Sistemas Industriales

fatronik tecnalia

Una mirada diferente

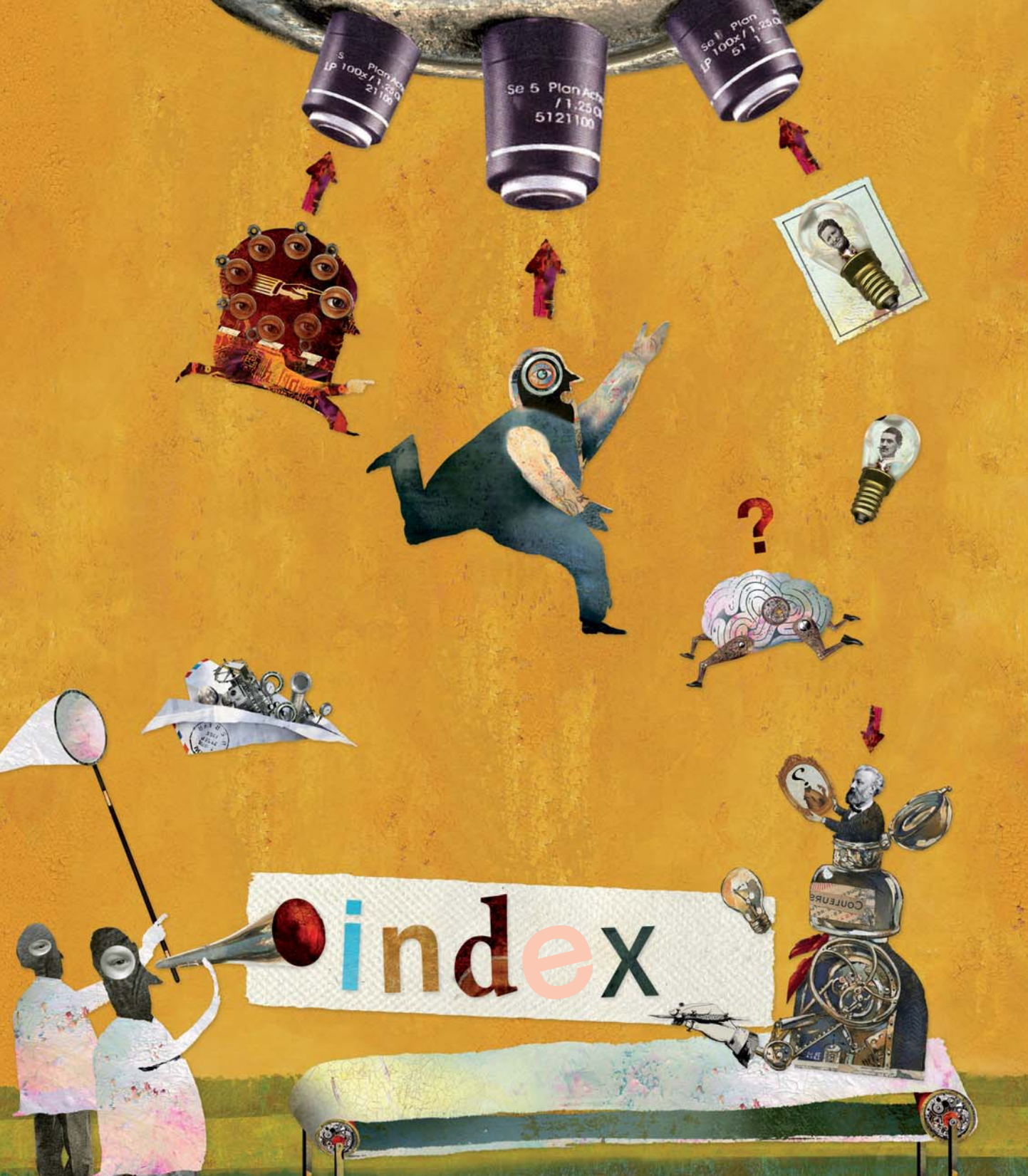
fatronik tecnalia Sistemas Industriales

fatronik tecnalia Industrial Systems

Industrial Systems

fatronik tecnalia

A different approach


index

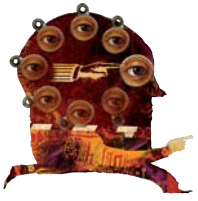

a.
w.
r.
x.
n.
y..

1 what is Industrial Systems, FATRONIK-Tecnalia

The Industrial Systems Unit of FATRONIK-Tecnalia always manages to surprise. Because we have something that sets us apart, we have a different approach and specific objective. What differentiates us lies in our contact eye on the target: the creation of value.

Knowledge per se is not a goal itself for us, but a route to take. A route for achieving maximum profitability, in economic and/or competitive terms, for our clients, for our associates and for society in general.

The application of knowledge is our objective, turning knowledge into value.



Sistemas Industriales
FATRONIK-Tecnalia
Tecnalia
together we have no limits

Industrial Systems is one of the two business unit of FATRONIK-Tecnalia, a market oriented centre, dedicated to get through innovation and technological development the biggest **impact in economic terms**.

The activity of Industrial Sistems focuses on the development of **methods, techniques, and systems for the design, manufacture, maintenance and end of life of products and services** to improve the competitiveness of companies.

Since 2007 FATRONIK-Tecnalia is part of Tecnalia, a private and Independent technological corporation composed of 8 Technological Centres: Azti, Cidemco, ESI (European Software Institute), Fatronik, Inasmet, Labein, Neiker and Robotiker.

In Tecnalia we want our professional development to contribute towards the **growth of our society** in the context of knowledge that is both a tool for our work and the product of our activities.

We want to learn more so that we can **anticipate the needs** of our businesses and set trends that provide value and tangible scientific-technological excelence, and accompany them during the process of globalisation and internationalisation.

And we get it thanks to the commitment of each person that is part of Tecnalia. Because we are convinced that together we have no limits.

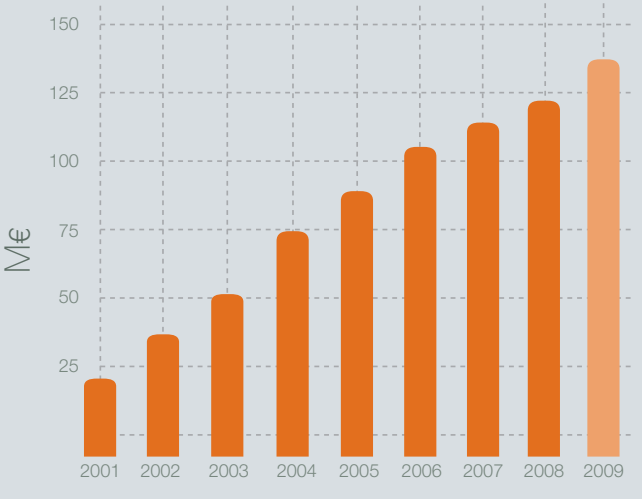
Tecnalia is the biggest private R&D organisation on a national scale and the 5th in Europe

In 2008 we keep on growing

128 M € total revenue

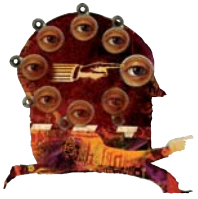
1.378 People on the Payroll

3.800 Clients



The organisation of Tecnalia foments cooperation, multidisciplinarity and transversality as a response to technological challenges demand global and highly specialised answers.
The synergies that arise from our union as well as reinforcing our overall capacity and broadening our network of relations multiply our **competitiveness and effectiveness**.

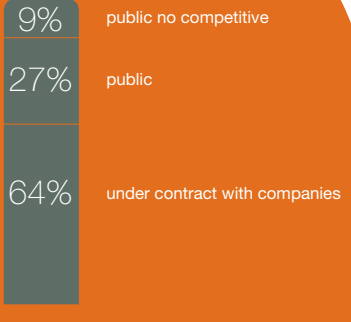
An example of the integrated offer created from the complementarity of its units is the development of a fish sexing robot between the Industrial Systems unit and Foodstuffs unit.



Industrial Systems in figures

turnover (M€)

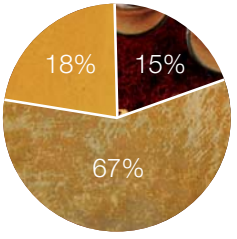
financing



6 network nodes

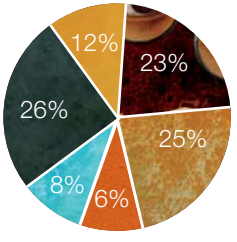
Application Fields

- Maintenance and End of Life
- Production Systems and Automation
- Robotics and Manipulation



Application Sectors

- Aeronautics
- Machine Tools
- Food and Agriculture
- Construction
- Transport
- Others



Most significant alliances

ARTEMISIA: Association for R&D actors in the field of ARTEMIS: Advanced Research & Technology for Embedded Intelligence and Systems

CEA-IFAC: Spanish Committee of Automation, IFAC

EARTO: European Association of Contract Research Organisations

EURON: European Robotics Research Network

EUROP: European Technology Platform on Robotics

EUROTECH: Advanced Engineering and Technical Documentation Services

HEGAN: Aeronautical and Space Cluster of the Basque Country

IEEE: Institute of Electrical and Electronics Engineers

IEEE: IES (Industrial Electronics Society) - Technical Committee on Industrial Agents, Chair of the sub-committee on Infrastructure (Manufacturing)

INNOBASQUE: Basque Innovation Agency

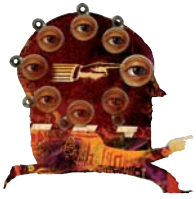
INVEMA: Machine Tool Research Foundation

MANUFUTURE: Spanish Technological Platform for research in the sphere of manufacturing

MARGUNE: Cooperative Research Centre in High Performance Manufacturing

NESSI: Networked European Software and Services Initiative

PROMETEO: Spanish Technological Platform on Integrated Intelligence Systems (Embedded Systems)



Industrial Systems in people

Their knowledge is our greatest asset, their passion our motor

capturing talent

We employ people of 14 **different nationalities**. Our recruitment knows no frontiers.

keeping and developing talent

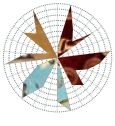
We satisfy the personal and professional expectations of our employees by keeping and stimulating talent and maximising abilities, because **we care about the present and the future.**

For every single person working for us we measure their value through:

A contribution map:

the value the person contributes to FATRONIK-Tecnalia.

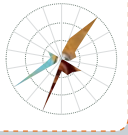
- Results • Knowledge
- Culture/Prestige that generate positioning



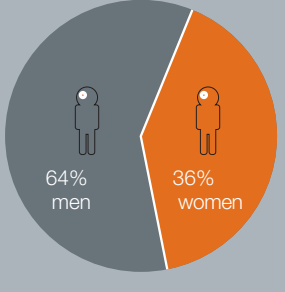
A reward map:

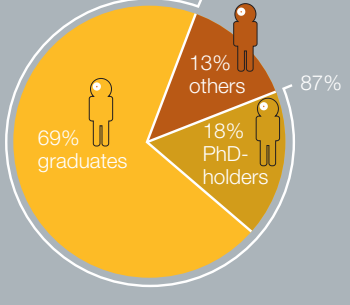
the value FATRONIK-Tecnalia contributes to the person.

- Working conditions • Work environment
- Professional development



our achievement:
an extraordinary team





Comprising people of 14 nationalities:

Spain	France	Germany
Switzerland	Austria	United Kingdom
Italy	Mexico	Holland
Sweden	USA	Korea
Serbia	China	

mixed research teams

formed by people from:

fatronik tecnalia

+

clients

+

alliances
(universities, laboratories…)


?
COULEURS

2 spirit Industrial Systems

To meet its mission, the Industrial Systems Unit builds its foundations on three fundamental pillars, which define and constitute its differentiating feature:

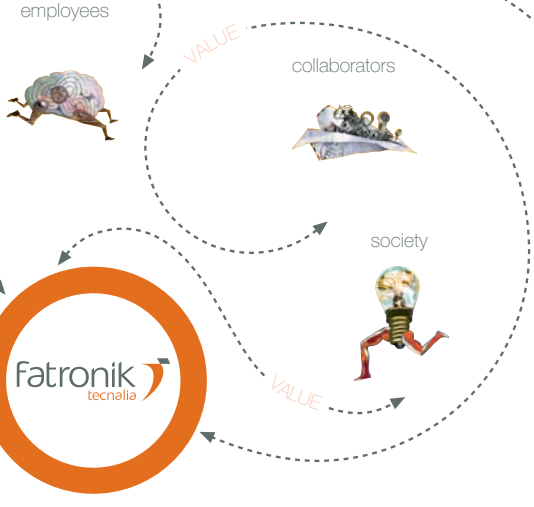
- **Value** Management
- **Open** Innovation
- **Results** Orientation

Industrial Systems
value management

Everything we do is designed to generate and exchange VALUE

VALUE is a relative and personal concept. The Industrial Systems Unit has a different approach that allows it to offer each client or collaborator and each person from the organisation what each of them consider to be **VALUE** at any given moment.

- From Resource management to Value management
- From Standard management to Individualised management
- From Occasional management to Relational management
- From short-term management to short, medium and long-term management



VALUE

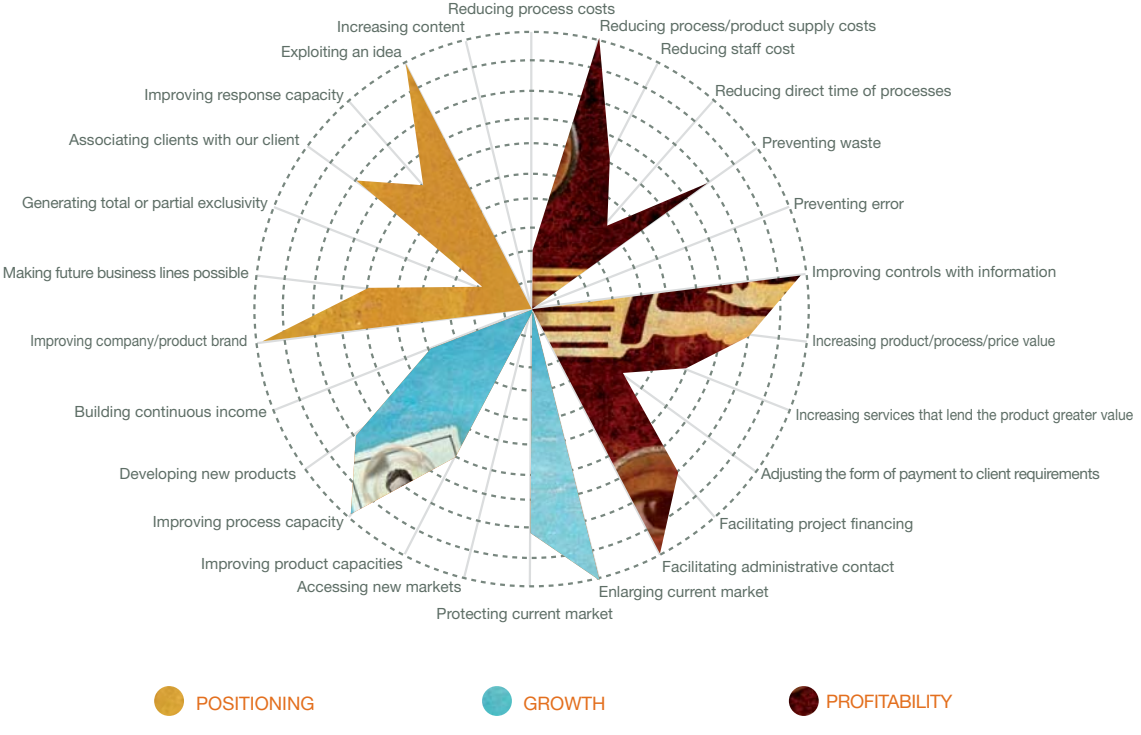
At the Industrial Systems Unit we have changed the concept of management, moving on from resource management to **VALUE management:**

- Applied to the management of all internal and external agents:
  - **Clients:** contributing to their profitability, growth and positioning.
  - **People:** responding to their professional and personal expectations.
  - **Society:** facilitating economic and social development, quality of life and sustainability.
- Applied to the design and execution of research projects and optimisation of processes
- Individually defined and dimensioned through **value maps**




CLIENT value map

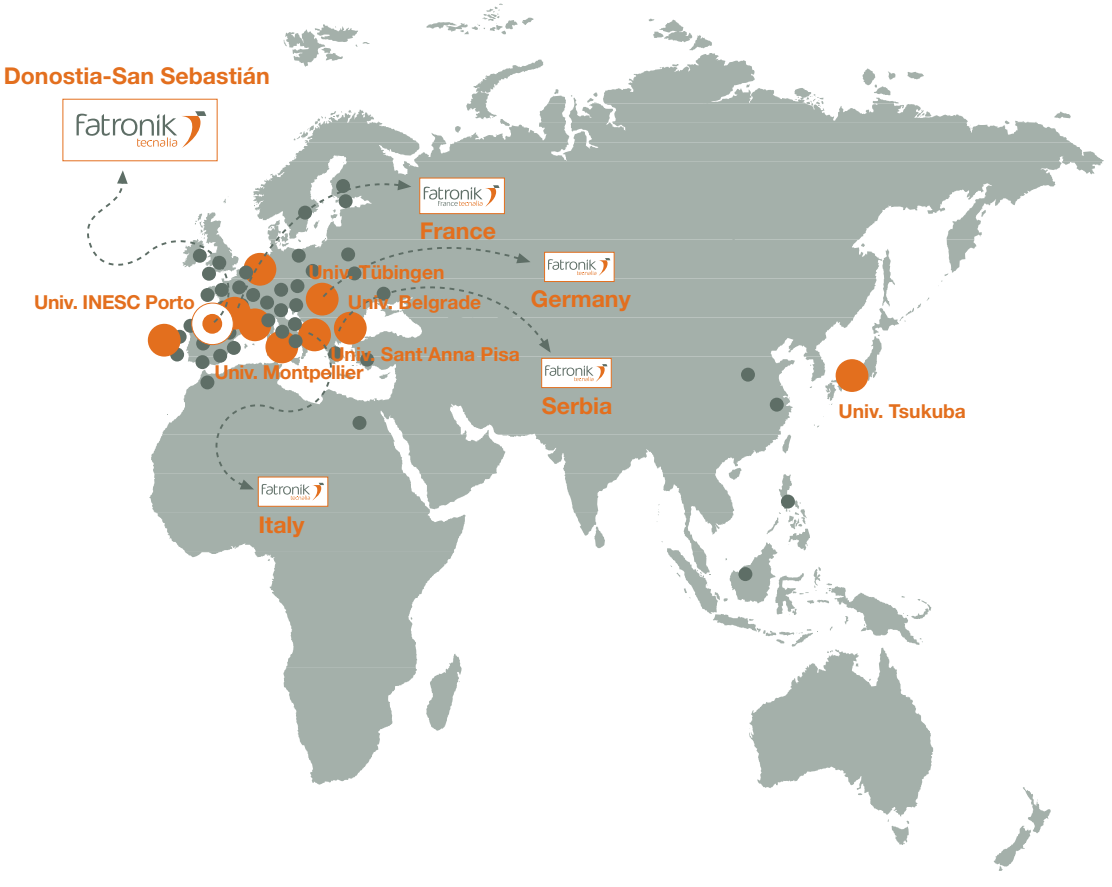
We personalise value for our clients through the **Client Value Map**, with which we identify their strategy in order to maximise the **VALUE** that we contribute in concrete terms of Profitability, Positioning and Growth.



Industrial Systems
open innovation

We are convinced that **innovation today must be open**. This is why we set up contacts with international knowledge centres and with people from all over the world, in order to speed up our research process and increase our results, which translates into advantage for our clients.

We do this to capture knowledge, talent and tendencies, as a bridge between ideas and the market, to create jobs, provide and obtain access to state-of-the-art technology and link up companies and institutions from different countries. Because if open innovation is not **two-directional**, it makes no sense.



Different kinds of open innovation at FATRONIK-Tecnalia:

- Creation of **international technology nodes**: network nodes in strategic locations for our activity
- Establishment of stable relations in time terms with **associated centres** of world relevance
- **Exchange of researchers** with leading universities
- **Use of Web 2.0** in order to collaborate with experts all over the world
- Transfer and purchase of **intellectual property**

Industrial Systems
results orientation

The Industrial Systems Unit carries out research geared towards achieving an economic impact within the entrepreneurial environment. To do so, it has developed **innovative business models** with its clients, opening up new spaces of encounter with industrial demand, **sharing investments and aligning interests**.

Industrial Systems uses different technology-risk formulas to fit projects to the demand, with the aim of establishing stable long term relations and the basis for large joint projects.

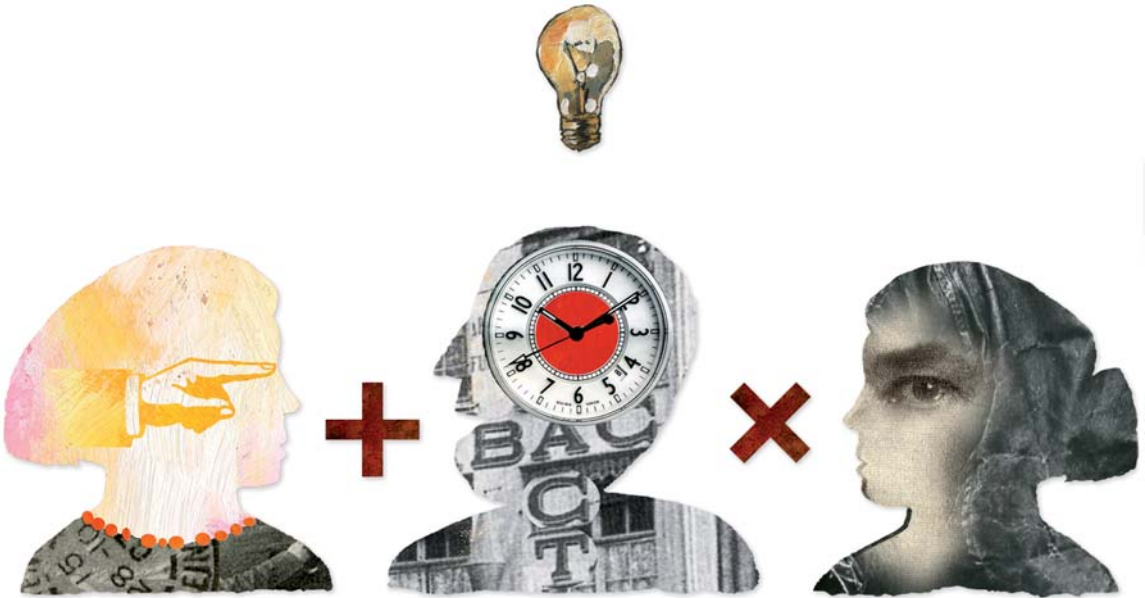
Industrial Systems
results orientation:
R+D+i projects with companies

Our unit **does not offer technology services** (tests, issue of certifications, homologations,…). 100% of our turnover comes from R+D+I projects that we develop with companies, via the different forms of collaboration we have established. **Our activity is R+D+i in a pure state**.

The Industrial Systems Unit carries out projects with companies as the **main mean for transferring results to the industrial fabric** so as to maximise the conversion of our knowledge into value for them.

With our investigations we seek to obtain **results and generate new knowledge** that materialises in **our products, processes or production systems** as well as in the improvement of characteristics or applications, the aim being that they differ substantially from those that previously existed.

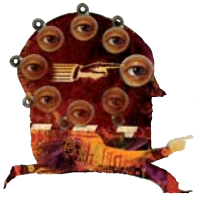
A high degree of R+D+i represents an increased strengthening of companies, because their products or processes can be **positively differentiated** from those of their competitors. Moreover, many of the activities are potential generators of economic and social advances.



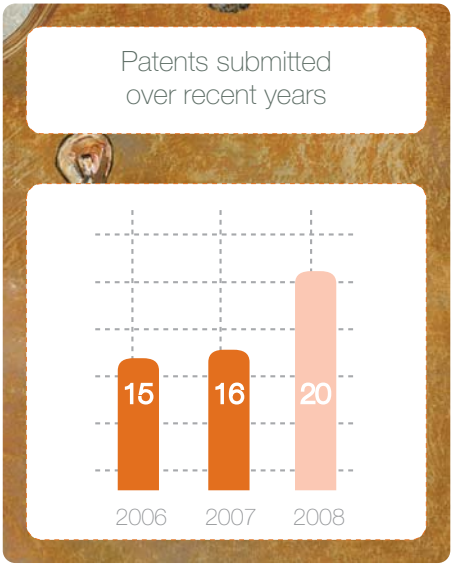
Industrial Systems
results orientation:
patents and sale of licences

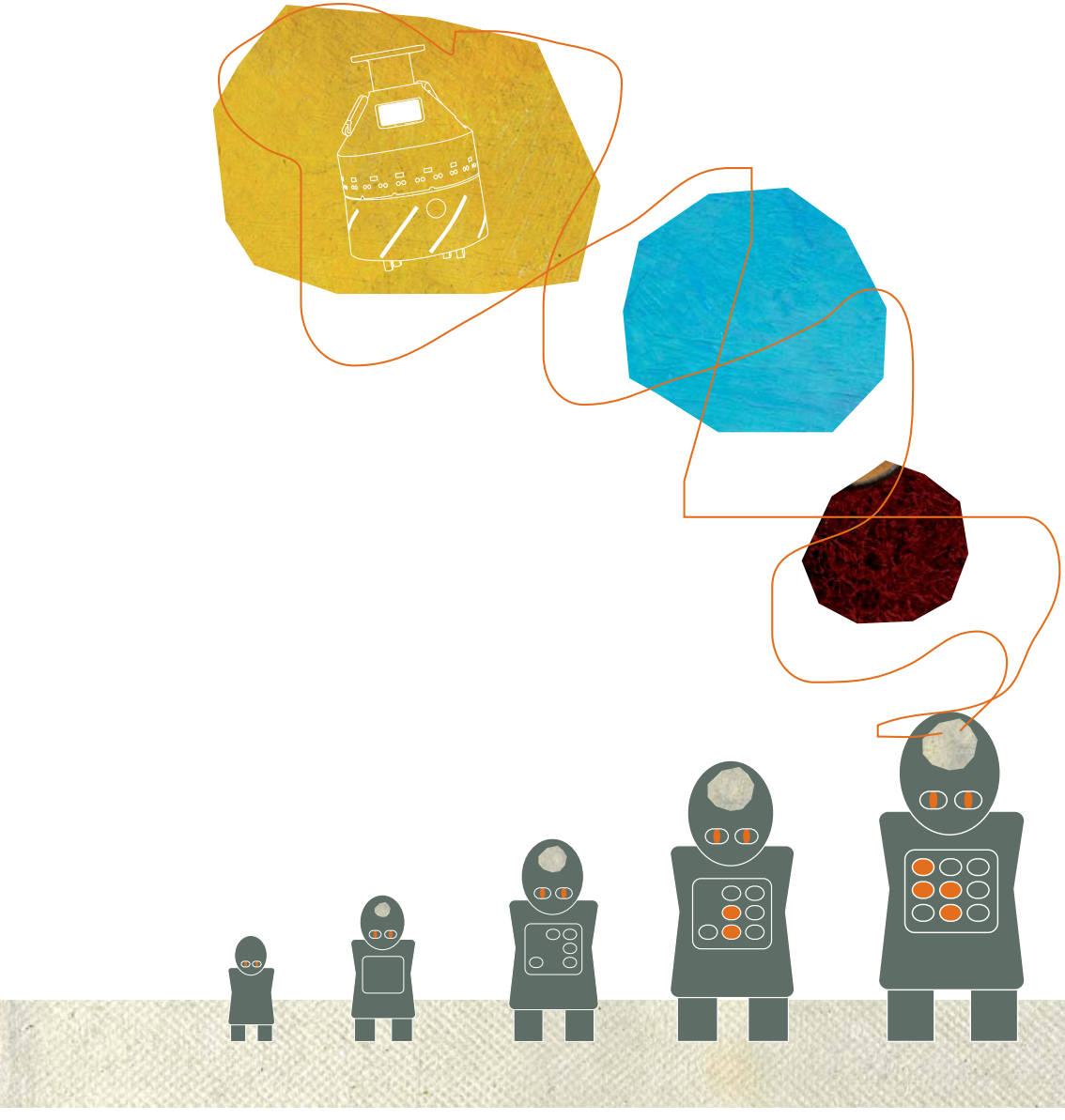
The developments of the Industrial Systems Unit give rise to numerous exploitable results. We uphold an active policy to protect these developments by means of patents and other intellectual property rights, which makes it possible to exploit them at a later date.

In consequence, Industrial Systems provides companies with a chance to acquire licences for patents so that they can be commercially exploited.



Lattice for machine structure
Rotor device for independent control of the step variation of each blade
Rotor device for independent control of the step variation of each blade
Kinematics system for machine spindled
Kinematics system for machine spindled
Kinematics system for machine spindled
Máquina herramienta con regulación de posición en continuo
Machine tool with continuous regulation of position
System for the analysis of a person's activity and automatic fall detection
Method for monitoring burr formation in piece drilling processes
Solar sun tracker based on parallel kinematics
High speed parallel robot with four degrees of freedom
Control device for one, two or three-dimensional units for assisting disabled people
Machine for sheet forming and forming procedure
Holding device
Parallel robot with four degrees of freedom and unlimited rotation
Friction Stir Welding machine tool
Tool for the Friction Stir Welding of two metal pieces with one joint angle
Method and automatic system for the determination and classification of foodstuffs
Two-degree of freedom parallel manipulator
Portable device for the rehabilitation of an upper limb





3

the project pyramid of Industrial Systems

The Industrial Systems Unit develops **innovative business models** that, along with the singularity of their solutions, equip our clients with solid and decisive **competitive advantages**.

Industrial Systems
projects pyramid

Our collaboration models are structured around the Projects Pyramid. This is an innovative way of offering clients different modes of collaboration involving:

The source of financing | Ownership of developments | The technological risk assumed by the client

Results

Solutions for clients

Industrial Property

New Technology-based Companies (NTBCs)

• Specialisation projects:

Projects that are **completely defined and financed** by the Industrial Systems Unit without present demand or clear interest from the market. A tendency is, nevertheless, observed towards this technology or sector, which is why we attempt to anticipate the future needs of our clients.

•• Viability projects:

Projects that **are jointly defined with interested companies** that demonstrate their interest through support of a minimum nature, which may come in the shape of economic or human resources input.

••• Shared risk projects:

Projects that are **jointly defined** with one or several companies that demonstrate their interest via a prior contract that establishes the later exploitation of the results on condition that they are as expected by the client.

•••• Contract projects:

The **client**, with Industrial Systems, defines the project and **finances 100% of the developments** made by the unit, whilst also being the owner of the intellectual property involved.

The combination of these forms of technology-risk, or any other kind of relation that aids the development of the objective, may give rise to projects, patents and companies.

Through the Pyramid Project other relation models can be established in which various types of projects can be combined with the one and the same client:

Shared risk collaborations

These are collaborations in which **we participate in the client's strategy**, taking on responsibility and risk with regard to the results. With the client we develop type •• and ••• projects in which both, the costs of the development and the benefits are shared. We share the risk.

In this context, the Industrial Systems Unit has developed the **ROPTALMU** project in collaboration with **Airbus España**, type •••. Development of a light portable robot whose purpose is to drill holes in large aeronautical components, in which Airbus España has jointly shared, with the Industrial Systems Unit, the financing and ownership of the results.

This kind of collaboration is possible thanks to **trust from the client** and the **unit's interest in the knowledge of the technologies involved.**

AIRBUS

Technology Partner: agreements with a future

With clients with whom it shares a close relation, the unit defines **type • , •• and ••• projects financed with our own resources**, in alignment with the interest of the technology associate company, in order to execute R+D+i projects. In exchange, **the industrial partner undertakes to sign a contract for type •••• projects.**

Under the protection of this collaboration model, the unit commits itself to specialise technologically on lines of interest for the industrial partner that will help to foresee medium and long-term needs.

The Industrial Systems Unit is the Technology Partner of **NEM Solutions** & **CAF**, which involves:

- **Large-scale value-added solutions** that allow NEM to offer global system maintenance services to its main clients
- Development of **shared risk projects** with high technological content in exchange for the contracting of projects under contract
- Support to different collateral activities relating to its activity:
  - Participation in public financing projects
  - Transfer of knowledge and training to its staff
  - Training for its future employees: they begin by working in FATRONIK-Tecnalia




Integrated Staff

In this case, the Industrial Systems Unit assigns its own staff to companies with which it has a stable relationship, to act as **external consultants** with a vision of technology. When they are in FATRONIK-Tecnalia they share the vision of the client and vice versa.

The Industrial Systems Unit, thanks to its knowledge of **EZARRI's** needs, managed:

- **To increase** the value of their product **using technology**
- To arrange **cooperation with other Tecnalia centres**
- **New projects** in the area of automation

In **any kind of collaboration that we establish with a client**, we are their advisors from start to finish, accompanying them at all stages of development and project launch. Because the end of a project is just the beginning of a **stable relationship.**

If you want to develop or improve an idea, product or process, if you need advice on the road to innovation, if you are looking for a technology partner who will get involved in your projects, or you wish to invest in new technology based business projects because you consider investment in technology to be a guarantee of competitiveness, at the Industrial Systems unit you have the answer.

4

What do we do in Industrial Systems?

The Industrial Systems Unit develops new methods of design, manufacture, maintenance and end of life of products and services for the improvement of company competitiveness.

Industrial Systems
our clients' profit & loss account is our concern

We are innovators, avant-garde and technologically advanced. And what is more, we are **efficient, fast, professional and accessible**, and we are so because it is our daily mission, our leitmotiv.

Our activity is organised around **three technical departments**: Mechanical Engineering, Manufacturing, and Control and ICT, where we develop the technologies, that is to say, the knowledge we apply to different sectors of activity, are gestated.

There is also the **Project's Management Department**, which is made up of a small number of Project Managers who are out to achieve results. They possess a comprehensive vision of each project: from its conception to its conversion into value. At an internal level, they are the voice of the client.

We go to:

- Machine Tools
- Aeronautics
- Rail Transport
- Other sectors

Our action fields are...

Robotics and manipulation

- Professional/Industrial service mobile
- Service and personal assistance mobile
- High speed manipulation and packing
- Advanced flexible manufacture

Maintenance and end of life

Comprehensive maintenance and post-sales services of:

- Railway systems
- Wind farms
- Plants and production systems
- Aeronautical systems
- Building works and construction

Production Systems and automation

Machines for:

- Machining
- Forming
- Bining
- Composite materials transformation
- Construction

We know about...

Mechanical Engineering

- Kinematics and dynamics of systems and machines
- Structure engineering
- Product design and development

Manufacturing

- Development of advanced manufacturing techniques
- Control and monitoring techniques

Control and ICT

- Advanced mechatronic systems control
- Intelligent robotic systems control
- Artificial Intelligence applied to knowledge management
- Intelligent machine vision
- Information and communication technologies

Industrial Systems
technologies in which we have expertise

We have expertise in an ample group of technologies which, integrated within complex systems, bring about singular technological innovations. Their transversality and complementarity constitute the key to project success.

Mechanical Engineering

- Kinematics and dynamic of systems and machines
- Structure engineering
- Product design and development

1

Manufacturing

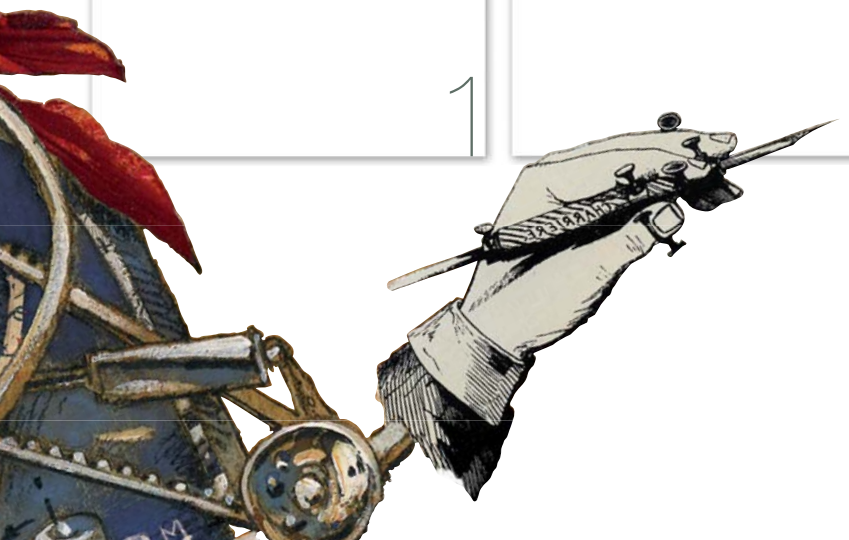
- Development of advanced manufacturing techniques
- Control and monitoring techniques

2

Control and ICT

- Advanced Mechatronic Systems Control
- Intelligent Robotic Systems Control
- Artificial Intelligence applied to Knowledge Management
- Intelligent artificial vision
- ICT-Information and communication technologies

3



1 Mechanical Engineering

Kinematics and mechanisms | Systems dynamic
Structure engineering | Product design and development

In terms of Mechanical Engineering, the Industrial Systems Unit's offer includes the **design, analysis, simulation and development of mechanical and structural systems** for robots and other advanced production systems, the aim always being to optimise techno-economic aspects.

Kinematics and Mechanisms

Synthesis and development of mechanisms

Conception, simulation, analysis and design of mechanisms with high dynamic requirements to meet the starting specifications of the system.

Systems Dynamic

Dynamic analysis

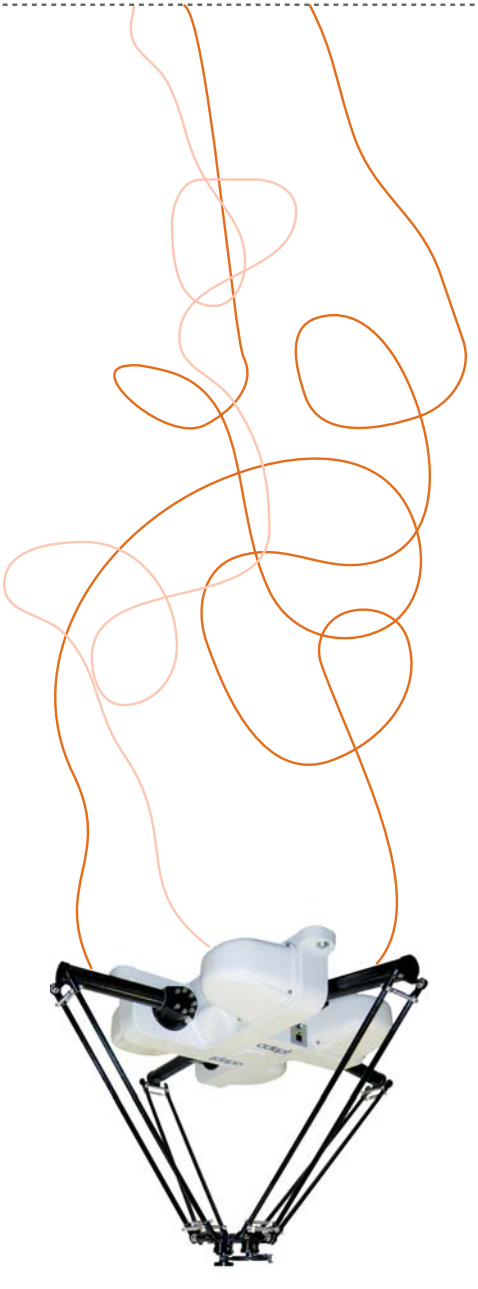
Design of mechanical systems for the absorption / reduction of vibrations.

Modal and dynamic experimental analysis

The carrying out of **experimental modal trials** in order to obtain vibration modes and natural frequencies or dynamic response of diverse systems and characterisation of the dynamic response of servo-activated systems and analysis of the results obtained.

Drive and actuator design

Design based on static and dynamic criteria for servo-drives: selection of the most suitable drives type for a specific case, and of the characteristics of its constitutive elements.



Structure Engineering

Structural Design and Optimization

Conception, design, calculation and optimisation of the mechanical structure of systems under existing load requirements: static, dynamic, thermal, … by means of the finite elements method (FEM)

Innovative materials

Knowledge of the techno-economic characteristics of advanced materials liable to be applied to industrial production systems (FC, glass fibres, metallic foams, sandwich panels, joint structures) and their application to structures, as well as their control needs.

Agile and flexible systems

Development of agile, portable, flexible systems for advanced manufacture.

Product Design and Development

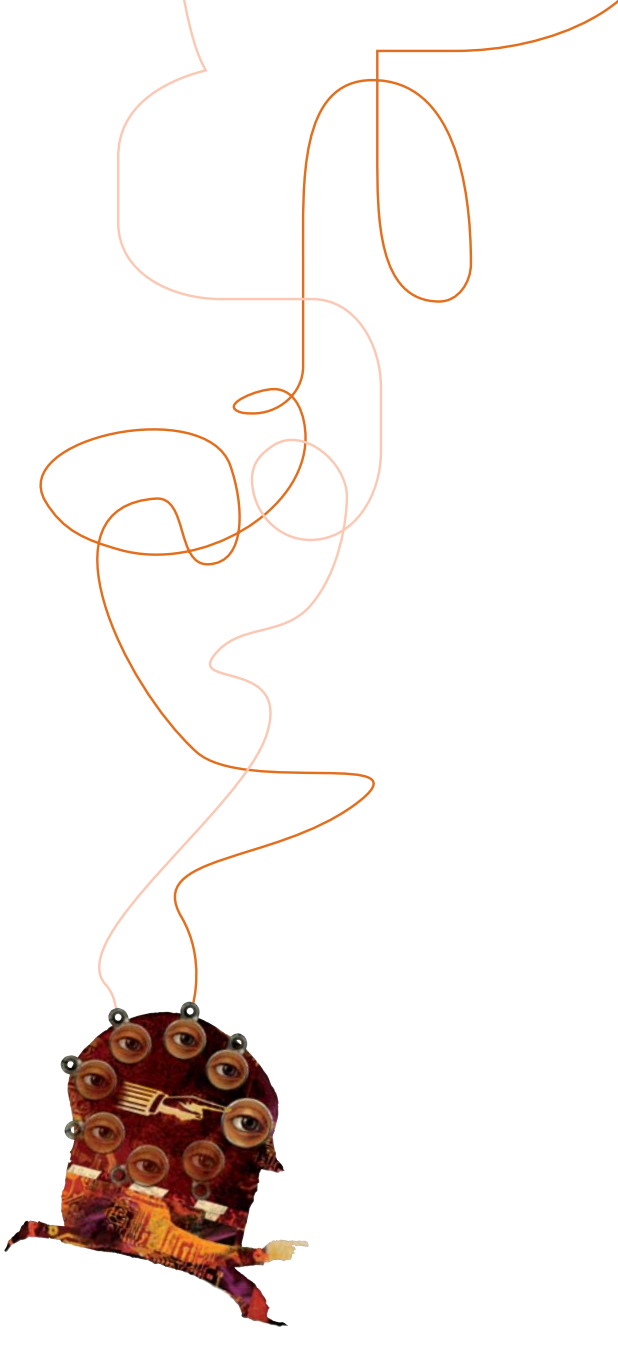
Detail design

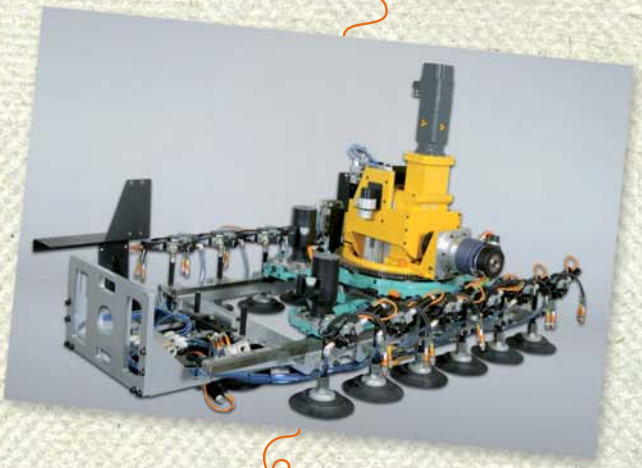
Complete detailed product design (complete 3D CAD) including the generation of their manufacture and assembly plans, pneumatic and hydraulic product outlines, and systems whose conceptualisation and engineering have been developed by Industrial Systems Unit. This design work includes the selection of commercial components.

Product design under criteria of sustainability-ecodesign, safety, reliability, ergonomy and user comfort.

Prototyping and commissioning

Building of prototypes and commissioning. Comprehensive fine tuning of machinery and industrial robotics.






AIRBUS
roptalmu


atom


VERNE

2 Manufacturing

Machining process | Incremental forming

Friction welding | Water-jet machining

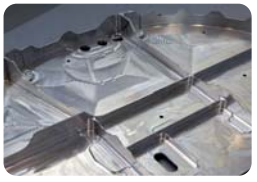
Plasma assisted material deposition | Ultrasound-assisted processes

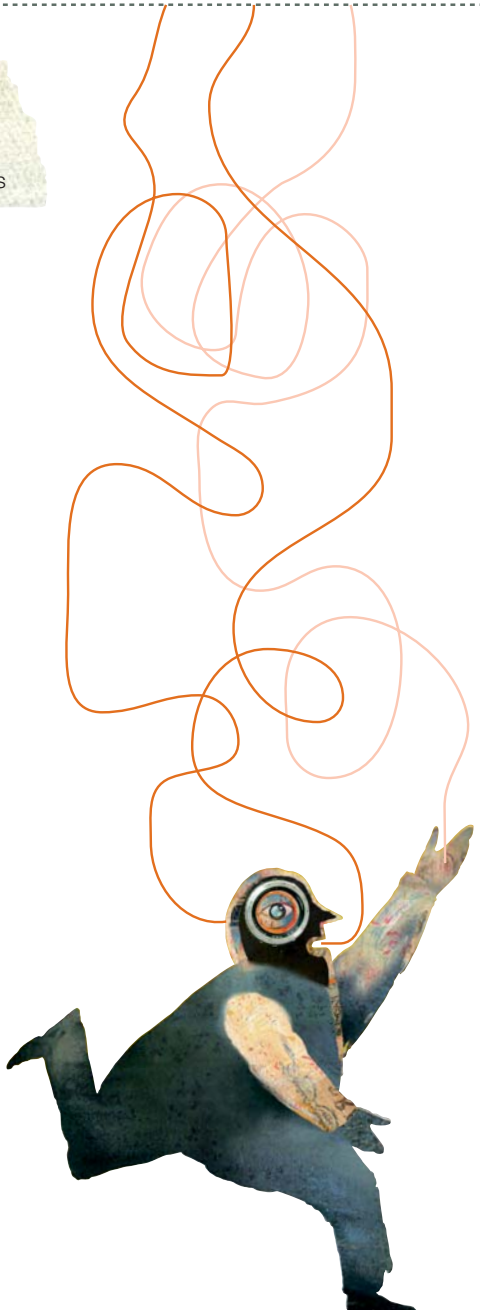
The technology offer from Manufacturing at the Industrial Systems Unit includes the development and optimisation of advanced manufacturing techniques for the processing of materials, the development of monitoring techniques, and specific technologies for non-destructive trials for the quality control of final products and semi-products in technologies within the area of machining, forming and welding.

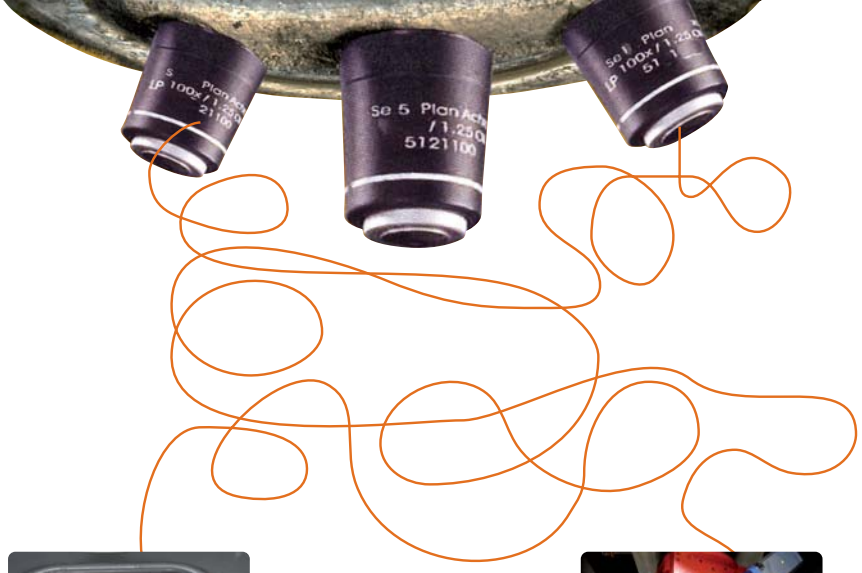
Chip removal processes

Experimental development of machining processes both in terms of basic fundaments and of industrial applications.

- **High-performance machining** for all kinds of sectors (aeronautical, automotive, mould and matrix, and capital goods)
- **Machining of composite materials and non-conventional materials**
- **Optimisation of processes and search for optimum cutting conditions, fine tuning of machines**







Incremental forming

Incremental forming is a process in which a punch with a spherical point gradually deforms the sheet with a continuous movement that produces the desired geometry. As it is a technique that totally or partially dispenses with the matrix, it represents a flexible low-cost solution for sheet prototypes manufacturing or short series.

- **Experimental development of the process** (new materials, new strategies, process parameters, conformability limits)
- **Prototype manufacturing**
- **Machine design, development and integration of specific mechanisms** (tools, sheet metal fastening equipment), new machine concepts

Friction stir welding

Friction stir welding (FSW) is solid state joint technology in which the action of a revolving tool, which advances along the line of joint with strong pressure, produces in the area a heating and stirring of the materials to be joined which results in their plastification. It makes it possible to weld, amongst other materials, most aluminium alloys.

- **Development of applications in aluminium alloys** (new geometries, dissimilar materials)
- **Process improvement through advanced control strategies** and specific measuring devices
- **Design and manufacture of prototypes using FSW** and tools for the manufacturing of components
- **Adaptation of milling machines to proces srequirements**

Water jet machining

Abrasive water jet cutting is an advanced and versatile cold cutting method that offers great flexibility and precision and makes possible the processing of a wide variety of materials (steel, aluminium, composites, bronze, stone, titanium, Inconel, glass…).

- **Water jet machining** of non-conventional materials
- Development of controlled depth **3D milling operations**
- **Characterisation of** nozzle **wear mechanisms**
- **Improvement of machine performance**
- **Development of new applications**

Plasma material deposition

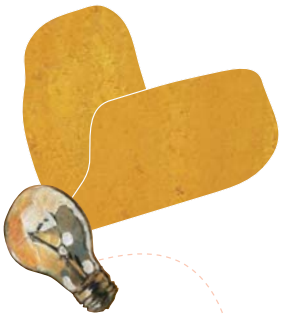
Plasma material deposition is a technique consisting of adding previously melted material (using transferred arc plasma) to a piece in order to recover damaged pieces or make new ones. It makes it possible to obtain less intense heat focuses and greater automation flexibility than when using conventional processes such as TIG or MIG.

- **Experimental development of the plasma welding process**
- **Manufacture and repair of pieces using plasma based material deposition**

Ultrasound-assisted processes

Through the application of ultrasonic vibrations (vibrations of a frequency covering between 20 KHz and 1 GHz) it is possible to reduce the forces associated with the friction between the piece and the tool and thus to contribute to improving the manufacturing process.

- **Design and development of mechanisms** for the integration of ultrasounds in different processes
- **Optimisation of ultrasound-assisted processes** (process parameters vibration amplitude and frequency)



3 Control and ICT

Advanced mechatronic systems control | Intelligent robotic systems control

Artificial Intelligence applied to knowledge management | Intelligent Artificial vision

The Control and ICT offer from the Industrial Systems Unit runs from the design and implementation of personalised control systems for the **automation of mechatronic and robotic production systems**, to **intelligent monitoring** solutions, diagnosis, fault prediction and optimisation.

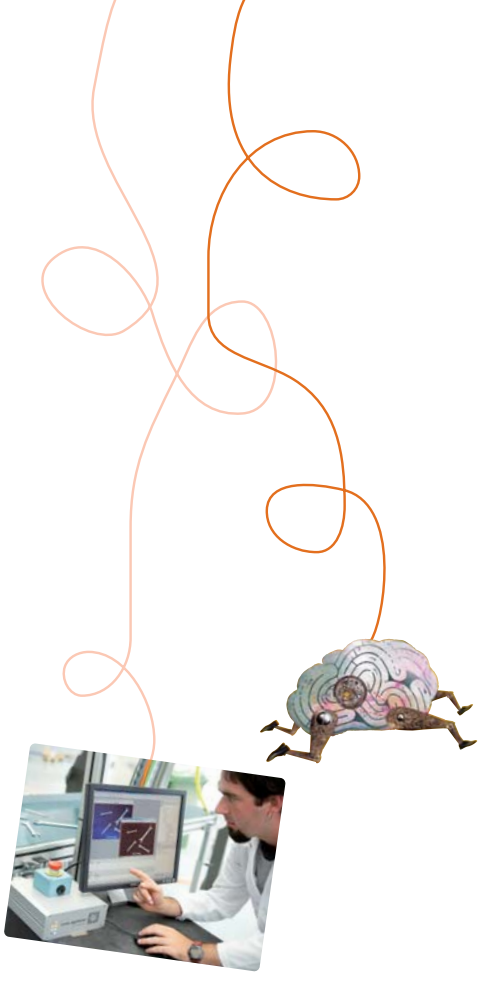
These solutions are supported by **advanced knowledge in information and communications technologies** (ICT), where we are backed up by consolidated experience of distributed software solutions and embedded systems, as well as of the advanced integration of specific sensorics and communication systems.

Advanced Control and Automation of mechatronic production systems

- **Development and development of control systems** and optimised automation solutions for complex processes and production means. Personalisation using standard platforms: Siemens (Compiled Cycles), Adept, Beckhoff, embedded applications based on VxWorks and other embedded systems.
- **Conception, design, development and commissioning of advanced control strategies** to satisfy the kinematic and dynamic requirements of highly specific solutions.
- **Development methodologies based on Hardware-in-the-loop simulation**, which make possible the development and validation of control systems upon the plant model from very initial stages (DSpace).

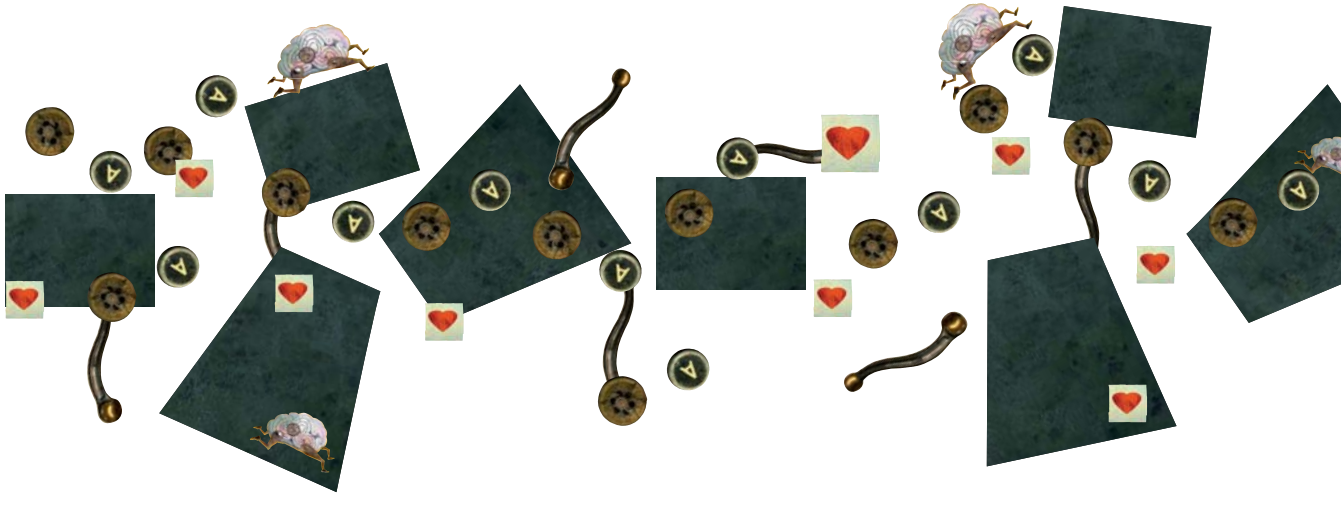
Intelligent control of robotic systems

- **Indoor mobile robotic systems navigation:** industrial and professional service robotics working for people and with people: path/task planning, sensor-fusion, behaviour-based local navigation, machine learning, PC and/or embedded systems-based control.
- **Maps localisation and generation:** autonomous systems of movement within semi-structured environments: position tracking, ground analysis-based location (visual ego-motion, monoSLAM), global location, maps and exploration generation.
- **Manipulation:** sensor-based control (real time), visual servoing, 3D trajectory planning, strength control in machine-person manipulation (real time), and compliant-motion and collaborative systems.



Artificial Intelligence applied to knowledge management and information analysis

- **Design and development of intelligent global solutions,** which offer remote and distributed monitoring services, anticipated diagnosis, fault prediction in critical components, optimum life system calculation, optimisation of systems and industrial processes and automated re-planning of maintenance plans.
- **Artificial Intelligence-based solutions:** modelling of Fuzzy Logic-based knowledge, CBR and neuronal networks. Complete analysis of information and time based domains (DataMining). Machine Learning and other "soft-computing" techniques such as genetic algorhythms and ontologies.



Intelligent Machine Vision

- **Detection and treatment of objects hard to characterise**, such as those of an organic nature, due to their flexible morphology, heightened shine, humidity, etc.
- **Visual-Servoing and intelligent system guiding:** intelligent processing of visual information for self-localisation (visual ego-motion, MonoSlam,...) and rototranslations (system piece-repositioning).
- **Specific techniques:** 3D vision (three-dimensional reconstruction), active vision, calibration, tracking and scene-analysis (object observation and monitoring, information extraction) and RT processing.

ICT - Information and communication technologies

- **Software design and development:** distributed, multi-platform (different operating systems) software architectures, based on components and/or agents, solutions for portable and mobile devices with synchronisation with centralised servers; embedded solutions for micro-PC architectures, micro-controllers and DSPs.
- **Advanced sensorics integration:** advanced monitoring and inspection processes, Visual Servoing and sensor-based control, optical advanced sensors, laser, ultrasounds, infrareds…., advanced analog and digital signal treatment and RFID.
- **Communication systems integration:** highly distributed systems based on short-reach communications (WiFi, Bluetooth, Zigbee, RF…), long reach (GPRS, 3G…) and industrial field buses (CAN, Ethercat, Fieldbus, Firewire,..).

Industrial Systems
Action fields

At Industrial Systems we pay special attention to each action fields aiming to the benefit of the transversality and complementarity of our technologies, which results in different kinds of products and services.

ACTION FIELDS	PRODUCTS, TECHNOLOGIES, SERVICES DEVELOPED BY THE UNIT
ROBOTICS AND MANIPULATION	• **Professional/industrial service mobile robotics** for construction, and production and maintenance workshops • **Service and personal assistance mobile robotics** • **High speed manipulation and packing robotics** • **Advanced flexible manufacture robotics**
MAINTENANCE AND END OF LIFE	• Comprehensive maintenance and post-sale services for **railway systems** • Comprehensive maintenance and post-sale services for **wind farms** • Comprehensive maintenance and post-sale services for **plants and production systems** • Comprehensive maintenance of **aeronautical systems** • Maintenance, monitoring and safety in building **works and construction** • **Management and traceability** systems **for maintenance and security** • Automated **demanufactured solutions**
PRODUCTION SYSTEMS AND AUTOMATION	• Automated **machining** systems • Automated **forming** systems • Automated **joining** systems • Automated **composite material transformation** systems • Automated **construction** systems: composite-based structures, traditional materials, automated modular construction • **Flexible advanced tools** • **Machining processes** • **Incremental sheet forming processes** • **Joining processes** • **Processes for the manufacture and transformation** of composite materials

1 Robotics and manipulation

Robotics, which is present practically from the production, to demanufacture and end of life of products, is **one of the fields in which the** Industrial Systems **Unit imparts the greatest competitive advantage** to current production systems and services, and will in the short term, prove to be more important.

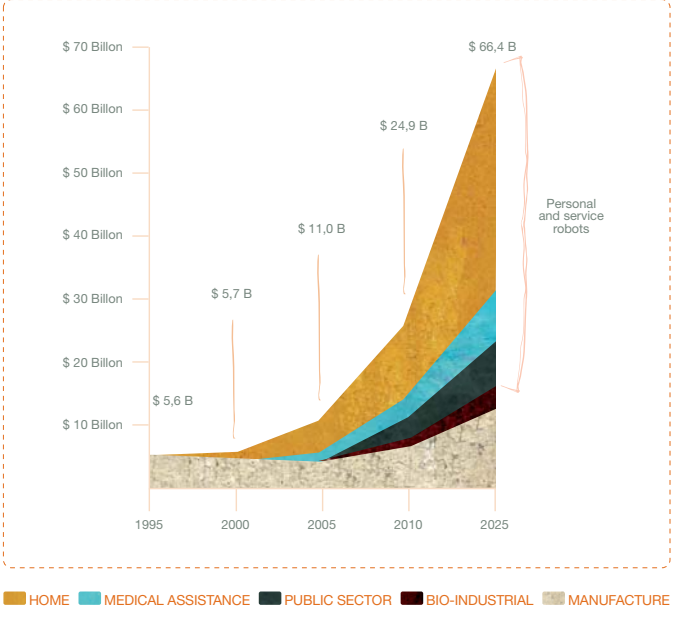
At the beginning of the decade, the different markets we addressed were demanding a **radical change in traditional productive systems.**

Big production systems have given way to **productive systems of smaller dimensions that are portable and endowed with greater intelligence** so that they can constantly adapt to the conditions of a changing environment as well as the piece they are working on.

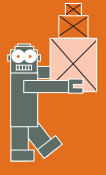
The Industrial Systems Unit develops highly **personalised and reconfigurable** robotic devices that perform their task with high levels of intelligence and autonomy.

- Solutions oriented towards the **industrial field** through the development of **specialised robots** that work on production, manufacture, assembly, manipulation, inspection, analysis, joining, cleaning lines and among others.
- New solutions, such as **assistive robots, which collaborate and assist in work environments,** in entertainment or in personal assistance.

Forecast of robotics evolution

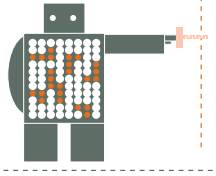


ROBOTICS AND MANIPULATION

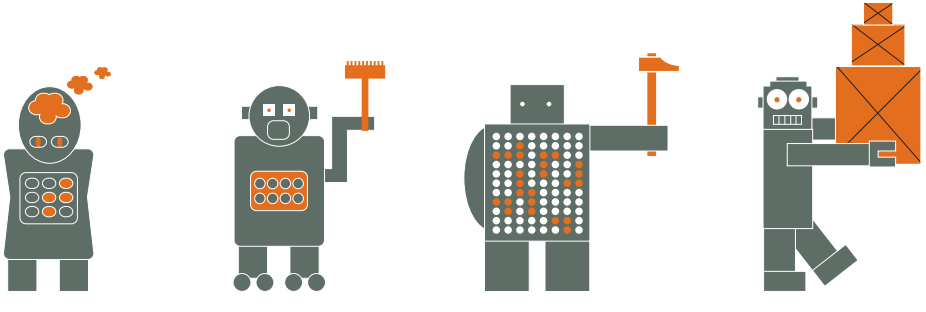


- Professional/industrial service mobile robotics for construction, and production and maintenance plants
- Service and personal assistance mobile robotics
- High speed manipulation and packing robotics
- Flexible and advanced manufacturing robotics (robotised mobile cells, climbing robots for big structures)

Results



- **Intelligent mobile robots**
  - Cooperation with operators in loads movement
  - Automated cleaning
  - Intelligent guiding
- **Multi-service manufacturing robots with a mobile base**
  - Robots for drilling cross beams in big production workshops
  - Crawler robots for structures or final piece
  - Cable-based kinematics
- **High speed Pick&Place manipulation robots**
- **Industrial manipulation robots** for specific objects using as-hoc mechatronic grippers

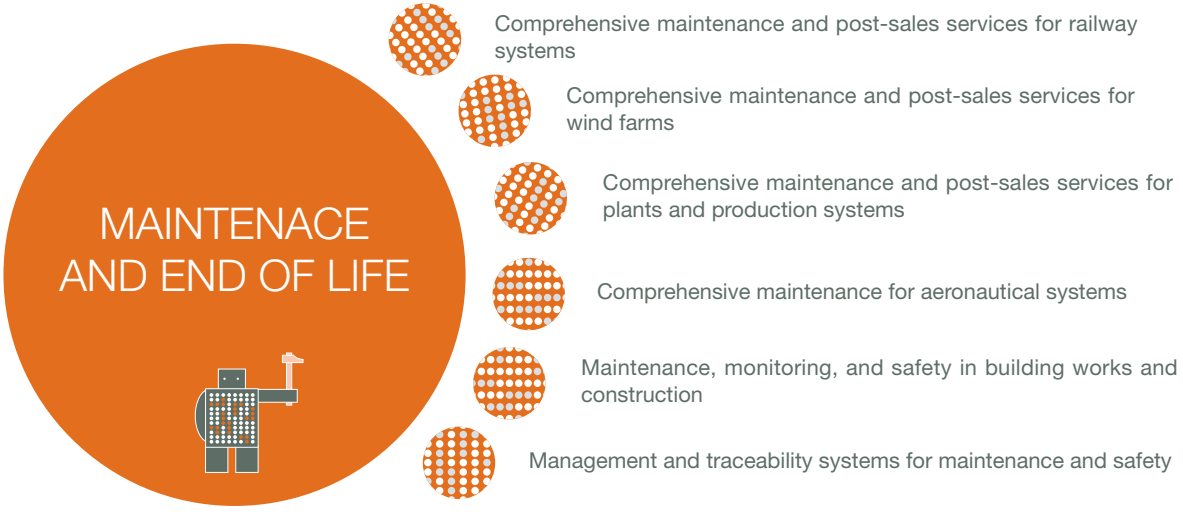


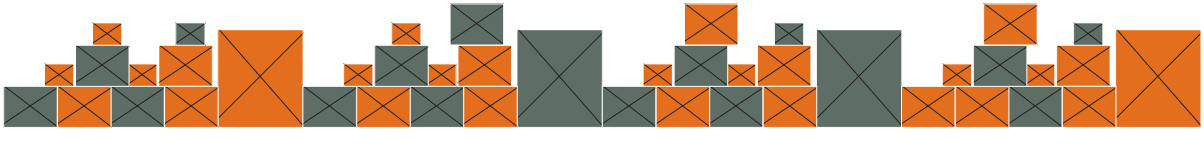
2 Maintenance and end of life

In a society increasingly oriented towards the services sector, maintenance has become a **key competitiveness factor**, evolving from simple reactive maintenance schemas to predictive maintenance.

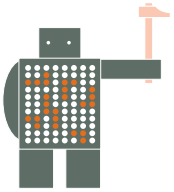
- Consequence: over recent years there have opened up big niches and **opportunities based on new business models** in the area of maintenance.

The Industrial Systems Unit concentrates a great deal of its strategic efforts on providing **support for stages of the life cycle after product commissioning** (guarantee, post-sales services and maintenance, end of life…) with innovative technological solutions aimed at optimising time and costs, allowing clients to achieve a return on post-sales and maintenance operations:





Results

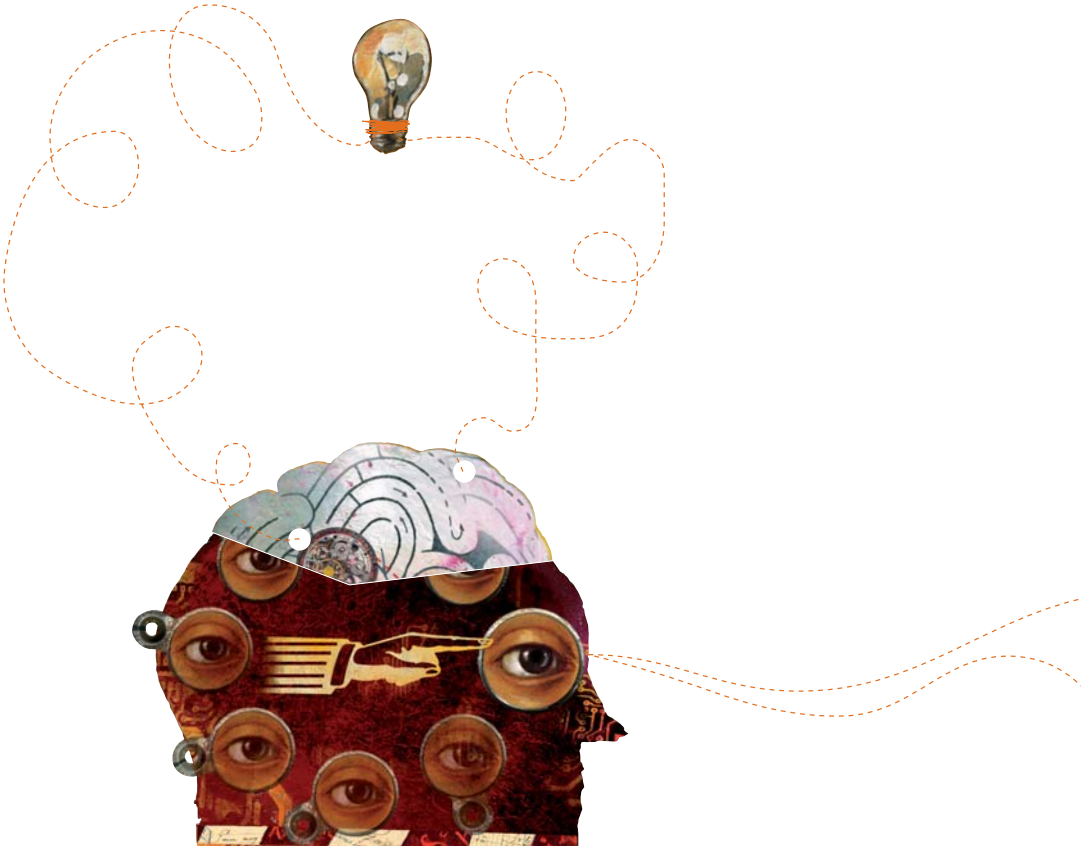


- **Knowledge management systems for maintenance optimisation**
  They make it possible to have a better knowledge of systems so as to optimise their maintenance via neuronal networks, case-based reasoning systems, fuzzy logic and data mining, with the objective of diagnosing critical faults in advance and optimising the life of components and maintenance plants.

- **Real time analysis, monitoring and remote assistance**
  Innovative solutions based on information and communication technologies (ICT) for after-sales assistance services which allow optimize the resources invested in the service provided to customers while optimizing the quality.

- **Advanced total traceability systems**
  Traceability knowledge systems for components that form a system during their entire life cycle and the global management of the information associated with them.

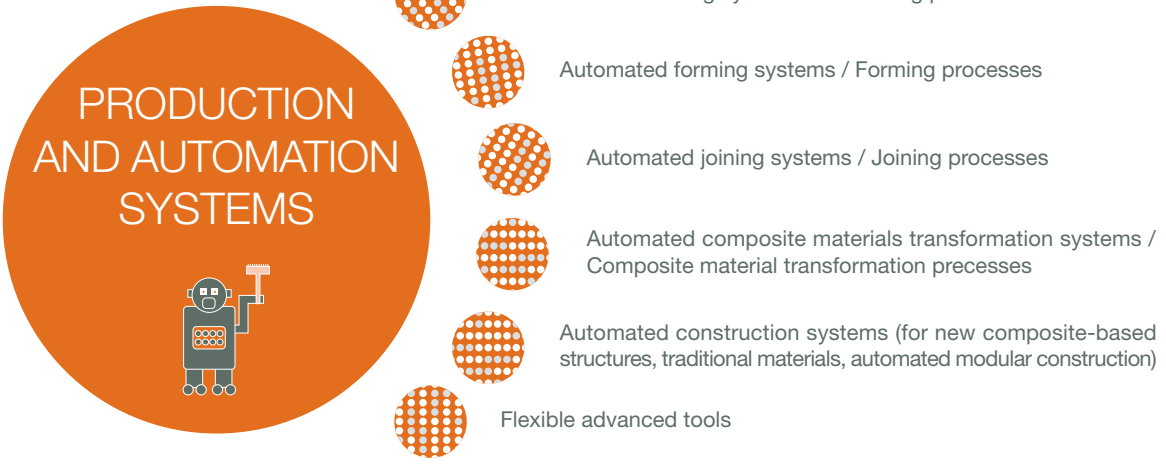
- **Advanced demanufacturing systems**
  Demanufacture and ecological and automatic disassembly of systems, using advanced mechatronic solutions.

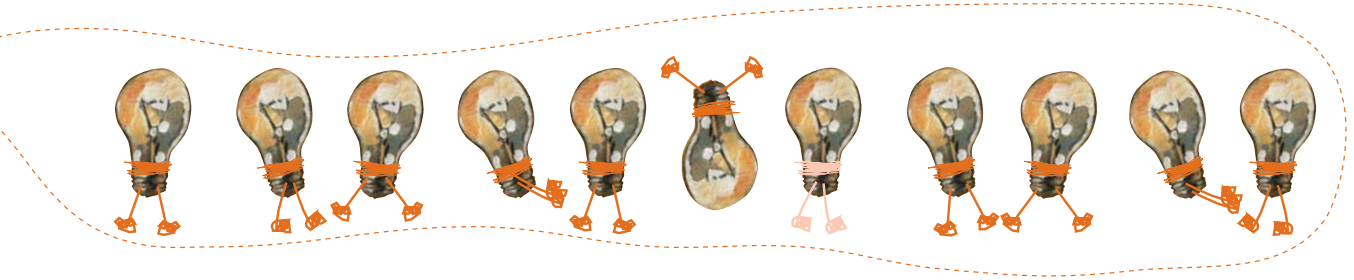


3 Production Systems and automation

It represents the evolution par excellence of the Industrial Systems Unit since its origin in Machine Tool and nowadays, this field has become a central sphere field of activity with sufficient power and flexibility to address the development of innovative solutions for industrial manufacture geared towards different sectors.

In this context, Industrial Systems has secured a very powerful positioning within this manufacturing area as a **Research Centre par excellence in manufacturing technologies.**





Our experience in this action fields deploys from two different focuses

Optimisation of manufacturing processes

- Development of advanced manufacturing techniques for processing materials
- Characterisation of transformation processes
- Development of new non-conventional manufacturing processes
- Control and monitoring of manufacturing processes
- Non-destructive trials for the quality control of final products and semi-products

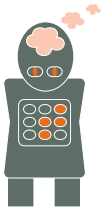
These techniques, which give shape to our current experience in manufacturing processes, are applied to:

- Machining processes
- Incremental forming processes
- Joining processes
- Manufacture and transformation of composite materials

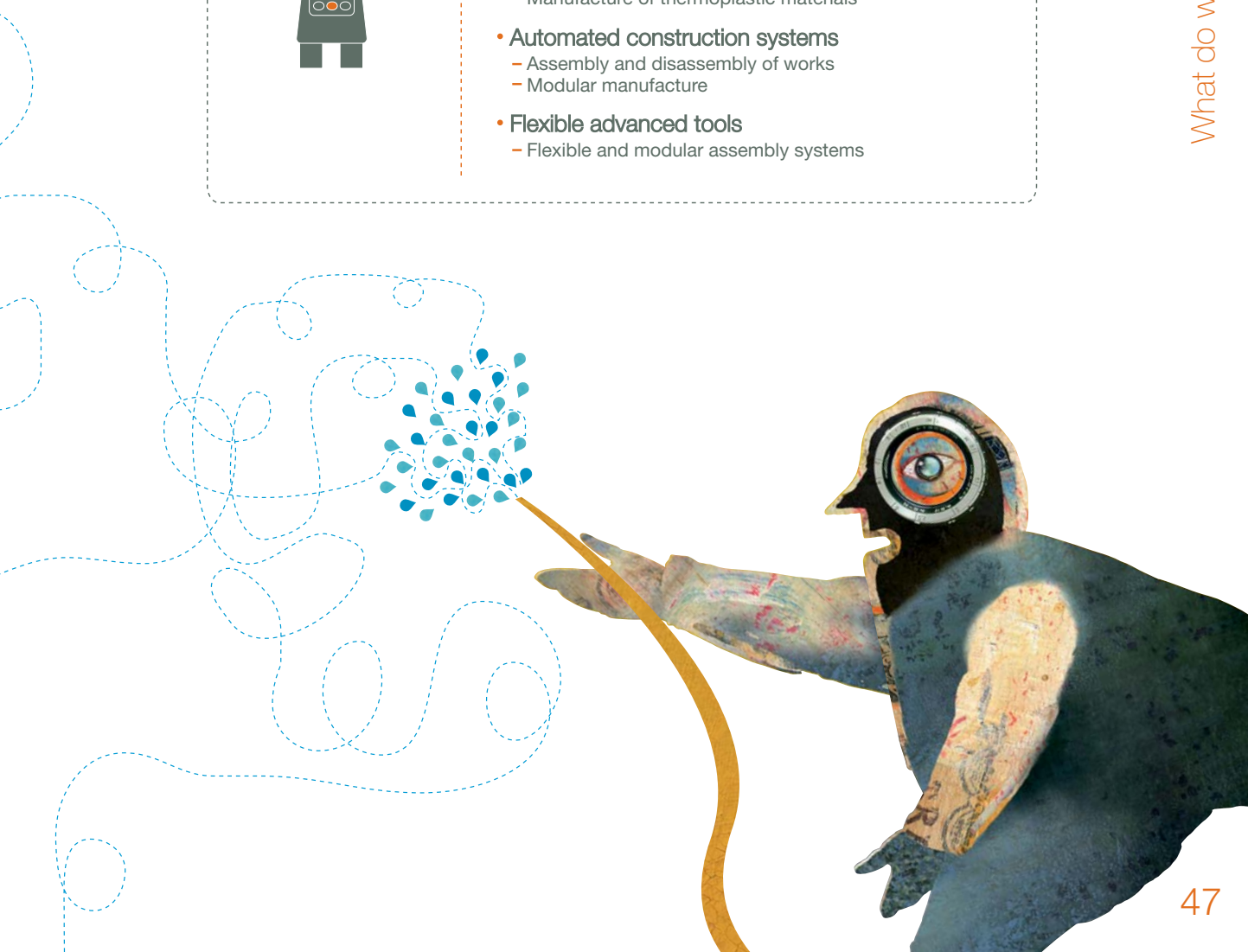
The design and development of innovative production solutions

- Development of advanced production systems oriented towards different processes of manufacture and assembly
- Experience in mechanical engineering, automation and control systems

Results



- **Automatic machining systems**
  - Advanced eco-efficient machine tools
  - Water jet cutting and machining
- **Automated forming systems**
  - Sheet metal forming
- **Automated joining systems**
  - Structure welding
  - Friction Stir Welding (FSW)
  - Large composite material structures
- **Automated composite material transformation systems**
  - Manufacture of thermoplastic materials
- **Automated construction systems**
  - Assembly and disassembly of works
  - Modular manufacture
- **Flexible advanced tools**
  - Flexible and modular assembly systems



Industrial Systems application sectors

Machine Tools

Fundamental action fields:

The origins of the activity at Industrial Systems has its roots in the machine tool sector. Today we have become one of **Technology Centre par excellence in the sector**, both nationally and internationally.

Machine Tool makes a decided commitment to innovation, devoting an average of 6% of turnover to R+D+i for the development of its own technology. Its competitiveness strategy is grounded in factors similar to those of the Industrial Systems Unit, such as internationalisation, technological innovation, training and inter-company cooperation.

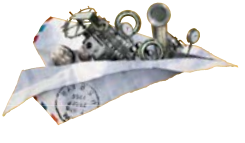
We are leading the main European project in the sector, **NEXT**, with 25 associates, the leading Machine Tool companies in Europe, and we are likewise the technical coordinator of the Cenit Machine tool project e**E**e, in which some of the most significant companies from the Spanish sector are participating.

Furthermore, FATRONIK-Tecnalia is a member of the European Technology Manufacturing Platform **MANUFUTURE**, and coordinator of its Spanish correspondent.

Our principal clients are: **Nicolas Correa, Zayer, Ibarmia, MTorres, Goi-Alde, Glual, Lazpiur, Alfa, Ona Electro-Erosion, Ger-Maquinas Herramienta, Ibertec Systems, Praxair, Fidia, Huller Hille, Ina, Kovosvit, Mecof, Siemens,...**

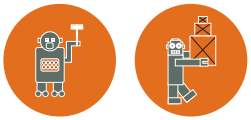
The Industrial Systems Unit develops frontline technologies within the field of mechatronics with the aim of encouraging companies to align themselves with key strategies for the future:

- **Eco-efficiency:** consideration of environmental aspects within the whole machine life cycle
- **Efficiency:** productivity and precision
- **Intelligence:** capacity to adapt the behaviour of the machine to the objective, incorporating advanced electronics through the integration of sensors and other sources of information
- **Multi-functionality:** to carry out new processes in an integrated fashion, eliminating wait times and investing the machines with greater flexibility.



Aeronautics

Fundamental action fields:



For more than a decade we have been carrying out developments within the aeronautic sector, which is characterised by its need for **complex and of large dimensions products**. This characteristic makes automation difficult, which is why aeronautic production continues to be highly manual in many of the operations performed, especially those involving the assembly of subsets or at the final stage.

The growing competitiveness between the different actors in this market, and pressure from clients for a reduction in prices, obliges the sector to reduce essential costs in order to survive, in particular where manual processes are concerned.

The Industrial Systems Unit **is a pioneer, at a national level, in the development of more flexible machines requiring less investment.** The main actors in this tendency are **automatic, flexible, reconfigurable manufacturing systems**, which permit changes in plant layout, and are able to get close to the piece, rather than the piece to the machine.

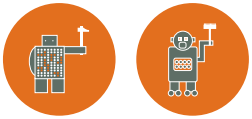
We work for clients such as Airbus and EADS.

In the framework of this sectoral trend, two main lines of work can be detected:

- The **integration of commercial anthropomorphic** robots to perform certain operations
- **Development of specific automated solutions** for a process or product

Railway transport

Fundamental action fields:



At present, the activity of the Industrial Systems Unit for the railway transport market is fundamentally concentrated on post-commissioning life cycle stages such as maintenance and post-sales processes, although this also takes in certain manufacturing stages. This market will clearly be **a strategic sector for the unit over the coming years**, because new exploiting ways for this knowledge are being sought today in other markets.

Our activity in this sector began more than three years ago, with two objectives in mind:

- To use and **adequately exploit the massive quantity of on-board information** that a train uses so as to function properly, as an off-line high value added services source dedicated to performance improvement.

- To transform traditional data compilation and basic monitoring **services into intelligent maintenance tools in order to provide services of anticipated diagnosis, critical fault prediction, optimisation of the life of fundamental components…** For this to happen, maintenance systems must have access to expert knowledge that initially only the human technician had.

We have closed frameworks of collaboration with important clients associated with the market, including the **Grupo CAF, NEM and Traintic,** and we have managed to position ourselves as a technology reference for intelligent maintenance and post-sales solutions within the railway market.

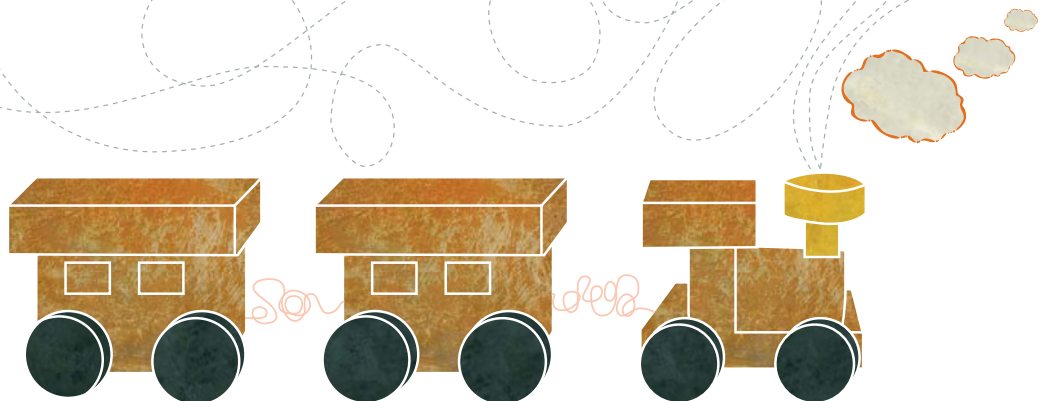
Among the main solutions that the Unit has developed within this sector are:

- **Intelligent solutions for the diagnosis and maintenance** of trains, which maximise their reliability, optimising the life of their critical components and their maintenance plans, and diagnosing in advance imminent faults within their operational process

- **Monitoring and global geographic location systems** for trains that associate their position and operational process with parameter monitoring

- **Global traceability systems** and railway component management

- **Automated system for the manufacture of stainless steel structures** for new trains using robotised welding



Other sectors

Other sectors: Construction, Food and Agriculture, Renewable Energies, Capital Goods

The transversality and complementarity of our technologies allow our developments to be oriented towards different markets. The main sectors that we address are those previously described, but at the same time we work for sectors such as renewable energies, food and agriculture and capital goods.

The great importance of construction within the business fabric has not so far translated into any repercussion on related research and innovation activities. This makes it essential that technologies, systems and more innovative and competitive constructive processes are developed, with a capacity to guarantee higher quality and safety levels, and an improvement in the general competitiveness of the sector through its modernisation and technification.

Our principal clients are: **Acciona infraestructuras, Arcelor Mittal and Modultec.**

The Industrial Systems Unit develops research activity within this market in projects oriented towards:

Robotics in the construction and automated manufacturing of structures based on composite materials

- **Automated methods of manufacturing and assembly** of the steel-based structures that constitute the building
- **Flexible tools** which make it possible to manufacture, on the same line, structures with different geometries and dimensions, and which are also reconfigurable
- **Original joints** to facilitate the automatic assembly of modules and their later disassembly and recycling

Within the **renewable energies** sector we have developed prototypes for **micro-windmills**, **solar system** sun trackers, the design of **robotised capital goods** for maintenance and the **inspection and cleaning of windmills** and solar panels.

For the **food and agriculture** sector we have developed high value added solutions in tasks of **manipulation and assembly**. What we cover ranges from conception and design to the development and integration of high performance robotics, combined with the latest technologies in machine vision and manipulation strategy systems.

Likewise, we have accumulated **wide experience** in the **capital goods** sector. We carry out product definition and conception, the design and development of high performance mechatronic systems, drive conception and development, experimental machine validation, process development and optimisation, and advanced numerical control systems.

Bruno Mallart:

The masterful illustrations used throughout this catalogue are all by the artist Bruno Mallart. He has worked as an independent artist since 1986, and has his work published in Newspapers such as Le Monde, The New York Times and The Wall Street Journal. As an image creator, the secret to enjoying his art lies in letting oneself be carried away by the countless visual metaphors that shape his creative universe: genius at art's service; inspiration as the essence of functionality.

Credits:

Our sincerest thanks for the collaboration received from all the colleagues at FATRONIK-Tecnalia who lent their image for this document.

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