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Why are such extensive facilities necessary?

01

The spallation neutron sources that will be used to observe matter are produced by means of collisions between high-energy subatomic particles with heavy metals. In order for the particles to reach the energy levels necessary, linear accelerators hundreds of meters long are typically used.

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In 2006, the European Strategy forum on Research Infrastructures included the European Spallation Source (ESS) among the first and most strategic Pan-European research infrastructures. With a power of 5MW, ESS will become one of the most important centres for Materials Science and Life Sciences studies with neutrons.

Neutron Sources using Long Pulse Spallation. (To the right, a rendering of a centre and indications of its main components)

01// Hydrogen ion (proton) source 02// Linear accelerator 03// Target for neutron production 04// Probes containing the material studied

Atomic Microscopes

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The most powerful microscopes in the world allow us to "see" the atomic structure of matter. To this end, they use a neutron beam as their light source. However, they do not have the shape or size of a microscope. They actually bear a strong resemblance to big industrial complexes and are often made up of several buildings, occupying an area of tens of hectares.



A new generation of neutron sources.

There are many new research centres involving neutrons, most of which are based on neutron production by means of small fission reactors. It is in these centres that much of the data leading to recent scientific breakthroughs has been collected. Such breakthroughs have been made in fields as diverse as Materials Science, long-lasting medical implants, contaminant free combustibles or fibre optics.

At the end of the past century, a series of measures were pushed in order to build more of these facilities. What motivated this interest was the projected short-term and medium-term closing of some neutron source facilities while the demand for neutrons among the scientific community kept increasing. This new generation of neutron sources was based on spallation, which produces beams of neutrons pulsed at great intensity.

Following the analogy of a light beam, we could say that, if the neutrons produced by a nuclear reaction allow us to see materials with the intensity of a candle glow, the neutron source produced by spallation allows us to see with the intensity provided by a surgical light.

In 2006, the first of these sources was started up. The SNS (Spallation Neutron Source) is located in ORNL (Oak Ridge National Laboratory, Tennessee, USA) and has a nominal design power of 1.4 MW. In 2008, came the opening of Japan's JSNS (Japanese Spallation Neutron Source), which has a power of 1 MW. And finally, the project of the European Spallation Source (ESS) was recently taken up again. The ESS will be a joint effort among more than 15 European countries; it will have a power of 5 MW and it planned to start operating in 2019.

THE SPALLATION TECHNIQUE

o1// Hydrogen protons are accelerated by means of alternating electrical fields, typically set at pulses of 1-2 milliseconds, until the protons reach velocities close to the speed of light.

o2// These protons strike against the surface of a heavy metal target, colliding with the atomic nuclei of the metal and causing the atoms to fragment. As a result of this fragmentation neutrons are expelled. This process of ejection or expelling is also known as spallation.

03// The neutrons produced in the target are also pulsed and initially have great energy. This energy is reduced down to the levels appropriate for experimentation in the "moderators". The moderated neutrons are then guided to the instrumentation rooms.

04// The instruments house probes of the material which is wished to be tested, as well as detectors that read the dispersion print left by the neutrons once they have gone through the probe. With this print, it is possible to obtain information regarding the position and behaviour of the atoms belonging to each material.





Rotating Target

A new design for high power sources

The rotating target is a possible alternative to the concept of liquid target, implemented in the two existent MW spallation sources (SNS and JSNS). In both cases the target material is removed from the area of impact so that it can be refrigerated before the following impact occurs. In the case of the rotating target, the material is removed by rotation, and in the case of the liquid target, the material is removed by flux.

The greatest advantage of the rotating target is that the case that contains the target material also moves, so that the radiological harm undergone by the vase is reduced significantly. Thus, the life time of the target can be prolonged by a factor of 30 when compared to the liquid target.

Another important advantage is the reduction and simplification of the facilities necessary to maintain and substitute the target – a process involving complex operations that must be done in rooms suitably protected and by means of remote manipulation techniques.

In 2009, ESS Bilbao started a Research and Development (I+D) project to improve target technologies for ESS. They contracted Idom for the conceptual design of the rotating target for 5MW, as well as the study and prototyping of some critical aspects, such as the mechanical behaviour or the refrigeration of these types of systems.

The project has been developed in collaboration with the Oak Ridge laboratory, which is working on the rotating target option for its Second Target Station (STS) project.



The preliminary design developed by Idom presents a highly compact tungsten disc, with which the production of neutrons is maximized, and a mechanical system supported by a horizontal carriage that retracts the target so to facilitate the substitution of moderators and of the inside of the reflector.

In 2010 Idom presented this design study in collaboration with ESS Bilbao, SNS/ ORNL and the Institute of Fusion (UPM) at the 19th International Collaboration on Advanced Neutron Sources (ICANS XIX), where the thermo-hydraulic analysis, safety considerations, neutron production estimations and maintenance studies conducted, were presented.

SNS STS Target. Prototyping and testing

The SNS design displays a disc of diameter 1.2 m that "hangs" from a 4 m long axis. The advantage presented by this design is that it allows hands-on maintenance to be done on it, by locating its mechanical system (motor, bearings and ceramic rings) out of the target room, which is a zone of high radiation levels.

The prototyping of the target module designed and fabricated by Idom was turned in to SNS in autumn 2009. Its mechanical properties were successfully tested during more than 5000 hours in Oak Ridge National Laboratory in 2010. During the tenth meeting of the Nuclear Applications of Particle Accelerators (AccApp'11, April 2011, Knoxville, Tennessee, USA), SNS presented, with the participation of ESS Bilbao and IDOM, a summary of the tests and main conclusions obtained in relationship to the target.





Devices for refrigeration testing



"Rotating Target Flow Test". The device

Refrigeration is one of the key aspects in the development of spallation targets. The RTFT is a device that will be used to validate computational models, study possible adverse effects and evaluate the overall final design.

This testing method uses PIV (Particle Image Velocimetry) technology. A digital CCD camera captures pairs of consecutive images of one of the trace particles which are diluted in water so that the velocity in the flux can be inferred by comparing the two images.





Characterization of the water flow. Uses PIV techniques to calculate the velocity of the trace particles.

"Rotating Target Flow Test". Start-up

After having successfully completed the partial tests of the RTFT towards the end of 2010, a prototype of the latest SNS design was installed for a 1.5 MW source in March of 2011. The stainless steel disc has a clear window made from poly(methyl methacrylate) so to observe the flux. The tungsten segments have been replaced by aluminium blocks and special care has been put into correctly representing the geometry of the refrigeration channels, with depths between 1.5 and 3 mm.

Right now, the prototype is being tested in the facilities of ESS Bilbao.

01// Rotating coupling for the water
02// Ceramic Ring
03// Direct torque motor
04// Bearing
05// Exterior Axis

o6// Interior axis



Fire in the Tunnel

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When a fire breaks out in a subway tunnel, the mortal trap tends not to be the fire, but the smoke. Idom is researching new ways to design these tunnels to prevent toxic gases from accumulating in the interior of the tunnel.



Virtual image of the section of a well-type station.

A new and innovative system has been adopted in the design

has been adopted in the design of Barcelona's new subway line, Línea 9, as a consequence of the city's irregular and dense urban weave, and the depth of the tunnels necessary for the subway layout. The system foresees a tunnel of two heights with one track on each level, which allows for the location of train platforms on the very inside of the tunnel profile.



This fire scenario simulates the case of a train arriving to a station with a fire in the bogie. The train stops at the station, the fire is detected, the doors of the train open and a sign is sent to the ventilation system so that it activates its emergency mode. In this case, the CFD model has enabled us to gain in-depth knowledge regarding the behavior of the smoke produced by the fire – how it enters the platform and is distributed through the spaces of the station and the tunnel. This knowledge lead to the development of the optimum evacuation strategy, as seen from a safety point of view. It also enabled us to determine the variations in carbon monoxide, temperature, visibility and radiation undergone by the tunnel occupants throughout the entire process.

Simulation of smoke streamlines in the event of a fire in the Can Zam Station.

Ventilation plays a crucial role in the safety of travelers in any type of tunnel. In the case of infrastructure located at great depths, the importance of ventilation for passenger health and safety only becomes greater.

Barcelona's Metro Line 9 travels at great depths and displays an innovative two story design that allows for one train to travel over the other. This system, which offers a significant decrease in construction investments, also introduces complex variables in air fluxes and circulation. Already in the early phases of design it became evident that, in order to guarantee adequate temperature and health conditions of the air, detailed studies of the ventilation system needed to be conducted. These conditions included both the daily use of the tunnel and the undesirable event of a fire. Only through a deep understanding of the smoke's behavior in an intricate subway network, could the safety design of stations and tunnels truly be optimized.

During the undertaking of this analysis, models of three types were developed: unidimensional, tridimensional and experimental trials.







Images from the stations of lines 2 and 4 in Barcelona, in which technologies for smoke evacuation in the case of a fire have been implemented.



Smoke streamlines in the vestibule of the Singuerlin Station in Barcelona.

SES (Subway Environmental Simulation) software was used for the unidimensional model. This simulation enables us to determine the flow and pressure of the ventilators that will give rise to the optimum wind speeds in each scenario (daily operation and event of a fire).

By means of CFD (Computational Fluid Dynamics) technology, a tridimensional model of air and smoke movement was developed. This technology consists in discretizing a given domain into small volumetric cells over which numerical calculation techniques are applied. These calculations solve the non linear equations present in the behavior of fluids, also known as RANS.

Lastly, the results obtained from the simulations were confirmed by means of experimental trials conducted in the tunnel and station, thus reasserting that the ventilation system was functioning as desired.

Sustainable Cities New city models



Mexico is currently undergoing an important living space shortage, which affects numerous population groups - those characterized by low income levels and low social security affiliation. This is a problem which must be tackled with specific solutions. It requires both public institutions and private initiatives to work jointly with the aim of providing the people affected with access to decent homes; this means reducing costs, coming up with better finance plans and integrating social life with the environment.

During the past decades, the problem of subsidized homes in Mexico has been solved by creating scarcely planned, endless building agglomerations. These agglomerations are lacking in infrastructure, spaces for social interaction and transportation to and from the trade centres in the region. Due to these deficits, the price of housing in these areas has plummeted, causing the market value of some properties to be even less than their mortgage.



9.6 million new homes will be needed in Mexico in the next couple of years



In order to alleviate this issue, the Government is starting to work on new urban models, which must be conceived based on a territorial ordinance plan and an urban planning oriented toward sustainability, mobility of people and connectivity between areas of commerce and trade. The goal is therefore to create Regional Development Poles, equipped with the necessary infrastructure, and planned with an integral approach that satisfies all the social, working and equipment needs.

In these new models, called Integrated Sustainable Urban Development (ISUD), private developers and Public Administration are trying to give economical viability to projects that dedicate more land for parks, roads, health services, education and business with the capacity to generate a economic and social ecosystem.

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The beneficiaries of this project will be the millions of Mexicans who currently live in slums, have low income levels and who, unless the DUIS methodology is put into practice, could see themselves trapped in a harmful urban, social, economic and environmental situation.

Images: Master Plan Conceptual for Mochis and Cañaverales



Idom has participated in the planning of the first Sustainable Urban Developments: Tlajomulco (State of Jalisco), Zampango (Mexico), Tlaltizapán (Morelos), Ucú (Yucatán) and San Francisco (Campeche).

The Sustainable Integral Urban Developments (DUIS) model means a step forth in the coordination of federal, state and municipal governments in the territorial ordainment of states and municipalities, as well as joint efforts to put forth strategic projects.

In addition to enabling many population groups to enjoy a lifestyle more typical of the middle class, these projects will minimize the negative impacts inherent to their scale, and they will channel more efficiently the public funding available for their realization.



Urban mobility in the future

Planning mobility systems for more liveable cities o1// Project MARTA



During the past four years, Idom has participated in project **MARTA** (Mobility and Car Industry with Advanced Transport Networks), one of the sixteen research projects approved by the Centre for Industrial and Technological Development (CDTI) during the third summoning of CENIT (the National Strategic Consortium Program in Technical Research). CENIT is a part of the INGENIO 2010 initiative, which is aimed toward fostering public-private cooperation in I+D+i. The CENIT projects entail a qualitative leap forward in the collaboration between companies and research organisms in the interest of I+D+i.

The goal of the project is to promote research and development of communications among vehicles as well as between vehicles and road infrastructures. The purpose is to find feasible, reliable and safe technological solutions that will facilitate the urban mobility of citizens.

Project **MARTA** intends to boost twenty-first century mobility by means of communication between vehicle-vehicle-infrastructure (V2V-V2I). The idea behind the project arises because of the need to specify, design and implement interoperable systems along the road network, and because of the need to research data capture methods in cars equipped with the appropriate technologies. One last instigator of this idea was the desire to find a solution to the European efforts to promote sustainable mobility and to decrease traffic accidents and deaths.

Eighteen companies from different economic sectors (communications operators, vehicle manufacturers, infrastructure and service providers and mechanical component providers) have participated in this project, which has a budget of over 35 million euros. Their activity was conducted under the umbrella of a Consortium and 19 OPIS (University and Research Centres), with a global scope encompassing six autonomous communities.



Among all project goals, **Idom** will participate in the area of urban mobility, tackling its current problems and challenges and attempting to provide answers to the needs of twenty-first century mobility. This is done by initially approaching existing problems and then aiming to attain the long-term goals of sustainable urban development. The proposed strategies intend to be more respectful toward the environment and to be in synch with the existing city designs and the urban policies in place. This will guarantee that the new actions will improve the liveability of the city.





In the images, final demonstrations of project MARTA carried out in Barcelona in February 2011. Photographs by Alfonso Calza

Urban Mobility in the Future

Planning mobility systems for more liveable cities o2// The i-TRAVEL system for planning journeys

The goal of the i-TRAVEL project is to develop systems capable of offering the traveller all the transportation information he needs, right on his portable device or cell phone.

The project, included in the Seventh Framework Programme leaded by ERTICO – ITS EUROPE, featured 19 international participating companies, a budget of 1.7 million euros and it lasted 18 months. The project was presented at the ITS Congress in Stockholm with the purpose of finding a common solution to the key problems faced by travellers, content providers and service providers.



The services currently available to travellers focus on pre-trip planning, and are simple mobile applications. However, there is lack of applications and information services without boundaries, which should work while the traveller is moving and should provide relevant on-trip information.

Users need to have access to information regarding their trips wherever and whenever they request it. The system needs to be built so that it allows the development of mobile applications by the pertinent companies, such as airlines, travel agents, hotels, bus companies, railway companies and even leisure trip providers.

For transportation and travel companies, the goal is that, by using the i-TRAVEL platform, their contents, services and offers can be published in a normalized manner, guaranteeing that the travel services are easy to find and easy to buy.

Comfortable and Efficient

Thanks to the joint work of architects and engineers, Idom's new headquarters in Madrid have become a reference in the field of energy efficiency, comfort and intelligent use of water in office buildings.





The high energy cost of conventional buildings demands a serious reconsideration of their design criteria. The need for efficiency must be taken into account as a first priority so that, among other things, the daily use of the building minimizes the need of energy, be it heat or cooling. The only power that is truly free is that which is not generated in a plant and does not need of artificial means for its distribution. However, no matter how much we advance in this sense, there will always be an irreducible budget for heating and cooling needs which will have to be attended by the implementation of technologies of the highest efficiency possible. Only after taking these two steps – design that minimizes needs, and use of efficient energies – will we be able to consider renewable energies as a plausible resource option. Renewable energies today are still very expensive and must be used as a last resort.



The design criteria of Idom's new building (orientation, shape and architecture), respond mainly to two principles:

1) Energy savings: by completely minimizing energy demand and employing efficient technologies to produce the energy that necessarily must be consumed.

2) Comfort: by utilizing simple solutions of reasonable cost and easy maintenance.

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The energy demand of the building has been and the final energy reduced up to % % $\mathbf{\overline{\mathbf{V}}}$ consumed has been reduced up to

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Minimization of the energy demand

The envelope of the building incorporates a series of design elements aimed toward the minimization of the energy demand: high thermal insulation, high quality glass, exceptional solar protection and double vegetable skin both in the façade and the cover, among others. Natural ventilation is another one of the strategies featured in they building's design. The headquarters have several atriums for interior communication which act as chimneys, thus substituting mechanic ventilation when the season and temperature so permit it.

Energy activated structure

The building possesses an energetically activated structure (TABS: Thermally Activated Building System), which entails a series of energetic benefits that cannot be attained by any other system. The structure transports, distributes and stores heat and cooling energy, and it regulates the amount of heat transmitted or absorbed from the environment. The structure is charged and discharged by evaporative cycles of 24 hours. Idom's office is one of the first to incorporate this technology in Spain.



Design Strategies



Passive Air Conditioning system

VEGETABLE COVER

It diminishes the solar charge received by the building, thus regulating the temperature of the surface exposed to the sun. It retains water and reduced the "heat island" effect.

NORTH FAÇADE

Woodwork of great dimensions and double windows with low emissions and an air chamber. It has steel panels that offer direct protection against radiation from the west. Day-lighting techniques implemented include the absorbance of diffuse light from the north.

NATURAL VENTILATION

During seasons of intermediate outdoor temperatures (spring and autumn) the atriums act as chimneys and allow natural ventilation to enter the building. This system takes the place of mechanic ventilation, thus attaining the desired energy savings.

SOUTH AND WEST FAÇADES

Protection against solar radiation by means of a steel structure that supports a vegetable cover. In summer, the leaves prevent direct radiation from going through, and in winter the lack of leaves allows for a better lighting in the interior.

NATURAL VENTILATION

An open ground floor allows for free circulation of cool air through vegetation and wells. The rest of the floors have also been designed to take advantage of this natural ventilation.

ARCHITECTURAL DESIGN /// SUMMARY

ENVELOPE

Insulation
Empty spaces and enclosures
Glass U=1
Orientation
Extremely low loads
Double vegetable skin

THERMAL MASS

In direct contact with the interior environment

ATRIUMS

Enabling better air distribution



Natural ventilation systems

Cross section

Innovation and technology

Design Strategies

Active Air Conditioning system



TABS SYSTEM

Energy savings Low exergy

Free-cooling and ability to recover heat Thermal mass Separation of demand and production

Comfort

Hygrometric comfort Acoustic comfort Air quality

TEXTILE CONDUITS (VAV > VAMV)

(Variable Air Volume and Very Variable Air Volume))

Temperature of water in drums is closer to ambient temperature Better humidity control Offers higher potential to use free-cooling Lack of noise

TABS Thermally Active Building System

Hydronic system: This concept, already used in Ancient times, became popular once again at the start of the twentieth century and is currently widely extended. It is employed in approximately one third of new buildings in Germany. Idom's Madrid headquarters is the second building in Spain to incorporate this technology, and the first to combine TABS with Textile conduits.

Temperature of water pumped in summer 19-21°C Temperature of water pumped in winter 24°C



Section of the TABS framework



Concrete thermal mass Storage effect. The production and demand of heat are separated in time.



What is energetically efficient architecture?

It is architecture that incorporates efficient building systems in themselves, which is not the same as the use of efficient systems. In the latter case, the systems are elements added and juxtaposed to the design. An efficient system is, for example, the above mentioned TABS (Thermally Activated Building System) system of active structure. This system combines the two characteristics that determine the performance of all heating and cooling system: the use of temperatures as close as possible to ambient temperatures, and the capacity to store energy.

Historic models

Designs with high energetic efficiency have used – conscious or unconsciously – heat transmitting fluids at near ambient temperatures, as well as structures with the capacity to store energy. A clear example is that of traditional rural houses, where the animals in the stable warmed both the ambient and the thick walls that separated the animals from the residential space. The granary and hay barns acted as insulating elements for the roof

In search of low energy

Thermodynamics has proved that systems using near ambient temperatures – also known as "low exergy" – exhibit extremely high performance. Such is the case with TABS, a system that also contributes to the framework's energy-storing capacities. This enables the separation in time of the periods of energy demand (office hours), from those when the systems must produce

A KEY CONCEPT: EXERGY

energy (night time). In a conventional building, heating systems need to overcome the heat charge at the time when it occurs. This presents two downsides: firstly, the power of the systems will be over-engineered, given that it will have to exceed the greatest expected demand (worst day and time of the worst possible year). Secondly, the performance of the systems will be smaller, given that the conditions of outside air at times of great demand will be extreme (high temperatures in summer and low temperatures in winter).

Uncoupling production and demand

Thanks to the fact that the building's structure is the main element to meet its thermal needs, with the TABS system, demand and production can be uncoupled. This enables the machines to work in time intervals of low demand. The systems can be smaller (and cheaper) than those corresponding to maximum demand scenarios. In addition, they can also work when outside conditions are more favourable, hence multiplying the absolute performance up to a factor of 10. In fact, during the summer, approximately 50% of the energy used in Idom's building is removed from the building at night by direct evaporative cooling (Direct Cooling or Hydraulic Freecooling). This "removal" is carried out using a cooling tower which contributes about 400kW of power and consumes about 10kW, including both pump and ventilator. The building's structure stores the energy obtained (or freed) at night and uses it the next day.

Exergy is a thermodynamic property that measures the available work potential existent in a system and its surroundings. For example, a mass of water at very high temperature and pressure in an atmospheric environment is a system of high exergy, given that the water can be transformed into mechanical energy (vapour turbine). If the same mass were to be diluted in a greater mass of water, the resulting mass would be at a lower pressure and temperature, and would be able to produce less work. It would be a system of less exergy. The most efficient heating and cooling systems are those of low exergy or less exergetic destruction.

Top image: TABS system during its construction



A comfortable environment at a reasonable cost

The intention was to create a healthy and enjoyable environment that is both professional and somewhat resembles that of a home. To this end, great attention has been paid to ventilation, installing a system of textile conduits with a high quality filtering system and a practical framework which enables natural ventilation. The heating and cooling systems use temperatures close to those of the outside, therefore establishing equilibrium between radiation and convection while using systems of the smallest size. All this, in addition to the instalment of double windows, leads to a silent interior environment. Humidity, CO2 and temperature sensors, as well as the rest of the facilities, operate under centralized management.

The wooden framework and the practical installations have given rise to a building of easy maintenance. In short, it is a building of reasonable costs, easy to use and understand, kind in its appearance and ready to adapt to any changes.





"We have tried to design a strictly sustainable building, balancing its ecological, economic and social aspects, convinced of the high architectural return of such efforts. We have tried to build a comfortable environment, where one can work free from excessive heat or cold, without blinding lights nor toxic elements. From what we have observed, the occupants have noticed this too."

J.M. Susperregui, J. Martínez Bermejo y A. Villanueva Project authors

Free from thermal responsibility, the air renewal process is carried out in a peaceful manner, by means of a textile conduit system, seen in the image on the right. It is a technology of excellent hygienic and sanitary features, born in the food industry field. Until now, it had never been adapted to an office building project in Spain. The system has been adapted to its new use through a thorough research process and joint developments with its manufacturer, until the desired featured were attained.

CO2 emissions are reduced 64 with respect to the building of reference established by the regulation currently in force (CALIFICACIÓN CALENER = A).



Water Collection and Redistribution

COLLECTION SYSTEMS

Due to the semiarid climate of Madrid (only 436mm of precipitation per year), the optimum usage of the available water is crucial to attain the highest energetic and environmental goals.

COVER

The water is collected in the building cover, channelled toward the gutter in the South façade and lead toward the patios.

SOUTH FAÇADE

The water collected is channelled between the metallic skin and the glass, thus being used once the cycle for the vegetable irrigation has been completed.

PLENUM

In the ground floor, a false bottom allows for the housing of a water storage system made of several water layers and interconnected wells.

TREATMENT AND DISTRIBUTION

The water accumulated in the water reserves located under the ground floor generates around itself a space of vegetation which contributes to the temperature regulation of exterior zones during the summer. Thereafter, the water is treated and redistributed in the toilets, irrigation system and refrigeration tower, which leads to savings of over 400.000 litres per year.



Cross section



When a Ship Reaches the Docking Port

An army of workers is mobilized

A ship, whether it is a cargo or a passenger ship, can be described as a microcosm that requires essential services (water, fuel, food, cleaning, security, mobility, loading, unloading, surveillance...) at an especially complex degree due to the fact that it is a floating microcosm.

Shipping companies around the world are becoming more and more sensitive to waiting times, given that their productivity is at stake during these periods: traffic operations such as port pilotage, mooring and towing, processes at the terminal such as loading, connections with other means of transportation, and other docking services, such as bunkering, residues, water cleaning and tolls.

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Vessel Traffic Management System

Control of Previous Authorization

Docking and nautical services

Anchoring zone control Docking management Coordination of technical services (nautical: pilotage vs towing vs mooring)

Centre for reception, information and instructions offered to docked ships

Coordination and control of nautical activities Information centre for the Port Community Supervision of basic port services such as port-pilotage, mooring and towing Supervision of residue collection service provided to the ships Supervision of water cleaning Supervision and coordination of environmental incidents occurring in the maritime environment.

Goods Declaration

mannan

Management of Authorizations to Load and Unload Dangerous Merchandise Management and Tracking of Dangerous Goods in terminals – Stay and Segregation controls

For every hour a container ship medium size reduces its docking time, a saving of \$10,000 is generated for their owners.

Hence the constant challenge of shipping companies to increase productivity by minimizing the cost of terminal services. The quality and timeliness of these services depends on the companies that serve and on the Port Authority that coordinates those services as well.

Port authorities are public bodies responsible for planning and control of basic port services. As their job is becoming more complex, they are being pushed into implementing private enterprise business models.

Port Management System (PMS) is one of these models. It facilitates the collection of information on activities and services, their analysis and generation of indicators to take the necessary decisions to make the port increasingly more efficient and competitive. A Port Managements System (PMS) is a real time information system that assists in the management off the main processes carried out in the harbour.

Loading and unloading services

Control of Loading and Unloading processes Supervision of stowing handles Supervision of cranes

Supervision of bunkering services Maintenance and repairs **Idom is developing a complete management system** for the port authorities of Barcelona and Algeciras, which will allow a global and automated management of the port, with technical indicators in all the services offered. With this system, not only will the port authority guarantee that all the manoeuvres are carried out within the safety criteria, but they will also guarantee optimum levels of productivity. In short, the port will provide greater economic savings to the shipping companies and the volume of traffic and business in the port will be greater. A good management system can be the key to the economic revitalization of all the port hinterland.

> Control of access by land Trucks and personnel

Pass Control

Coordination with pertinent organizations Centre for Port Land Information Centre for Port Land Emergencies Supervision and coordination of environmental incidents occurring on land. Monitoring of the availability of port infrastructure

Clear Runway

Systems for automatic detection of obstacles in the airport environment

One of the greatest threats to airport safety is the appearance of uncontrolled obstacles in areas of airplane operation. Past experience has shown that, no matter how strict the building restrictions established by airport authorities may be, unexpected objects frequently appear on the runway. Idom has designed a system that automatically detects and warns of unforeseen obstacles, guaranteeing absolute safety in airport operations.

> PHASE I /// IDENTIFICATION OF SENSITIVE AREAS

Until quite recently, no methodology had been able to guarantee the detection of obstacles with the frequency required by the strictest safety standards. The first step taken by Idom was, therefore, to design a system prototype and test it in the environment of an airport (2009). The analysis of the results obtained confirmed the validity of the system and the viability of its implementation. It is currently in the process of obtaining an international patent.



MDT /// Digital Terrain Model

The safety perimeters of airports are becoming more and more extensive and, inside them, very high levels of activity are carried out. The danger within these perimeters does not arise from objects that are controlled and registered in the MDT (terrain) – rather, the danger is posed by objects which appear without previous notice.

MDS /// Digital Surface Model

Starting from pre-existent information, such as 3D cartography, LIDAR models and orthophotography, the areas most susceptible to the penetration of uncontrolled obstacles due to human activity are identified.

/// The sum of several information sources allows the identification of areas that are particularly susceptible to the intrusion of uncontrolled obstacles.

3D Cartography + Orthophotography

o1/// LIDAR Systems To obtain MDT and MDS models o2/// Conventional cartographic systems



///DETECTION FROM SENSITIVE AREAS

The communication systems will guarantee the communication between the monitoring station and the land sensor by means of GPRS, UMTS or radio. This way, it will be possible to programme large observation campaigns, as well as selective observations, over especially sensitive areas.

///GEOMETRY CAPTURE



///DATA SENDING to the management platform







///IDEO Tool (Obstacle Identification) designed by Idom for the detection of obstacles.

/// Diagrams showing how the system works **Another goal of the project** was to design a digital application that can manage the available information. Once installed in the airport grounds, this application will enable:

/// The control of all land sensors in real time

/// The management of all starting geographical information available /// The identification, alert, and generation of reports regarding the possible obstacles

The control of the land sensors in real time will allow the operator working in the monitoring station to look out as far as the horizon, or to conduct a selective search of the area he wishes to observe. That way, in the case of an alert regarding the presence of obstacles, he can observe the area once again; have information about the geometry of the possible obstacle and a photograph of the exact moment of observation. In order to better interpret the physical surroundings, this information will be coherent with the rest of baseline geographical information. The manager will also possess stereoscopic images with which he will be able to visualize a raised image of the physical surroundings of the object, thanks to a stereo visualization system.

The manager will allow the exchange of 3D information about possible obstacles with the geometry of the different limiting planes of the obstacles. This way, alarms are set off by the appearance of uncontrolled obstacles. The result is a report with all the available information about the obstacle: description, panoramic image, orthoimage, coordinates, etc.



Electricity sails out to Luanda

The first floating electricity plant developed in Spain



Electrical supply to the capital of Angola

Between 1975 and 2002, Angola went through a prolonged war that caused the migration of many people from the south provinces to the capital of the country, Luanda. However, the capital currently lacks the basic infrastructures needed for its inhabitants, which are more than 7 million persons. To illustrate the seriousness of the situation, only 30% of Luanda's homes have running water.

With the aim of supplying electrical energy to Luanda, IDOM has collaborated in the start-up of a turbine of over 40 MW that will function from a barge anchored in the harbour of the capital. The turbine was installed on its barge in the port of Vigo, from where it was transported to Luanda by means of a semi submergible boat.

The barge, entirely made of steel, is not propelled and its dimensions are 63x18x4 meters. It can be divided into two distinct zones: the hull and the deck.

In the hull we find the tanks of diesel oil that is fed to the turbine, the tanks of ballast water and the pump room.



From Vigo to Luanda: an innovative means of transportation

The Eagle, a semi submergible cargo boat, was in charge of transporting the 1700 kg pontoon along the 6.500 km that separate Vigo from Luanda.

01///The pontoon is placed on the water layer above the deck of the Eagle using a towboat.

02/// After having stabilized and fixed the barge in its position, the Eagle emerges and sets off on its journey.





On February 29 2011, the generating plant was boarded in the Port of Vigo and it set off to the Central African country, where it is currently located, thus completing its implementation process.



The GIS substation, water treatment plant, 11,5/63kV power transformer, generating sets, auxiliary equipment, storage rooms and all the main components of the turbine (control room, turbine, alternator, auxiliary equipment) are located on the deck of the boat.

The electrical connection with the dock is carried out by means of an isolated cable supported by an output gate. The delivery of fluids for services and other processes is possible thanks to flexible pipes. The turbine is a 6B General Electric model, and has a power of 42,1 MW.



Killer Algae

The invasion of the Blue-Green Algae

% OF LAKES IN THE WORLD that suffer from eutrophication *

North America 48%
I Europe 53%
I Asia 54%
Africa 28%
South America

*Survey of the State of the World's Lakes promoted by the International Lake Environment Committee, 2008

The intense green color seen in some lakes is due to the proliferation of Blue-Green Algae or cyanobacteria, a type of unicellular organisms that obstruct the penetration of sunlight. As a result, the plants in the bottom of the lake cannot carry out photosynthetic processes correctly to produce oxygen, thus bringing about the death of many of the ecosystem's species.

This universal and evermore occurring phenomenon, also called eutrophication, usually reaches is critical period at the end of the summer. It occurs in basins where there are excess nitrogen and phosphorous concentrations, as a consequence of the intensive use of fertilizers, livestock nutrients and phytosanitary products, animal excrements or, simply, urban contamination.



The A Baxe dam, located in Caldas de Reis on the Umia River, has been increasingly suffering from this process, up to the point that it presented provision problems in the year 2010. Because of this problem, the Autonomous Region Organization, Waters of Galicia, commended Idom the writing of an Integral Plan of Action for the improvement of the reservoir's condition.

The study has already been carried out. It analyzes all the influential factors in the process of eutrophication and proposes a series of measures that affect the nearby agriculture, livestock and foresting activities, as well as the dam exploitation practices or the sewage and water treatment networks. Measures to spread awareness of this problem and to educate farmers, city halls and inhabitants of the river basin have also been included. A pilot project for the control and collection of purines has also been proposed.

As a result of this commission, another two similar projects are underway in the near future: the improvement of the sewage system in the locality of Cuntis (the locality contributing the most phosphorus to the reservoir) and the pilot plant for the treatment of purines.

Farmers of Hidalgo, unite!

The integration of the sheep farmers in Valle de Mezquital (Mexico) is one of the 300 entrepreneurial innovation experiences that are being promoted in the State of Hidalgo.

The Otomie ethnicity, one of the most ancient populations of Mesoamerica, lives in the Valley of Mezquital. This group of people created an extensive irrigation system, thanks to which they became experts in agriculture and grain production. After 1570, colonizers introduced sheep-farming in the area and, little by little, these ancient agricultural lands became grazing lands, and the hills suffered from deforestation. The Otomie people became small farmers and did not know how to develop their practice, due to a deficient production structure that prevented them from competing in the global market.



Many communities continue with the "breeding and fattening of sheep at a very small and individual scale", explains Máximo Pérez, president of the Administration Council of the cooperative society called "Hñäl-Hñus Integrating Society of Sheep Farmers of the Mezquital Valley". "The tradition is that each sheep farmer has a small farmyard and manages his animals independently. If he wishes to sell or consume an animal, the decision is his to make."

In the past few years, a process of entrepreneurial integration and integral accompaniment has been put into practice. Thanks to these efforts, awareness has been raised among the members of the Integrating Society about the need to carry out activities together, whether it is to buy vaccines and medicines or to sell the animals that have reached a given weight. This way, it has been possible to integrate all the value chain and obtain benefits for the indigenous community.



This is one of the 372 examples of entrepreneurial initiatives that are being helped to evolve from the individualist focus typical of traditional activities, to the associative and innovative ways, necessary for any activity that wishes to compete in a global market.

Through the elaboration of a strategy plan, Idom has been able to unify the efforts of the twelve incubators in the State of Hidalgo under one shared vision and mission, in which all can benefit from the resources and common experience, obtain funding, and foster an innovative spirit.



Organic and Bioclimatic

The Bilbao Arena has been recognized as one of the milestones of sustainable design in sports facilities. It combines systems such as cogeneration, reutilization of rainwater, ecological covers and an innovative recyclable enclosure of low visual impact that integrates organic forms.

The sports complex has a central sports pavilion with a capacity for 8.500 spectators, a 25m long swimming pool with six lanes, a children' swimming pool, a 500 m2 gym and a parking lot for over 200 vehicles.

THEFT

Ille In

Façade Design

The wish to integrate the building with its natural surrounding has given rise to a peculiar multicolor façade, an enclosure designed by the architects at IDOM and baptized with the name of "Alligator Scale System". It has been adopted as a standard enclosure by a steel multinational company.

> Design Phases

01. Starting Concept.

Deciduous trees over a rock

In the search for integration with the surrounding natural elements, volumes were conceived as arboreal masses (Sports Complex), over a stony mass (Sports Pavilion).

02. Generation of the arboreal mass image

Selection of the photograph image. Pixelization. Selection of the color map.

Application of color on each metallic sheet (leaf)





03. Design of the basic elements (leafs)

Rhomboid metallic elements that allow complete permeability of air, necessary for its function of hiding the ring of cooling and heating facilities of the Sports Complex.

> Final Result

A façade that provides solar protection, ventilation and natural illumination, of easy maintenance and with one additional function: to hide all the equipment and conduits of the building. The shell, manufactured using steel sheets 0.7 mm thick, is assembled by placing the rhomboid shingles contiguously and slightly elevating their inferior side, so that the façade resembles a scaly skin.



The enclosure houses a compound of notable dimensions. 10.000 m2 of flat recyclable aluminum sheets were used in its construction. In the stadium, we find 3.500 seats provided by the permanent stands, and 5.000 seats on the retractable stands (image above).

Saving schemes

One of the technological innovations of the complex is the implementation of a cogeneration system that allows the heating of the water in the pools without the need to use conventional heaters, hence reducing losses in energy transport due to its in-situ or decentralized production.

In addition to reducing fuel and electricity consumption, and decreasing the emission of greenhouse gases into the atmosphere, the system is capable of providing additional electricity, thanks to the microgeneration technology, CHP (Combined Heat and Power), which enables the attainment of annual efficiencies of 8.400 kWh, which are then introduced into the electrical grid. The global efficiency of the cogeneration system is greater that that of a modern electrical plant, presenting an estimated savings in primary energy of about 32%, as well as decrease in CO2 emissions of about 130 tons per year with respect to conventional systems of equivalent production.

The uptake of natural light by means of the skylights, the natural ventilation systems and the reutilization of rainwater – very abundant in Bilbao – for the cleaning of the urban surroundings, provide additional examples of the saving strategies that have led several publications to refer to this complex as "an iconic building of bioclimatic architecture".



Given that large cities concentrate 50% of the electricity consumption of a country, cogeneration is a system promoted by UE Directives to foster energy efficiency.





Internet for All

Reaching the last village. Wimax Technology

With the aim of reducing the existing digital gap between urban and rural areas, and of improving the social and economic state of the latter, the Provincial Council of Pontevedra requested the Ministry of Public Administrations to carry out a project co-financed by FEDER funds: the deployment of a wireless telecommunications network that would reach a great number of inhabitants and companies in the 55 City Halls adhered to the project – out of 62 City Halls in the Province of Pontevedra.

The job was divided in two phases. First was the realization of two pilot projects in four rural areas with the goal of testing and selecting the most appropriate technology. Second, the telecommunications network was deployed in all the municipalities adhered to the project.

The result of the first phase was the selection of the Wimax Technology (Worldwide Interoperability for Microwave Access) in licensed bands. It is one of the technologies belonging to the so-called last mile technologies, which enables the reception of data through microwave, and its retransmission through radio frequency. The protocol that characterizes this technology is IEEE802.16. One of its advantages is that it provides wide band services in areas where, due to a low population density, the deployment of cable of fibre optic presents very high costs per user.

The second phase is still in process of implementation, and it consists in the deployment of 55 base stations that will permit a wide band internet connection to 85% of the population. The service will not only be provided at very competitive prices, but it will also enable the use of Internet, an indispensable tool in the world of today, to a population that has been deprived from this opportunity until now.

The services contracted to Idom by the Provincial Council consisted in the Technical Assistance for both phases: the definition and supervision of the pilot projects, the elaboration of the tender specifications, and the Project Management of the network deployment, currently in state of finalization.



This Project has enabled, among other things, the deepening of the knowledge regarding wireless networks, which empowers Idom's offer and corroborates the company's expertise in these types of technologies. This also improves Idom's positioning in the convocation of the distribution of the frequency spectrum, recently announced by the Ministry of Industry. This distribution will be the incentive for most of the telecommunications tenders that will be carried out in Spain during the next few years.

From the Barcode to the Intelligent Chip

A new way to label products

Any shop owner would love to rest assured that there are no human errors in the purchase bills, to dedicate his employees to attend customers instead of having them stand in the cashiers, to automatically control expiration dates, install nearly invisible anti-theft systems, or simplify the overall management of his stock (entry, exit, returns and refunds). Today, all this is possible thanks to RFID (Radio Frequency Identification), a new object identification technology.

RFID uses silicon chips capable of storing a great variety of data and transmitting it by radio frequency, i.e. without physical contact. Traditional technologies used information containers constituted by barcodes and data readers in the form of infrared devices. In the RFID technology, a tiny emitter chip receives and responds to the signals sent by the radiofrequency device that periodically checks for labels in its vicinity. When the reader receives a signal, it extracts the information and passes it on to the data processing subsystem.

Idom has carried out the successful implementation of the identification by radio frequency system (RFID). This includes the control software specifically developed for an international perfume chain which has more than 1.700 different products and 300 stores.

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