PROJECT FINAL REPORT

Grant Agreement number: 232242

Project acronym: NOFIRE

Project title: HIGH SPEED FIRE STOPPING SECTIONAL DOOR

Funding Scheme: Research for the benefit of specific groups (in particular SMEs)

Period covered: **from 01/06/09** **to 31/05/11**

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1. Final publishable summary report

1.1. EXECUTIVE SUMMARY

The present project fills the gap existing in the European market concerning fire stopping garage doors capable of providing high speed closure, together with sensors and components for fire stopping capabilities at an affordable price. Before the development of the project, these types of doors and sensors (light barriers and contact bands) had not been completely developed, fact that contributes to the creation of new business opportunities in the field of security, especially considering the important benefits for a wide range of applications (transport, construction…) offering higher security and reducing the risk under fire accidents.

All over the project, the key issues have been the reduction of the maintenance costs, increasing the cost-efficiency and durability, improving thermal insulation, development of a dual performance: high speed and fire stopping door and providing solutions complying with the most strict safety and environment preventing standards (all materials have been carefully selected in order to ensure environmental friendliness even at high temperatures).

The development of such complex products could only be done if the key components were capable of providing a faster and more reliable performance under extreme conditions that could not be found in the market. For that reason, the project was planned at the European level forming a consortium able to meet the project needs and formed by 4 SMEs willing to obtain final products to be integrated in their catalogue in the short term and 3 RTD institutions experts in mechanical/electrical design and accredited certification of construction components under different standards.

In order to carry out this work, the project has been organized in 6 workpackages plus two additional workpackages for management and dissemination issues: WP1: Definition of the design criteria for industrial doors, sensors and electronics with fire security performance, WP2: Development of a dual performance high speed and fire stopping sectional door, WP3: Design of light barriers, contact bands electrical and electronical design for fire applications (specially for the project targeted doors), WP4: Generation of concept prototypes, WP5: Experimental verification of concept prototypes and materials, WP6: Environmentally friendly optimised production process development, WP7:Management, WP8: Dissemination and Exploitation of the results.

At the project end, all the **goals** of the project have been **fulfilled, fact that make all partners consider it a success.** The following results have been obtained:

- Definition and design of a new high speed fire stopping door with electronic devices (contact bands and light barriers as security devices for protection of persons against crushing).
    - **The new door (obtained door) provides insulation values close to 2 hours** and can be **classified according to the standard EN 13501-1:2009+A1:2010 as $EI_2$90 90** (category B). This category allows the extension to bigger doors according to the criteria of the EN 1634-1:2008. Apart of that**, the new development complies with all functional security requirements** and, in normal conditions, **the door opens at 1.5 m/s and closes at 0.5m/s which can be considered as a high speed door**. In case of fire the door closes.
- Improvement of existing contact bands, in order to enable them for being used as security devices for persons in fire stopping doors.
- Improvement of available light barriers in order to enable them for being used in high speed fire stopping door. Integration of the RS485 communication port.
- New control panel complying with all functional security requirements for high speed fire stopping door.

The opening/closure of the obtained fire stopping door is controlled by reliable electronics and presence sensors which were developed to fulfil all the specifications of the project door.

1.2. A SUMMARY DESCRIPTION OF PROJECT CONTEXT AND OBJECTIVES

Given the globalization of all market products, the European industry should find a differentiation level when compared to other industrial economies by the production of high added value products as the new **high-speed fire stopping door, the improved light barriers or the high temperature withstanding safety border edges** proposed by the present project.

The proposed solution **should fill the gap existing in the European market, where** this type of doors, before the project, had to be yet developed **and should contribute to the creation of new business opportunities in the field of fire security** thanks to the application of the new developed sensors.

Apart from the particular scientific and technical objectives for each project partner, the project should contribute to strengthen the European industry and improve the security within Europe. The project development should lead to several advantages, the ability to safeguard human life in case of fire accident being **a priceless aspect that constitutes the main goal pursued by the different products developed within the project and the most important benefit**. It should be mentioned that **adding the fire detection and contention capabilities to sectional doors would make possible to reduce fire hazard in many ambits in which such protection is not currently contemplated** due to price, installation needs or necessary open/close speed.

During the past two decades, the free circulation of products and merchandises has become one of the bases of the World Market Inside the European Union this has been supported thanks to the development of new innovative and efficient strategies to eliminate barriers, making easier the opening of markets to the European industries and improving the supply to the users and consumers. Both storing and providing a reliable and secure transport for travellers and products is an important concern for all European countries. **Security doors and security systems constitute one of the key tools** in all this mechanism.

Prior to the project end, for outdoor doors, applied solutions consisted of a light fast manoeuvre canvas curtain, to control or reduce the entrance, **complemented by a slow sectional door for security and safety reasons; for indoor areas in which fire risk exists, the Directives indicate to install fire stopping doors** that close only a few times a day (1~2, being its closure difficult to confirm in case of sudden fire).

In most cases, a tailor-made door was assembled and adjusted at the final location, thus lacking the reliability and performance demanded by the customers in case of accident. The installation costs were high because fire stopping doors were heavy and stiff structures should be attached to the floor or to the building structure (reason for which they could not be installed in some cases). In those workshops close or inside urban locations, the lack of fire stopping doors was a risk because the possibility of fire inside the building could produce important damages (including risk of death).

The participants in the project considered that complying both specifications (fast movement and fire stopping) should be desirable and should be compulsory in a medium future to provide a practical service in usual life and offer an added value of **human safeguarding in case of fire** (complying with the imminent EU and national instructions). **The project proposal of joining both performances into one only product, would bring an important cost reduction (reducing the installation and maintenance time and costs**, being one of the key issues addressed within the project**), apart from a smaller occupied area and extending the application of fire stopping doors to a wider range of businesses and locations**.

Concerning the electronic sensors and controls, market available presence sensors (contact band) and electronics **could not** be applied for temperatures over 85ºC, smoke or fire conditions, thus lacking the required specifications for security devices in case of fire, which has been achieved in the development of the project.

The project challenges were important: For doors, **both goals high speed and fire stopping imply opposite design solutions** and **solution providers for each field belong to different sectors focusing their interest in opposite directions**. **For sensors,** it was difficult to develop such solution if an important demand was not foreseen. In this case the project targeted doors constituted a promising market that could support the development of such sensors

With the current developed door, the previously existing gap constitutes a business opportunity for project participating SMEs whose current range of products will be widened in order to reach the demanded capabilities. These companies present a commercial network capable of introducing the product in the market in a short to medium time.

After the development of the project, many market applications will take benefit from the project: the developed door **can be installed outdoors** as entrance to/from dangerous/security buildings **and also indoors** as danger area separator where there is **an important transit of persons** (airports, bus, subway or train stations, shopping centres, skyscrapers, large office buildings, public buildings, etc.) **or merchandise** (airports, harbours, train stations luggage transfer sorting systems, valuable products transport or production storage areas, docking bays, automotive industry, chemical and pharmaceutical plants, all sectors of food-processing industry, etc.) in which, apart from high speed motion some mechanical, acoustic, thermal and burglar-safety performances are demanded.

Some critical aspects achieved in the new system have been the dynamic and kinematic door design, the thermal and acoustic design, the performance of all those sensors identifying and acting under an emergency situation and the door response time. Validation and certification issues, market production facilities and market network have been other important issues taken into account for a fast market introduction.

Given the size of the companies involved (SMEs) and the difficulty of developing an optimised product envisaging commercialization in a short time, the sum of efforts made by experts in the fields demanded by **the project could only be achieved** if the development was made **by partners within the European scope**. In the present project, partners from different EU countries have contributed with their technical and technological skills and background to provide the best results from the development.

One of the SMEs involved (PORTES BISBAL) is a producer of industrial and garage doors for some of the markets addressed and knew the needs of the market. The other SMEs involved in the project are experts in the development of electronic controls and presence sensors for outdoor and indoor applications based on light barriers and safety borders. Prior to the project development, the available systems did not work properly in presence of fire or smoke and degraded causing dangerous toxic or dense smoke clouds. Also it was necessary the development of a fast and reliable control for high speed fire stopping doors.

The improvements included in the current products by the participating SMEs have been possible thanks to **subcontracting an important part of the research to R&D partners specialised in the design, calculation and certification of components according to the standards** that were applicable to the present project.

The developed door constitutes an important breakthrough for the future of these companies, especially because the unique characteristics of the developed products will push the European market to a leading position in the World market.

S&T Objectives

TECHNICAL -INDUSTRIAL OBJECTIVE

1- A **new high speed fire stopping sectional door** has been developed, guaranteeing a fast closing operation with an optimum performance against fire in order to save human lives in case of fire:

The proposed concept door and components are **suitable for all kind of indoor and outdoor locations where there is the risk of fire** due to the reduced occupied space, the easy assembly and low maintenance and installation costs.

The door will remain **efficient for a minimum of 10 years**, being **capable of stopping the fire (temperatures higher than 1000ºC) for a lapse of time close to 2 hours** (**$EI_2$90** (category B) according to EN 13501-2:2009+A1) and **closing the door without risk of trapping a person according to the functional security requirements once the high temperatures are sensed**.

Not only this door meets the requirements by current Directives, but also those that are currently discussed regarding fire security. The door has been designed with highly advanced materials providing the best performance, recyclability and cost-efficiency.

Apart of that**, complying with all functional security requirements**, in normal condition, **the door opens at 1.5 m/s and closes at 0.5m/s**. In case of fire the door closes.

The opening/closure of the obtained fire stopping door is controlled by reliable electronics and presence sensors which have been developed to fulfil all the specifications of the project door. The correct integration of the mechanical design together with the electrical design, have been tested with the **generation of prototypes (WP4) and with its experimental verification** (WP5), **providing successful results**.

Apart of that, **it must be mentioned that the NOFIRE door has been tested and certified, obtaining successful results.**

2-The system incorporates a contact band and a light barrier as safety devices. The **light barrier** works **in the normal operation of the door** (high speed) and in case of **fire the contact band** is used as security device.

The **only small deviation in relation to one of the first project objectives** has been **the incapacity of the light barriers of being used as security devices** in **case of fire**. In case of fire, the light barriers are not able to distinguish if a person or smoke as located between its emitter and receiver (in the operational test under smoke conditions according to EN54-7:2000, test fire TF2 to TF5, the smoke was detected by the light curtains, in all kind of fire tested), and therefore it is not safe to use them as security devices in case of fire.

3-To install edge safety borders capable of withstanding fire for at least 60 minutes and **integrating plastics that do not produce toxic degradation** in case of fire.

However, **the goal of installing edge safety borders** (contact bands) **in doors which withstand fire for at least 60 minutes, has been clearly reached**. They can be installed in doors which provide almost 2 hours (111minutes of insulation) fire resistance, without any risk.

INDUSTRIAL -ECONOMIC OBJECTIVE

The importance of all the products developed lies in their unique performance capabilities, which will make the partners make an important profit but will also **lead the European sector to a leadership position in World market**.

As mentioned before, apart from the door application, the components present important breakthroughs that can be applied to other applications constituting a market opportunity for the SMEs producing these components. In all cases, a **new product line** means that current sales divisions must be updated (new sectors, applications, etc.) and new customers contacted.

After **doing the cost analysis with the functional prototype**, PORTES is in this moment involved in the search for standard components and best prices for all the components that constitute the door, aiming at a price reduction close to the 35% for the industrial prototype. Furthermore**, this cost** would be considerably inferior in a mass production **which will do its market price really competitive and attractive.**

Together with this study, adding to the high speed and fire resistance performances, all the partners see a great business opportunity, since there are no doors in the actual market providing fast movement and with high resistance to fire.

The products **are going to be offered in a short term after the project completion**. Many of these SMEs foresee an important growth that will increase their market share, turnover and, in consequence, will make them create specific divisions with the creation of new jobs.

SOCIAL -ENVIROMENTAL OBJECTIVE

The project has addressed both aspects with an important premise: **Providing the society with** new products that comply with all the **security requirements** (speed, versatility, reliability).

Not only will the **developed door** be a **reference in the field of the security**, but also a target **in the field of fire protection**.

The costs (comparable to currently applied high speed closing doors) and the security provided will be important reasons to **apply these doors in all those businesses in which, despite fire risk, fire stopping doors were not used** due to installation difficulties and high cost. Something **similar could be said about the sensors and control.**

As basic specification, the **application of materials and components whose degradation under fire produces a reduced environmental impact** (smoke toxicity, etc.) is stated. This guarantees that no dangerous substances are released into the atmosphere in the event of fire and high temperatures. The proposed product should provide a service life of **at least a 10 years,** but in case of substitution or replacement, all the materials disposed will not constitute a problem for the environment because **most of the components will be recyclable or degradable.**

The **creation of a new market field** in which Europe can keep a leading position, will produce the **creation of new employments**. As a second target, the growth of the SMEs should make them capable of increasing their RTD performance and boost their position in the future.

Improvement of security and safety

The result obtained in the project will contribute to achieve the capability to safe human lives in case of fire accidents, **providing the society with** new products that comply with all the **security requirements** (speed, versatility, reliability).

Not only will the **developed door** be a **reference in the field of the security**, but also a target and a reference **in the field of fire protection**, providing a door was not existing in the market and that it was very required (Normal operation: High speed performances in case of no fire, and providing fire performances (fire insulation) in case of fire.

Improvement of environment

The door **will have a positive effect on the environment**, since the application of materials, covers and components whose degradation under fire produces a reduced environmental impact is stated or makes that the **products burns in a controlled way.** This guarantees that no dangerous substances are released into the atmosphere in the event of fire and high temperatures.

Improvement of employment and sales

This project has contributed to the improvement of the competitiveness of the different SMEs involved in the project. All the partners see a great business opportunity, since there are no doors in the actual market providing fast movement and with high resistance to fire. It is expected that the improvement of the competitiveness of SMEs as result of the project, will improve their sales rates and increase their market share and turnover. As a result of this trend, they will improve their economical situation, which will cause an improvement on their employment rates and will make them create specific divisions with the creation of new jobs.

1.3. DESCRIPTION OF THE MAIN S&T RESULTS/FOREGROUNDS

Eight work packages (WPs) to **be completed in two years** were identified to achieve the objectives stated for the project**.** The final results should be **an innovative door, a new series of contact bands and new capabilities in current light barriers, to be** offered by the SMEs participating in the project. All these products should present a **direct integration in the market** and all these systems should be the result of the project RTD performances and the acquired knowledge, **providing a solid base for future developments** along this line.

In order to carry out this work, the project was organized according to the following Scheme: **WP1: Definition of the design criteria for industrial doors, sensors and electronics with fire security performance, WP2: Development of a dual performance high speed and fire stopping sectional door, WP3: Design of light barriers, contact bands electrical and electronical design for fire applications (specially for the project targeted doors), WP4: Generation of concept prototypes, WP5: Experimental verification of concept prototypes and materials, WP6: Environmentally friendly optimised production process development, WP7:Management, WP8: Dissemination and Exploitation of the results**

The following results have been obtained:
Workpackage 1 has provided the initial **definition of the design criteria for industrial doors, sensors and electronics with fire security performance**. All partners, especially the RTD partners have participated in this task.

As a first approach, an industrial or garage door complying with the compulsory CE marking and consequently their safety requirement, did not necessarily comply with any requirement concerning fire stopping. In the course of the project, these requirements have been complemented taking information about standards and directives for other products with similar specifications (HÖRMANN and EFAFLEX provide high speed rolling doors; MIR and FLEMA produces fire resistant roller shutters (60 minutes insulation)…). Nevertheless, **given that there was no regulation for the proposed product**, partners put their experience together to state the specifications level for this product/system as compared with other similar ones.

The specifications for the components were analysed and **revised** (according to the door application demanded requirements), in order to better-state the project targets. These specifications were established after taking into account all possible solutions to improve the door performances and having identified the key aspects:

- Tolerance and material selection
- Influence of friction between selected materials at different temperatures
- Manufacturability of proposed solutions in different materials
- Counterweight design
- Performance of the intumescense band at different temperatures

The results of WP1 have provided a deliverable document containing the initial project specifications, which has been be updated (with new directives, instructions or results) in the course of the project.

In relation to this deliverable, it must be mentioned that the first goal of the project was achieving a fire stopping door (60 minutes of insulation) capable of providing high speed opening and closure (fast movement of the door).

However, the good results that were achieved during the project, leaded the partners of the consortium to agree in increasing the fire insulation of the door, to the highest possible value.

THERMAL PERFORMANCE: **Finally, the new door (obtained door) provides insulation values close to 2 hours** and can be **classified according to the standard EN 13501-2:2009+A1:2010 as $EI_2$90 90** (category B). This category enables the extension to bigger doors according to the criteria of the EN 1634-1:2008.

SHUTTER speed: **apart of complying with all functional security requirements**, in normal condition, **the door opens at 1.5 m/s and closes at 0.5m/s**. In case of fire the door is closed.

The obtained door surpasses all the first expectations concerning thermal performances (fire insulation) stated in the project.

When analysing the standards, the following ones have been studied:

- **INDUSTRIAL DOORS WITHOUT FIRE RESISTANCE CHARACTERISTICS. EN 13241-1 "Industrial, commercial and garage doors and gates - Product standard - Part 1: Products without fire resistance or smoke control characteristics"**.

Normative references for safety requirements cited in this normative:

- **EN 12604** – "Industrial, commercial and garage doors and gates - Mechanical aspects – Requirements". Concerns mechanical requirements for safety in normal service operation of industrial doors to avoid the door being cause of possible injuries or damages to users/ This normative is related to **EN 12605** – "Industrial, commercial and garage doors and gates – Mechanical aspects - Test Methods"
- **EN 12453** – "Industrial, commercial and garage doors and gates - Safety in use of power operated doors – Requirements". Concerns all the additional safety aspects related to power operated doors, for which the possible hazards are identified. This standard states requirements like the limitation of forces exerted by the door, the sensitive protective equipment to be installed and additional devices to avoid damages in case of collision between the door and a vehicle. This normative is related to **EN 12445** – "Industrial, commercial and garage doors and gates - Safety in use of power operated doors - Test methods".

OTHER STANDARDS:

- **EN 12978** – "Industrial, commercial and garage doors and gates - Safety devices for power operated doors and gates - Requirements and test methods". It specifies requirements and test methods for safety devices to be installed on the door.
- **Electromagnetic compatibility related to EMC e MD directives:**
- **EN 61000 – 6 - 2** – "Electromagnetic compatibility (EMC) – Generic standards – Immunity for industrial environments" ;
- **EN 61000 – 6 - 3 – "Electromagnetic compatibility (EMC) – Generic standards – Emission standard for residential, commercial and light-industrial environments"**

- **INDUSTRIAL DOORS WITH FIRE RESISTANCE PREN 13241-2 HAS BEEN REPLACED BY PREN 16034 – WI 00033380 - PEDESTRIAN DOORSETS, INDUSTRIAL, COMMERCIAL, GARAGE DOORS AND WINDOWS - PRODUCT STANDARD, PERFORMANCE CHARACTERISTICS – FIRE RESISTANCE AND/OR SMOKE CONTROL CHARACTERISTICS**

  It is very important this requirement: Fire resisting and smoke control doors can only provide their designed fire resistance or smoke control capability when they are in the closed position.

  Normative cited in this normative **PREN 16034 – WI 00033380:**

  EN 14600 – "Doorsets and openable windows with fire resisting and/or smoke control characteristics - Requirements and classification". It concerns all aspects related to the fire performance of doorsets. The fore resistance of the door must be tested according to EN 1634-1

- **ADDITIONAL REQUIREMENTS FOR EVALUATION OF CONFORMITY FOR THE PROJECT DOOR**

  It must be said that system 1+ (system of evaluation conformity) applies to the project door with fire resistance and this makes that, apart from carrying out the initial tests for the product according the mentioned standards, additional requirements must be also considered by the Notified Body for the approval of the system.
  BUILDING DEPARTMENT MINISTRY in Spain was contacted for the certification of the new project developed product, to prevent possible problems during the certification of the project results.

  This department, **according to the Basic Document DB SI - Safety in case of fire in the Technical Building Code (Spain),** has developed a procedure (an evaluation of technical suitability) for certification of complex systems (non conventional system) as the project door. **This evaluation of technical suitability,** is a document that must be issued by an **accredited body** that is recognized by the BUILDING DEPARTMENT (MINISTRY).

Workpackage 2 has been focused on the development and implementation of the mechanical development of a new system for high speed door, taking into account mechanical and thermal aspects (not electrical aspects).

In the first steps of this task, a revision of the patents related to garage and industrial doors and high speed mechanisms were conducted, in order to avoid patentability problems in the design of the leaves and the new kinematic design for the new door.

After that, in order to achieve a dual performance, high speed and the fire stopping capabilities for the door, it was necessary to generate a new design for the leaves considering the following aspects:

Geometry and design: tentative design of the leaves were analysed and constructed having into account that the space required by door should be as small as possible and the new geometry should provide a fast movement of the door (high speed). In this geometric design the leaves should be light and avoid the risk of finger trapping.
Thermal design: The best suitable materials were identified and analysed to define the material for the door shutter leaves. These materials should provide on one hand fire resistance and on the other hand must be light.

The consortium in this field, agreed in increasing the fire insulation of the door, willing to improve its performance from 60 to the highest possible, making more difficult the search for the most adequate leaves.
During the first period of the project, in order **to obtain the right design, several designs (eight) and different materials were designed and tested according to EN 1634-1:2008 during the fist period of the projec**t.
During the fist period of the project, a first version **of the leaves providing 133 minutes** of insulation and integrity (EI_2 120) was obtained, according the mentioned test.

Sample aspect at the minute 133 of the Test

However, in this design (tentative design developed during first period of the project) the hinges were welded, which was not the best solution for the final concept prototypes. **Therefore, having into account these performances, 2 new of prototypes were generated in WP4 and verified in WP5, according the design developed in this task (WP2).**

In one of them the external side of the leave has been divided in 4 pieces while the other is divided in 2 symmetric pieces and both of them have screwed hinges.
Finally the results of the tests in WP5, did not present too many performance differences between the design of the leaves in 2 pieces and the design of the leaves in 4.

Therefore, because of the symmetry of the cover of the leaves, and **easiness of manufacturing** the **DESIGN OF THE LEAVES IN 2 PIECES HAS BEEN SELECTED FOR THE GENERATION OF THE PROTOYPES** (WP4).

As results of this task, a foreground of how design leaves for a rolling door (light, which small thickness), how to make the union between leaves and a big knowledge in performance of materials under fire have been obtained. This knowledge can be used for the design of all kind of doors (sectional doors, horizontally and vertically sliding doors, hinged or pivoted doors….)

After having defined the total weigh and thickness of the door leaves, the design of the kinematic for the high speed door avoiding the current patents was started. The proposed opening system, should not present any legal conflict with the circular and elliptic fast door patent protected systems.

In this part, a new kinematic design was developed, after analyzing the best solution. The kinematic design was important because the mechanism should be capable of opening/closing in just a few seconds and the door should close quickly in case of fire.

The guides of this new design were studied in order to reduce the noise associated to the opening and closing of shutters and to achieve the highest velocity. Apart of that, it should provide an emergency mechanism for opening and closing and a safe gearbox performance.

The system consisted of a vertical guiding system for the door sheet that was bended on a horizontal closure by a motorized slider pulling from the upper leaf. The structural support of the door was conformed by two vertical columns to which the guides **(and eventually a set of resorts acting as counterweight)** were fixed and two horizontal beams with guides (for the slider and the door leafs) and two linear racks for the gearing system.

The mechanics of the system were provided by a motor-reducer assembled on the slider connected by two pinions to the horizontal racks.

The inertia and friction of all moving components were calculated and the maximum speed should be reached applying counterweights or selecting coatings and materials capable of reducing the friction while providing low inertia and high fire resistance.
Some of the key aspects like: tolerance selection, material selection, manufacturability of proposed solutions in different materials, counterweight design, influence of friction between selected materials were taken into account.

During the generation of concept prototypes (WP4), some changes were necessary in the kinematic design in order to achieve the optimum design, for example with the introduction of new hinges and a mechanics in order to minimize the deflection in the horizontal movement of the door.
Finally, in this task the design and foreground for designing:

- High speed doors
- Fire resistant doors
- High speed fire stopping doors (both performances together) were obtained.

Workpackage 3 has been focused on **the fire performance improvement of the Electronic Safety Protection Devices (ESPEs), i.e. light barriers and wireless contact bands and the control system**, taking the specifications given in WP1 application as initial specifications and interacting with the door design (WP2) to perform an optimal component installation.

Objectives:
The opening/closure of fire stopping doors and the activation of fire security elements should be controlled by reliable electronics and presence sensors achieving the highest level of reliability in all situations.

This work package was focused on the development and implementation of the electric and electronic design for fire stopping systems and the optimisation of currently available light barriers and contact bands to be applied as security elements in case of fire.

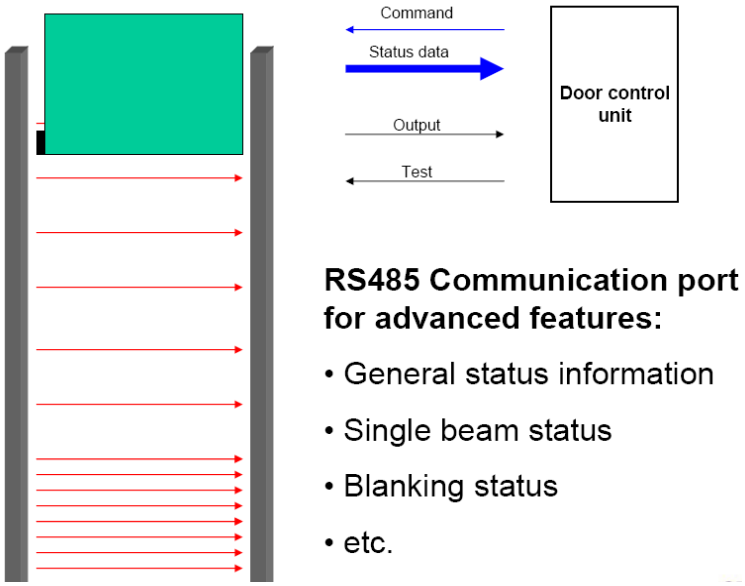
All security and sensor systems (light barriers, contact bands) developed in this WP present a dual objective of high speed reaction and closure together with human safe guarding avoiding people trapping. The door sensors should have avoided that people get locked inside the fire area or under the door while enclosing the dangerous area as fast as possible.

The project partners performed an estimation of the production costs of the project developed components in WP3 (M3), appreciating that the manufacturing costs were suitable for the introduction of a market competitive product and continuing the project. The generation of concept prototypes developed in WP4, were used for this purpose, to confirm the feasibility and choose the best option.

LIGHT BARRIER
The idea of this task was the development and implementation of new light barriers, improvement the current range of products adequate for been used in high speed fire stopping doors, which has been fullfilled.

The main goal was improving the current range of products while keeping its security to obtain a market competitive advantage for high speed fire stopping doors.
In the developed light barriers the software was modified to integrate the high speed door operation mode and to detect a continuous blocking (more than 120s) and displaying this status to the control unit, DURING SELF-CLOSING IN CASE OF FIRE (SF3), deliverable D 1.3.
Detailed SF3 requirements were:

GridScan operation. All needed functionality for high speed doors like stop&go operation and partial opening were developed during the fist period of the project and have been optimised during the second period of the project.
120 s timeout: This was a new requirement that the GridScan signals the status when the light curtain was fully blocked for more than 2 Minutes. This feature was included after step 1 (GridSan Operation) and optimised in this second period.
In case the light curtain was fully blocked by smoke, this fault condition must be transmitted to the control unit. During the second period of the project, CEDES integrated this detection into the software and hardware, together with an **RS485 Communication port for advanced features**, adapting it to the project door with successful results.



RS485 DATA COMMUNICATION

This integration **made during this second period of the project** has allowed a door control unit to monitor the function of the light curtain. Status like continuous movement of the door, blow-out/crash of the door or stop position of the door can be monitored.

The GridScan software always knows the current status of following information:

- Number of beams installed (i.e. number of optical elements)
- Beam status of each beam (i.e. interrupted or free)
- Current GPI position or door lower edge position
- Output status
- End position status
- Input line configuration
- Light curtain configuration and manufacturing data

Based on the information available above, the RS485 communication port enables the implementation of customized solutions according to NOFIRE project requirements, with successful results (functional and safety performance of the door). Therefore, the corresponding communication protocol, commands and parameters are defined in separate documents.

It must be also mentioned that the NOFIRE door obtained and tested with successful results, incorporates contact band and light barrier as safety devices. The light barriers will go on in the normal operation of the door (high speed) and the in case of fire the contact band will be used as security devices. The use of the light barriers has not an adverse effect in fire stopping doors.

The only small deviation in relation to one of the first objectives of the project has been the incapacity of the light barriers to perform as security devices in case of fire, since after all the work and test developed in WP5 (Operational test under smoke conditions according to EN54-7:2000 (test fire TF2 to TF5)), in all kind of fire, the smoke has been detected by the light curtains. In case of fire, the light barriers are not able to distinguish whether a person or smoke is crossing its emitter-receiver, and therefore it is not safe to use them as security devices in case of fire.

This lack of security device performance in case of fire by the light barrier has been solved with the possibility of using the contact band for this purpose.

CONTACT BAND

LIMITATIONS: It was tested that FEGEMU sensors got burned and generated toxic clouds in case of fire (Directive NF F 16-101 to describe the performance of a plastic when burning).

However analysing the standards in detail (task1), the most important aspect for the NOFIRE door was to know whether the contact band **could provide, when** installed in the **door,** or not an adverse effect in the fire classification.

The test requested for the NOFIRE door was the **Fire Resistance Test** as per standard **EN 1634-1:2008 "Fire resistance test for doors and compartmentalization elements. Part 1: Doors and firewalls**" and following the standard procedure **(I_2) of aforementioned standards as insulation criterion**.

Different specimens were tested:

Specimen 1, 3100.1610, elastomer on the basis of ethylene-propylene-terpolymer (EPDM, CAS:250 038-36-2), with paraffinic oil, and a sulfur-vulkanising system: In 850s **inflammable gas appeared .**

Specimen 2, 3100.1610N, profiLe of NBR/CR : Acrylonitrile (34% nitrile) Butadiene Rubber / Chloropriene Rubber **: In 850s inflammable gas appeared.**

Specimen 3, 3100.0310I EPDM, elastomer on the basis of ethylene-propylene-terpolymer (EPDM, CAS:250 038-36-2), with paraffinic oil, and a sulfur-vulkanising system: **In 650s carbonizes and 700s takook flame.**

RESULT: These contact bands could not be installed in a garage door since they did not burn in controlled way.

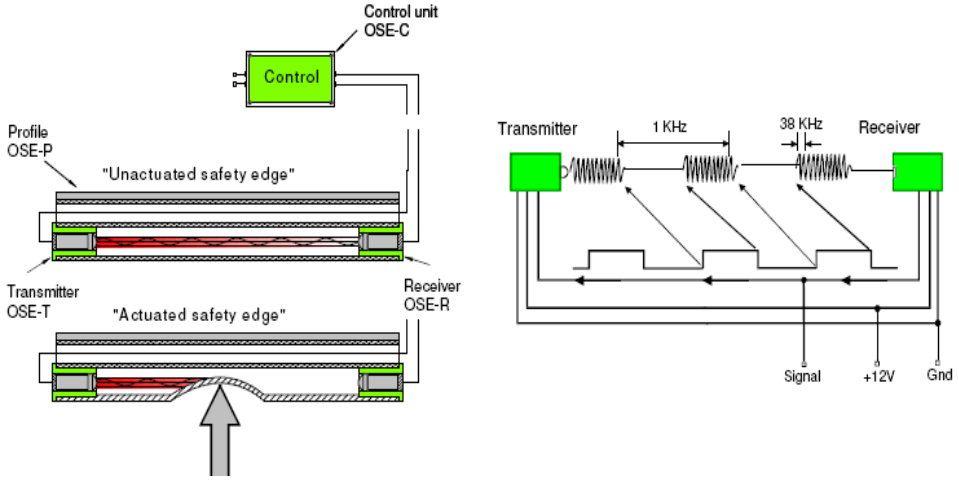
Specimen 3 during the test

To solve this problem, FEGEGU CONTACT band had to be improved or protected so that, if this security devices were installed in a fire resistant door, it would burn in a controlled way not causing a negative influence in the classification of the fire resistant door.

Apart of that, the developed solution (wireless contact band) concepts are:

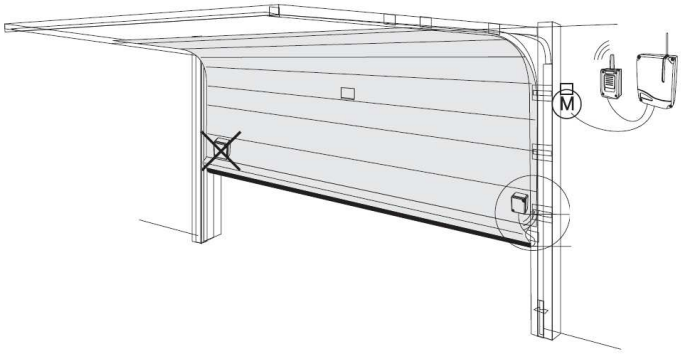
- Opto-electronic safety edge (OSE): based on an infrared safety light barrier enclosed in a hollow rubber profile
- The system is fail-safe, as its intelligence has been integrated directly into the sensors
- Control unit should analyse the reliable dynamic transmitter-receiver signal and should send the resultant status signal to the output unit.

General function for the contact band:
Diagram:



Wireless communication for the new contact band: Radioband 2G

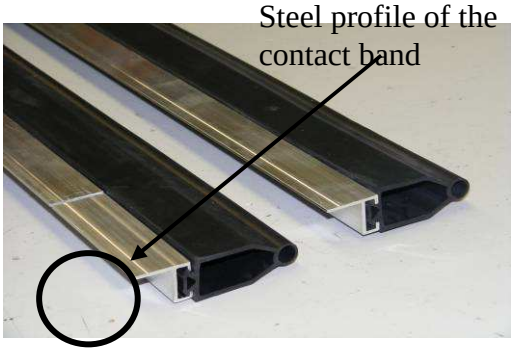
- The system should provide a wireless system replacing spiral cables or energy chain systems to provide the safety signal to the door control panel. The receiver should monitor the status of transmitters connected to it
- The system should comply with EN 954-1 Category 2

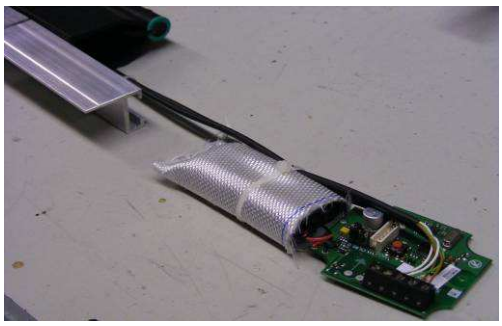


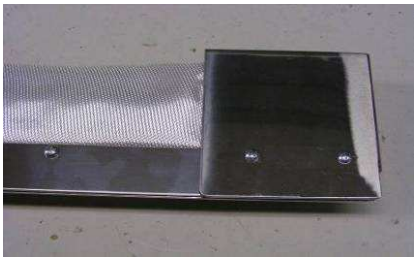
This developed band should provide the following temperature protection:

- Special isolation of the safety rubber profile by a combination of two different fireproof covers
- DC 600 (Outer) and DC 1300 (Inner)
- Both separated by air gaps
- DC 600 mainly stops the heat air flow
- DC 1300 for high temperature resistance

Following the previous specifications, the wireless **developed contact band** with temperature cover (first version) was mounted in the prototype of the 12th NOFIRE meeting, but it has not been **tested under fire**, until **the second period of the project:**

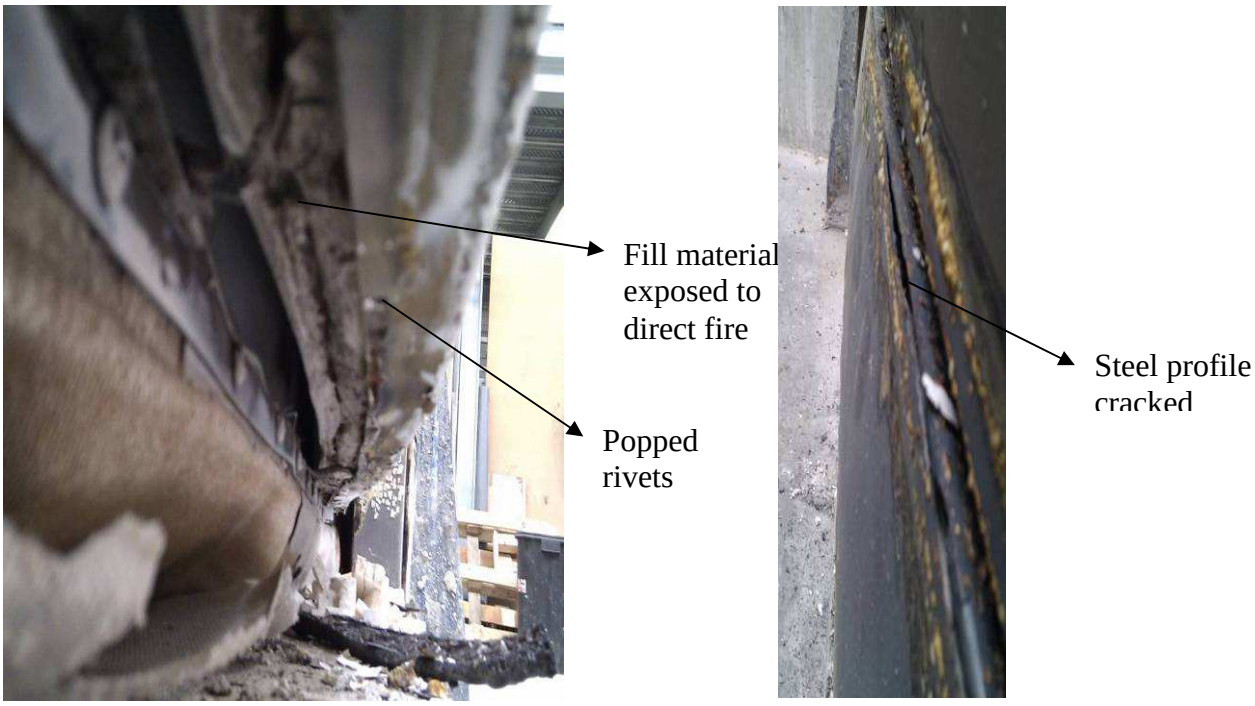






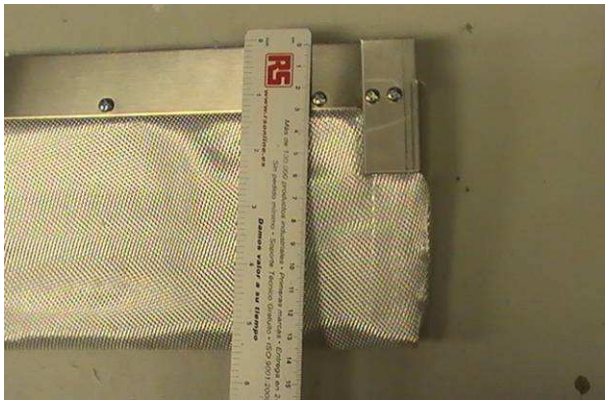
One of the fire test performed to the complete door (WP5) stood out the necessity of some changes:

- **In this test, the deformation of the last leaf caused an excessive deformation of the steel** profile of the contact, probably due to a defective performance of the intumescent mesh covering the contact edge, this would cause the contact band to burn in a not controlled way:



To avoid this problem, the following changes were done and tested:

1- The profile was reinforced
2- The wide of the fire blankets was increased to avoid air gaps between the door and the floor when the door is closed



The final fire test provided successful results. As a summary, **the goal of installing edge safety borders** (contact bands) **in doors withstanding fire for at least 60 minutes, has been clearly passed**. They can be installed in doors which provide almost 2 hours (111minutes of insulation) fire resistance, without any risk.

CONTROL SYSTEM

The control system was aimed at managing the movement of the door in all the possible situations avoiding any risk to people during normal use (high speed movement of the door), guaranteeing the right door fire-proof behaviour in case of fire detection, taking into account the design requirements and safety functions for the control system

The developed control system uses fast electronics capable to identify potential problems and perform a reliable control of the door in normal conditions and in case of fire, obtaining the information from the different sensors disposed all over the design.

The control should detect power supply problems and activate the auxiliary power supply when needed and should also detect information about people moving under the door or inside the fire area, temperature distribution close to the door, correct performance of all auxiliary systems and enable the opening and closing door manoeuvres.

Risk of person-trapping under the door should be specially observed. Warning signals will be supplied prior to closure and, whenever a person is suspected to be under the door mechanism. When a high temperature threshold is reached on the door location, the door must be closed in order to prevent the fire from getting in the building or out of it.

All actuators and mechanisms (security brakes, etc.) should be controlled by the developed hardware. The control will provide a reliable and safe continuous motion even at the highest speeds and above-average ready-for-operation availability.

The developed control followed all these specifications.

During the first period of the project, the specifications for the control were established:

- The control panel should present buttons for opening, closing and an emergency button (Motor stop, the door must stop when the stop command is required. The response distance must be smaller than < 50 mm for opened height < 500 mm and < 100 mm for heights > 500mm).
- Connections for additional opening/closing command interfaces
- Input port for smoke detection signal
- Input ports for photo-cell barrier and/or contact band, encoder and limit and referencing sensors

- Output ports for warning lights, flashing lights, speakers, buzzers, horns, etc.
- Connection for power feed.
- Connection for motor power feed.

The door closure is controlled by means of a resort system or a counterweight. The absence of power feed in case of fire was specially considered, that is the reason why the movement under resort or weight action limited by counterweights was proposed. The door brake should be an inverted type brake (non operative in case of power failure) or alternatively, a non-interrupted power system should be assembled for the brake operation during the closure.

The control developed in the fist period of the project was tested in the 12th NOFIRE meeting in PORTES BISBAL with successful results to be the first prototype only opening and closing of the door and stop in case of presence of person in the closing of the door.

However, **this software did not provide the functional security** requirements yet. Therefore, it was necessary **to redesign this software during the second period of the project, according the above table**. The control has been indeed optimised during the whole project. It has not been easy due to the big number of cases to have into account.

Apart of that, during the second period was necessary:

- To adjust the opening and closing velocities, opening acceleration ramp variation and closing deceleration ramp variation, ramp variation
- Adjustment of top and bottom positions of the door
- Auto-diagnosis of opening/closing positions
- Programming the door performance **for normal operation, non power supply and smoke detection, according the following table**;

	Result	Safety for door springs (wire breakage)	GridScan (Light barriers)	Contact Band	Emergency STOP (button)	STOP and AUTO/MANUAL (button)	UP (button)	DOWN (button)	ENABLE_DOWN (button: DOWN above set maximum position)	Brake of engine	
Normal operation: when door is stopped at the top (opened - zero position)	X	The system switch to manual mode	only reports (gridscan is not free)	It doesn't work	The system switch to manual mode	The system switch to manual mode	Up limit activated	It causes closing of the door (auto mode) or move down the door (man mode)	The door is closing in manual mode	Brake is ON	Normal operation: when door is stopped at the top (opened - zero position)
Normal operation: when door is stopped at the bottom (closed - maximum position)	X	The system switch to manual mode	X	It doesn't work	The system switch to manual mode	The system switch to manual mode	It causes opening of the door (auto mode) or move up the door (man mode)	Bottom limit activated	The door is closing below set maximum position in manual mode	Brake is OFF	Normal operation: when door is stopped at the bottom (closed - maximum position)
Normal operation: when door is stopped in the middle (between zero and maximum position)	X	The system switch to manual mode	only reports (gridscan is not free)	It doesn't work	The system switch to manual mode	The system switch to manual mode	It causes opening of the door (auto mode) or move up the door (man mode)	It causes closing of the door (auto mode) or move down the door (man mode)	The door is closing below set maximum position in manual mode	Brake is ON	Normal operation: when door is stopped in the middle (between zero and maximum position)
Normal operation: when door is opening	X	It causes immediately stopping of the door and switch to manual mode	only reports (gridscan is not free)	It doesn't work	It causes immediately stopping of the door and switch to manual mode	It causes stopping of the door with set decceleration for opening	It doesn't work	It doesn't work	X	Brake is OFF	Normal operation: when door is opening
Normal operation: when door is closing	X	It causes immediately stopping of the door and switch to manual mode	It causes immediately stopping of the door, after 2 sec continues closing or reopen	It doesn't work	It causes immediately stopping of the door and switch to manual mode	It causes stopping of the door with set decceleration for closing	It doesn't work	It doesn't work	X	Brake is OFF	Normal operation: when door is closing
No power supply of system	The door will be closed in pulsed brake after the selected time (1 to 10 min) .	It can be closed by manual mode	It causes immediately stopping of the door, and after the gridscan is released, the door continues closing by gravity	It doesn't work	It causes immediately stopping of the door but after selected time (1 to 10 min) the door closing	The system switch to manual mode	It doesn't work	It doesn't work	X	Brake is switched between ON/OFF (pulse braking)	No power supply of system
No power supply of inverter	The door continues in the same status that it was before the power supply failure.	It can be closed by manual mode	It causes immediately stopping of the door. After 2 seconds when GridScan stop detecting somebody, the door will be closed.	The door close by gravity and by pulse braking	It causes immediately stopping of the door and after it can close by pulse braking. The pulse braking is activated by selected time (1 to 10 min).	It causes temporary stopping of the door, after that the door will be closed	It doesn't work	Is enabled and it can close by gravity and pulsed brake.	The door is closing below set maximum position	Brake is switched between ON/OFF (pulse braking)	No power supply of inverter

	Result	Safety for door springs (wire breakage)	GridScan (Light barriers)	Contact Band	Emergency STOP (button)	STOP and AUTO/MANUAL (button)	UP (button)	DOWN (button)	ENABLE_DOWN (button: DOWN above set maximum position)	Brake of engine	
Smoke is detected: a) door is opened	The door will be closed with set speed. After 3seconds when smoke is detected, the door will be closing and then Contact Band is active.	The door start closing	It doesn't work	After 3seconds when smoke is detected, the door will be closing and then Contact Band is active. Only then Contact Band causes immediately stopping of the door. When somebody stop the door by touching Contact Band more than 2 minutes, the door will be closed regardless of Contact Band	It doesn't work, and the door start closing	It doesn't work	It doesn't work	It doesn't work	It doesn't work	Brake is ON	Smoke is detected: a) door is opened
Smoke is detected: b) door is closing	The door continue closing	The door continue closing	It doesn't work	**1)** When somebody touch Contact Band for a while, it will cause stopping of the door. When somebody stop touching the Contact Band, after 3 seconds the door will be closing **2)** When somebody stop the door by touching Contact Band more than 2 minutes, the door will be closed regardless of Contact Band	It doesn't work. The door continue closing	It doesn't work	It doesn't work	It doesn't work	It doesn't work	Brake is OFF	Smoke is detected: b) door is closing
Smoke is detected: c) door is closed	It is possible to open the door. After opening, the door is stopped and then the door will be automatically closed.	It continue closed.	It doesn't work. Only reports (gridscan is not free).	X	It doesn't work	It doesn't work	It causes opening of the door (auto mode) or move up the door (man mode)	It doesn't work	It improve the bottom closure	Brake is OFF	Smoke is detected: c) door is closed
Smoke is detected: d) door is opening	When the door is stopped, the door will be automatically closed.	It causes immediately stopping of the door and start closing.	It doesn't work. Only reports (gridscan is not free).	The door open and after 3seconds when smoke is detected, the door will be closing and then Contact Band is active. Only then Contact Band causes immediately stopping of the door. When somebody stop the door by touching Contact Band more than 2 minutes, the door will be closed regardless of Contact Band.	It causes immediately stopping of the door and after start closing immediately.	It causes stopping of the door with set decceleration for opening and after start closing.	It doesn't work	It doesn't work	It doesn't work	Brake is OFF	Smoke is detected: d) door is opening
No power supply of inverter AND/OR PLC Smoke/fire is detected	The door will be closed inmediately by gravity with speed 150mm/s (pulse braking)	The door close inmediately	It doesn't work	After 3seconds when smoke is detected, Contact Band is active. Only then Contact Band causes immediately stopping of the door. After 2 minutes of continuos blocking (or fault signal) the door must be closed by gravity and pulse braking. After 1 minute more, the door will close by gravity, without pulse braking.	It doesn't work	It doesn't work	It doesn't work	It doesn't work	It doesn't work	Brake is switched between ON/OFF (pulse braking)	No power supply of inverter AND Smoke/fire is detected

ALGORITHM OF THE CONTROL SYSTEM DEVELOPED FOR THE NOFIRE PROJECT

A. NORMAL OPERATION

A.1. Description of normal operation

In normal operation the door can be closed/opened or automatically or by hold-to-run buttons.

Automatic opening/closing

In this case when the UP button is pressed the door opens at 1,5 m/s and it reaches this speed in 1 second.

If the DOWN button is pressed the door closes at 0,5 m/s and it reaches this speed after 1 second.

During the automatic closing the light barriers (GRIDSCAN) are active.

If the emergency stop is pressed the relevant movement (up or down) is stopped and manual control is re-activated.

Manual opening/closing

In this case when the UP button is pressed continuously (hold-to-run) the door opens at 0,15 m/s up to the upper limit travel.

If the DOWN button is pressed the door closes at 0,15 m/s down to the limit travel.

During the manual closure, the light barriers are active while the safety edge is not active.

If the emergency stop is pressed the relevant movement (up or down) is stopped and when the emergency stop is released the manual control remains enabled.

In case of power supply failure only the down button is activated and it allows movement due to gravity even in case of power feed failure (i.e.: gravity pulse-braking).

Gridscan - normal operation

When the gridscan detects an object the door is stopped and after 3 seconds from removal of obstacle the door continues the closing operation.

It is possible to choose between 2 options:

1- self closing after the obstacle is removed (GridOpen = OFF);

2- when the obstacle is detected the door is stopped and immediately re-opened (if GridOpen= ON).

Failure of power supply

In case of failure of power supply the UP button is disabled while the down button is enabled and closing by pulse-braking is activated once the down is pressed and the gridscan is active.

In case the emergency stop is pressed the door is stopped at its current position. If the door is not closed after 2 minutes, the door closes slowly at 0,15 m/s by pulsebraking and acoustic and luminous warnings are activated.

Wire breakage/failure

If one wire is broken only manual mode is activated. If both wires are broken then the door acts as if the emergency stop is pressed.
In case of wire breakage/failure the motor can hold the maximum weight of the door.

Two closing positions are available and can be set:

- the door in the closed position is stopped at around 10 cm from the ground (for ventilation);
- the door is completely closed without leaving any gap (in this case by pressing the closing button (or due to automatic closing) the door closes up to the intermediate position and then pressing again the closing button the door closes completely).

Schematic description of normal operation

NORMAL OPERATION					
SIGNAL	**Automatic[1]**	**Manual[1]**	**Emergency**	**Wire breakage/failure**	**Failure of power supply**
UP BUTTON	**Opening of door at 1,5 m/s reaching the speed in 1 second**	**HOLD-TO-RUN opening door at 0,15 m/s up to upper limit travel. The safety in normal use is granted by the gridscan.**	**DISABLED**	**HOLD-TO-RUN opening door at 0,15 m/s up to upper limit travel**	**DISABLED**
DOWN button	**It causes the closing of the door at 0,5 m/s reaching speed within 1 second. The safety in normal use is granted by the gridscan.**	**HOLD-TO-RUN closing door at 0,15 m/s up to lower limit travel. The safety in normal use is granted by the gridscan.**	**DISABLED**	**HOLD-TO-RUN closing door at 0,15 m/s up to lower limit travel**	**Enabling of pulse-braking (closing by gravity)**
Emergency stop	**It stops upwards and downwards movements and re-activates manual control.**	**it stops movement and it can be re-activate only in manual**	**it stops movement and it can be re-activate only in manual**	**it stops movement and it can be re-activate only in manual**	**The door is stopped at its position. If the door is not closed after "a time 2 minutes" it closes slowly at 0,15 m/s by pulse-braking with acoustic and luminous warnings**
Failure of power supply	**DISABLED**	**ENABLE ONLY DOWN BUTTON - breaked down movement (i.e.: gravity pulse-braking)**	**The door is stopped at its position. If the door is not closed after "2 minutes" it closes slowly at 0,15 m/s by pulse-braking with acoustic and luminous warnings**	**The door is stopped at its position. If the door is not closed after "2 minutes" it closes slowly at 0,15 m/s by pulse-braking with acoustic and luminous warnings**	

De-activating of safety edge.

B- FIRE DETECTION

B.1-Behaviour of CONTROL SYTSEM IN CASE OF FIRE DETECTION

In case of fire detection the door starts closing after 3 seconds from fire signal. During closing the light barriers are disabled while the sensitive edge is activated. In case sensitive edge detects an obstacle the door re-opens and when the obstacle is removed the door continues closing.

After 2 minutes from receiving the fire signal the door, in any case, closes and, if the closure does not finish within the following 60 s, the door is unlocked and forced to self-close by gravity and acoustic and luminous warnings are activated.

In case of power supply failure, the door starts closing by gravity with pulsed braking with the sensitive edge active. After 2 minutes from receiving the fire signal, the door, in any case, closes and, if the closure does not occur within following 60 s, the door is unlocked and forced to self-close by gravity and acoustic and luminous warnings are activated.

If 1 wire is broken then, in case, of fire the door closes as “normal” fire condition (i.e.: not failure power supply case). If 2 wires are broken then, in case of fire, the door closes by gravity with pulse braking.

Within 2 minutes from fire signal the door can be opened by pressing the up button. In this case the door opens but as soon the button is released the door closes (this is used in case people need to get out of the room).

Schematic description of control system behaviour in case of fire

<table>
<tr><th>SIGNAL</th><th>FIRE DETECTION[2]</th></tr>
<tr><td>UP button</td><td rowspan="3">DISABLED UP and DOWN BUTTONS and EMERGENCY STOP. The door starts closing using the sensitive edge as safety device. When an obstacle is detected the door re-opens slightly and then continues closing. After 2 minutes from receiving of signal the door closes and if the closing does not occur within the following 60 seconds the door is unlocked and forced to self-close by gravity and acoustic and luminous warnings are activated.</td></tr>
<tr><td>DOWN button</td></tr>
<tr><td>Emergency stop</td></tr>
<tr><td>Failure of power supply</td><td>DISABLED UP and DOWN BUTTONS and EMERGENCY STOP and the door starts closing by pulse-braking and the sensitive edge is the safety device. When an obstacle is detected the door is stopped for a few seconds and then re-starts closing. After 2 minutes from receiving of signal the door closes and if the closing does not occur within the following 60 seconds the door is unlocked and force to self-close by gravity and acoustic and luminous warnings are activated.</td></tr>
</table>

[2] Gridscan is disabled while the sensitive edge will be activated. After 3 seconds from fire signal the starts closing.

ANALYSIS OF THE DOOR CLOSING

On the basis of what has been reported above the door can close in several manners: by gravity or with motor and by pressing manual controls or by self-closing. For the activation of these modes please refer to previous points of this document.

There is a button on the control panel that switches between manual or automatic mode for the manual controls.

	MANUAL CONTROLS		SELF-CLOSING	
	AUTOMATIC MODE (single impulse)	**MANUAL MODE (continuous impulse, i.e.: hold-to-run)**	***(i.e.: closing automatically activated by control system)***	
Closing with motor	**FAST CLOSING at 0,5 m/s** **Light barrier: ACTIVE** **Sensitive edge: NOT ACTIVE**	**SLOW CLOSING at 0,15 m/s** **Light barrier: ACTIVE** **Sensitive edge: Not ACTIVE**	**FAST CLOSING (fire condition)** **Light barrier: NOT ACTIVE** **Sensitive edge: ACTIVE**	**FAST CLOSING (AutoClose case)** **Light barrier: ACTIVE** **Sensitive edge: NOT ACTIVE**
Closing by gravity *(i.e.: pulse-braking)*	**SLOW CLOSING at 0,15 m/s** **Light barrier: ACTIVE** **Sensitive edge: not ACTIVE**	**SLOW CLOSING at 0,15 m/s** **Light barrier: ACTIVE** **Sensitive edge: not ACTIVE**	**SLOW CLOSING At 0,15 m/s** **Light barrier: NOT ACTIVE** **Sensitive edge: ACTIVE**	**SLOW CLOSING At 0,15 m/s** **Light barrier: ACTIVE** **Sensitive edge: NOT ACTIVE**

The **Workpackage 4** included all those activities in which **the solutions proposed in WP2 (door) and WP3 (components) should be implemented into concept prototypes**. The idea was to confirm the viability of the proposed solutions or to choose the best alternative, especially concerning the design solutions for the project targeted door.

The manufacturing technology solutions were studied in this WP. The prototypes generated included all those components needed to test the performance of the solution (WP5) or the differences with respect to other solutions (WP2). Simple subassemblies or complex assemblies had been manufactured depending on how far the prototype performed to obtain the required specificationa.

All auxiliary components and systems for the tests have been manufactured in this WP.

In the deliverable D2.1 and in the tasks 3, a lot of simple subassemblies were constructed in order to confirm the feasibility and choice of the best option. However, the work developed in this task, has allowed to check the mechanical design together with the electrical design and determine the most simple prototypes or specimens and critical problems and the tests to be performed in WP5.

This workpage was divided into two tasks:

- Tasks 4.1: Definition and generation of prototypes/test prototypes for mechanical and electrical tests
- Tasks 4.2: Definition and generation of prototypes/test prototypes for fire contention tests

Task 4.1 Final functional prototype

Task 4.2. Final functional prototype.

Four prototype fire test

For each one of these tasks, a lot of prototypes were generated, since that the consecutive tests (WP5) performed in order to validate these prototypes, have introduced the urgent needs of modifications in the concept prototypes (WP2) and in its corresponding generation of these prototypes and so on.

Four big prototypes were generated for the fire contention tests and tree big prototypes for the mechanical and electrical tests.

For example, after testing the first prototype under fire it was necessary to generate a **new design (fire second prototype with a new version of enclosure) to solve the problem of the union or connection of the leaves with the frame of the door since this point** was not well resolved in the previous prototype. Then, this new design was manufactured in WP4 and tested in WP5.

The goal of the new profile system was in one hand, to keep column's inside area and motion system's inside area in a controlled temperature, and in the other hand to increase the stiffness in the top of the door. An improvement of the previous version's stiffness to flexion (bending) of the leaves has been possible with changing the upper closure.

It is important to indicate that with this prototype was plainly functional and it constituted a foreground of a fire stopping door with fast operated vertical movement. This knowledge can be used to design the enclosures for other types of fire resistant doors.

Two additional prototypes were needed for fire performance assessment. The test of these prototypes enabled an important knowledge and force the consortium to improve the existing contact band by a good performance in case of fire- The final product can be used as security device for persons in fire stopping doors.

Finally, **this task obtained a functional prototype that provides fire resistance and high speed movement in normal case, and complies with all the functional security requirements**. This final prototype has been considered to estimate manufacturing and assembling costs and timing.

It is important to stand out that all partners want to keep the drawings/schematics of the different improvements as confidential. The developed results constitute the breakthroughs to generate a successful door, complying with all initially established targets.

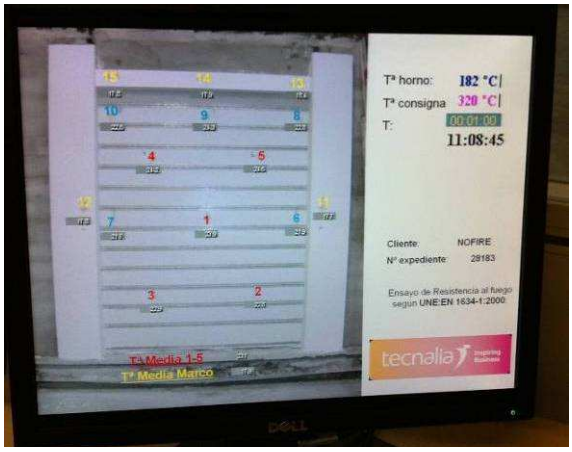
One of the partners has the intention to patent the kinematic design of the door (prototype of task 4.1), before the workshop that will be held in October, according to the minutes of the 24th month NOFIRE meeting. This makes not possible to show the generated prototypes in this document (more information in the second period report of NOFIRE and in the deliverables of the corresponding tasks, only for the EC).

In **Workpackage 5** the **experimental verification of the prototypes** manufactured in WP4 has been performed. The tests has been done according to those directives and standards identified in WP1, focusing the problems identified in WP2 and WP3 as primary objective for design optimisation.

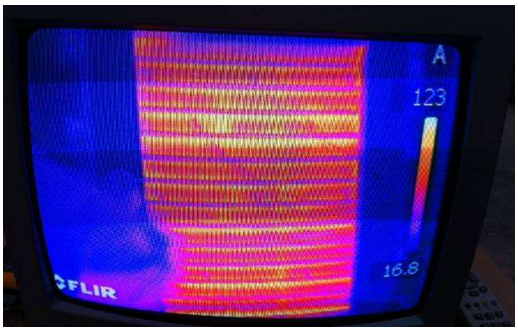
The verification has been done at two levels. The first level has consisted of analyzing the mechanical properties, thermal insulation, water resistance and fire performance. **The information compiled in should enable to compare the results with those available in the market.**

The second level has involved **improving the systems according to the results** of the experimental verifications. The complying of standards and directives has been observed in this phase applying R&D to achieve the highest level.

As a consequence of the present work, the new door **(obtained door) provides insulation values close to 2 hours** and can be **classified according to the standard EN 13501-2:2009+A1:2010 as $EI_2$90 90** (category B). This category allows the extension to bigger doors according to the criteria of the EN 1634-1:2008.



Four prototype (final prototype) fire test. Tested according to EN 1634-1:2008

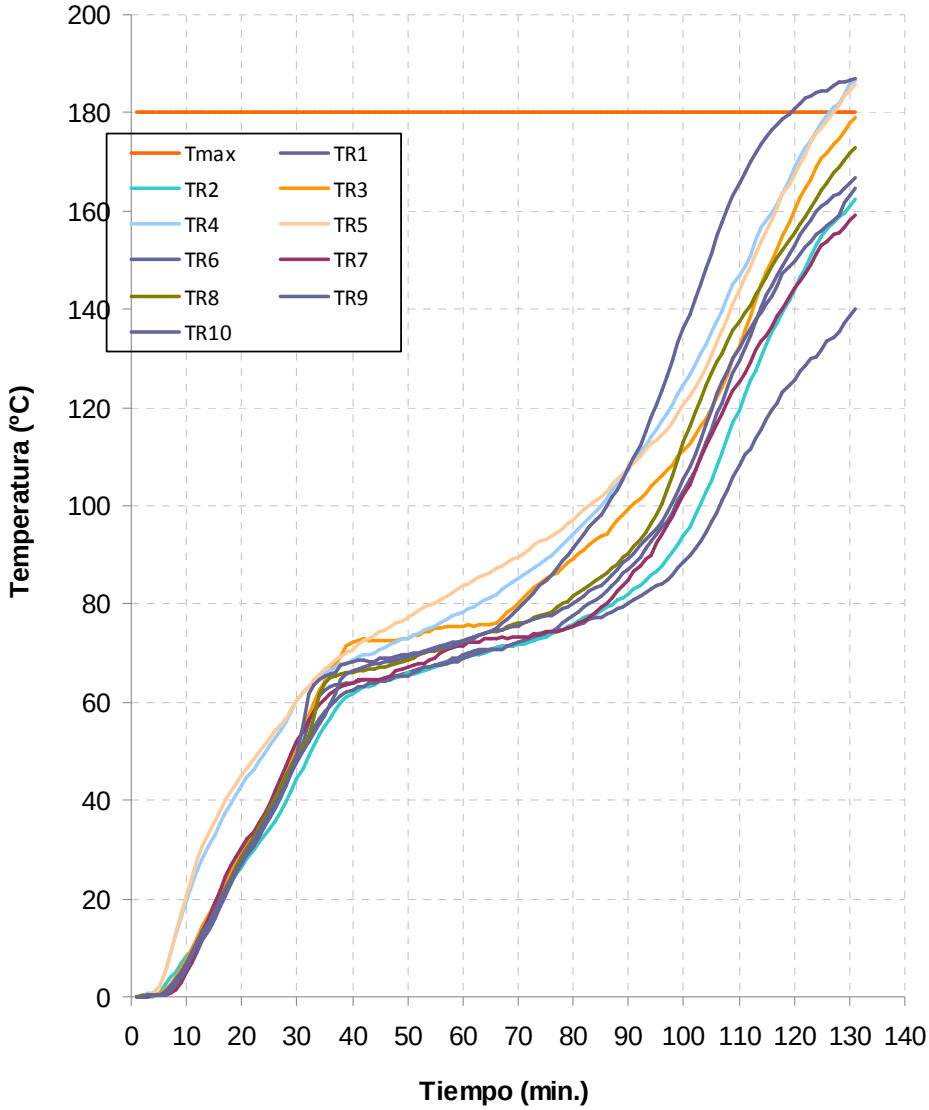


Four prototype fire test. Temperatures of the leaves

Four prototype fire test.

Four prototype fire test.

Door after the fire test



Temperatures evolution

The final door, apart of **complying with all functional security requirements**, in normal condition, **opens at 1.5 m/s and closes at 0.5m/s**. In case of fire the door closes.

The opening/closure of the obtained fire stopping door is controlled by reliable electronics and presence sensors which were developed to fulfil all the specifications of the project door. The correct integration of the mechanical design together with the electrical design, were tested with the **generation of prototypes (WP4) and with its experimental verification** (WP5), **providing successful results**.

Apart of that, **it must be mentioned that the NOFIRE door was tested and obtained successful results. The system incorporates a contact band and a light barrier as safety devices**. The **light barrier** works **in the normal operation of the door** (high speed) and in case of **fire the contact band** is used as security device.

The **goal of installing edge safety borders** (contact bands) **in doors which withstand fire for at least 60 minutes, has been clearly get reached**. They can be installed in doors which provide almost 2 hours (111 minutes of insulation) fire resistance, without any risk.

Workpackage 6 has analysed the **production process for all components and the environmental hazards** that can come up due to material burning, aging or the possible recyclability of the applied material. The goal was to develop an environmentally friendly optimised production process, then optimise the technical/economical aspects of the production and finally establish the control routines during the product life cycle to ensure the best performance and the minimum environmental impact.

In this task, a **lifecycle of the developed door was done including the final recycling/ degradation analysis in order to safeguard the environment** due to the influence of the components applied in the project (according to ISO 14040:1997 "Environmental managing. Life cycle analysis. Results interpretation") to comply with the available environmental regulations. The potential environmental impact during the manufacturing process has been estimated from the information arising in WP4 and WP5 (manufacturing of the prototypes). This WP has interacted with WP4 in order to define the best production technologies from the environmental point of view and has also interacted with WP5 to define tests to be performed for environmental impact definition.

As result of this task, can be seen that besides presenting a good condition in fire, **designed door has a reduced environmental impacts compared to traditional solutions**.

Apart of that, this task has given for the functional prototype the **definition of manufacturing viability including estimated prices, timing, supervision plans and recyclability aspects**.

After **doing the cost analysis with the functional prototype**, PORTES is in this moment involved in this looking for standard components and best prices for all the components that constitute the door, **wanted for a reduction of this price around the 35% for the industrial prototype**. That it is more, this cost would be considerably inferior in a mass production which will do its market price really competitive and attractive.

With this study adding to the high speed and fire resistance performances, all the partners see a great business opportunity, since there are no doors in the actual market providing fast movement and with high resistance to fire.

In conclusion: **The project has been completely successful, thanks to the good RTD performed and the adequate management performed during the 2 years of the project (WP7).** The goal of the project has been totally fulfilled. This goal was to achieve a fire stopping door (60 minutes of insulation) capable of providing high speed opening and closure (fast movement of the door), these objectives have been clearly got over.

Apart of that, the developed made in the control and presence sensors to fulfil all the specifications of this door, allow to this SMEs the introduction in another markets, as can be the case of the contact bands, which initially were not thinking as security devices in fire stopping doors.

Concerning the dissemination and management activities it is to be remarked that the website of the project has been built up and published at the following web address: www.nofiredoor.eu

Other dissemination activities include press notes in printed journals, press notes in internet portals and the elaboration of posters and brochures.

Concerning the dissemination and management activities, press notes in printed journals and magazines can be highlighted (InfoTECNALIA, RDi Press, Estrategia Empresarial, Arte y Cemento, El correo, CIC) as well as press notes in internet web sites (Contrunario, Contruarea, Basqueresearch, Euskadinnova, Physorg, Fireriskonline) or TV interviews (EITB 2, Basque country TV). The website of the project has been updated during the project.

Other dissemination activities include elaboration of posters and brochures for fairs as the presented in VETECO. International Window, Curtain Walls and Structural Glass Trade Show and

the workshop that will be held on July 2011. More information can be seen in the other chapter of this report.

The management of the project has been carried out by strictly keeping in contact the partners with the coordinator. All the partners have been involved in the main strategic and executive decisions. Five plenary meetings have been organised during the first year of activities in which the different committees met. The Project Officer representing the European Commission was invited to all these meetings.

A Kick-Off Meeting was held in June 9th, 2009 in the facilities of TECNALIA (Azpeitia-Spain). The 6-Month Meeting was held in October 28th, 2009 in Bellaria-IG (Italy). Finally, the 12 Months Meeting was held on 15th-16th June 2010 in Portes Bisbal´s facilities in La Bisbal, Girona (Spain). Unfortunately Mrs. Grazyna Galazka on behalf of the European Commission was unable to attend the meeting and excused her attendance. The 18 Months Meeting was held on 25th-26th October 2010 in TECNALIA's facilities (Azpeitia-Spain). Unfortunately Mrs. Grazyna Galazka on behalf of the European Commission was unable to attend the meeting and excused her attendance. The 24 Months Meeting was help on 14th June 2011 in PORTES BISBAL's facilities (La Bisbal-Spain).

These plenary meetings have covered different aspects including the discussion of technical issues, meeting of the Steering, Project Management and Exploitation Committees, travelling as many persons as required by each situation in order to discuss the project technical and non-technical relevant aspects.

In all moment a regular communication by e-mail has taken place among the partners along the project.

Apart of these 5 plenary meetings in different locations and given the importance of the technical activities of the centre, several short trips (4) have been made to visit the closest companies, especially TECNALIA to PORTES BISBAL (1) and FEGEMU (1) and some partners have travelled to disseminate the project results in some exhibitions BATIMAT in Paris, MOTEC in Stuttgart, EMPACK in Madrid, CEMAT in Hannover…. In the second period of the project, more general meetings have been done.

CEDES and GIORDANO has travelled to England (month 16) to analyse technical results of some of the project developments. COMPLEX, TECNALIA and ISTITUTO GIORDANO has visited PORTES BISBAL (month 21) to solve the technical aspects of the project. In the month 24, ISTITUTO GIORDANO and TECNALIA have travelled to PORTES BISBAL to solve technical aspects of the project. Other travels have been made by TECNALIA to supervise the coordination of the project.

The management of the project has lead the partners to an effective collaboration all over the project, playing each partner an important role with no overlapping. Moreover, it is important to stand out that each task carried out by the partners has constituted a part of a chain that could have been broken in case any partner did not fulfil its work.

1.4. THE POTENTIAL IMPACT (INCLUDING THE SOCIO-ECONOMIC IMPACT AND THE WIDER SOCIETAL IMPLICATIONS OF THE PROJECT SO FAR) AND THE MAIN DISSEMINATION ACTIVITIES AND EXPLOITATION OF RESULTS

1.4.1. THE POTENTIAL IMPACT

The project has been consistent with the objectives specified in the Call Work Programme (FP7-SME-2008-1), research for the benefit of SMEs. This project has contributed to strengthen the innovation capacity of European SMEs and their contribution to the development of new technology based products and markets by helping them outsource research. As consequence of the project, the SMEs have increased their research effort and have started to extend their networks: They have acquired technological know how, bridging the gap between research and innovation and this will give them the opportunity of getting better exploit research results.

Indeed, **regarding the project developed products (high speed fire contention door, improved light barriers and the fire withstanding contact bands) as industrial products**, the project contributes to develop European approaches for improved competitiveness (as the program call indicates: "strengthening the competitiveness of SME participants and contribute at programme level to improve industrial competitiveness across the European Union") by enhancing the industrial output of the aforementioned products in terms of responsiveness to market requirements with regard to better quality, security and environmental friendliness.

- By integrating in the design of high speed fire stopping doors with security devices (light barriers and contact bands) innovative materials and design technologies in order to provide a new functionality such as **fire performance**, while achieving **better quality and environmental friendliness (EU policies**).
- Many of the project solutions lead to the **arising of new or enhanced products for a wide range of applications** (transport, construction…) related to fire security design, reducing the risks under fire accidents.
- Making available to the European market, enhanced garage doors and electrical safety sensors and controls (**Advanced production and construction technologies**) capable of providing to the industry with higher safety requirements while providing higher reliability.
- Fully exploiting technologies that, once proved viable in the manufacturing environment, may have widespread applications in the entire World.

Regarding the production system of the prototype developed, it contributes to the optimisation of the European industrial environment through the deployment, integration and application of innovative systems. Furthermore, **regarding the impact that project developed products have on the environment (WP6: Eco-efficient processes and design**) it is the reduction of the environmental hazard that fire contention provides (reduced emission of smokes with polluting atmospheres). Besides presenting a good condition in fire, designed door has a reduced environmental impacts compared to traditional Solutions.

Community Added Value and contribution to EU Policies

Although the Garage Doors Industry in the construction Sector, as compared with other industry sectors, appears to be of limited importance in terms of total turnover, nevertheless it bears a strategic role in providing the manufacturing industry with the safety equipment to reduce the risk of fire propagation. The value delivered by the Garage Doors Industry, in Europe as well as in the other Economic regions of the world, must be measured in terms of increased competitiveness and provided safety for all those industries in which fire constitutes a real risk.

The main problems tackled by the project, i.e. **to obtain high speed fire stopping door**, or the other targeted components (security devices or electronic controls adapted to high speed fire stopping doors) were fundamental to the entire manufacturing industry. These goals have been achieved, **obtaining better performances for the targeted products** with competitive prices to the market. The developed door, which integrates new electronic and security devices, can be important for fire security design in a wide range of applications including transports, public

buildings, skyscrapers, etc, confirming that **human life safeguarding in case of fire is definitely the most important contribution of the developed products.**

Transnational approach

The consortium has benefited from the mutual experience and expertise of the partners, to achieving the expected results. In addition to this, the complementary and transnational character of the partners has ensured wider requirements, a bigger impact of the results and a better diffusion. At the same time, it has help potential technology transfer processes to happen between the industrial sectors involved in the project.

The results of the project have contributed to the **European technological progress** in:

- Know-how and experience have been exchanged between companies of different European Regions, overcoming possible barriers and lags and promoting synergies between those areas.
- Transference of technology and know-how from RTD institutes to the SME s have been taken place.
- Due to this first contact between SMEs and RTD institutes during the project, cooperation in other projects has being planned.

As consequence of the project, participants are finding other opportunities based on their knowledge for mutually beneficial cooperation on products for other applications and sectors.

EU's horizontal policy of promoting innovation and the participation of SMEs is strongly supported as a result of collaboration between SMEs and RTDs across Europe along this project.

Considering the state of the art related to the beginning and the completion of the project:

Project developed light barriers and contact bands have enhanced the capabilities of the products (light barriers, contact bands, control electronics) which were offered by three of the project participating SMEs, which were similar to those offered by the competence and should be considered as representatives of the previous state of the art.

For the **light barriers**, the developed improvement consists in the use of these security devices in high speed fire stopping doors, since until the project they have not been adapted to these kind of doors, responding with the required velocity and security needs.

For the **contact bands**, before the project, there were no contact bands that could be used in fire applications as security devices since that they burnt in a not controlled way and they constitute a danger by themselves. The developed solution allows the use of the contact bands as **security devices in fire stopping doors**. The systems could be applied in many other applications when the highest safety level is desired.

Concerning the control electronics, only a limited number of sectors could afford to invest in developing reliable electronics for high speed fire stopping doors complying with all functional requirements. The developed solution allows standardise such systems in all those locations in which the fire security it is required (public buildings, offices, skyscrapers, etc.) or fast reaction it required when a fire situation arises. The project has developed fast electronics capable to react in a reliable way in a normal condition (high speed) and even in case of fire.

Finally, as it was introduced in previous points, **the developed door did not exist in the market**. Nevertheless, there were companies offering doors for fire contention and companies offering high speed doors.

CONSEQUENCES OF THE PROJECT

Improvement of security and safety

The result obtained in the project will contribute to achieve the capability to safe human lives in case of fire accidents, **providing the society with** new products that comply with all the **security requirements** (speed, versatility, reliability).

Not only will the **developed door** be a **reference in the field of the security**, but also a target and a reference **in the field of fire protection**, providing a door was not existing in the market and that it was very required (Normal operation: High speed performances in case of no fire, and providing fire performances (fire insulation) in case of fire.

Improvement of environment

The door **will have a positive effect on the environment**, since the application of materials, covers and components whose degradation under fire produces a reduced environmental impact is stated or makes that the **products burns in a controlled way.** This guarantees that no dangerous substances are released into the atmosphere in the event of fire and high temperatures.

Improvement of employment and sales

This project will contribute to the improvement of the competitiveness of the different SMEs involved in the project. All the partners see a great business opportunity, since there are no doors in the actual market providing fast movement and with high resistance to fire. It is expected that the improvement of the competitiveness of SMEs as result of the project, will improve their sales rates and increase their market share and turnover. As a result of this trend, they will improve their economical situation, which will cause an improvement on their employment rates and will make them create specific divisions with the creation of new jobs.

The potential impact of RTD on economic development perspectives is very high. As a direct impact on their business, SME partners foresee increasing direct economical gains in a medium term (by year 2013). After implementing a strengthen commercial network capable of reaching new customers, partners will be able to export and exploit the project results. The situation is propitious for them to reach a higher market share and grow in both staff and turnover by means of the inclusion of the project results in their business.

All the partners, but specially PORTES BISBAL, **exploitation manager** (that offers the most complex product obtained out of the project) will take all necessary steps to make this product a commercial success, such as generation of product documentation, organization of a workshop for the dealers, introduction of the product to the market via exhibitions, entry of product information on the web site, use its sales network, etc. Some of these steps have been done. In relation the patents, PORTES BISBAL wants to patent the kinematic design of the door, before the workshop that will be held in October, according the minutes of the 24th month NOFIRE meeting.

The Consortium will thus follow the three basic obligations with regard to project results: 1) Protection (defining results coming from the project, including information, materials and knowledge generated); 2) Use (commercial activities and further R&D activities); and 3) Dissemination of results (letting the market know about the new developments).

The market for garage doors is important if the number of employments and the turnover (>3 billion Euro/year) are considered. Current market is property of the big companies or groups which make **too difficult for the SMEs to introduce themselves in the market in equal opportunities and rights**.

The production of garage and industrial doors developed by PORTES BISBAL, represented a minimum part of the world production. More than 25% of PORTES BISBAL's production was destined for export and this company has offices and distributors in various countries in Europe.

In this situation **the gap identified by this project** and successfully developed, **constitutes a business opportunity** especially for one of the project SMEs (Portes Bisbal). Offering an innovative product, based on an important research job made by the project participants, will be able to reach the market rapidly and **could position the company prior to the entrance of any major competitor.** The company has improved its competitiveness by creating a new product for the market in which not only high speed but also fire performance is extracted from a garage/industrial door.

One of the key objectives of the project achieved was the **high speed fire stopping door**. The SME **"PORTES BISBAL" is interested in this moment in its commercialization and it is doing the integration of this product in its product line**. At present the company has a staff of 57 employees. The company foresees to grow slowly in the next years thanks to the acceptance of its current product line (5% growth in turnover and 2 more employees per year).

The integration of the new product line in 2011, depending on the market response, could open a new division with special dedication to the new product. The division could **start with 6 dedicated persons** for design, technical assistance, assembly and manufacturing (apart from taking benefit from the already existing workshop and staff of the company) and, despite starting the commercial activities during the project, the fire stopping sectional door **could follow the usual demand curve with a low demand during the product introduction** (~1 year, until 2012, 2~3 doors per month are considered), **followed by a fast growing demand** that will be important because the product will constitute the unique market solution for high speed closure in case of fire the growth should be important **during the next 5 years (probably duplicating the number of orders every year during this period)**. The division will need **more personnel** if this expectative is achieved with more technical persons (1 **per** year) and more production staff (growing together with the production from the initial number of 3 employees for this activity).

The new product division should be constituted by more than 20 persons and will invoice a 16% of the company turnover by year 2016. The expected company **turnover will grow** at higher rates (**from a linear 5% assumed with the current product line to a 15% by year 2016 including the new division**). Aiming to keep an important role in the new segment, a 10% of additional investment in RTD expenses is contemplated by year 2016.

CEDES GmbH has developed new algorithms for high speed movement of the door and reliable performance under for a high speed fire stopping door in light barriers. The company can integrate the new capabilities in its current product line with a very low cost increase. The idea is **offering something completely new in the sector and obtaining a higher market share** and an increase in sales that would grow during the next years boosting the company to a better position with respect to its competitors. The current staff consists of 30 employees. **The light barriers constitute a 20% of the current turnover, being important its influence on the company balance**. The integration of the new capabilities should impulse the sales of the light barriers to obtain a **31% of the company turnover by year 2016 and generate 9 specific employments due to the needs of the higher product sales,** expecting a **total staff of 49 employees by 2016**.

The expected company **turnover will grow** at higher rates (**from a linear 4~5% assumed with the current product** line **to a 8% by year 2016 due to the influence of the light barriers market share**).

FEGEMU AUTOMATISMOS sells contact bands. **Seeing the results of the project the company is interested in developing a new series to be installed in doors with fire performances** (fire stopping doors), added to the sells associated to the NOFIRE door. The new product will be integrated in the company catalogue as a new product model. **Given that contact bands are always used for security applications,** the extra add-on of fire-proof (integration of them in fire resistance products which required person security devices) will constitute an important argument for future sales.

The current staff consists of 28 employees and in the company turnover its including all offered automatisms, services and products. **The contact bands are an important product providing almost a 15% of the current turnover**. The market for these products is well established and there are important players sharing the market with almost constant shares. FEGEMU aims to obtain a higher market share due to the new product, which should modify the current balance, obtaining a **20% of the current turnover by 2016** due to the contact bands. The **global turnover should increase over the estimated 5% per year to reach a 8% by the year 2016** due to the increase in sales of the new product range. **The staff should also be increased** but, given that production methods and design will be mainly carried out by the current staff, only production staff

will be augmented due to the introduction of the new product, so the company could reach 33 persons by the year 2016).

COMPLEX: the electronics developed in the project can be applied in future products produced by other project partners (specially the doors) and the project will establish some important connections that can make the company expand to new markets. If the door sales are as expected, the business can be important to COMPLEX that could become the electronics provider for the product and the company could grow dragged by the market demand.

With a current staff of 6 employees, the SME could increase its current turnover in more than a 100%, and the staff could be increased up to 18 persons considering the production needs specially. **Doing a conservative planning for the staff and the turnover of the company up to 2016.**

All the SMEs participant in the project agree in the importance of the RTD results for their activities obtained and the important benefit that project results could bring to their current RTD departments in the future, since that there are no in the market products as the obtained and there is a need of this kind of products.

This goal was to achieve a fire stopping door (60 minutes of insulation) capable of providing high speed opening and closure (fast movement of the door), these objectives have been clearly got over.
As consequence of this work, the new door (obtained door) gives insulation values near to the 2 hours (fire stopping door) and high speed opening and closure (fast movement of the door, in normal condition the door opens at 1.5 m/s and closes at 0.5m/s), complying with all functional security requirements.

1.4.2. MAIN DISSEMINATION ACTIVITIES

The Dissemination strategy of the Consortium partners addresses the increase awareness among European industries and the promotion of the use of results, leading to the eventual marketing of the products through seminars, workshops, fairs…

NOFIRE project's dissemination activities are addressed to a wide community. Taking into account that safety and security in construction are important priorities of the European Commission, the results coming from this project will provide important benefits expected from the introduction of a new high speed fire stopping door.

A detailed list of the **dissemination activities** carried out by the partners is shown below:

- The publication of the NOFIRE web-site http://www.nofiredoor.eu/ and presence in other websites (see in the following section)
- Press notes in magazines:
    - partners are including a reference to the project in each partner's website. Up to now, TECNALIA and IG have included it and uploaded news about the project.
    - www.basqueresearch.com.
        - TECNALIA- Tecnalia investiga puertas de garaje rápidas cortafuegos, 23/12/2009
    - www.construarea.com
        - "TECNALIA Tecnalia investiga puertas rápidas cortafuegos en el sector de la construcción", 24/09/2009
    - www.construnario.com
        - "TECNALIA participa en el proyecto NOFIRE del FP7", 24/12/2009
    - www.euskadinnova.net
        - "TECNALIA quiere desarrollar puertas rápidas cortafuegos", 24/01/2010
    - www.construnario.com
        - "TECNALIA coordina el proyecto NOFIRE del FP7", 26/01/2010

- www.ciberperfil.com
  - "TECNALIA Tecnalia dentro del proyecto NOFIRE", 4/05/2010
- www.construnario.com
  - "TECNALIA Tecnalia investiga puertas rápidas cortafuegos en el sector de la construcción", 13/05/2010
- www.tecnalia.com
  - "Mayor seguridad en puertas rápidas cortafuego" Tecnalia desarrolla puertas rápidas cortafuego más seguras y más económicas en el proyecto "NOFIRE" incluido en el 7º Programa Marco (7PM).", 04/11/2010
- www.construnario.com
  - "Tecnalia participa en un proyecto para lograr mayor seguridad en puertas rápidas cortafuego", El proyecto europeo "NOFIRE" pertenece al Séptimo Programa Marco (7PM). 10/11/2010
- www.basqueresearch.com
  - "Tecnalia participa en un proyecto para lograr mayor seguridad en puertas rápidas cortafuego", El proyecto europeo " NOFIRE " pertenece al Séptimo Programa Marco (7PM). 22/11/2010
- www.agenciasinc.es
  - Tecnalia participa en un proyecto europeo para lograr mayor seguridad en puertas rápidas cortafuego. 22/11/2010
- www.alphagalileo.org
  - Tecnalia participa en un proyecto europeo para lograr mayor seguridad en puertas rápidas cortafuego. 22/11/2010
- www.physorg.com
  - Tecnalia participates in European project for enhanced safety in rapid fire doors. Tecnalia is taking part in the "NOFIRE project" (within the EU 7th Framework Programme). 22/11/2010
- www.accidents.com
  - Tecnalia is taking part in the "NOFIRE project" within the EU 7th Framework Programm, in which rapid opening and closing fire doors that are safer and more economic are being developed. 22/11/2010
- www.rr.com/home/topicdl/article
  - Tecnalia participates in European project for enhanced safety in rapid fire doors. Tecnalia is taking part in the "NOFIRE project" (within the EU 7th Framework Programme). 22/11/2010
- www.fireriskonline.net
  - Tecnalia is taking part in the "NOFIRE project" within the EU 7th Framework Programm, in which rapid opening and closing fire doors that are safer and more economic are being developed. 27/11/2010

- Press notes in magazines and press:
  - Estrategia empresarial: "TECNALIA Tecnalia looks at high speed fire stopping doors", First fortnight of January, 2010.
  - RDi Press. Red de innovacion (http://rdipress.com/tag/tecnalia/). Nuevo proyecto europeo para lograr mayor seguridad en puertas rápidas cortafuego. 27/11/2010
  - Arte y cemento. Número 11, 2010. November 2010. Investigan puertas rápidas cortafuegos más seguras. NOFIRE
  - Trater Press "Tecnalia participa en un proyecto para lograr mayor seguridad en puertas rápidas cortafuego". 01/11/2010
  - elEconomista.es "Tecnalia participa en un proyecto para lograr mayor seguridad en puertas rápidas cortafuego". 04/11/2010
  - CiC Centro Informativo de la Construcción "Tecnalia participa en un proyecto para lograr mayor seguridad en puertas rápidas cortafuego".16/11/2010

- Hierro y aluminio "Tecnalia participa en un proyecto para lograr mayor seguridad en puertas rápidas cortafuego".17/11/2010
- AECC "Tecnalia participa en un proyecto para lograr mayor seguridad en puertas rápidas cortafuego".23/11/2010
- El correo
  - "Tecnalia participa en un proyecto europeo para conseguir puertas cortafuego más seguras". Tecnalia participa en el NOFIRE. 06/12/2010
- CIC: 482. "I+D+I contra el fuego", Proyecto Europeo NOFIRE. Apuesta por la investigación del sector de la protección y seguridad contra incendios. January 2011

- Events:
  - 15 October 2010 CATANIA**.** "LA DIREZIONE LAVORI CON LE NUOVE NORME TECNICHE PER LE COSTRUZIONI"
  - 18 November 2010 – PAVIA. "LA DIREZIONE LAVORI CON LE NUOVE NORME TECNICHE PER LE COSTRUZIONI"
  - 11 December 2010 – SIRACUSA. "LE NUOVE NORME TECNICHE PER LE COSTRUZIONIE E L'ACCIAIO"

- Presentation of the NOFIRE project in TV programs:
  - An interview at TEKNOPOLIS in June 2011 concerning the research activities for promoting the NOFIRE project and its objectives. This interview will be broadcast in October or November 2011.
- TECNALIA is preparing a poster for dissemination purposes in the workshop that will be help in October 2011.
- A poster (Figure 1) with the project presentation was prepared in English and Spanish. Another poster (Figure 2) with the project presentation was prepared in Spanish to be shown it in VETECO. International Window, Curtain Walls and Structural Glass Trade Show (Madrid, Spain, 4-7 May 2010). Figure 2 shows the poster in Spanish.

Figure 1

Figure 2

Among the next dissemination activities of the project, the Consortium plans to use the own tools offered by the European Commission, such as CORDIS news or other different internet portals, in order to try to diffuse the activities carried out within the NOFIRE project.

The following overview table resumes the main fairs related with the project objectives that the Consortium partners have attended in order to ensure the adequate dissemination of the knowledge generated by the project:

Event	*Dates*	*Partner responsible / involved*
MOTEC Fair (Stuttgart, Germany)	*20-24 September 2009*	*COMPLEX*
SAIE (Bologna, Italy)	*28-31 October 2009*	*IG exhibitor/TECNALIA visitor*
BATIMAT (Paris, France)	*7-12 November 2009*	*TECNALIA, PORTES BISBAL exhibitor*
SPS Drives (Nüremberg, Germany)	*24-26 November 2009*	*CEDES*
Embedded Word (Nüremberg, Germany)	*2-4 March 2010*	*TECNALIA*
SICUR (Madrid, Spain)	*2-5 March 2010*	*PORTES BISBAL exhibitor*
VETECO (Madrid, Spain)	*4-7 May 2010*	*TECNALIA exhibitor*
HMI (Hannover, Germany)	*4-8 April 2010*	*FEGEMU AUTOMATISMOS*
IFSEC (Birmingham, England)	*10-13 May 2010*	*TECNALIA*
NAVALIA (Vigo, Spain)	*18-20 May 2010*	*PORTES BISBAL exhibitor*
SIL (Barcelona, Spain)	*25-28 May 2010*	*PORTES BISBAL exhibitor*
SAIE (Bologna, Italy)	*27-30 October 2010*	*IG exhibitor*
EXPOEDILIZIA (Rome, Italy)	*11-14 Nov 2010*	*IG exhibitor*
Equip Baiem (Paris, France)	*16-19 Nov 2010*	*CEDES, PORTES BISBAL*
SPS Drives (Nüremberg, Germany)	*22-24 November 2010*	*FEGEMU AUTOMATISMOS*
EMPACK (Madrid, Spain)	*24-25 November 2010*	*PORTES BISBAL exhibitor*
BAU (München, Germany)	*14-19 January 2011*	*CEDES, TECNALIA*
Forum Serramenti (Rimini, Italy)	*7-8 April 2011*	*IG*
CEMAT (Hannover, Germany)	*2-6 May 2011*	*PORTES BISBAL exhibitor*
LOGITRANS (Portugal)	*10-11 May 2011*	*PORTES BISBAL exhibitor*
INTERPACK (Düsseldorf, Germany)	*12-14 May 2011*	*FEGEMU AUTOMATISMOS*

1.4.3. EXPLOITATION OF RESULTS

The main purpose of the project was the development and manufacturing of new fire safety products (high speed fire stopping sectional door, light barriers and contact bands) that should fill the gap existing in the European market concerning the availability of this kind of systems.

The introduced breakthrough should lead to several advantages concerning human security and the reduction of death risks due to fire accidents. Other important targets addressed by the project were the reduction of maintenance costs (increasing the cost-efficiency), improving thermal-fire insulation and developing market competitive products.

All products should be designed according to safety standards and the materials considered for all components should be friendly to the environment avoiding the production of hazardous gases even at high temperatures and in case of burning.

The project addressed combination of European manufacturer of doors and expertise in electronic sensors and controls in order to develop the new high speed fire stopping doors and fire safety products.

Concerning the **exploitation** of the project, these are the possible exploitable results:

- Definition and design of a new high speed fire stopping door with electronic devices (contact bands and light barriers as security devices for protection of persons against crushing).
- Improvement existing contact band by adding good performance in case of fire, in order that they can be used as security devices for persons in fire stopping doors.
- Improvement the light barriers in order to use then in high speed fire stopping door. Integration of the RS485 communication port.
- New control panel complying with all functional security requirements for high speed fire stopping door.

Likewise, the exploitable knowledge coming from this project can be mentioned:

- Design of fire resistant leaves with small thickness and weight.
- Design of a new kinematic for the door for high speed doors
- The way of using security devices made of polymer in fire stooping door (door with fire resistance)
- Development of a new fire safety products and knowledge of the key components.

Partners have envisaged two different types of exploitation and dissemination strategies:

- Local strategies:

  These strategies include the exploitation and dissemination activities carried out by industrial partners, who will use the results within their companies such as Introduction of the new products developed on the project, introduction and implementation of new technologies into their production structure, training and education on knowledge management, continuous improvement into production areas.

- Advanced strategies:

  These include the activities carried out by partners, in order to achieve a wider exploitation of the results of the project as well as a proper dissemination of those results to the whole European industry as well as to research organisations. Those activities include: use of the communication and diffusion networks provided by the European Commission, such as CORDIS, etc, presentation on International Conferences and Publications on Specialised Journals, inclusion of results on the Partners' Web Sites, presentations on Public workshops, publication of best practices reports for industrial readers, disclosure of information through project brochure to relevant associations and organisations, attendance to national and international trade fairs, direct marketing actions, conferences and promotion through Industrial Associations in each country.

The **exploitation line** proposed by the Consortium partners aims that each industrial partner can exploit the project results individually, while other Consortium members would have advantageous conditions. In this sense, SME partners can expand their markets to new customers maintaining the roots of their know-how. They can acquire and offer to their market a high-technology material which can increase their competitiveness in their respective countries. They will introduce a new line of products in their actual market.

After the development of the project, increased skills and know-how as well as increased product/service quality were acquired by the partners. This will finally lead towards increased sales of new to market products.

As it has been mentioned, after doing the cost analysis with the functional prototype, PORTES BISBAL as has been mentioned, is in this moment involved in this looking for standard components and best prices for all the components that constitute the door, wanted for a reduction of this price around the 35% for the final prototype. That it is more, this cost would be considerably inferior in a mass production which will do that the market price for this door really competitive and attractive, since there are no doors in the market that provide high speed and fire performance in the same door.

With this study adding to the high speed and fire resistance performances, all the partners see a great business opportunity, since there are no doors in the actual market providing fast movement and with high resistance to fire.

All the partners, but specially PORTES BISBAL, **exploitation manager** (that offers the most complex product obtained out of the project) will take all necessary steps to make this product a commercial success, such as generation of product documentation, organization of a workshop for the dealers, introduction of the product to the market via exhibitions, entry of product information on the web site, use its sales network, etc. Some of these steps have been done. In relation the patents, PORTES BISBAL wants to patent the kinematic design of the door, before the workshop that will be held in October, according the minutes of the 24th month NOFIRE meeting.

The Consortium will thus follow the three basic obligations with regard to project results: 1) Protection (defining results coming from the project, including information, materials and knowledge generated); 2) Use (commercial activities and further R&D activities); and 3) Dissemination of results (letting the market know about the new developments).

1.4.4. ADDRESS OF THE PROJECT PUBLIC WEBSITE

The publication of the **web-site** was the first step in the exploitation and dissemination activities. The NOFIRE website (D8.1) can be found at the following web address: http://www.nofiredoor.eu/.

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The final goal of the web site was the exchange of information among the partners and between the Consortium and the Society. Basic information on the project, contacts, links to other partners' websites, on-going activities and preliminary results will be available on the web site. The web-site has been frequently updated during the first year of the project, by introducing news about the project, available official documents for the consortium partners and expected goals. The web site consists of different pages. Some of them constitute a "private area", whose access is allowed only to the partners, where they can exchange private documents related to the project.

In 1.4.3 can be seen the presence in other websites.