UC3M R&D FOR INNOVATING
in the Aeronautics Area
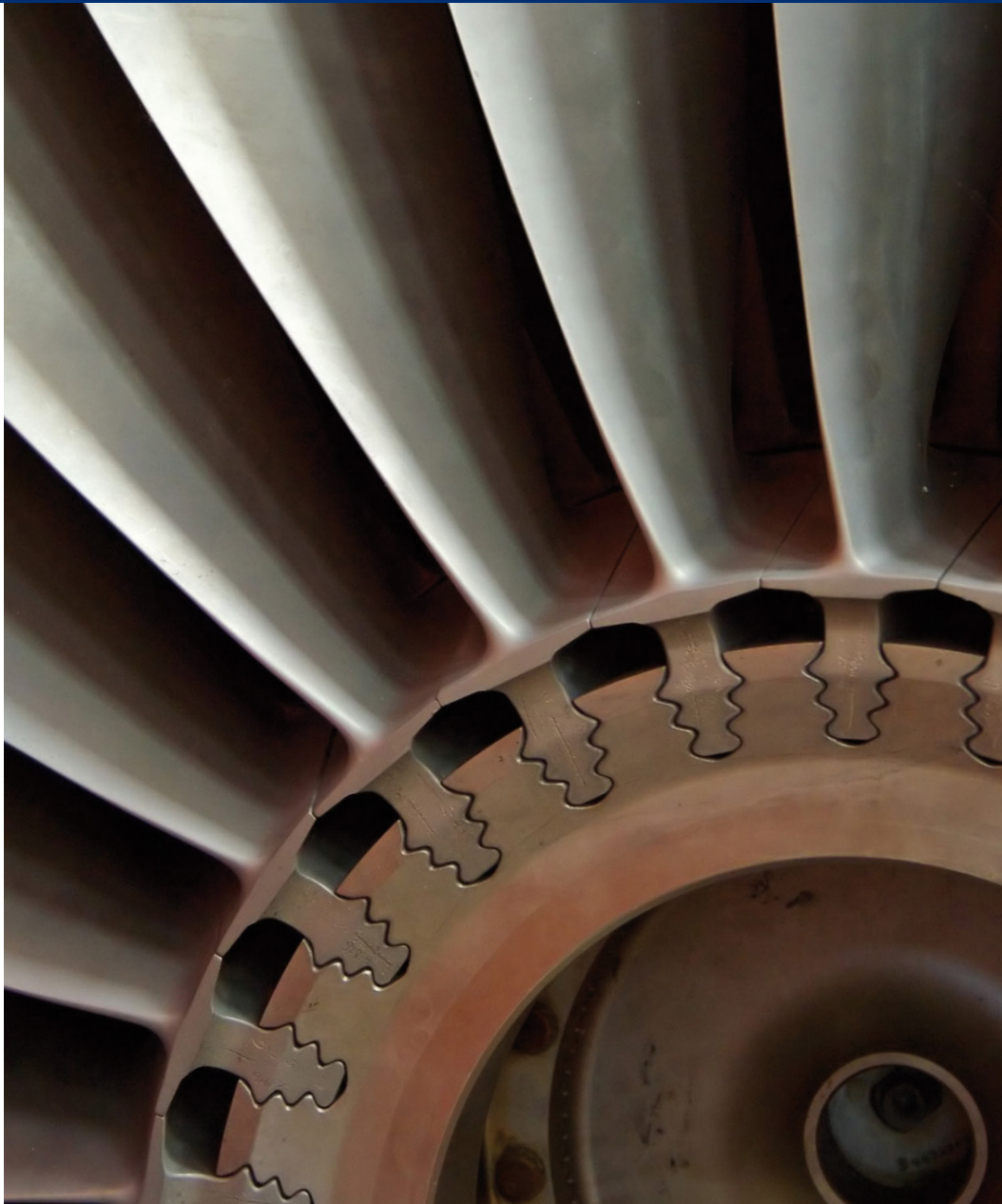
IDENTIFICATION OF THE RESEARCH ACTIVITY, TECHNOLOGIES, PATENTS, INFRASTRUCTURES AND OTHER UC3M CAPABILITIES IN THE AERONAUTICS AREA

Laboratorio de impacto en estructuras aeronáuticas del Parque Científico UC3M

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Vicerrectorado de Política Científica

Servicio de Apoyo al Emprendimiento y la Innovación

The Entrepreneurship and Innovation Service Supportz SEI of the Universidad Carlos III de Madrid wants to present the potential of the university in this "knowledge map" through the research areas developed in the frame of R&D projects, both national and international, patents and other results of UC3M investigators, in the Aeronautics Area.

The global knowledge obtained, the experience of collaborating with the industry, the existence of infrastructures and proper laboratories and, above all, the multidisciplinary nature of UC3M are characteristics that provide an added value so that our support towards the innovation of institutions, big companies and SMEs has an integral quality.

We invite you to deepen the knowledge of the UC3M and to collaborate in new R&D and innovation projects.

Entrepreneurship and Innovation Service Support
Universidad Carlos III de Madrid

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Universidad **Carlos III** de Madrid

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		AEROSPACE ENGINEERING	

Aerospace Engineering Research Group

PI: Eduardo Ahedo

Lines of Research:

- **Space plasma propulsion**
  · Hall effect thrusters
  · Helicon thrusters and magnetic nozzles
  · Plasma jet expansion
  · Plasma-spacecraft and plasma-surface interactions
  · Space debris deorbiting with plasma jets
- **Computational fluid mechanics**
  · Unsteady aerodynamics of flapping wings
  · Spray diffusion flames
  · Stratified flows
  · Multiphase fluids
  · Wall-bounded turbulent flows
  · Flow separation
- **Experimental fluid mechanics**
  · Infrared thermography
  · Tomographic particle image velocimetry (PIV)
  · Convective heat transfer
  · Swirl Flows
  · Flapping wings
- **Space flight dynamics**
  · Space tether dynamics
  · Trajectory optimisation
- **Aerial navigation and control**
  · Flight plan optimisation
  · Conflict detection and resolution algorithms
  · Contrail mitigation strategies
  · Stochastic optimal control

Research Projects:

FP7 and H2020 Projects

- 'Improving LEO Security With Enhanced Electric Propulsion (LEOSWEEP)' (Grant 607457)
- 'HeliconPlasmaHydrazyne.COmbinedMicro (HPHCOM)' (Grant 218862)
- AFDAR (Advanced Flow Diagnostics for Aeronautical Research. (FP7/2007-2013)
- HALA! SESAR WP-E Project

ESA (European Space Agency) Projects

- 'Ion Beam Shepherd for Contactless Debris Removal' (A0/1-6411/10/NL/CBI)
- 'Helicon Plasma Thrusters for Space Missions' (4000107292/12/NL/CO)
- 'Ion Beam Shepherd IOD Mission (IBS-IOD)' (4000109292/13/NL/MV)
- 'Modification of the orbit of a small asteroid with ionic collisions(MOSAIC)' (4000107023/12/F/MOS)
- 'Specific testing equipment and methodology for sputtering tests of electric propulsion materials'

US–AFOSR Projects

- 'Analysis of the rotating-spoke oscillation in Hall thrusters and its role on turbulent transport' (Award FA8655-13-1-3033)
- 'Plasma detachment mechanisms in propulsive magnetic nozzles'(Award FA8655-12-1-2043)

Technological Offer / Others:

Capabilities in Space Technology

- Magnetised plasma discharge simulation code. Info: aero.uc3m.es/ep2
- Magnetic nozzle for plasma jet orientation. Info: aero.uc3m.es/ep2
- Three-dimensional unsteady simulation code for aerodynamics (TUCAN). Info: aero.uc3m.es/cfd
- Tomographic PIV codes. Info: aero.uc3m.es/EFMlab
- Dynamic electrodynamic tether simulation codes. Info: aero.uc3m.es/sfd
- Low-thrust trajectory optimisation tool. Info: aero.uc3m.es/sfd

Equipment and Facilities
Research Laboratories:

- Water tunnel
- Vacuum chamber for testing space plasma thruster
- Tomographic PIV

Aerospace Technology Laboratories:

- Aerodynamics Lab
  · Subsonic Aerodynamic Tunnel: 0.4 x 0.4m, Vmax=20 m/s, Intensity of turb. ‹1%
- Propulsion Lab
  · Hybrid Rocket Engine
  · Gas turbine (131 mm diameter, max thrust 230 N)
  · Fireproof installation for combustion experiments

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R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		AEROSPACE ENGINEERING	

AEROSPACE ENGINEERING

R&D GROUP

Aerospace
Engineering
Research Group

PI: Eduardo
Ahedo

RESEARCH PROJECTS

- 'Magnetic nozzles for plasma thrusters: acceleration, thrust, detachment mechanisms' (Award FA8655-10-1-3085)
- 'Two-dimensional modelling of the Hall thruster discharge'

R&D National Plan Projects

- Spray Diffusion Flames. Consolider-Ingenio 2010 project, SCORE (CSD2010-00011)
- Unsteady Aerodynamics of flapping wings. (TRA 2012-37714)
- 'Plasma Space Propulsion' (AYA2010-16699)
- Plasma Space Propulsion: Simulation and Experimentation (ESP2013-41052-P)
- 'Electric propulsion testing chamber' (UNC313-4E-1552)
- 'System for the simultaneous measurement of wall-bounded heat transfer and 3D flows in a hydrodynamic tunnel' (UNC313-4E-2231)

TECHNOLOGICAL OFFER / OTHERS

- Navigation and Flight Mechanics Lab
  · EyasSat Rev C+ nanosatellite trainer
  · Hexapod (Steward platform)
  · Cockpit instrument demonstrator
  · Flight simulator with integrated avionics
- Aerospace Design Lab
  · 3D Printer (max. size 254 x 381 x 203 mm)
  · Manual lathe
  · Orthogonal cutting testing machine (with force measurement system)
- Computer clusters
  · 156 cores (26 Intel Xeon X650 processors), 632GB total RAM
  · Cluster with 2 redundant RAID5 and 2x 10TB

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R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

MATERIAL SCIENCE AND ENGINEERING

In-Service Material Behaviour (CSM)

PI: Miguel Ángel Martínez Casanova, Francisco Javier Velasco

- Surface treatments and adhesion: paints and adhesives
- Failure analysis and solution design
- Tribology: friction and wear
- Corrosion

European Projects

- PARTICOAT: New Multipurpose coating systems based on novel particle technology for extreme environments at high temperatures. European Union

R&D National Plan Projects

- Study of open-cell and microcellular foams and their adhesive bonding with other construction elements: Mechanical behaviour and durability
- Surface treatments of PMCs by physical and/or chemical techniques for the improvement of the in-service behaviour in structural adhesive bonding

Internal Projects (UC3M Funding)

- GRABOND: Graded adhesive bonding between dissimilar materials with healing and recycling properties
- MULTIPLY: Multimaterial layered lightweight structures for automotive applications using atmospheric pressure plasma pretreatments and adhesive bonding manufacturing technologies
- MULTIPLY-2: Multi-material layered lightweight structures using atmospheric pressure plasma technology and adhesive bonding manufacturing

Technological Offer

- Provision of solutions to problems that arise in the event of bonding a number of materials with industrial application that must be glued and/or painted to be part of structures
- Analysis of parts that have exhibited problems during their service life and trying to determine possible causes of failure. Furthermore, the group is trained for designing new materials which may exhibit optimised behaviour in those circumstances
- Characterisation of the wear materials sustain or may sustain
- Improvement of the durability of metals and structures with metallic components

The "In-service Behaviour of Materials" Research Group is a member of the Inter-university Structural Adhesives Research Group with Universidad Pontificia Comillas-ICAI

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R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		MATERIAL SCIENCE AND ENGINEERING	
In–Service Material Behaviour (CSM) PI: Miguel Ángel Martínez Casanova, Francisco Javier Velasco		**Private Funding** • Improvement of polymeric material tack by atmospheric plasma torch treatment for adhesive bonding • Characterisation of protective coatings to evaluate protection against corrosion provided to metallic substrates • Study of materials with high thermal conductivity and development of sintered bronze technology for expanded polypropylene moulds	

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
	MATERIAL SCIENCE AND ENGINEERING		

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<u>**Polymer composites and Interfaces (GMCPI)**</u> **PI: Francisco Javier González Benito**	• Design and implementation of new nanocomposites, thermoplastic matrix multifunctional materials (electrical, mechanical, and thermal characterisation) • Utilisation of high-energy grinding mechanics as a method to disperse nanoparticles in thermoplastic matrices • Nanoscale material characterisation • Polymer mixtures and composites • Interfaces and fluorescence in probes and markers • Physicochemical characterisation of materials	**R&D National Plan Projects** • New nanocomposites with special electrical properties and development of new characterisation methods: Nano piezo-deformation and nano heat deformation • New nanocomposites based on the dispersion, by means of high-energy mechanical grinding, of nanoparticles in plastics, material recovery, interfaces, and characterisation • Interfacial structure and morphology of polymer blends in composites and their relation with final properties **Private Funding** • Study and characterisation of a thermoplastic material filled with carbon nanofibers for rotational moulding processes with applications for the aeronautical industry • Study of fillers supported by a part obtained by rotational moulding	**Infrastructure** • Electron Microscopy Laboratory • Atomic Force Microscopy Laboratory • Polymer Characterisation Laboratory • Material Preparation Laboratory • Material Technology Laboratory

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		MATERIAL SCIENCE AND ENGINEERING	
Polymers and Composites **PI: Juan Baselga**	• Luminescence techniques in polymers, composites, and nanocomposites • Hybrid thermosetting polymers and polymer mixtures • Nanoreinforcements and nanocomposites • Atomistic simulation	**R&D National Plan Projects** • Nanocomposites with hierarchically structured architectures • Nanocomposites with functionalised particles • Synthesis and applications of doped carbon nanotubes **R&D Regional Plan Projects** • Nanostructured polymer-based materials: Interface phenomena in relation to advanced properties and applications **Private Funding** • Aircraft Lightning Strike Protection with Graphene Hybrid Nanomaterials (LIGHTGRAPH) • Determination of surface electrical conductivity in carbon fibre sheets • Improvement of mechanical and electrical properties in carbon fibre composites • Research in the development of nanoreinforced composites with advanced mechanical and electrical properties	**Technological Offer** • (Nanoreinforced polymers. Patent: P201230600

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

MATERIAL SCIENCE AND ENGINEERING

Powder Technology (GTP)

PI: Jose Manuel Torralba, Elena Gordo

Lines of Research:

- **Special production and characterisation techniques**
  - Spray-pyrolysis for the production of nanoparticles
  - Atomisation
  - Mechanical grinding
  - Powder injection moulding
  - Corrosion of powder-metallurgical materials
  - Sol-gel coatings
  - Surface treatments by diffusion for protection against corrosion, wear, and high temperature
  - Thermodynamic and kinetic optimisation of processes
- **Materials**
  - Sintered low-alloy steels
  - Sintered stainless steels
  - Sintered tool steels and FE-based composites
  - Sintered Ti alloys and composites with a Ti matrix
  - Sintered Cu-based alloys
  - Sintered Al alloys and composites with an Al matrix
  - Nickel-based alloys

European Projects

- ELENA: Electroceramics from Nanopowders Produced by Innovative Methods

R&D National Plan Projects

- Processing of new ODS-ferritic alloys (CrZr-fe al) for severe use conditions by powder-metallurgical techniques
- PeTitNeST: High Performance Titanium by Near Net Shape Technologies
- Processing by the association of colloidal and powder-metallurgical techniques for the design of metal-ceramic nanocomposite structures
- Design of the microstructure and microarchitecture of metal-ceramic materials using colloidal and powder-metallurgical technologies
- Development of self-healing monolayer coatings with high anticorrosion properties
- Development of Fe-Cr alloys mechanically alloyed with yttrium oxide for application in the window of accelerator-driven subcritical (ADS) reactors
- Development of advanced gamma TiAl alloys for high-performance components by powder-metallurgical techniques (DATIAL)
- Development of a new generation of tool materials using powder metallurgy processing

Technological Offer

- Intermetallic-reinforced stainless steels useful against corrosion and wear
- New methods for the manufacture of Jos metal parts.
- Development of feedstocks for metal injection moulding (MIM)
- Design and manufacture of master alloys for the activation of the sintering of high-performance sintered parts
- Method for obtaining metal foams from rolling process mill scale
- Method for the manufacture of metal and/or ceramic parts using a thermoplastic binding system based on polysaccharides
- New heat-treatable CERMET type materials for cutting and forming applications
- Application of high-energy grinding for the development of materials
- Manufacture of lightweight titanium-aluminium alloys by powder metallurgy
- Protection against metal corrosion by means of nanoparticulate sol-gel pretreatments promoting organic paint/metal adhesion
- Method for the synthesis of nanostructured materials with functional and structural properties by means of aerosol methods (spray pyrolysis)

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
MATERIAL SCIENCE AND ENGINEERING			
Powder Technology (GTP) PI: Jose Manuel Torralba, Elena Gordo		**R&D Regional Plan Projects** • Advanced structural materials (ESTRUMAT) **Internal Projects (UC3M Funding)** • MUSIMACO: Multifunctional Sintered Materials and Composites • NANOMET: From metal powders to nanostructured metals and nanometals	**Patents:** • Low-cost titanium alloys and method for preparation thereof. Patent WO2010015723 • Intermetallic-reinforced stainless steels. Patent ES2146168 • Process for the manufacture of metal parts from metal powders using thermosetting acrylic resins as a binder. Patent ES2167130 • Steels sintered with alpaca. Patent ES2211248 • Electrodes for the electrochemical recognition of ionic or molecular species based on polysiloxane membranes and the method of preparation thereof. Patent ES2160052 • Multifunctional coatings applying sol-gel type technologies. Patent P200802175 • (Low-cost Ti alloys. Patent P200802403 • Method for obtaining metal foams. Patent P200900087 • Method for the manufacture of metal and ceramic parts by means of powder injection moulding using a thermoplastic binding system based on quickly eliminated polysaccharides. Patent P20090194 • (Boron-based fuels by powder technology for reactors and rocket engines for civil and military application. Patent: ES2189618

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

PHYSICS

Remote Detection, Sensors, and Infrared Imaging Laboratory (LIR)

PI: Fernando López

- Design and manufacture of advanced multispectral IR sensors and microsensors for space applications
- Gas detection by means of infrared spectral imaging
- Infrared sensors for the detection of particles and powder in suspension
- Modelling and simulation of synthetic IR images
- Analysis of tightness in fuel tanks
- Multi- and hyperspectral IR imaging with high spectral and spatial resolution for specific applications and analysis
- Advanced IR thermography
- Quality control by means of NDT-IR (Non-destructive and non-invasive analysis techniques)
- Analysis of the behaviour of materials subjected to fire
- Design of microsensors and microsystems

R&D National Plan Projects

- Jem-Euso Mission: Infrared remote detection of cloud temperature and manufacture of breadboard models based on microbolometer focal plane arrays

Internal Projects (UC3M Funding)

- CIROCCO: Construction and InfraRed evaluation Of Cyanate ester Composites (PPI-A)

Private Funding

- Development and validation of predictive models of the behaviour of carbon fibre-reinforced composites under fire loading
- Research project in advanced systems for a more eco-efficient airplane (PROSAVE)- Empirically obtaining the diffusivity, heat capacity, conductivity, and specific heat of flat specimens subjected to fire. Validation by means of models
- Microleaks in EFA wings
- Empirically obtaining the diffusivity, heat capacity, conductivity, and specific heat of flat specimens subjected to fire
- Empirically obtaining parameters for validating calculation methods which determine the behaviour of specimens subjected to fire

Technological Offer

- Detection of microleaks in fuel tanks
- Systems for the detection and quantification of gas by means of IR

Patents

- Differential autonomous detection system. Patent ES2190308
- Method of detecting gases by infrared absorption using solid state Fabry-Perot filters. Patent ES2109166

Laboratories

- LATIR: Laboratory specialising in calibration and testing by means of thermographic analysis and infrared images
- LABSENS: Hyperspectral Sensor Laboratory

Equipment

- IR Cameras: MIR, LWIR, and VIS/NIR
- FTIR Spectrophotometer and spectroradiometry
- High-resolution hyperspectral imaging system
- Calibration black bodies
- IR detectors and electronic instruments for the manufacture of prototypes

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		PHYSICS	
Remote Detection, Sensors, and Infrared Imaging Laboratory (LIR) **PI: Fernando López**		• Calculation-behaviour models for specimens subjected to fire s/NT-T-SGL-10002 • SENSIA CHAIR for advanced studies in applied optics and infrared sensors • Development of a parametric sensor model and support tasks for the analysis and design relating to system EO/IR sensors	**Scientific–Technical Services** • Design and incorporation of IR techniques when conducting testing and calibrations on materials, devices, and systems • Design and development of low-weight and volume IR sensors for specific applications

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		COMPUTER SCIENCE	
Computer, Communications, and Systems Architecture (ARCOS) **PI: Jesús Carretero**	• Real-time systems: · Simulation of real-time systems in airplanes and trains · Wireless sensor networks · Remote system monitoring • High-performance computing: · Scalable massive data management · Cloud and grid computing · Parallel file systems • Distributed and parallel systems: · High-performance data retrieval and transmission system · Social networks data analysis · Peer-to-peer systems	**R&D National Plan Projects** • SCENTUAS: Security and Civil European Network for UAV Applications • Scalable input/output techniques in distributed environments and high performance computing **R&D Regional Plan Projects** • Design and implementation of cache hierarchy architecture for high-performance E/S **Private Funding** • HIDDRA: Highly Independent Data Distribution and Recovery Architecture • Research Programme for testing and rapid prototyping in avionics	**Technological Offer** • Tool for the efficient management of massive data storage • ParFiSys, Parallel File System, compatible with UNIX, which can be run outside the operating system • Adaptive, fault-tolerant and light data storage system (AFTSYS)

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		PHYSICS	

Applied Artificial Intelligence Group (GIAA)

PI: José Manuel Molina, Jesús García Herrero

Lines of Research
- Machine learning and data mining techniques
- Evolutionary computation and multi-objective optimisation
- Computer vision
- Contextual information and data fusion systems
- Surveillance systems
- Air Traffic Control (ATC)
- Indoor localization systems
- Inference in adaptive, non-linear dynamic systems
- Unmanned vehicles
- Augmented reality

Research Projects

R&D National Plan Projects
- Advanced monitoring in ports and airports: concepts, tools, and evaluation (MAPACHE)
- Context-based adaptable fusion: advanced surveillance, traffic control, and navigation systems (FALCON)
- ATLÁNTIDA Application of leader technologies to unmanned aerial vehicles for research and development in ATM
- LOCATIL: Sensor fusion techniques and rationale for services based on location and context: application to AAL
- Sensor fusion for the detection of conflicts, route planning and aerial vehicle guidance in an airport surface for future a-smgcs systems on the 2015 horizon
- Smart techniques applied to the evaluation of data processors for air traffic control

Private Funding
- Software for radio frequency blocking system. Private Funding
- Design and implementation of the SIGINT programme data fusion process
- Design and implementation of the multisensor data fusion system

Technological Offer
- Surveillance system based on cameras, to monitor and identify surface traffic in airports (planes, trucks and buses)
- Airport data fusion simulation system, for the processing of surface radar and integration with other sensors, following the A-SMGCS paradigm
- Optimisation, Prediction and Data Analysis Software
- System of software agents for surveillance. The technology improves the surveillance process, reducing human attention and introducing automatic alarms
- Context-based reasoning system for high level fusion
- Multi-sensor fusion platform for monitoring systems

Equipment
- Time-of-flight and Kinect cameras
- High-performance computing systems, cameras, locating and communications network
- Unmanned ground vehicle (UGV) and lightweight UAVs with sensorisation for navigation

Patents and Software Registrations
- (Method for the capture and tracking of objects and device for carrying out said method. Application no.: 200900538
- (Method of coding and interframe comprehension of video with JPEG2000. Application no.: 200900262
- Software tools for web consultation by means of service deployment. Application no.: _008733/2011

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		ELECTRICAL ENGINEERING	

Diagnosis of Electrical Machines and Insulating Material (DIAMAT)

PI: Guillermo Robles Muñoz, Juan Manuel Martínez Tarifa, Juan Carlos Burgos

Lines of Research:
- Instrumentation and measurement of voltages, intensities, and magnetic fields by means of non-invasive methods
- Measurement of the corona effect and partial discharges in electrical insulations
- Measurement of space charge in insulating materials
- Characterisation of dielectric materials
- Diagnosis of electrical equipment. Identification of degradation mechanisms

R&D National Plan Projects
- Advanced electrical and opto-magnetic instrumentation development for the measuring of partial discharges in transformers
- Multi-channel equipment for the on-line measurement of partial discharges based on high-frequency inductive sensors
- Technologies for the automatic and intelligent management of future distribution networks (ENERGOS). SubTask PTIV1-T2: New signal capture sensors and devices
- Technologies for the automatic and intelligent management of future distribution networks (ENERGOS). SubTask PTIV-T1: Variables for the characterisation of degradation mechanisms

R&D Regional Plan Projects
- Diagnosis of insulation in power transformers by means of UHF detection of partial discharges

Private Funding
- Technological state of the art report on the service life of insulated power cables in high-voltage lines subjected to non-uniform operating loads

Technological Offer
- Inductive sensor with galvanic insulation for the detection and measurement of high-frequency current pulses. P200801174
- Method and device for the differentiation of partial discharges and electric noise. P201330413
- Design of HF and VHF inductive sensors
- Measuring and locating electromagnetic pulses with UHF sensors
- Algorithms for the classification, separation, and identification of impulse signals in environments with a low signal-to-noise ratio
- Measurement of dielectric strength, electric space charge, voltage impulses, insulation resistance, infrared thermography

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		MECHANICAL ENGINEERING	
Organisation Engineering **PI: Gil Gutiérrez Casas**	• Simulation and optimisation of production and logistics systems • Design and management of the complete supply chain • Strategic management of the information systems	**European Projects** • ICARUS: Innovative Changes in Air transport Research for Universally designed Services **Private Funding** • Action techniques and methodologies for adopting the "lean manufacturing" approach in the Eurofighter aircraft right wing assembly line • Programme for the analysis, definition, and development of the methodology of the EADS-CASA process improvement management	

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R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

MECHANICAL ENGINEERING

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
Mechanical and Biomechanical Component Manufacture and Design Technologies (FABDIS) **PI: Mª Henar Miguélez**	• Machining • Numerical modelling of machining processes • Process definition and optimisation • Machinability tests • Machining of prototypes • Application of CAD-CAM computer programmes • Study on the machining of special materials • Ecological machining • Processes for shaping by means of plastic deformation • Numerical modelling of plastic deformation processes • Process definition and optimisation • High temperature folding • Computer-aided design, manufacturing and engineering: CAD-CAM-CAE • Application of heuristic techniques (neural networks, genetic algorithms) for the modelling of manufacturing processes • Neural networks • Genetic algorithms • Damage identification techniques • Inverse problems in mechanical engineering	**R&D National Plan Projects** • Finishing process optimisation for critical turbojet components • Carbon fibre composite drilling process modelling. Ministry of Science and Innovation • Numerical modelling and surface integrity in the dry turning of Inconel 718. Interministerial Commission for Science and Technology • Propagation of fatigue cracks in rotating shafts. Interministerial Commission for Science and Technology **R&D Regional Plan Projects** • Dry drilling of the Ti6Al4V alloy: Analysis of the thermal damage and wear of tools by means of experimental and numerical simulation techniques • Numerical simulation of orthogonal cuts: residual stresses and tool wear **Internal Projects (UC3M Funding)** • DATES: Interaction and damage of the system of n deformable bodies of different nature • HSREMNi: Analysis of high speed removal processes of ni alloys +	**Technological Offer** • Technologies for manufacturing components for the aeronautical industry

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		MECHANICAL ENGINEERING	
Mechanical and Biomechanical Component Manufacture and Design Technologies (FABDIS) **PI:** Mª Henar Miguélez		**Private Funding** • Cryogenic treatment for integral sustainable production in the machining of hardened metal parts • Project for the design and construction of coupling mechanisms for the AS-355-NP helicopter flight simulator dual control. Private Funding • Project for SA-350-B2 helicopter flight simulator sensorisation of the DGT	

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		TELEMATIC ENGINEERING	
<u>Advanced Switching and Communication Technologies</u> **PI: David Larrabeiti**	• Multimedia networks • Design of networks for real-time multimedia data transport (RTP/RTCP) • Traffic modelling for efficient bandwidth- and delay communications	**European Projects** • BONE (Building the future Optical Network in Europe) **R&D National Plan Projects** • FIERRO (Future Internet: Efficiency in High-performance Networks) **Internal Projects (UC3M Funding)** • NASDAC: Next Generation Wireless Architectures based on Distributed Antenna Systems with Centralised Processing and Transport over Optical Networks • MobiToken: Secure Mobile Token for Access Control	**Technological Offer** • Multipath secure ad-hoc communication networks • Onboard multimedia networks, multipoint optical networks • Telecommunication network optimisation

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		TELEMATIC ENGINEERING	
Telematic Applications and Services (GAST) **PI: Carlos Delgado Kloos, Carlos García, Andrés Marín, Natividad Martínez, Abelardo Pardo, Luis Sánchez**	**Real–time distributed systems** (Marisol García Valls): • Modelling of real-time software systems (UML, MARTE, etc.) • Real-time middleware (DDS) and distribution of critical software systems • Partitioned architectures and planning with temporary requirements. IMA. ARINC 653 • Trustworthy distributed and parallel high-performance systems	**European Projects** • ARTISTDesign Network of Excellence on Embedded Systems Design **R&D National Plan Projects** • Gateway between DDS (Data Distribution Service for real time systems) and Web Services • ILAND-middlLewAre for deterministic dynamically reconfigurable NetworkeD embedded systems • REM4VSS (TIN 2011-28339). Development of middleware for real time reconfiguration of distributed surveillance video systems • Open and dynamic physical cyber systems **Internal Projects (UC3M Funding)** • Strategic action in physical cyber systems: large-scale distributed real-time systems (CPS) **Private Funding** • Integration of innovative developments in a platform for critical system software quality management	**Laboratory of systems real–time** • Real-time middleware for secure execution in hot reconfigurable systems • Partitioned architectures

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R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		TELEMATIC ENGINEERING	
Telematic Applications and Services (GAST) –GRADIENT Laboratory **PI: Carlos Delgado Kloos**	• Training simulators in virtual (2D/3D), real, and mixed environments. Modelling of systems aiding edition, deployment, and evaluation of learning experiences • Training gamification. Serious games in indoors and outdoors • Mobile learning. Indoor and outdoor augmented learning experiences using tags	**R&D National Plan Projects** • EEE: Educational Reflective Spaces • RESET-UC3M: Reformulating scalable educational ecosystems • Learn3: 3D Learning, Learning 3.0, 3rd place learning **R&D Regional Plan Projects** • eMadrid: Research and development of technologies for e-Learning in the Community of Madrid **Internal Projects (UC3M Funding)** • CARTEL: Creativity with Augmented-Reality Tablet enhanced learning • SCOOL: Smart Connected Open Classroom • Acrosspaces: Inspiring Learning Across Spaces	**Technological Offer** • Agile, modular and flexible design of learning experiences in real, virtual, and mixed environments based on existing courses by means of using simulation engines and templates • Design of games, storyboards and interaction for training and evaluation based on expertise: targets, missions, rewards, and learning analysis • Design of in-situ training experiences based on mobile learning

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		THERMAL AND FLUID ENGINEERING	

Fluid mechanics (GMF)

PI: Antonio Luis Sánchez

- Combustion
- Multiphase flows
- Biofluid dynamics
- Computational fluid mechanics

European Projects
- MyPlanet: Massively Parallel Computations of Combustion and Emission Simulations

R&D National Plan Projects
- Fundamental ultra-compact rotary engine combustion analysis.
- Sustainable Combustion Research (SCORE)
- Fundamental aspects of hydrogen combustion
- Aerodynamic study of ignition problems

R&D Regional Plan Projects
- Development of predictive tools for hydrogen combustion in gas turbines

Private Funding
- Experimental characterisation of the atomisation of jets of diesel fuel

Installations
- Low Speed Wind Tunnel
- Recirculating Water Channel
- Ultrasound Laboratory
- Computer Cluster
- Combustion Cell

Equipment
- High Speed Camera
- Compact Continuous Wave Solid State Laser

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		SYSTEMS AND AUTOMATIC ENGINEERING	
Robotics Lab **PI: Miguel A. Salichs, Carlos Balaguer, Luis Moreno**	• Aerospace systems • Visual tracking & servoing	**European Projects** • Robot@CWE. Advanced Robotic Systems in Future Collaborative Working Environments **Private Funding** • EADS Simulations of ECS, ETC and LFE systems. Private Funding • New electronic seal with remote supervision via satellite (project eSEAL). Private Funding	**Technological Offer** • *Outdoor mobile robot.* To be applied in the aerospace sector, the navigation, planning, and the propulsion system for the robot are autonomous The activity of the Robotics Lab in the aeronautical sector focuses on the area of simulation of some general Eurofighter aircraft systems.

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

MECHANICS OF CONTINUOUS MEDIA AND STRUCTURE THEORY

Lightweight Structure Dynamics

PI: David Varas Doval, Jorge López Puente

- Behaviour of metallic structures against impact of different types of objects (rigid fragments, ice, ballistic gelatin...)
- Behaviour of structures made of composites against impacts of different types of objects (rigid fragments, ice, ballistic gelatin)
- Development of material behaviour models at high strain rates
- Analysis of the behaviour of ice under impact conditions
- Behaviour of fuel tanks subjected to impact (HRAM)
- Analysis of impact of composite fragments
- Identification and numerical and experimental characterisation of the models of compressible anisotropic plasticity in both quasi-static and dynamic regime
- Homogenization in elastic regime, for materials with anisotropic elasticity and microstructure

European Projects

- CROR Engine debris Middle Level Impact Mechanical Test

R&D National Plan Projects

- Analysis of the behaviour of carbon/epoxy sheets subjected to carbon/epoxy sheet fragment impacts
- Analysis of the behaviour of carbon/epoxy sheets subjected to ice fragment impacts

R&D Regional Plan Projects

- Development of a multi-scale model for the impact behaviour of carbon/epoxy sheets with a woven architecture

Internal Projects (UC3M Funding)

- Strategic action in the study of the behaviour of structural materials subjected to dynamic loads
- Strategic action in the behaviour of aeronautical structures made of composite subjected to high strain rates

Private Funding

- Additional studies of impact configurations and method validation
- Testing of the impact of gelatin against static plates
- Low level ballistic impacts on metallic and composite plates for method validation

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Technological Offer

- The group has developed various experimental methodologies for carrying out complex high and medium velocity impact tests. The group also holds extensive experience in establishing behaviour models for materials under high strain rates and developing simple analytical models for the modelling of phenomena of impact

Capabilities

- Complete mechanical characterisation of structural elements at different strain rates
- Filming of the tests by means of high-speed photographic cameras
- 3D image digital correlation
- Ultrasound inspection (C-SCAN)

Equipment

- Numerical Simulation Laboratory
- High-velocity pneumatic launchers that allow propelling rigid objects, ice fragments, or ballistic gelatin for artificial bird strike testing

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
MECHANICS OF CONTINUOUS MEDIA AND STRUCTURE THEORY			
Lightweight Structure Dynamics PI: David Varas Doval, Jorge López Puente		• Innovation in advanced and rear-end optimised composites (ICARO) • Simulation capabilities for Impact predictive models and blade impact damage characterisation • Research papers on the impact of ice on composites	

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R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

MECHANICS OF CONTINUOUS MEDIA AND STRUCTURE THEORY

Dynamics and Fracture of Structural Elements

PI: Ramón Zaera, José Fernández Sáez

Lines of Research
- Dynamic behaviour of structural elements: experimental simulation and analysis
- Thermomechnical behaviour of materials
- Energy-absorbing structures
- Problems of impact on structural elements for aeronautic use
- Constitutive models of materials under a high strain rate
- Fracture mechanics
- Damage mechanics
- Fracture testing under dynamic conditions
- Dynamic regime plastic instabilities
- Metal matrix composites
- Cellular materials
- Residual stress in structural elements

R&D National Plan Projects
- Non-local continuous models for analysis of the behaviour of structured solids
- Numerical implementation of advanced metal material behavioural models for the design of energy-absorbing systems in collisions

R&D Regional Plan Projects
- Numerical simulation of problems of impact on lightweight structures for energy absorption
- Use of meshless numerical methods in problems of impact on lightweight structures for energy absorption
- Lightweight structures for energy absorption and protection against impact

Private Funding
- Open Rotor Driven Rear Fuselage. Private Funding
- Research papers on the impact of ice on composites
- Ice Impact Tests on Air Intake representative panels of A400M aircraft: Influence of impactor shape
- Ice impact tests
- Vulnerability testing of integrated fuel takes made from composites

Equipment

• Materials Mechanical Characterisation Laboratory (LabMec)

The objective of this laboratory is to provide service to the industry in those fields that require knowledge about the mechanical properties of any type of material under different strain rates and temperatures, particularly under dynamic conditions. It has a wide range of equipment and highly qualified personnel.

• Numerical Simulation Laboratory

Laboratory capable of dealing with a wide range of numerical problems of industrial interest, starting with simple static problems up to dynamic problems, impact problems, fracture and fatigue problems, etc.

Technological Offer
R&D&I to increase aeronautic safety

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

MECHANICS OF CONTINUOUS MEDIA AND STRUCTURE THEORY

Advanced Materials Mechanics

PI: Enrique Barbero

Lines of Research
- Analysis and modelling of laminated and sandwich-type structures subjected to high and low velocity impulsive loads
- Analysis and modelling of composite structures for energy absorption
- Study of the damage tolerance of structural elements made of composites subjected to different load conditions
- Innovation and development of non-conventional testing methodologies for structural elements subjected to impact loads, with special emphasis on damage tolerance evaluation
- Experimental modelling and analysis of the mechanical behaviour of composites under dynamic conditions

Research Projects

R&D National Plan Projects
- Analysis and modelling of structural adhesive repairs of thin sheets for the air transport sector
- Analysis of the behaviour of carbon/epoxy sheets subjected to carbon/epoxy sheet fragment impacts
- Analysis of mechanical joints in aeronautical structures subjected to impulsive loads
- Behavioural models and failure criteria applied to PMMA subjected to impulsive loads
- Numerical formulation and implementation of failure criteria in structural metal elements for energy absorption
- Influence of the strain rate on failure conditions of metal structures for energy absorption
- High-speed 3D image correlation system

R&D Regional Plan Projects
- Use of meshless numerical methods in problems of impact on lightweight structures for energy absorption

Internal Projects (UC3M Funding)
- Strategic action in composite structures for aeronautical and aerospace applications
- Strategic action in the behaviour of aeronautical structures made of composite subjected to high strain rates
- Line of research in the behaviour of aeronautical structures subjected to high strain rates

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Equipment
- Computing Laboratory
- Experimental Laboratory

Technological Offer
R&D&I to increase aeronautic safety

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		MECHANICS OF CONTINUOUS MEDIA AND STRUCTURE THEORY	
Advanced Materials Mechanics **PI:** Enrique Barbero		**Private Funding** • Dynamic tensile analysis on aeronautical materials • Analysis of the compressive behaviour of A400-M aeronautical components • Study of high-velocity impact behaviours of sandwich structures • Additional studies of impact configurations and method validation • Rear end architecture concepts (CURVED) • Ice impact tests on aluminium plates • Low level ballistic impacts on metallic and composite plates for method validation • Open Rotor Driven Rear Fuselage	

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		ELECTRONIC TECHNOLOGY	

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<u>Displays and Photonic Applications (GDAF)</u> **PI: José Manuel Sánchez Pena, Carmen Vázquez**	• Electro-optic devices and applications: Optical and electrical characterisation of devices (liquid crystals, electrochromic material • Advanced instrumentation and sensors: Development of advanced instrumentation, fibre optic sensors and their integration into WDM networks • Photonic devices for optical networks: design and characterisation of integrated optical devices	**European Projects** • FIBRESTAR:FIBRE-optic sensors for Smart Thermal Ablation at Radio frequency **R&D National Plan Projects** • New photonic transmission, monitoring, and sensing techniques in broadband low-consumption networks • New switching and sensing techniques in optical networks • A new generation of photonic devices based on self-organising materials: characterisation • Self-referenced fibre optic intensity configurations for single and multi-sensors • Advanced liquid crystal devices and electroluminescent organic diode devices. Hybrid applications for 3D vision **R&D Regional Plan Projects** • Photonics in displaying, communications and sensors • SINFOTON-CM. Sensors and instrumentation in photonic technologies • New photonic and electronic applications of liquid crystal devices (CLAFE) **Private Funding** • Study of atmospheric propagation of optical communications with HAPS and design of a tracking system for a terrestrial optical station (OPTILINK) • EADS- Adecco Foundation Chair for the integration in employment of people with disabilities in aeronautical environments	**Technological Offer** • Vehicle signalling device. Patent WO2007ES000197 • (Optical sensor for liquid level control. Patent ES2146546 • System for measuring the fuel level in ultralight aircraft. Patent ES2339205 • Self-referencing optical fibre sensor for the detection of liquid and/or measurement of a liquid level. Patent ES2343607 • (Optical sensor system for measuring level in critical environments. Patent ES2213411 • Optical sensor for measuring projecting velocity

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		ELECTRONIC TECHNOLOGY	

Optoelectronics and Laser Technology (GOTL)

PI: Horacio Lamela

LINES OF RESEARCH

- Interferometry laser for the diagnosis of fusion plasma
- Experimental design, modelling and characterisation of high-speed (mode-locking) semiconductor laser diodes
- Interferometric instrumentation systems with high sensitivity optical fibres for the measurement of vibrations, temperatures and acoustic signals
- Design and implementation of transmitters and receivers for optical communications systems
- Development of optoelectronic neural networks for vision systems

RESEARCH PROJECTS

European Projects

- MITEPHO: Microwave and Terahertz Photonics

R&D National Plan Projects

- Multimode photonic sources for spectroscopy and optical fibre sensor interrogation
- Improvement of performance in terahertz generation systems: increase in maximum frequencies and usability
- New electronic and optical techniques for the development of IMAGING ARRAYS (cameras) in millimetre and terahertz (THZ) waves. Applications
- TEPHOCA: Terahertz photoconductive antenna phased arrays: A new paradigm in high quality, high power, continuous-wave THz generation

Internal Projects (UC3M Funding)

- CELTA: Convergence of Electronics and Photonics Technologies for Enabling Terahertz Applications
- ILUMILAS: Injection Locked Ultrafast MIcroring LASers
- TRIPOD: Training and Research Involving Polymer Optical Devices

Private Funding

- Feasibility of a precise guidance system for receivers aircrafts for AAR operations
- Distribution of OL signal by optical fibre applied to scalable phased array radars

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R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

ELECTRONIC TECHNOLOGY

Electronic Power Systems (GSEP) **PI: Andrés Barrado, Emillio Olías**	• Electronic power system analysis, design and optimisation • Magnetic component analysis, design and optimisation • Photovoltaic and hybrid energy system design and optimisation • Electromagnetic interference measurement and correction in equipment and systems • Evaluation of environmental radiation level.	**R&D National Plan Projects** • Design and modeling of aerospace electronic systems. Subsystem level. • ELECTRA: Electric Aircraft Platform • Modeling and study of the stability of 270 V DC power distribution systems with solid-state power controllers in aeronautics applications • Uninterrupted power systems with distributed storage and generation. **Private Funding** • Auxiliary electric propulsion system for general lightweight and sport aviation • Modeling and study of the Airbus A-400 feeders and generator. • Design of multifunctional maintenance equipment for aircraft (AMSE). • Project for the development of avionic PTMU NG equipment for the TIGRE Program. • Development and innovation in polymeric membrane and solid oxide fuel cells (DEIMOS) • Application for modeling and identification of ultracapacitors • Auxiliary electric propulsion system for general lightweight and sport aviation • Three-filter power testing of SATCOM equipment for AIRBUS A400, according to Mil-Std-220 standard.	**Experience and Capabilities** The Electronic Power Systems (GSEP) group provides comprehensive services in the consultation, analysis, custom design, and optimisation of electronic power systems and magnetic components, as well as photovoltaic and hybrid energy systems, and electromagnetic compatibility. • **Energy conversion systems** · Converter design, modeling, and optimisation · Design of prototypes · Modeling of DC supply systems, including a behavioural model of converters and stability analysis. · CAD tools for electronic power system and equipment design • **Magnetic components** · Design of magnetic components · Optimisation of magnetic component volume, losses, and temperature · Finite element-based analytical models of high-frequency magnetic components · Contactless power supply systems • **Photovoltaic and hybrid energy systems** · Optimisation of power electronics in photovoltaic systems · Design of energy control, regulation, and conditioning systems for autonomous and networking systems · Hybrid systems

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		ELECTRONIC TECHNOLOGY	
Electronic Power Systems (GSEP) PI: Andrés Barrado, Emillio Olías			• **Equipment electromagnetic compatibility** · Pre-certification testing of equipment electromagnetic compatibility · Development of EMI filters · Evaluation of environmental radiation level • **Training courses** **Technological Offer** • *Método de optimización del diseño de componentes magnéticos integrados y componente magnético integrado obtenido por dicho procedimiento* (Method for optimising the design of integrated magnetic components and integrated magnetic component obtained by means of said method). Patent: ES2334532. • *Convertidor de Corriente Alterna-Continua de una Etapa con Corrección del Factor de Potencia* (Single-step AC-DC converter with voltage factor correction). Patent: ES2192992. • *Convertidor de Corriente Alterna-Continua de una Etapa con Corrección del Factor de Potencia* (Single-step AC-DC converter with voltage factor correction). Patent: P200200658. • *Dispositivo para conexión de extremos de cables apantallados adecuado para ensayos de medida de impedancia de transferencia superficial* (Device for connecting ends of shielded cables suitable for surface transfer impedance measurement testing). Patent: P201031840. • *Conector de cables apantallados para la medida de impedancia de transferencia superficial* (Connector of shielded cables for surface transfer impedance measurement). Patent: P201031840

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R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		SIGNAL AND COMMUNICATIONS THEORY	

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
Radio frequency, Electromagnetics, Microwaves, and Antennas (GREMA) **PI: Daniel Segovia, Magdalena Salazar**	• Antennas, devices, and systems in the millimetre and submillimetre bands (30 GHz -2 THz) • Active antennas and arrays • Ultra Wide Band RF antennas and systems • Design and development of antennas regardless of frequency • Computational electromagnetics. Scientific software. High Performance Computing • Advanced synthesis methods for the design of filters and multiplexers for satellite communications • Design and development of low noise amplifiers • Design and development of metamaterial structures and negative impedances • Design and manufacture of sensors based on metamaterials for industrial and biomedical applications	**R&D National Plan Projects** • Terahertz technology for electromagnetic sensing applications • New electronic and optical techniques for the development of IMAGING ARRAYS (cameras) in millimetre and terahertz (THz) waves. Applications • New Materials. Devices and Systems. Radiant element for miniaturising and improving radio frequency header performance • Analysis of regular and irregular finite periodic structures by means of techniques of decomposing parallel domains with automatic hp adaptivity • Instrumental photonic and radio frequency developments and application to experimental space geodesy techniques (CAM Macrogroups, Coordinating Group) • Development of a high-capacity wireless integrated communication system in the THz range • Antenna miniaturization for the aeronautic sector **Other competitive projects** • Design and construction of a UWB antenna for radio astronomy instrumentation • Broadband feeder supply for the RAEGE project radio telescope VLBI2010 receivers metamaterial-based immunosensors	**Technological Offer** • Antenna arrays • New technologies in the construction of antennas • Broadband high performance active antennas • Multifrequency antenna improved with metamaterials for adjustable bandwidths • Analysis of massive electromagnetic problems (airplanes, ships...) • Integral hardware/software technological service for high-performance electromagnetic simulation • Microwave filter designs • Design and analysis of onboard antennas • 2 GHz to 2 THz wireless communications link • Measurement and characterisation of antennas and systems in the 0 – 2 THz bands • 0 to 2 THz spectroscopy. • Capability to manufacture microwave antennas and circuits with a precision in micra: 30 micra tracks, 25 micra gaps, 0.5 micra resolution • Analysis and study of reflectors **Patents:** • *Antena apilada multifrecuencia con metamateriales* (Stacked multifrequency antenna with metamaterials) • Patent P200930859

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R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		SIGNAL AND COMMUNICATIONS THEORY	
Radio frequency, Electromagnetics, Microwaves, and Antennas (GREMA) **PI: Daniel Segovia, Magdalena Salazar**		**Private Funding** • Design, construction, and measurement of a dual band antenna in the S and C bands • Design of a patch with metamaterial structures in the 160 MHz band • Numerical Methods for Antenna Analysis and Design: A New Full Wave Electromagnetic Simulator • General multiplexer synthesis programme • Self-Adaptive Electromagnetic Solver Using hp-Finite Elements for the Analysis of the Scattering and Radiation of Electromagnetic Waves". FA8655-07-1-3041, Funding Entity: European Office of Aerospace Research & Development (EOARD), Air Force Office of Scientific Research (AFOSR) • Radio frequency sensors for metamaterial-based detection and monitoring	

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		SIGNAL AND COMMUNICATIONS THEORY	

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
Communications **PI: Ana García Armada**	• Multi-antenna systems (MIMO) for broadband communication • Multi-carrier modulation OFDM • Turbo-coding • Cooperative transmission and relays • Signal processing in digital communications • Optical wireless transmission systems • Communication systems prototyping • Satellite communication systems	**European Projects** • CRUISE, CReating Ubiquitous Intelligent Sensing Environments • NEXWAY, Network of Excellence in Wireless Applications and Technology **R&D National Plan Projects** • LTEXTREME, Optimisation of multi-user and multimedia services over LTE and LTE-Advanced • COMONSENS, Foundations and Methodologies for Future Communication and Sensor Networks • GRE3N, General Radio concepts for ENergy cogNizant mobile communications • MULTI-ADAPTIVE, Multicarrier systems with multi-antenna diversity and adaptive coding: Filter bank- and OFDM-based technologies • MACAWI, Channel modelling, algorithms, and WImax communications CApability **Private Funding** • Analysis of New Multipath Mitigation Techniques for Navigation Receivers • Smart Li-fi: Wireless Internet access through the light from public light fixtures • Identification of improvements in 3G video transmission • Identification of signals on the ELVIRA platform • Investigation for the automated control of agricultural processes • Consultancy and support for emergency communications	**Laboratories** • Communications and Multimedia Processing Laboratory at the Science Park and Communications Laboratory at the Leganés Campus **Scientific–Technical Services** COMMUNICATIONS: Signal processing and transmission • Cooperative transmission in sensor networks • Design and prototyping of robust wireless communication systems (OFDM, MIMO technologies) • Techniques with a high spectral efficiency • Cooperation of base stations and cancelation of interferences in cellular systems

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
		SIGNAL AND COMMUNICATIONS THEORY	
Multimedia Processing (GPM) **PI: Fernando Díaz de María**	• Image/video classification, analysis, and indexing • Object recognition and tracking in images/video • Speech technologies • Multimedia applications of machine learning • Video coding	**Private Funding** • Research project on advanced systems for a more eco-efficient airplane (PROSAVE) - Development of computer vision technologies for in-flight refuelling operations • Developments of computer vision algorithms for road safety and other applications	**Technological Offer** • Modern computer vision, video coding, and multimodality

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

AIRBUS – UC3M CENTRE FOR THE INTEGRATION OF AEROSPACE SYSTEMS

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
Identification Systems Testing Laboratory (IDTEST) **PI: Raúl Sánchez Reíllo**	• Information security: passwords, keys, cryptograms, etc. • Identification devices: cards, tags RDIF, etc. • Biometric devices: personal features, veins, iris, fingerprints, etc.	**Description** The Identification Systems Testing Laboratory (IDTEST) is formed by a team of professionals who are experts in the biometric identification of people and objects in different environments. The Laboratory works primarily on the evaluation, specification, and standardisation of methodologies for this purpose. It also develops identification solutions in accordance with client needs, offering its services for a number of platforms, working in Windows, Linux, and mobile devices, Apple, Androids, Blackberry.	**Scientific-Technical Services** • Functional evaluation of identification systems · Biometric identification systems · Smart cards • Evaluation of identification system robustness in different scenarios · Under adverse conditions · Concerning different aspects which may affect the user's interaction with and usability of the system. • Security evaluation according to common criteria · Preparing protection profiles • Definition of evaluation methodology Consultancy, research, and development in identification systems • National and international standardisation **Use of special equipment** • Temperature and humidity environmental chamber • Light cage, with the possibility of using different (from IR to solar white, pure white) • Fire-resistant cabinet - secure servers for storing files

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

AIRBUS – UC3M CENTRE FOR THE INTEGRATION OF AEROSPACE SYSTEMS

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
Computer Security Laboratory (EVALUES) **PI: José María Sierra**	• Design and implementation of security solutions · Based on the establishment of Virtual Private Networks (IPSEC) · User authentication (mobile devices and smartcards) · Risk analysis and management (Magerit v2) · Easing of security protocols and architectures for mobile devices (AdaptCrypt) · Drawing up secure guidelines for network system configuration • Evaluation of architectures and protocols · Analysis of compliance and performance in security protocols (IPSEC and SSL) · Controlled analysis of the effects of denial-of-service attacks · External remote system security audit · Interoperability studies for networked systems	**Description** The Networking and Computer Security Laboratory (EVALUES) is formed by a team of professionals who are experts in the design and implementation of security solutions and security assessment.	**Scientific-Technical Services** – DESIGN AND IMPLEMENTATION OF SECURITY SOLUTIONS • Based on the establishment of Virtual Private Networks (IPSEC) • User authentication (mobile devices and smartcards) • Risk analysis and management (Magerit v2) • Easing of security protocols and architectures for mobile devices (AdaptCrypt) • Drawing up secure guidelines for network system configuration – EVALUATION OF ARCHITECTURES AND PROTOCOLS • Analysis of compliance and performance in security protocols (IPSEC and SSL) • Controlled analysis of the effects of denial-of-service attacks • External remote system security audit • Interoperability studies for networked systems **Technological Offer:** • SMOTY-Security system based on emerging intelligence on the Internet of Things • Support for performing audit and security tasks in companies • Data privacy and CLOUD-PKI framed in cryptographic hardware on the cloud • Light Air Platform Command & Control System

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
AIRBUS – UC3M CENTRE FOR THE INTEGRATION OF AEROSPACE SYSTEMS			
Computer Security Laboratory (EVALUES) PI: José María Sierra			• Collaborative tools and processes for the detection, prediction, and correction of vulnerabilities of web applications for security auditors and developers • Reference models for secure architectures of e-payment with intermediation

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

AIRBUS – UC3M CENTRE FOR THE INTEGRATION OF AEROSPACE SYSTEMS

Spectral Sensor Laboratory (SPECTRALAB)

PI: Fernando López

- Use of hyperspectral and multispectral sensors
- Infrared spectral imaging for remote detection
- IR spectral thermography applied to non-destructive analysis

Description

As a result of the properties that matter presents in the IR and of the large number of molecular transitions taking place in this region of the electromagnetic spectrum, the Laboratory is capable of applying these techniques to infrared (IR) thermography, the detection of gases, and the non-destructive testing of composites.

Scientific–Technical Services

- IR Tomography
  - · Remote temperature measurement
  - · Industrial process monitoring
- Use of hyperspectral and multispectral sensors
  - · Detection of gases with very well defined IR emissions, with possible defence, security, and environmental applications
- Infrared spectral imaging for remote detection
- Non-destructive testing of composites (detection of defects, fire resistance)
- SAFETY: rescue of people, maritime surveillance, fires, mining, and night vision
- SECURITY: Night vision and surveillance

Use of special equipment:

- Quantum Cascade Laser
- Developer Laser Module
- Control Module
- XEVA-CL 320x256 60HzT4 Camera
- Hyperspectral SWIR Lens
- Narrow-Angle Telescope
- Boresight Visible Camera
- Infrared Spectrophotometer

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS

AIRBUS – UC3M CENTRE FOR THE INTEGRATION OF AEROSPACE SYSTEMS

Aeronautical Structure Impact Laboratory (IMPACTLAB)

PI: José Antonio Loya

Lines of research:
- Dynamic behaviour of structural elements: experimental simulation and analysis
- Energy absorption structures
- Problems of impact in structural elements for aeronautical use
- Constitutive models of materials under a high rate of strain
- Fracture mechanics
- Damage mechanics
- Fracture testing under dynamic conditions
- Residual stress in structural elements
- Analysis and modelling of laminated and sandwich-type structures subjected to high and low velocity impulsive loads
- Study of the damage tolerance of structural elements made of composites subjected to different load conditions
- Experimental modelling and analysis of the mechanical behaviour of composites under dynamic conditions

Description

The Aeronautical Structure Impact Laboratory is formed by a team of skilled professionals with extensive experience in providing innovative solutions to the industry relating to the mechanical behaviour of components and to the calculation of structural elements.

The lab provides services for mechanical testing at different strain rates and at different temperatures and holds experience specific to the field of dynamic and impact testing. It also possesses extensive experience in the modelling of problems relating to solid mechanics by means of internally developed tools and the use of commercially available numerical codes.

Scientific–Technical Services
- Analysis of the impact behaviour of elements in aeronautical and aerospace structures
- Development of specific methodologies for the study of damage tolerance under different load conditions of aeronautical and aerospace structures manufactured with composites
- Mobile security and defence systems subjected to impact loads
- Analysis and modelling of lightweight structures subjected to impact loads