This will give a big boost to awareness of the importance and richness of the veterinary collections and will facilitate the research and the educational role of the collections and the search for financial resources for their maintenance.

Title of Action	**A24. IMPLEMENTATION OF THE MUSEUM PROJECT: "JAVIER PUERTA" ANATOMY MUSEUM**

Objectives

Enhance the preventive conservation of the collections in the museum, among which are pieces of great historical and artistic value.

Contribute to a new project raising awareness about the Complutense's Museums and Collections, which will allow their true value to be demonstrated, in addition to facilitating access for the public and improving study conditions for researchers and teaching staff and therefore for projects and students related to these.

Description of the action and justification of the need for the action:

The sorry state of the Anatomy Museum's premises was endangering the conservation of the pieces in its collections

It was necessary to remodel the space, change the electrical system, refurbish the walls and ceiling and fix leaks and paintwork. Also required was the replacement of the shutters, the installation of blinds and the repair of the windows, to allow for greater control of the natural light and temperature. These actions were necessary to prevent damage to the pieces, especially the important collection of anatomical waxes.

This work meant that all the pieces and most of the display cabinets in the Museum had to be temporarily moved.

This movement was used as an opportunity to conduct a full audit, photographing all the pieces and adding them to the University's database, assessing the condition of each piece and creating a report with the data.

The return of the pieces was carried out to reflect a new exhibition plan, relocating the display cabinets and creating a new route through the exhibition more in keeping with the nature of the pieces and their display to visitors and researchers.

Use of human, material and financial resources:

The work involved in altering the museum space and the pieces in its collection has been funded entirely by the Moncloa Campus of Excellence International (CEI-Moncloa).

This project has been designed by members of the Cultural Technical Unit at Complutense University, who supervised and directed the movement of the pieces and the personnel from its service involved in handling pieces.

It involved cooperation from the Department of Anatomy and Human Embryology I, which houses the Museum, and from Anatomy and Human Embryology II, which temporarily housed the pieces, both part of the Medical Faculty at Complutense.

Members of the Faculty of Fine Arts, specialists in the field, were involved in drawing up the exhibition plans.

International aspects

The refurbishment of the space and the exhibition raises awareness about this museum and the research projects taking place there.
Some of the collections on display are unique in the world and their importance can attract a large number of foreign researchers and visitors.

Expected impact

An improvement in the conservation of these collections, which include pieces of great historical

and artistic value, increased visibility for the collections, their dissemination and an increase in the possible number of visitors

Title of Action	**A24. Implementation of the museum project: storage that can be visited for the Educational textile collection's museum at the Complutense University of Madrid**
Objectives – Create a store that can be visited to house the Complutense University of Madrid's Educational Textile Collection. – Increase the visibility of this collection, contributing to its diffusion and making it accessible to more visitors, providing researchers with a study space that is appropriate given the materials in the collection. – Improve the conservation of these collections, which include pieces of great historical and artistic value, some dating back to the fifteenth century, and many pieces from the seventeenth to twentieth centuries.	
Description of the action and justification of the need for the action: The pieces in UCM's Educational Textile Collection have been housed in a classroom on the third floor, the top floor, of the Faculty of Documentation Sciences since November 1997, a space that is unsuitable for the conservation of the textile and documentary works that make up this museum collection. Therefore, it was considered necessary to transfer it to UCM's space on the ground floor of the Costume Museum, due to the need for conservation and display space that is more appropriate given the type of heritage collection. Incidentally this move would improve accessibility for researchers and the general public. The old furniture that did not meet the minimum requirements for the conservation of the textiles has been replaced with new furniture more in keeping with recent advances in preventive conservation systems for textile heritage.	
Use of human, material and financial resources: This project is funded entirely by CEI Moncloa. We have dismantled the items from their former location in the Faculty of Documentation and moved them to the new facilities located on the ground floor of the Costume Museum. The storage and display furniture has been purchased, as has the computer equipment proposed. This has all been stored pending the completion of the work planned. The materials purchased for the new facility are the appropriate ones according to studies and research in the preventive conservation of textile collections. Its location in the new space will allow for the optimisation of the personnel working at the museum since it will have the support of the personnel in the museums, located in rooms adjacent to it.	
International aspects: One of the objectives of UCM's Educational Textile Museum is to become known internationally through the UMAC (University Museum and Collections), ICOM Section, with formal links to UNESCO, which deals specifically with University Museums). From among the collections in the Educational Textile Museum we can highlight the lace collection which is internationally famous, having featured in international exhibitions "Espanjalaisia Pitsejä" in Finland in 1991 and receiving visits from Germany, Mexico and the Netherlands, among others, during its exhibition in the Faculty of Documentation Science building.	

Strategic area	**TRANSFORMATION OF THE CAMPUS FOR THE CREATION OF AN INTEGRAL SOCIAL MODEL AND ITS INTERACTION WITH ITS TERRITORY**
Action	A25. CAMPUS MONCLOA EDUCATION ORIENTATION PROGRAM FOR SCHOOLCHILDREN IN THE MADRID REGION (PROMOVER)
Objectives	Raise awareness among secondary-school students of the institutions and educational possibilities available on the CEI Moncloa Campus

Progress towards the objectives

SUMMER SCIENCE CAMPUS

Raise awareness among secondary-school students of the institutions and educational possibilities available on the CEI Moncloa Campus.

In collaboration with the Ministry of Education, Culture and Sport and FECYT (Spanish Foundation for Science and Technology), since 2010, the aim of these Campuses has been for students in the fourth year of compulsory secondary education and the first year of the sixth form to have a preliminary contact experience with the research work carried out in the CEI Moncloa by taking part in science outreach projects designed and run by university professors of the highest possible level, in collaboration with secondary education teachers.

Photo: Official inauguration of the Science Campuses in 2012 with the presence of the Ministers of Science and Innovation and Education, and the Vice-chancellors of the UCM and UPM, with some of the participants.

PRE-UNIVERSITY ORIENTATION COURSES

The aim of these courses is to provide future students of the CEI Moncloa with information on the university access exam and the educational offering, and to help them with the task of choosing their university studies.

Description of the work carried out

SUMMER SCIENCE CAMPUS

In order to comply with the proposed objectives, each year a range of different theoretical and practical programs have been designed which combine theoretical classes with practical activity and scientific and technological visits, in addition to other activities with a recreational and cultural content.
Projects carried out:

- Biodiversa: Scientific collections as evidence of biodiversity.
- Introduction to research through astronomical observation.
- Scientific applications to the field of conservation and restoration of heritage.
- New technologies in agri-food and health: from the farm to the table.
- Global change and teledetection.

These projects took place in several research departments in the universities of the CEI Moncloa, always in July, with differing lengths of stay and a number of participants ranging from 60 students in 2010, to 112 last year.
The Campuses were taught by university professors and secondary school teachers, and were also tutored by qualified leisure and activity instructors. Staff from the UCM Students Department took part in coordinating and setting up the program.
The students had access to the material and instrumental equipment of the laboratories in which they carried out their practical work, in addition to the necessary IT and audiovisual material for creating the scientific presentation they were required to make on completion of the activity.

More information:
http://www.campusmoncloa.es/es/formacion/campus-cientificos.php
https://docs.google.com/file/d/0BwvvL6QBtPwfYnpvZ2dJUENIQ0E/edit?usp=sharing
https://docs.google.com/file/d/0BwvvL6QBtPwfT3dmc1VBZy1MRWs/edit?usp=sharing

PRE-UNIVERSITY ORIENTATION COURSES
These courses take place in four different venues according to the knowledge area with which they are associated: Science and Engineering, Health Sciences, Social and Legal Sciences, Arts and Humanities. In each venue the visiting pre-university students receive a preliminary explanation by students currently attending the Campus of the characteristics of the PAU (university entrance exam), the offering of educational courses, the cultural resources and services they will find on the Campus, and any queries they may have about what they have heard are answered. Then, teachers from each faculty deliver a presentation of each of the degree courses on offer and answer any queries the students may have. Finally the university students take the future students on a guided tour of the Campus.
The number of university students taking part is around 150, the number of sixth-form centres that have visited the Campus is around 200, and the total number of students in the program is around 12,000.
More information:
http://www.ucm.es/estudiantes-1

Most significant results

SUMMER SCIENCE CAMPUS

The main achievement of the Summer Science Campuses has been to improve awareness among secondary and sixth-form students of the activities carried out in a research laboratory at the CEI Moncloa, from the methods applied through to the usefulness of the results obtained for society; another result has been to stimulate and reinforce the scientific vocation among the participants.

PRE-UNIVERSITY ORIENTATION COURSES

Improvement of the information available to future Campus students on university entrance exams, educational offering, facilities and services, in order to help them to choose their university studies.

Use of human, material and economic resources

The Science Campuses were taught by university professors and teachers of secondary education, and were also tutored by qualified leisure and activity instructors. Staff from the UCM Students Department –mainly– and other services of the UCM-UPM (Student residences, Culture etc) took part in coordinating and setting up the program.

The students had access to the material and instrumental equipment of the laboratories in which they carried out their practical work, in addition to the necessary IT and audiovisual material for creating the scientific presentation they were required to make on completion of the activity.

The campuses, in their different editions throughout these years, have been supported by funding from the Science and Technology Foundation (FECYT), the body that organised them. In 2011 the CEI Moncloa Campus obtained funding through the 2011 Reinforcement program from the Ministry of Education, Culture and Sport for financing the summer campuses; however this subsidy could not be applied as the decision to award it was made after the activity had been carried out, and therefore the UCM bore the expenditure generated.

Most significant deviations in the progress towards the objectives

There were no deviations.

Proposal for corrective actions

Not applicable

3 Tables showing Results, Indicators and Future Milestone

Table II. Main Results

Number	Strategic Area	Description	Format	Date completed
1	1. Teaching Improvements and Implementation of the European Higher Education Area (EHEA)	Moncloa Campus International Postgraduate School (EIP-Moncloa) Signing of Protocol for its creation	Document	21 May 2013
2		Three new inter-university degrees offered by the EIP	Document	June 2013
3		School of Government: Signing of protocol for its creation by both Universities	Document	21 May 2013
4		International Centre for Latin-American Studies Signing of protocol for its creation by both Universities	Document	21 May 2013
5		First seminar CEI-AL: "A look at Latin America"	Event	18 June 2013
6		María Zambrano Library: new services offered	Facility	1st phase December 2010
7		Adaptation of teaching infrastructures to EHEA deployment: New infrastructures for academic management and electronic administration	Facility	2012-2013 academic year
8		Improvement to data networks: Optical fibre network shared by the institutions on the Campus	Facility	December 2012
9	2. Scientific improvement and knowledge transfer	Program for International Talent Recruitment (PICATA) Sub-program Young Doctors, Sub-program Pre-doctorate aide, Sub-program Mobility for pre-doctorate students 7 calls for applications finalized (http://www.campusmoncloa.es/es/convocatorias/)	Document	From October 2010
10		Aid for the acquisition of scientific and technological equipment and infrastructures (CAIMON)	Document	March 2011.
11		Creation of scientific clusters and publication of master plans	Document	May 2011
12		Creation of the Sustainable Mobility Cluster	Document	December 2011
13		Purchase of high-performance scientific equipment for the work being done by the Campus Moncloa research teams.	Facility	2012-2013 academic year

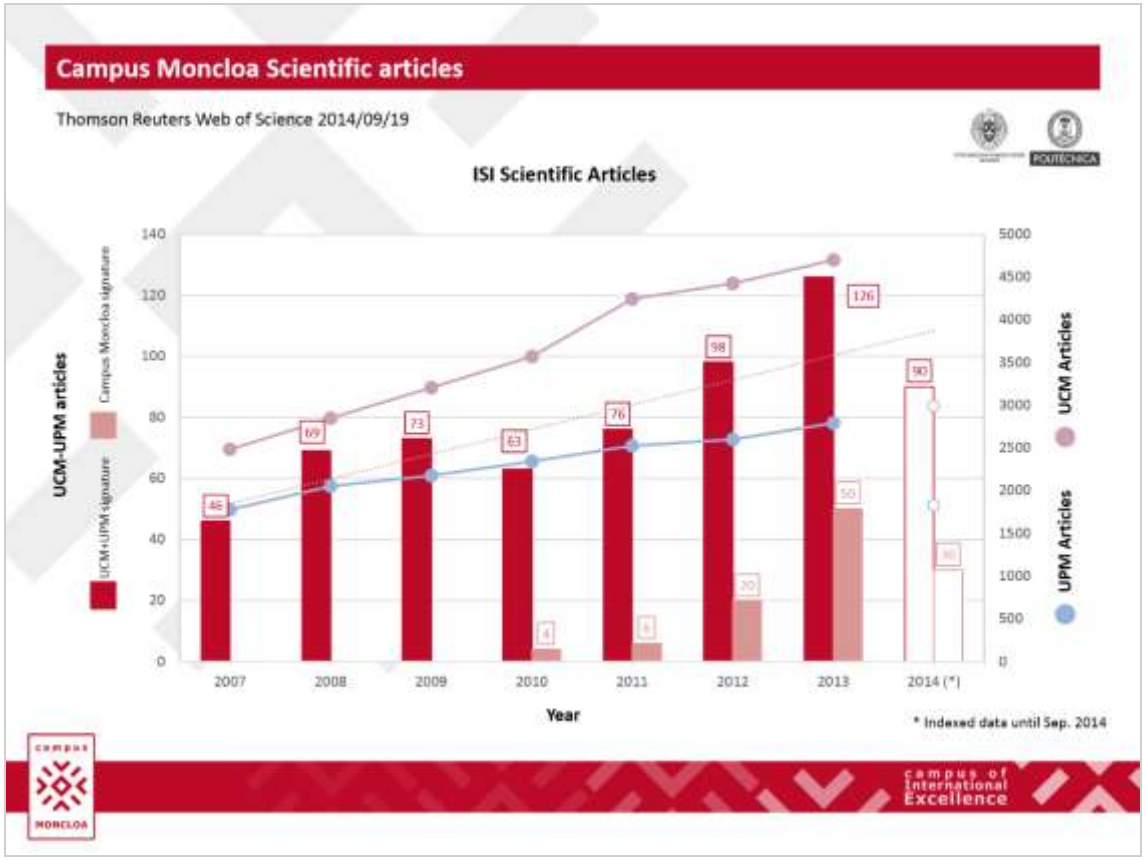
14		Singular Scientific and Technical Infrastructure – Advanced Electron Microscope: Install new electronic microscope	Facility	January 2013
15		"Living Lab", initiated and co-funded by UPM (ETSIT)	Facility	March 2010.
16		First Campus Moncloa conferences held	Event	23-25 February 2010
17		[cei]nnova innovation conference	Event	13 June 2012
18		Materials Week in the Moncloa Campus	Event	29 – 30 April, 2013
19		PICATA meetings: Annual meeting of all of the students that had received support from the PICATA program	Event	2011, 2012 and 2013
20		General Accessibility Plan: Adaptation of the Colegio Mayor Santa Teresa de Jesús to provide access for the disabled	Facility	May 2012 and May 2013
21		Agri-food Corridor installations work	Facility	December 2012
22	3. Transform the campus to promote an inclusive social model and its interaction with its surroundings.	Campus Project: Recovery of green areas	Facilities and Document	2011, 2012 and 2013
23		Campus Project: Sustainable Mobility Plan for the *Ciudad Universitaria* (PMUS)	Facilities and Document	May 2013
24		Campus Project: Implement a system of bicycle stations	Facilities and Document	2011, 2012 and 2015
25		Participation in the Summer Science Camps from 2010 to 2013	Document	July 2010, July 2011, July 2012 and July 2013
26		International Visitors Reception Centre	Facility	September 2012

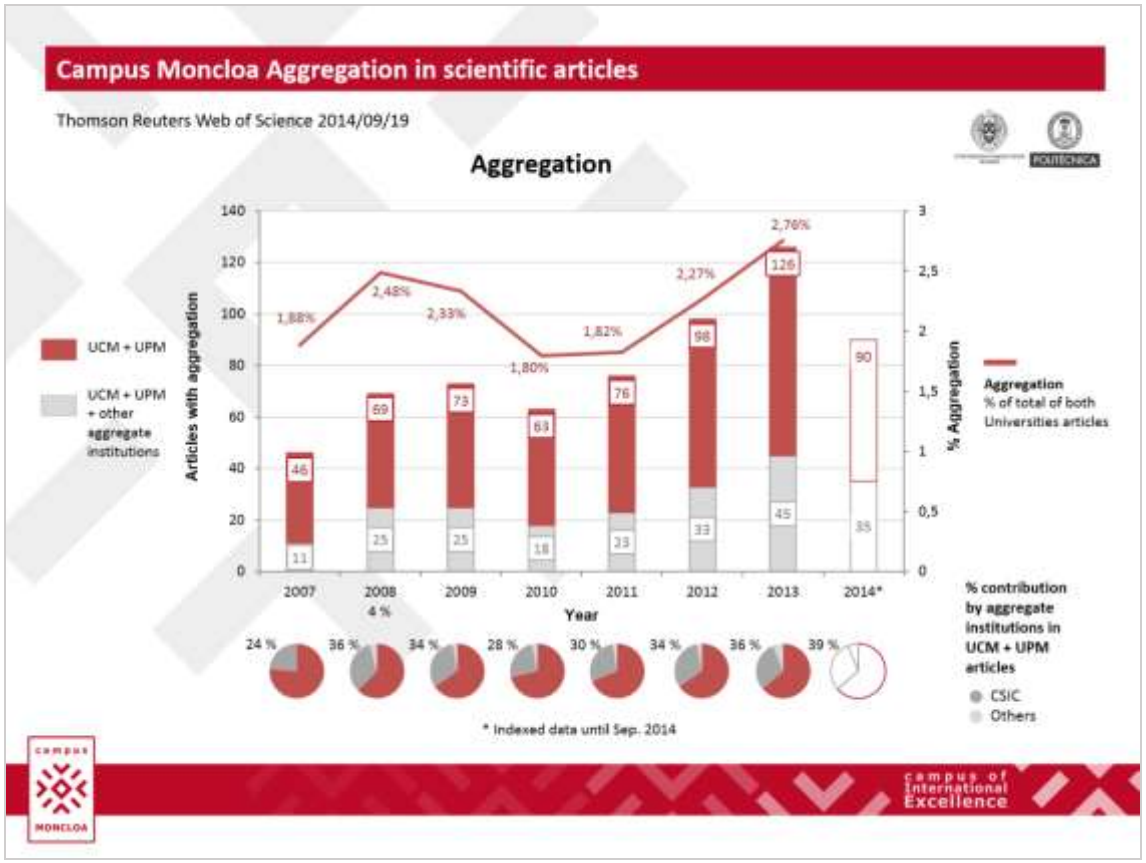
Table III. *Progress indicators*

Area	Indicator	Starting point	At the time report issued	% progress
Scientific improvement	Number of R&D projects with national public funding	793	1.020	29%
Scientific improvement	Amount for R&D projects with national public funding	65.750.000	100.965.141 €	54%
Scientific improvement	Number of R&D projects in international programs	161	330	105%
Scientific improvement	Amount for R&D projects in international programs	14.000.000	73.328.454 €	424%
Scientific improvement	Number of Singular Scientific-Technical Infrastructures (ICTS)*	2	2	0%
Scientific improvement	Number of students with pre-doctoral aid (PICATA)*	0	35	
Scientific improvement	Number of post-doctoral contracts (PICATA)	0	36	
Knowledge transfer	Number of spin-offs	7	16	129%
Knowledge transfer	Number of nationial patents applied for	36	84	133%
Knowledge transfer	Number of international patent extension applications (PCT)	22	27	23%
Knowledge transfer	Number of University-Firm cooperation projects (R&D, consulting, services)	1.371	791	-42%
Knowledge transfer	Amount for University-Firm cooperation projects (R&D, consulting, services)	85.420.000	75.477.838 €	-12%

*During the period being evaluated the Program for International Talent Recruitment (PICATA) was launched. This is a specific CEI Campus Moncloa program where young researchers can run their projects under the co-direction of a professor from each university.

Joint projects by CEI Moncloa Campus researchers




Campus Moncloa Aggregation in scientific articles
Thomson Reuters Web of Science 2014/09/19
Aggregation
UCM + UPM
UCM + UPM + other aggregate institutions
Articles with aggregation
% Aggregation
Year
2007
2008
2009
2010
2011
2012
2013
2014*
1,88%
2,48%
2,33%
1,80%
1,82%
2,27%
2,76%
46
69
73
63
76
98
126
90
11
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45
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4 %
24 %
36 %
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36 %
39 %
Aggregation
% of total of both Universities articles
% contribution by aggregate institutions in UCM + UPM articles
CSIC
Others
* Indexed data until Sep. 2014
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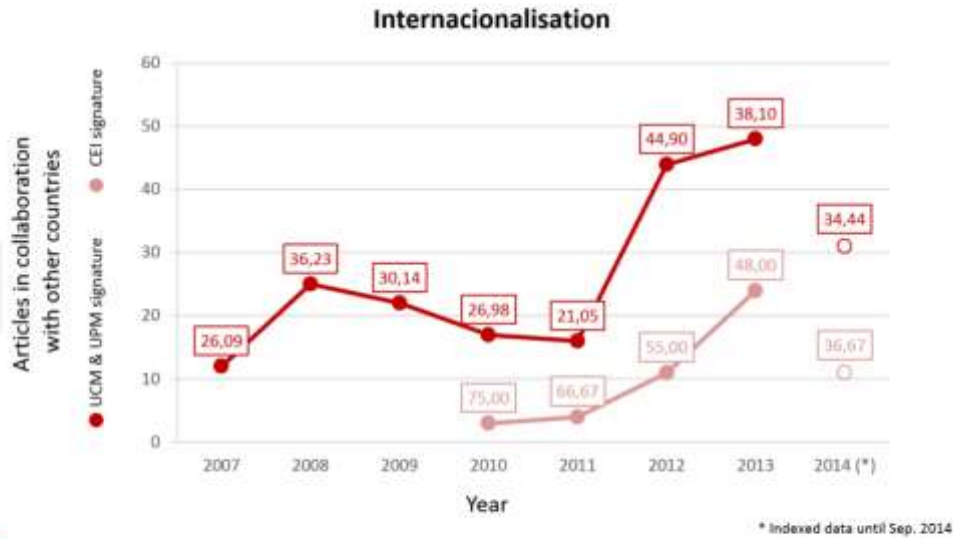
Campus Moncloa Internacionalisation of scientific articles

Thomson Reuters Web of Science 2014/09/19

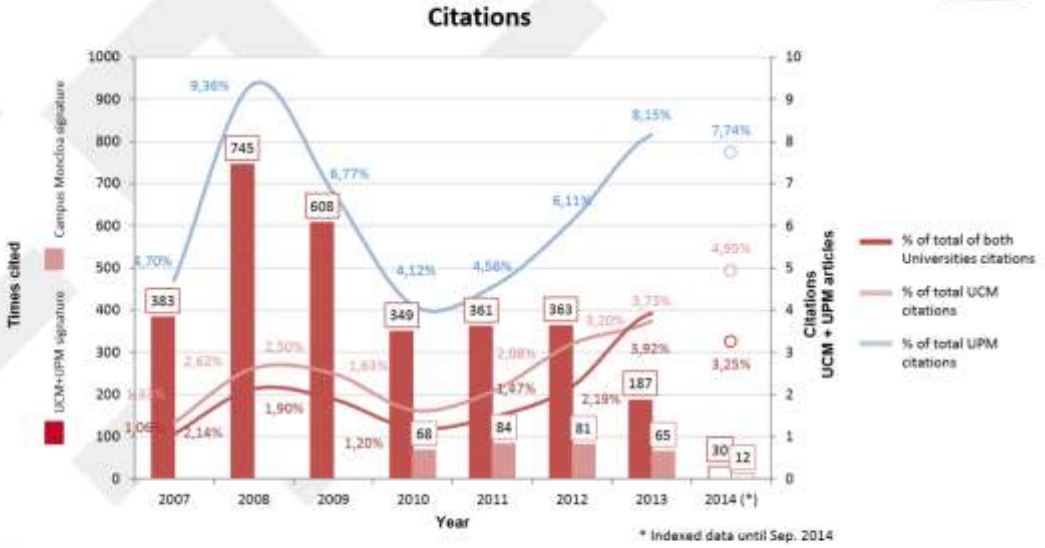


* Indexed data until Sep. 2014

campus of International Excellence

Campus Moncloa Citations of scientific articles

Thomson Reuters Web of Science 2014/09/19



campus of International Excellence

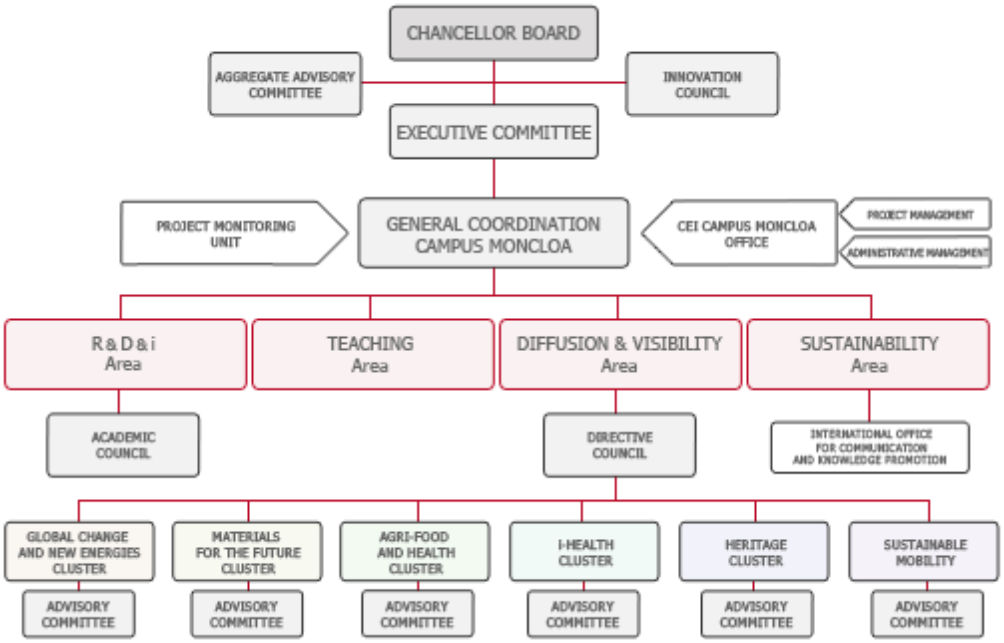
*Table IV. Use of Resources**

*The table shows audited spending through January 2013

STRATEGIC AREAS	ACTION	FUNDING	PERSONNEL	OPERATIONAL EXPENSES	INVESTMENT	TOTAL
Scientific improvement	A9. International Program for Talent Recruitment (PICATA)	CEI 2009/CEI2010	3.583.405 €	26.959 €		3.610.364 €
	A5. Moncloa Campus call for Research Grants (CAIMON)	CEI 2009		4.420 €		4.420 €
	Clúster´s resources	Subprograma B/Innocampus/CEI 2009 y 2010	59.595 €		11.187.561 €	11.247.156 €
	A6. Drafting of the Cluster Master Plans.	CEI 2009		28.032 €		28.032 €
	A22. Joint office for the Evaluation of Research Results.	Innocampus		39.999 €		39.999 €
	G1. Agri-food Corridor	CEI 2009 Y 2010			426.955 €	426.955 €
Teaching Improvements and Implementation of the European Higher Education Area (EHEA)	A4. International Postgraduate School (EIP)	Fortalecimiento 2010			10.101 €	10.101 €
	A7. Improvement to data and communications networks	CEI 2009 / Fotalecimiento 2010			692.919 €	692.919 €
	A2. Adaptation of Teaching Infrastructure to EHEA Deployment	CEI 2009/2010/Fort2010			159.139 €	159.139 €
	A8. María Zambrano Library	CEI 2009/2010			632.798 €	632.798 €
Transform the campus to promote an inclusive social model and its interaction with its surroundings.	A1. Governance	CEI 2009	372.897 €	35.317 €		408.214 €
	A10. International Visitors Reception Centre	CEI 2010			153.587 €	153.587 €
	A12. International Office of Communication and Promotion	CEI 2011	32.139 €	150.677 €		182.816 €
	A13. Campus Project	CEI 2009/2010			182.211 €	182.211 €
	A16. Moncloa Campus University Residence	CEI 2009/2010			173.660 €	173.660 €
	A23. iRTV-CampusMoncloa	Fortalecimiento 2010		20.400 €		20.400 €
	A24. Creation of the Moncloa Campus Museum	CEI 2009/2010			305.871 €	305.871 €
	A25. For Guidance In School Education (PROMOVER)	CEI 2009		634 €		634 €
	A26. School of Government	CEI 2010		1.601 €		1.601 €
	A27. International Centre for Latin American Studies (CEI-AL)	CEI 2011		1.262 €		1.262 €
		Total	**4.048.035 €**	**309.302 €**	**13.924.803 €**	**18.282.141 €**

4 Governance of the project

The governance structure has the following configuration, in which the main bodies have representatives from the two universities:



General Coordination of the Moncloa Campus. This is the unit directly monitoring the project, a responsibility that lies with the vice rectors for research at both universities. It is the decision making body involved in implementing the project.

As support for the General Coordination of the Moncloa Campus we have the **Management Board,** consisting of the general coordinators of the campus together with the coordinators of the clusters. This management board sets the strategic areas relating to R&D and innovation activities and to the coordination of the research groups associated with the CEI. The coordinators of the clusters are renowned scientists belonging to the universities and appointed by the rectors after being nominated by the vice rectors, for the tasks entrusted.

The **Partner's Advisory Council** is the body coordinating the representation on Moncloa Campus of the research institutes, hospitals and other institutions that constitute the critical mass of research on the Moncloa Campus. These institutions are actively engaged in developing the CEI strategies through their participation on the Advisory Boards for the clusters.

Photo: Meeting of the Partner's Advisory Council

The **Innovation Council** has been created, along with the Partner's Advisory Council, and is waiting for there to be a large enough critical mass of business representatives to formalise an independent body. Cooperation agreements have already been signed with renowned companies such as Indra and Central Lechera Asturiana (CAPSA) and contact has been made with others, which will hopefully soon culminate in new agreements. Agreements and ongoing collaborations with large companies and SMEs are the foundation for our work on innovation.

Also in the scientific area, the Advisory Boards for the clusters were appointed to support and advise the cluster coordinators.

The Academic Committee created for the launch of EIP-Moncloa is composed of staff responsible for the post-graduate programs in both universities, together with the coordinators of the CEI and the Director of the School:

CEI Moncloa Campus Office

This office coordinates all the activities carried out on Moncloa Campus. Under the direction of the General Campus Coordinators we have the economic management structures of both universities along with the technical promoters of the project.

The Moncloa Campus Office comprises personnel from the general workforce and also staff hired to carry out the project.

The CEI Moncloa Campus Office was housed in a wing of the administrative offices of the Royal Botanic Gardens Alfonso XIII. The wonderful location of this Garden, equidistant and independent to the Rector's offices at the Complutense and Polytechnic universities in Madrid, allows for the connection with the university community since it is located at the southernmost point of the Moncloa Campus. The office has a meeting room often used by working groups formed by members of the UCM and the UPM who are involved in different areas of work. The office has become a meeting point for everyone bringing value to Moncloa Campus.

The people involved in the governing bodies for the Moncloa Campus can be found on the website:
http://www.campusmoncloa.es/es/campus-moncloa/gobernanza.php

5 Future prospects

The development of the Strategic Plan for Conversion to Campus of International Excellence Moncloa Campus has led to dynamic collaboration between the partner institutions which has now become normal practice for their members.

After these years of working together the results confirm that this has been a most productive experience, and our intention is to maintain the efficiency levels achieved, exploring further complementary areas and strengths.

Included in the plans for the immediate future are the implementation of many of the actions which have recently been finalized or are now in their final stages, the reinforcement of the research groups which have explored new capacities and services, and the putting into place of new cutting-edge technologies which we expect will shortly present satisfactory results.

In the longer term, we envisage the positioning of the International Postgraduate School as a point of reference in specialized multidisciplinary teaching, offering an internationally attractive programme leading to qualifications adapted to the new challenges emerging in present day society.

Moncloa Campus has now firmly established a collaborative culture in its quest for synergies between its partner institutions and this has already resulted in notable outcomes. This cooperation will continue to improve the university environment and its integrated social model, making full use of the resources available to satisfy the demands of our society with excellence, offering services of the highest quality.

campus de excelencia internacional