# UC3M R&D IN THE security and defense area

RESEARCH ACTIVITY, TECHNOLOGIES, PATENTS, INFRASTRUCTURES AND OTHER UC3M CAPABILITIES

The Entrepreneurship and Innovation Support Service (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 Security 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 Support Service**
**Universidad Carlos III de Madrid**

**Contact:**
comercializacion@uc3m.es

*Update date*
March 2017

# Index

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| | | PHYSICS DEPARTMENT | |
| **IR Sensor, Remote Sensing and Imaging Laboratory (LIR)**<br><br>**Director:** Fernando López | Infrared technology is key in the field of defense and security and remains in a process of continuous innovation. The LIR-Infrared LAB provides key technology solutions:<br>• Detection of dangerous gases<br>• Early detection of drones threat<br>• Rescue and surveillance in tough conditions<br>• Leak detection on aircraft<br>• Support efforts Firefighting<br>• characterization of targets and military interest funds | **Firefighting:**<br>• FIREPARADOX: An innovative approach of Integrated Wildland Fire Management regulating the willdfire problem by the wise use of fire<br>• FUEGO 2: FUEGO Instrument Design Prototype Construction and Validation<br>• System decision support for the management of fuel and reducing the risk of fires in the wildland-urban interface<br><br>**Spanish Ministry of Defense:**<br>• Experimental determination of the infrared emission of lures<br>• Obtaining a parametric model of the infrared signature of a missile by simulation procedures<br>• SIRIO Project. Characterization of the stage, target and seabed through spectral imaging techniques<br><br>**Gas detection:**<br>• AIRBUS: Check for leaks in fuel tanks by using analysis techniques IR infrared spectral image<br>• Exploitation of Patent P2012322013: "Method and device for the detection and measurement of gas concentrations"<br><br>**Early detection of drones threat:**<br>• Ongoing Project with the National Police | **Technological Offer:**<br><br>Gases:<br>• Detection of flame front through dense smoke using multispectral cameras go to support the work of firefighting<br>• Early detection of dangerous and explosive gases to protect people, buildings and multitudinous events<br>• Detection and location of leakage of gases in critical industrial environments<br><br>Early detection:<br>• Drones and unidentified Unnamed Vehicles<br>• Remote sensing to support the rescue in adverse conditions<br>• Radiometric characterization of backgrounds for the correct detection of targets<br>• Border control<br><br>Air safety:<br>• Control of aircraft pressure systems<br>• Tightness of aircraft fuel tanks<br><br>**Scientific-Technological Services:**<br>• Design and development of technological solutions based on IR technology<br>• Design and development of low weight and volume IR sensors for specific applications |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| PHYSICS DEPARTMENT | | | |
| IR Sensor, Remote Sensing and Imaging Laboratory (LIR)<br><br>Director:<br>Fernando López | | | **Equipment:**<br><br>• The LIR-Infrared LAB has the most advanced equipment at the national level in terms of technology IR: ability to work on all bands IR |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **COMPUTER SCIENCE DEPARTMENT** | | | |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **Applied Artificial intelligence (GIAA)**<br><br>**Directors: José Manuel Molina, Jesús García Herrero** | • Automatic Learning Techniques<br>• Evolutionary Computation and Multi-objective Optimisation<br>• Agents and Multi-agent Systems: web, information retrieval, electronic commerce, sensor management<br>• Artificial Vision<br>• Data Fusion Systems and Contextual Information<br>• Vigilance Systems<br>• Air Traffic Control (ATC)<br>• Coastal Surveillance and Maritime Traffic<br>• Indoor localization systems<br>• Inference in adaptive, non-linear dynamic systems<br>• Unmanned vehicles | **European Projects:**<br><br>• Design and arquitectura of and Adaptative Information Fusion/Information Integration (IF/II) Process for Proactive Decision Support<br>• Research on Ambient Intelligence<br>• European Concerted Research Action designated as COST Action IC1406: High Performance Modelling and Simulation for Big Data Applications (cHiPSet), European Cooperation in the field of Scientific and Technical Research<br><br>**R&D National Plan:**<br><br>• Advanced monitoring at ports and airports: concepts, tools and evaluation (MAPACHE)<br>• Estimation techniques for services activity in smart spaces<br>• Augmented science<br>• Adaptive context-based fusion: advanced surveillance, traffic control and navigation systems (FALCON)<br>• Integration of fusion and interpretation techniques for the development of services based on estimating activity in smart spaces<br>• DONDE: Innovative location platform and intelligent video processing<br>• LOCATIL: Sensor fusion techniques and rationale for services based on location and context: application to AAL<br>• CENIT Program (Ingenio 2010) SEDUCE | **Technological Offer:**<br><br>• Surveillance system based on cameras, to monitor and identify surface traffic in airports (planes, trucks and buses) by means of cameras<br>• Simulation system for data fusion in maritime environment, for the radar data fusion with other sensors (AIS and EOR/IOR)<br>• Task distribution platform based on Hadoop for analyzing large volumes of data<br>• Airport data fusion simulation system, for the processing of surface radar and integration with other sensors, following the A-SMGCS paradigm<br>• Software for optimization, prediction and data analysis<br>• System of software agents for surveillance. The technology improves the surveillance process, reducing human attention and introducing automatic alarms<br>• Activity recognition system<br>• Tracking system in marine environment<br>• Multi-sensor fusion platform for monitoring systems<br>• Multisensor Navigation System<br>• Software agent surveillance system<br><br>**Equipment:**<br><br>• High performance computing systems, cameras, location and communications network<br>• Sensor fusion area: the group has an unmanned ground vehicle (UGV) with high sensorization |

+

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| COMPUTER SCIENCE DEPARTMENT | | | |
| **Applied Artificial intelligence (GIAA)**<br><br>Directors: José Manuel Molina, Jesús García Herrero | | • System for the Detection of Explosives in Public Infrastructures and Centers<br>• CENIT program (Ingenio 2010) ATLANTIDA<br>• Application of leader technologies to unmanned aerial vehicles for research and development in ATM<br><br>**Private funding:**<br>• SOLERA Chair: Intelligente applied to automotion<br>• Intelligent Data fusion in the maritime domain (IDF-VTS)<br>• Design and implementation of the MULTISENSOR data fusion system<br>• Design and implementation of the SIGINT program data fusion process | |

**uc3m** | Universidad Carlos III de Madrid

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| | | COMPUTER SCIENCE DEPARTMENT | |

**Computer, Communication and System Architecture (ARCOS)**

**Director: Jesús Carretero**

- Real time systems:
  · Real time simulation systems in planes and trains
  · Wireless network sensors
  · Remote monitoring systems
- 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 network data analysis
  · Peer to peer systems

ARCOS is active in standardization representing Spain in ISO/IEC JTC1/SC22 (Programming languages) and is specially active in ISO/IEC JTC1/SC22/WG21 (C++ Language).

**European Projects:**

- REPHRASE: Refactoring Parallel Heterogeneous Resource-Aware Applications
- REPARA Project. Reengineering and Enabling Performance and poweR of Applications
- CLARISSE: Cross-Layer Abstractions and Run-time for I/O Software Stack of Extreme-scale systems

**R&D National Plan:**

- MemcachedFS: elastic hierarchical I/O caching architecture
- Scalable and robust architectures for supporting advanced network services
- TEALES: New scalable storage techniques for high-performance computing
- SCENTUAS: Security and Civil European Network for UAV Applications
- AMCORE: Advanced Management of Parallel Applications on Large Multicore Systems
- Scalable Input/Output techniques for high-performance distributed and parallel computing environments

**UC3M Funding:**

- Strategic Action in System Arquitecture and High-End computing systems
- ADAPCITY: a self-adaptive, scalable framework for heterogeneous systems in Smart Cities

**Technological Offer:**

- CRM tool for preventive maintenance in complex organizations that handle large volumes of data and with great dispersion of terminals and a variety of failures
- Tool for efficient management of mass data storage
- ParFiSys, Parallel file system compatible with UNIX that can run outside the operating system
- Light adaptive and fault-tolerant data storage system (AFTSYS)
- Automatic creation of secure applications for Wireless Sensor Networks (WSN) using Model Driven Architecture (MDA)

**Scientific–Technological Services:**

- Design, development and improvement of telematic applications in real time
- Design and development of distributed applications.
- Improving the ability of operating systems, both Windows and UNIX and LINUX
- Development of parallel applications for managing and storing large volumes of data
- Optimization of the IT infrastructure and data analysis centers

+

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| | | COMPUTER SCIENCE DEPARTMENT | |
| Computer, Communication and System Architecture (ARCOS)<br><br>Director: Jesús Carretero | | • ITC2S: In The Cloud-Intermodal Transport Control System<br>• NESUS:Network for Sustainable Ultrascale Computing<br><br>**Other Competitive Projects:**<br>• Planning of preventive maintenance of the railway infrastructure through a methodology based on the reliability and safety (RCM)<br>• Automatic creation of secure applications for Wireless Sensor Networks (WSN) using Model Driven Architecture (MDA) | |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| | | COMPUTER SCIENCE DEPARTMENT | |

### COMPUTER SCIENCE DEPARTMENT

**COSEC (Computer Security Lab)**

**Directors: Arturo Ribagorda, Juan Tapiador**

**LINES OF RESEARCH**

- Applied cryptography
- Privacy
- cyber defense systems
- Security in Smart devices (sensors, RFID, smartphones, wearables)
- Advanced techniques for detecting and analyzing malware
- Security and y e-health (implantable medical devices and biosignals)
- Hardware security (PUFS, troyanos hardware)
- VANET environment security.
- Forensics computer

**RESEARCH PROJECTS**

**European Projects:**

- ARVI: Runtime Verification beyond Monitoring (ICT COST Action IC1402)
- Cryptography for Secure Digital Interaction (ICT COST Action IC1306)
- Trustworthy Manufacturing and Utilization of Secure Devices (ICT COST Action IC1204)

**R&D National Plan:**

- SPINY: Security and Privacy in the Internet-of-You.
- E-Save: Evidence-based Security Arquitecture for Vehicular Environments
- SACO: An Advanced Cyberdefense Simulator
- iMAE: Mobile Identify for E-government
- Security 2020: Digital identity management in digital environments
- Reference models architectures for secure electronic payment intermediation

**R&D Research Plan (Comunidad de Madrid):**

- CIBERDINE. Cibersecurity, Data, Information and Risks.
- EVADIR: A Methodology for Evasion Attacks on Network Intrusion Detection Systems
- PRECIOUS: Privacy-preserving Processing of VANET Evidences

**Private funding:**

- SEGUR@: Security and Trust in the Information Society

**TECHNOLOGICAL OFFER / OTHERS**

**Patents and Software Registrations:**

- SETiChat - A secure Android chat. Ref.: M-003681/2014
- Alterdroid - Tool for analyzing obfuscated software in Android. Ref.: M-003190/2014
- Targetdroid - Tool for analyzing targeted malware in Android. Ref.: M-008457/2014
- E-RETO: e-mail usage pattern analyzer. Ref.:M-007044/2014
- Software of interactive learning PAB. Bridge learning system. Ref.:M-008729/2012
- eStorePasss: Password manager that works with chip cards. It is currently tailored for the Spanish National Identity Card (DNI-e). Ref.:M-003999/2012
- iPhone Shopping Assistant : iOS software that helps on creating the shopping list, based on user's preferences and data obtained from different shops

**Scientific-Technological Services:**

- Security Document of automated files containing personal data
- Advanced analysis of mobile malware and Android systems security
- Analysis and development of primitive and cryptographic protocols

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **COMPUTER SCIENCE DEPARTMENT** | | | |
| <u>Interactive Systems (DEI)</u><br><br>**Director: Paloma Díaz** | • Web Emergency Management Information Systems (WEMIS).<br>• Interaction and visualization tools to improve situation awareness in crisis and operation centers.<br>• Communities of practice and communities of interest<br>• Social networks<br>• Situation awareness | **R&D National Plan:**<br>• EmerCien: Civic Engagement in Emergency Management<br>• EMERGENSYS: global emergency management system<br>• Goal: to develop tools that improve communication between emergency management organizations and citizens<br>• Tipex: Information Technologies for Planning and Training in Emergencies<br>• urThey: Bulding citizens emergency preparation and respose capacity through web 2.0 tools<br>• SIGAME: Integrated system of media management in emergencies<br>• UIA4SIGE<br>• Goal: to develop models and mechanisms to improve the usability, interoperability and accessibility of information systems for emergency management<br><br>**Private funding:**<br>• INTEGRA<br>• Goal: to explore interaction and visualization mechanisms to support border control monitoring in operation rooms improving situation awareness | **Technological Offer:**<br>• *ARCE*, a secure web portal allowing Governmental Organizations for Civil Defense and Protection to share information about normal and alert situations, as well as to facilitate international cooperation in emergency situations<br>• *SIGAME*: web platform to favor cooperation and coordination between national civil protection agencies<br>• *Sema4ra*: ontology for the representation of knowledge about emergency alerts and routes for everyone<br>• *INeres:* app for viewing emergency alerts and routes for everyone<br>• *RemerWeb*: Web platform for communication of volunteers networks in early warning monitoring<br><br>**Scientific–Technological Services:**<br>• Design and development of information systems for emergency and crisis management<br>• Design and development of mobile and multiplatform applications<br>• Design and development of collaborative environments<br>• Design and development of complex data visualizations<br>• Design and develpment of 3D and AR games and simulations |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| COMPUTER SCIENCE DEPARTMENT | | | |
| **System Control, Learning and Optimization Laboratory (CAOS)** <br><br> **Director: Araceli Sanchis** | • Machine learning <br> • Evolving systems <br> • Activity recognition <br> • Classifiers ensembles <br> • Modeling and prediction of human behavior <br> • Artificial neural networks <br> • Evolutionary computation <br> • Agent modeling | **R&D National Plan:** <br><br> • ADAS-ROAD: Advanced system for driving assistance in Intercity Environments: Environment Perception and Simulation <br> • i-Support: Intelligent Agent-Based Driver Decision Support <br> • AIDA: Intelligent system driving assistance based on Agents <br> • POCIMA: Pedestrian, cyclist and motorist detection systems <br> • ASISTENTUR: Advance Driving Assistance System for Urban Environments: Artificial Intelligence | **Technological Offer:** <br><br> • System for efficiently identifying traffic signs by means of sets of classifiers <br><br> **Scientific–Technological Services:** <br><br> • Prediction of trends and process optimization based on intelligent data analysis <br> • Design of intelligent data retrieval –Data Mining- systems based on state of the art technologies. <br> • Forecasting Time Series by means of machine learning techniques <br> • Explicit representation of the key processes and the knowledge of complex organizations <br> • Application of Artificial Intelligence techniques to the resolution of business problems <br> • Application of activity recognition methods in Ambient Assisted Living, videogames and human-computer interaction |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **SYSTEM AND AUTOMATION ENGINEERING DEPARTMENT** | | | |
| **Intelligent System Laboratory (LSI)**<br><br>**Directors:**<br>**Arturo de la Escalera, José María Armingol, Francisco José Rodríguez** | • Computer Vision Systems<br>· 3D Vision<br>· Vision applied to robots<br>· Object Recognition using Geometric Model<br>· IR Images<br>· Machine Learning Algorithms<br>· Features Analysis: Color & Texture<br>· Surveillance Systems<br>• Advanced Driver Assistance Systems<br>• Autonomous Aerial Ground Vehicle Systems<br>• Autonomous Unmanned Ground Vehicle Systems | **R&D National Plan:**<br>• Advanced Driver Behavior Analysis<br>• FERRODON<br>· Create a light train vehicle, able to move over train tracks to perform automatic inspection, maintenance and surveillance tasks<br>• AVATRACK<br>· Create an advanced and an intelligent robotic system, which can used for automatic guidance of a ballast tamper with high performance<br>• ADAS-ROAD: Advanced Driver Assistance System for Road Environments<br>• INDIO<br>· Create an integrated system for the detection of trains at long distances and rail tracks ruptures<br>• FEDORA: Sensors Fusion for the Maneuver Analysis in Urban Environments for ADAS<br>• VISVIA<br>• On-board Sensorial System for Advanced Driver Assistance Systems<br>• 3-DS. Driver Distraction Detector System<br>• POCIMA. Pedestrians, Cyclists and Motorists Detection<br><br>**R&D Regional Plan (Comunidad de Madrid):**<br>• SEGVAUTO-TRIES. Vehicle Safety: Efficient & Sustainable Transport<br>• SEGVAUTO. Vehicle Safety<br>• PAPMI. Active Pedestrian Protection based on Infrared Vision | **Technological Offer:**<br>• Stereo Based Obstacle Detection<br>• Infrared Pedestrian Detection<br>• Camera-based Detection<br>• Detection based on Data Fusion<br>• Traffic Signs Detection & Identification<br>• Traffic Lanes Detection & Identification<br>• Visual Odometry<br>• Laser Scanner & Camera Data Fusion<br>• Autonomous Navigation<br>• Driver Monitoring<br>• Pedestrian & Vehicle Tracking<br>• Advanced GPS Localization<br>• CAN Bus Monitoring<br>• UAV Autonomous Landing<br>• People Detection from UAV<br>• Obstacle Detection from UAV<br><br>**Equipment:**<br>• Electric autonomous vehicles<br>• Unmanned Aerial Vehicles<br>• Intelligent Road Automobile<br>• 3D Cameras<br>• Image analysis equipment<br>• Computers with data acquisition card and control |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **SYSTEM AND AUTOMATION ENGINEERING DEPARTMENT** | | | |
| Intelligent System Laboratory (LSI)<br><br>Directors:<br>Arturo de la Escalera, José María Armingol, Francisco José Rodríguez | | **Private funding:**<br>• RECOVE. Vehicle recognition. | |

# uc3m | Universidad Carlos III de Madrid

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| TELEMATIC ENGINEERING DEPARTMENT | | | |
| **ADSCOM (Communication Networks and Services Group)** <br><br> **Director: David Larrabeiti** | • Digital Legal Interception <br> • Use of big data techniques in malware detection and detection of criminal activity <br> • Security in the Internet of Things (IoT) <br> • Telematic tools of Public Security and Cyber Terrorism <br> • Security in networks and critical infrastructure systems <br> • Deployment and design of emergency networks | **European Projects:** <br><br> • INDECT FP7 SEC (Intelligent information system supporting observation, searching and detection for security of citizens in urban environment) <br><br> **R&D National Plan:** <br><br> • IMPROVISA (Minimalist Infrastructure for service PROVISioning in Ad-hoc networks) <br> • T2C2 (Telematic Technologies for Citizen Collaboration) <br><br> **Private funding:** <br><br> • Identification of malware in stock Android applications with machine learning techniques <br> • Smart-trap energy-efficient m2m control protocol for an Internet of Things scenario | • Legal communication interception supported in specialized hardware: deep packet inspection, traffic analysis and digital tapwire warrant <br> • Digital forensics <br> • Consultancy, design and implementation of public key infrastructures PKI <br> • Electronic signature and secure protocol products based on digital certificates <br> • User and identity management. Design of Single Sign On mechanisms. Interoperability and federation of identities <br> • Device mobility and management. Privacy, Interoperability, remote management, data synchronization, remote wipe and reset, geo-location <br> • Customized cryptographic and steganographic algorithm design and implementation <br> • Design and implementation of systems based on powerful multi-factor authentication: token, biotoken, OTP, biometrics <br> • Design, implementation and installation of ad-hoc mobile networks (MANET) for emergency scenarios <br> • Design of wireless-fixed mobile emergency network infrastructure. Safe multi-trajectory ad-hoc routing in vehicle and pedestrian systems <br> • Citizen collaboration networks and applications during emergencies <br> • Key distribution systems and federation of identity management systems in vehicle networks. Alternative reputation-based systems <br> • Adaptive security, securitization and optimization of complex networks |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| | | TELEMATIC ENGINEERING DEPARTMENT | |
| **Telematic Applications and Services (GAST)** <br><br> **Director: Carlos Delgado Kloos** | • Ubiquitous computation <br> • Web technologies | **European Projects:** <br><br> • Ubisec: Ubiquitous Networks with a Secure Provision of Service Access and Content Delivery <br><br> **R&D National Plan:** <br><br> • NETLAB, Use Cases for Interconnected Testbeds and Living Labs <br> • ITACA: Semantic annotation and user-based community formation based on consults and supported by a confidence model <br> • Infoflex: Management of flexible and distributed content based on advanced web technologies <br><br> **R&D Regional Plan (Comunidad de Madrid):** <br><br> • NEWS: News Engine Web Services. Autonomous <br><br> **Private funding:** <br><br> • NDIS-SDIO | **Technological Offer:** <br><br> • Systems for managing the identity, confidence and reputation for distributed services <br> • Improvement and adaptation of particular identity management cases in next generation networks Aggregation of third party service profiles or accounts to the network profile for use in service access <br> • Risk management and assessment as part of the process for making decisions that affect the security level in open environments <br> • Development of middleware and drivers for interaction with application devices in smart cards for Windows mobile android (ADK) for authentication and signature purposes <br> • Secure policy and user profile management with confidence-based access control schemes <br> • Flexible authorization mechanisms with confidence negotiation based on different authentication mechanisms, tests and capabilities. Anonymity and interaction with previously unknown devices in opportunistic interactions <br> • Text mining in social networks |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **ELECTRONICS TECHNOLOGY DEPARTMENT** | | | |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **University Group for Identification Technologies (GUTI)**<br><br>**Director: Raúl Sánchez Reíllo** | • Mobility identification solutions (smart phones, tablets, netbooks...)<br>• Identification devices (particularly smart cards and RFID), since 1994<br>• Security and cryptographic instruments (both secret and public key)<br>• Biometric Identification Systems<br>• Biometric Modalities: iris, hand geometry, vascular systems, handwritten signature and fingerprints<br>• Multibiometrics: multimodal, multisensor, multialgorithm. Both fusion and complementarity<br>• Biometrics integration in smart cards and tokens<br>• Biometrics protection: in processes, storage, communications, etc.<br>• Evaluation methodology: both in performance and in security | **European Projects:**<br>• EKSISTENZ: Harmonized framework allowing a sustainable and robust identity for European Citizens<br>• MobilePass: A secure, modular and distributed mobile border control solution for European land border corssing points<br>• ORIGINS: Recommendations for Reliable Breeder Documents Restoring e-Passport Confidence and Leveraging Extended Border Security (MNG&OTHERS)<br><br>**R&D National Plan:**<br>• Universal access by means of biometric recognition in mobile environments<br>• Strategic action in identification systems and applications<br>• Secure and convenient authentication in mobile environments in Voice Biometrics<br>• SecuVoice. Voice biometrics to assure business application security<br>• EMOCION. Recognition through body odor in the Internet of the future and its securisation<br><br>**UC3M Funding:**<br>• AUGUR: AUthentication platform for Global and Usable secure biometRics access<br>• AUPET: Accessibility, Usability and Privacy Enabling Technologies<br>• CIBER-SAFE: Computational Intelligence Cyber-Security and Forensics<br>+ | **Technological Offer (Software Registration):**<br>• Multibiometrics system for biometric database capture with environmental condition information and user verification M-008747/2011<br>• System for developing applications with handwritten signature capture on Blackberry, Android, Windows and Apple-iOs platform M009149/2011, M-008746/2011, M-008745/2011, M-008741/2011<br>• Iris recognition algorithm for border control systems M-008739/2011<br><br>**Equipment:**<br>• Wave generator<br>• Digital oscilloscope<br>• USB protocol analyzer<br>• Ethernet protocol analyzer<br>• Biometric identification devices for different modalities (Iris, vascular, finger-print, handwriting, etc.) |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **ELECTRONICS TECHNOLOGY DEPARTMENT** | | | |
| University Group for Identification Technologies (GUTI)<br><br>Director: Raúl Sánchez Reíllo | | • IVIR: Usability vs. Vulnerability robustness in Iris Recognition<br>• P4CT: Privacy Ontology, Privacy Score, Privacy Platform and Privacy Alliance Control Toolkit<br><br>**Private funding:**<br>• Performance and Security Evaluation of Fingerprint Sensors and Algorithms | |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| | | ELECTRONICS TECHNOLOGY DEPARTMENT | |
| **Microelectronics Design and Applications Group (DMA)** <br><br> **Directors: Luis Entrena, Luis Hernández** | • Logic synthesis <br> • Fault tolerance in digital electronic circuits <br> • Sigma-Delta modulation <br> • Low consumption design <br> • Analogue/Digital converter design <br> • Digital circuit design with hardware description language <br> • Digital circuit design with FPGA Hardware acceleration | **European Projects:** <br> • AMATISTA: Automatic Tool for Insertion ans Simulation of Fault tolerant architectures <br> • SIMIC: Silicon Microphone <br><br> **R&D National Plan:** <br> • RENASER+. Cmprehensive analysis of digital circuits and systems for aerospace applications <br> • SIDECAR. identification and communications systems through reconfigurable hardware <br><br> **Private funding:** <br> • BIOMATCH: smart card reader with biometric Securing <br> • Touchless optical sensors technology for biometric applications <br> • Exploration of High Bandwidth Data Converters based on Time Encoded Architectures <br> • Generation of noise sequences for security applications <br><br> **National Intelligence Center:** <br> • Development of cryptographic protocols <br> • Adaptation of cryptographic protocols <br> • Cryptographic module carrier | **Technological Offer:** <br> • Electronic data acquisition systems in communications and sensing, generating IP at system and microelectronic level <br> • Hardware acceleration for biometrics and cryptography <br> • TRNGs and "lightweight" cryptographic modules for RFID |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| | | ELECTRONICS TECHNOLOGY DEPARTMENT | |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **Displays and Photonic Applications Group (GDAF)**<br><br>**Directors: José Manuel Sánchez, Carmen Vázquez** | • Electro-optic devices and applications: optical and electrical characterization of devices (liquid crystals, electrochromic materials…)<br>• Advanced instrumentation and sensors: Development of advanced instrumentation, fiber optic sensors and their integration into WDM networks<br>• Photonic devices for optical networks: design and characterization of integrated optical devices | **European Projects:**<br>• Novel and reliable optical fibre Sensor Systems for Future Security and Safety Applications (OFSeSa)<br>• FIBERSTAR:FIBER-optic sensors for Smart Thermal Ablation at Radiofrequency<br><br>**R&D National Plan:**<br>• Development of displays based on antiferroelectric liquid crystals and electroluminescent organic diodes for specialized portable systems with high added value<br><br>**New switching and sensing techniques in optical networks:**<br>• Development of an UMTS detection and interception equipment<br><br>**UC3M Funding:**<br>• MetropolitAn bRoad band basEd NetwOrkS for TRUe Multiple security<br><br>**Private funding:**<br>• Development of advanced electro-optic systems for security applications<br>• Optical Velocity Measurement System | **Technological Offer:**<br>• Optical sensor for measuring projectile velocity<br>• Prototype "Subtitle Glasses for Hearing-impaired"<br>• Device for aiding and protection of sight. Co-ownership, UVA and CIDETEC. Patent ES2334960.<br>• Vehicle signaling device. Patent ES2284399<br>• Optical sensor for measuring level in critical environments. Patent ES2213411 |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **SIGNAL AND COMMUNICATIONS THEORY DEPARTMENT** | | | |
| **Communications Group**<br><br>**Director: Ana García Armada** | • Multi-antenna systems (MIMO) for broadband communication<br>• OFDM multicarrier modulation<br>• Channel estimation, synchronization and power peak reduction<br>• Relays and cooperative transmission<br>• Signal processing in digital communications<br>• Coordinated transmission and interference cancellation in cellular systems<br>• Communication system simulation and modeling | **European Projects:**<br>• TELERESCUER: System for virtual TELEportation of RESCUER for inspecting coal mine areas affected by catastrophic events<br>• CRUISE: Creating Ubiquitous Intelligent Sensing Environments<br>• NEXWAY: Network of Excellence in Wireless Applications and Technology<br><br>**R&D National Plan:**<br>• CIES: Wireless communications in emergency and security environments<br>• Textile high-capacity device based on MIMO massive techniques<br>• ELISA: Enabling communication technologies with shared licensed and unlicensed<br>• HUMAN: Hybrid-locomotion collaborative robots for distruted Mobile Ad-hoc communication Networks<br><br>**UC3M Funding:**<br>• ATOMIC: Advanced TechnOlogies for 5G sMall cells with Constrained backhaul<br>• COLIBRI: Cognitive ultra-dense small cells with adaptive backhaul and interference reduction<br>• SARBOT: Advanced robots'phisycal and cognitive capabilities in all-terrain locomotion for search and rescue missions | **Technological Offer:**<br>• Algorithms for MIMO-OFDM wireless communications<br>• Improved transmission method for OFDM mobile communications<br><br>**Equipment Hardware:**<br>• DSP platform for communications system prototyping<br>• E4438C-ESG vector signal generator<br>• DSO90604A-Infiniium Oscilloscope<br>• II Probe Amplifier<br>• High performance vector signal analyzer<br><br>**Software:**<br>• Communications simulation software; Application development platforms for wireless systems; Software for content management applications in communications |

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

**SIGNAL AND COMMUNICATIONS THEORY DEPARTMENT**

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **Multimedia Processing Group (GPM)**<br><br>**Director:**<br>**Fernando Díaz de María** | • Automatic traffic incident detection by artificial vision<br>• Detection and monitoring of vehicles to improve mobility and road safety<br>• Automatic recognition of people, places and objects<br>• Events recognition in audio<br>• Classification, analysis and indexing of images and video<br>• Detection, recognition and tracking of objects in video sequences.<br>• Object tracking in images and video<br>• Video coding | **R&D National Plan:**<br>• Techniques complementary to HMMS for improving the robustness of speech recognition systems<br>• Salience and attention: multimodality, context-awareness, self-adaptation and bioinspiration<br>• annotation, indexing and coding of user-generated content<br><br>**UC3M funding:**<br>• Strategic action in applications of voice, audio, image and video applications<br><br>**Private funding:**<br>• Algorithmic prospective and design of for video coding<br>• Specific technical questions on Blue-ray optical recording technology | **Technological Offer:**<br>• Objects and people tracking<br>• Video analytics<br>• Vehicle brand and model recognition<br>• Classification of type of vehicle (car, truck, motorcycle, etc.)<br>• Automatic recognition of places, people and objects<br>• Events recognition in audio<br>• Applications of Artificial Vision in Security<br><br>**Equipment Hardware:**<br>• Equipment for infrared image recording and processing<br>• Video acquisition and reproduction hardware<br>• Anechoic chamber for acoustics<br>• Hardware for audio capturing, processing, effects, storage and reproduction<br>• Sonometers; real time acoustic and audio multi analyzer<br>• Computing cluster for HPC (High Performance Computing) with sustained computing power of 4.5 Tflops<br><br>**Software:**<br>• Software for automatic multimedia information indexing<br>• Text and voice databases for acoustic and language model design<br>• Audio and video editors<br>• Electro-acoustic and acoustic simulation software for enclosures |

**Universidad Carlos III de Madrid** — uc3m

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| | **SIGNAL AND COMMUNICATIONS THEORY DEPARTMENT** | | |
| **Signal Processing and Learning Group (GTSA)**<br><br>**Director: Antonio Artés** | • Discriminative and generative machine learning methods for signal and image processing<br>• Scatter analysis, compressive sampling and characteristic selection and extraction techniques<br>• Graphical models for channel coding.<br>• Location and tracking methods based on sequential Monte Carlo methods<br>• Data and information fusion<br>• Detection and estimation in sensor networks<br>• Pattern recognition applications in medicine and in security<br>• Signal processing applications in communications | **Public funding:**<br>• Detection of objects in infrared images for security applications<br>• Intelligent systems: concepts and applications<br>• Advances in statistical learning, communications and information theory<br><br>**Private funding:**<br>• Stress level assesment with non-intrusive sensors<br>• Design of data link | **Technological Offer:**<br>• Intelligent monitoring systems based on sensor networks with military, environmental, security, tracking and home automation applications |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| POLITICAL SCIENCE AND SOCIOLOGY DEPARTMENT | | | |

### POLITICAL SCIENCE AND SOCIOLOGY DEPARTMENT

**Public Security and Crisis Management Policies**

**Director:**
**Francisco Vanaclocha**

**Lines of Research:**
- Analysis, management and evaluation of public security policies
- Security design and management plans
- Risk analysis and evaluation
- Crisis management policy (catastrophes, major emergencies and high risk scenarios)

**Research Projects:**

**R&D National Plan:**
- Study of the prevention, management and evaluation models for environmental disasters in coastal areas
- Integral port security management
- Chart for the evaluation of public policies and programs in the general administration of the state

**UC3M funding:**
- Analysis and management of Public Security Policies. Its impact on the training of managers
- Reactive management of security in massive terrorist attacks: three sectorial approaches and a transverse analysis on how 11-M was handled.

**Private funding:**
- Consultancy on design, programming and evaluation of a special applied training in security and emergency
- Special training program for security managers

**Technological Offer:**
- Protection of critical infrastructures

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

### CENTER FOR AEROSPACE AND SECURITY SYSTEMS

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **Identification and Biometrics Systems Laboratory (ID Testing Lab)**<br><br>**Director: Raúl Sánchez Reíllo** | Identification System Testing Laboratory(ID TEST) is formed by a team of experts in biometric identification of people and objects in different environments<br>The laboratory works mainly in the evaluation, specification and standardization of methodologies for this purpose. ID TEST also develops identification solutions adapted to the customer needs by offering their services to multiple platforms, working on Windows, Linux, and mobile devices, Apple, Android, Blackberry | • Functional evaluation of Identification Systems<br>• Biometrics<br>• Smart cards<br>• Security Evaluation through common criteria<br>• Protection Profiles elaboration<br>• Evaluation methodologies creation<br>• Consulting and Systems identification R&D<br>• National and International Standarization | **Scientific–Technological Services:**<br>• Functional Evaluation of Identification Systems<br> · Biometric Identification Systems<br> · Smart cards<br>• Evaluation of the Robustness of Identification Systems in different scenarios<br> · Against adverse environmental conditions<br> · Against different aspects that may affect user interaction with the system and system usability<br>• Security Evaluation according to the Common Criteria Methodology<br> · Preparing Protection Profiles<br>• Defining and specifying Evaluation Methodologies<br>• Identification System Consultancy, Development and Research<br>• Nation and International Standardization<br><br>**Equipment:**<br>• Temperature- and humidity-controlled environmental chamber<br>• Lighting chamber (photosensitive camera), with the possibility of using different wavelengths (IR, solar white, pure white and combinations thereof)<br>• Fireproof cabinet and security servers<br>• Electronics bench with high-performance equipment: oscilloscope, wave generator, power source, protocol analyzers, digital multimeter soldering station, etc.<br>• Parameter-measuring instruments |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **CENTER FOR AEROSPACE AND SECURITY SYSTEMS** | | | |
| <u>**Communications and Signal Processing Laboratory**</u><br><br>**Directors: Ana García Armada, Fernando Díaz de María** | Communications and Signal Processing Laboratory is formed by a team of experts in:<br>• The study, design and implementation (HW) of signal processing and communications system, based on wireless technologies, specifically using OFDM and MIMO technologies<br>• The design of algorithmic solutions in the field of voice, audio, image and video processing, with special emphasis on machine vision, video coding and voice technologies | • **Communications: signal processing and transmission** (A. Gª. Armada)<br>· Cooperative transmission in sensor networks<br>· Robust wireless communication system design and prototyping (OFDM, MIMO technologies).<br>· High spectral efficiency techniques<br>· Base station cooperation and interference cancellation in cellular systems<br>• **Multimedia processing: Machine Vision and Video Coding** (F. Díaz de María)<br>· Video coding<br>· Video coding standards<br>· Machine Vision<br>· Voice technologies | **Scientific–Technological Services:**<br><br>Communications: signal processing and transmission<br>• Cooperative transmission in sensor networks<br>• Robust wireless communication system design and prototyping (OFDM, MIMO technologies)<br>• High spectral efficiency techniques<br><br>Multimedia processing: Machine vision, medical imaging, speech technologies and video coding<br>• Machine vision:<br>· Detection of events in video-surveillance (video analytics)<br>· Detection and recognition of objects/places/people/events<br>· Indexation and automatic annotation of multimedia contents<br>· Image/video segmentation, restoration, tracking, classification<br>· Medical imaging: aid in diagnosis<br>· Brain tumor classification by means of automatic MRI analysis<br>· Early detection of melanomas<br>• Speech technologies<br>• Video coding: Design of a proprietary algorithm for H.264/AVC, HEVC, 3D, SVC image or video coding |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| **CENTER FOR AEROSPACE AND SECURITY SYSTEMS** | | | |
| **Networks Security Laboratory (EVALUES)** <br><br> **Director: José María Sierra** | Networks Security Laboratory (EVALUES) is formed by a skilled professional team in designing and implementing security solutions and security assessment. | • Design and implementation of security solutions <br> • Architecture and protocol evaluation | **Scientific–Technical Services:** <br><br> • Design and implementation of security solutions: <br>   · User authentication (mobile devices and smart cards) <br>   · Risk analysis and management (Magerit v2) <br>   · Flexibilization of security architectures and protocols for mobile devices (AdaptCrypt) <br>   · Preparation of secure guidelines for network system configuration <br> • Architecture and protocol evaluation: <br>   · Analysis of conformity and performance in security protocols (IPSEC and SSL) <br>   · Controlled analysis on the effects of denial-of-service attacks <br>   · External audit on remote system security <br>   · Interoperability study for network systems |

**Universidad Carlos III de Madrid** — uc3m

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| | | CENTER FOR AEROSPACE AND SECURITY SYSTEMS | |
| **IR and Spectral Sensor Laboratory**<br><br>**Director:**<br>**Fernando López** | Thanks to properties that presents the matter on the IR and that large number of molecular transitions take place in this area of the electromagnetic spectrum, the Laboratory is able to apply these techniques to Infrared (IR) thermography, Gas Detection and Nondestructive testing of composite materials. | • Use of hyper- and multispectral sensors<br>• Infrared spectral imaging for remote detection<br>• IR spectral thermography applied in non-destructive analysis | **Scientific–Technological Services:**<br>• IR tomography: remote temperature measurement.<br>• Use of hyper- and multispectral sensors.<br>• Detection of gases with well-defined IR emissions, with possible applications in defense, security and the environment<br>• IR spectral imaging for remote detection<br>• SAFETY: personal rescue, maritime surveillance, fires, mining, and night vision<br>• SECURITY: Detection of hot spots and heat sources. Night vision and surveillance<br><br>**Equipment:**<br>• Multispectral cameras in all the IR spectrum bands.<br>• High spatial resolution FTIR spectrophotometer and spectroradiometers<br>• IR camera for detecting $SO_2$ and other gases<br>• High resolution IR microscope<br>• Optical IR remote detection system<br>• Black bodies for calibration and traceability from -25°C up to 800°C<br>• Optical laboratory installations: optical tables, laminar flow camera, interferential filters, lenses, micro-positioning lens holders, IR windows, etc. |

| R&D GROUP | LINES OF RESEARCH | RESEARCH PROJECTS | TECHNOLOGICAL OFFER / OTHERS |
|---|---|---|---|
| CENTER FOR AEROSPACE AND SECURITY SYSTEMS |||| 

**CENTER FOR AEROSPACE AND SECURITY SYSTEMS**

**Structural Dynamics Laboratory (InpactLab)**

**Director: José Antonio Loya**

Structural Dynamics Laboratory (InpactLab) is formed by a team of qualified professionals with extensive experience in providing innovative solutions to industry on the Mechanical Behavior of components and Calculation of Structural Elements

It provides mechanical testing at different strain rates and at different temperatures, with specific expertise in the field of dynamic tests and impact. It also has extensive experience in modeling solid mechanics problems using tools of self-development and commercial use of numerical codes

**RESEARCH PROJECTS:**

- Dynamic behaviour of structural elements: experimental simulation and analysis
- Structures for energy absorption
- Constitutive models for materials at high strain rates
- Fracture mechanics
- Damage mechanics
- Dynamic fracture testing
- Thermomechanical behaviour of materials
- Residual stresses in structural elements
- 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
- Damage tolerance study of composite structural element subjected to different load conditions
- Innovation and development of non-conventional 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 in dynamic conditions

**Scientific–Technological Services:**

- Analysis of aeronautic and aerospace structural element behaviour against impact
- Development of specific methodologies for the study of tolerance to damage against different load conditions of aeronautic and aerospace structures made of composites
- Safety and defense of mobile systems subjected to impact loads
- Analysis and modelling of lightweight structures subjected to impact loads
- Energy absorption testing

**Equipment:**

- The Laboratory has advanced equipment for the dynamic characterization of materials in static and dynamic conditions, at strain rates up to 2000s-1 and at temperatures ranging from -150 oC to 1200 oC.