1. Final Publishable summary report

1.1 Executive summary

- Innovative & Novel First Responders Applications

The overall objective of the INFRA project is to research and develop novel technologies for personal digital support systems as part of an integral, secure emergency management system to support First Responders (**FR**) in crises occurring in Critical Infrastructures (**CI**) under all circumstances.

The project was initiated with some very ambitious objectives and goals, and during two intense years the INFRA consortium has carried out activities at the following three main levels:

1. **Communication:**
   Creation of a communication system which will support FR's in the field, in difficult conditions. This involves the research and development of an integral and interoperable wireless communications system allowing the FR to have reliable means of communications as they enter subway tunnels and buildings with thick concrete walls.

2. **Applications:**
   The applications are developed based on an FR objective, which entails the research and development of a robust indoor site navigation system. The INFRA system is based on two location sensors (an inertial sensor, a wireless sensor), a video annotation system for FR PDAs, sensors for real time identification of hazardous materials, and applications for gas leakage and hidden fire detection.

3. **Demonstration:**
   INFRA was deployed twice in Live Environments with the objective of proving the feasibility of the concept, and demonstrating the validity of INFRA's standards, communications and First Responder applications being developed.

   Users were heavily involved throughout the process from the requirements gathering to the demonstration stages.

At the end of the INFRA project we are pleased to note that the project has achieved all of its overall technical objectives, with all the applications (with one exception) successfully tested and demonstrated, both in lab environment and in the field. Several integration sessions were held throughout the project in order to integrate and test the various applications. At the end of the project a final Field Trial was held, in January 2011, which successfully proved that the INFRA concept is indeed feasible. It also showed that the main features, though far from complete at the time of the test, nevertheless are functional and deemed very useful by FRs.

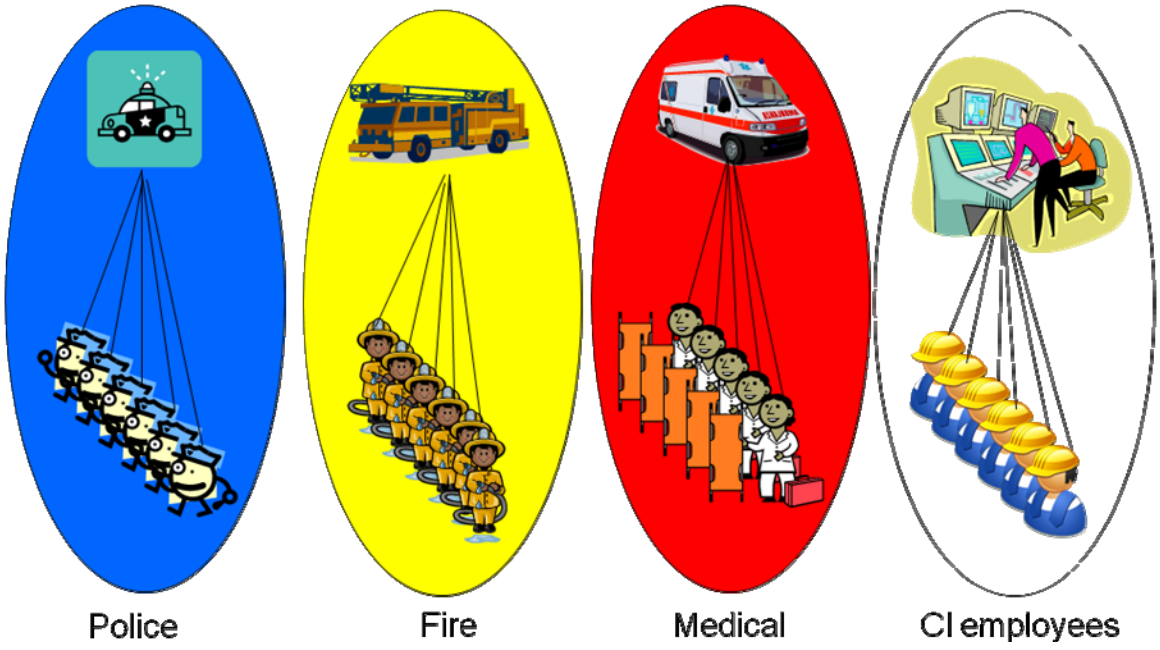
1.2 Project context and objectives

Critical Infrastructure (CI) networks typically have monitoring and control centres to manage the CI network and sites. When a disaster occurs in a CI site the control centre will usually continue to operate, but typically with degraded functionality. As First Responders (FR) arrive on site, they also set up one or more control posts. The most critical element to the successful mission of the FRs is to achieve a fully functional cooperation between:

1. The CI control centre
2. The FR control posts
3. Each of the individual FRs on site
4. The applications used by the first responders (such as thermal imaging applications, sensors for hazardous materials, indoor navigation, video communications and more)

The fundamental objective of the INFRA project is to research and develop novel technologies for personal digital support systems to be deployed in CI and disaster sites. This is part of an integral and secure emergency management system, aiming to support First Responders in crises occurring in Critical Infrastructures under all circumstances.

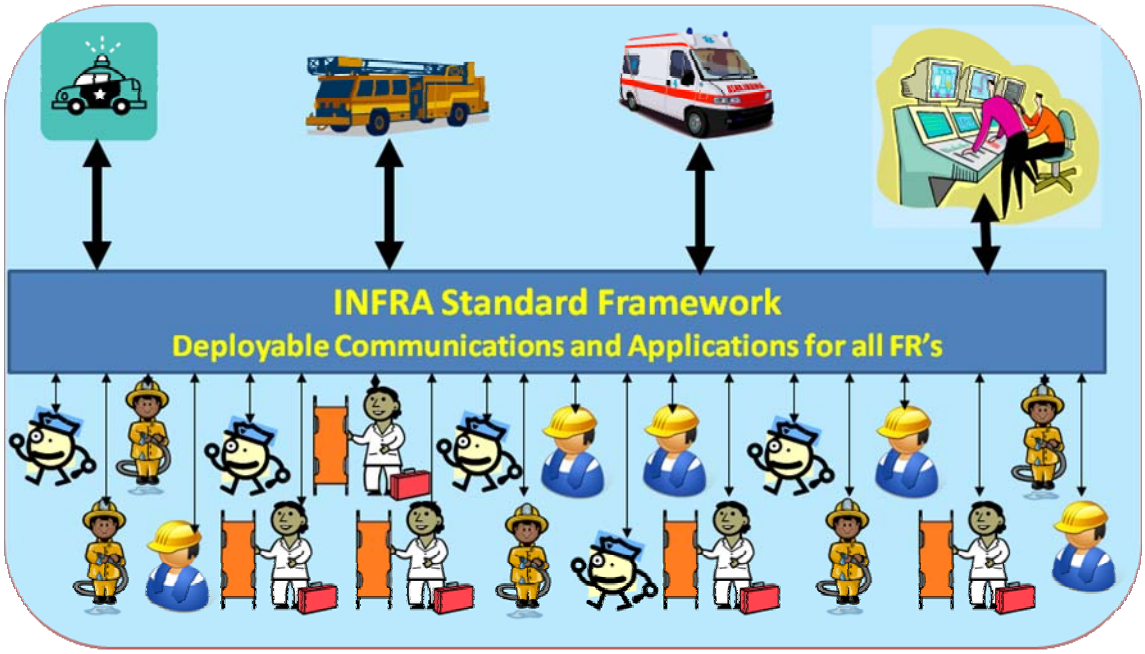
The required basic problem is illustrated in the following drawing:



Both the communications interoperability layer and the FR applications in INFRA are novel and go well beyond the current state of the art for the technology currently in use by FR teams.

Although the FR forces are quite fragmented and localised, achieving standardization on the issue of broadband applications for FR is of importance to all Europe, as it will allow significant cost reduction of FR equipment and cross region and cross border cooperation between FR units.

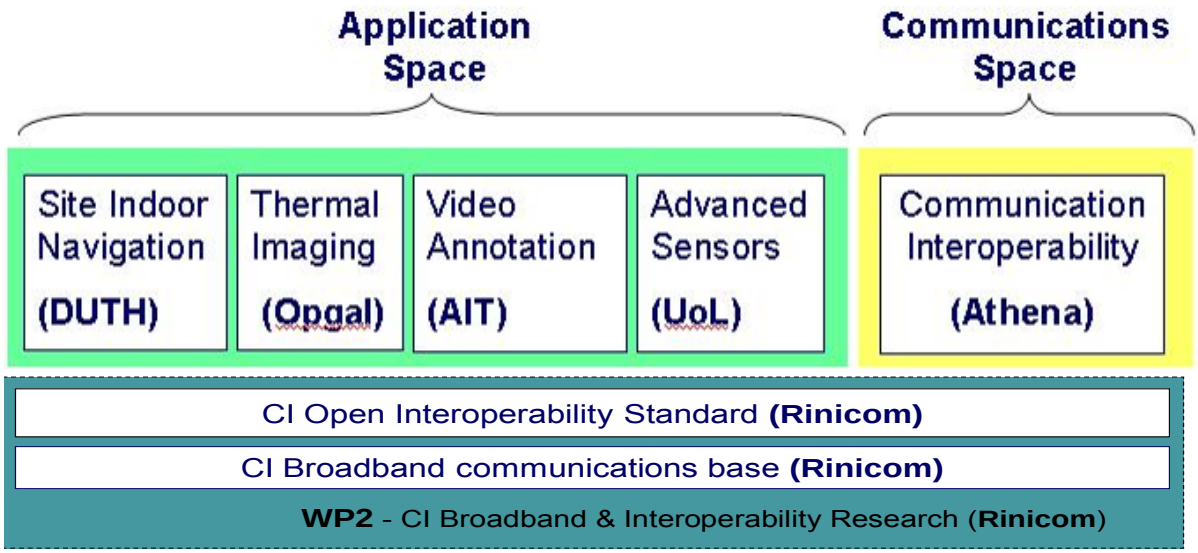
The following diagram illustrates the required solution:



The objective of project INFRA is to provide with innovative and novel applications to First Responders, in order to achieve a greater effectiveness in their work, at 2 levels:

- Firstly INFRA is an easy-deployment communication system by First Responders (FR) which allows the communication inside of Critical Infrastructures (CI) after a disaster, when normal communications systems do not work and FR are not able to communicate with the outside. This easy-deployment network allows for a more effectiveness communication thanks to the following functions:
    - Broadband access for high bandwidth applications (i.e. live video).
    - Autonomous wireless broadband in underground tunnels and concrete buildings – a severe problem in CI sites such as Subway tunnels, targeted by terrorists.
    - Full voice and data communication interoperability between all FR teams, their command posts and the CI sites control centre.
    - Full interoperability of FR applications in use by the FR teams.
- Secondly, INFRA has developed several innovative and novel applications for personal digital support systems as part of an integral, secure emergency management system to FR. These applications include:
    - Site indoor navigation
    - Advanced sensors
    - Thermal imaging
    - Video annotation

The system architecture of INFRA system is described in the following drawing (names of partners in charge are in parenthesis):



Major activities within the INFRA project:
The INFRA project has accomplished research and development of the following novel technologies and applications for the use of FR in CI sites:

- **INFRANODE Communication module –** At the heart of the INFRA solution a portable, high-bandwidth communication device has been created. This battery-powered, environmentally hardened device provides TETRA and other voice communications in places where there is no coverage, maintaining contact between FR's and the command centre. In addition, it provides high-band-width full-duplex data links between field applications (i.e. sensors) to the command centre. Finally, it allows several voice radio networks (i.e. TETRA and TETRAPOL) to interoperate at a local level – insuring proper coordination between organisations. The INFRANODE is completely self-configuring and uses a MESH topology which automatically links several such devices into a single, effective, long-ranged network.

- **Site Indoor Navigation** – An indoor navigation application has been developed, and successfully tested at several indoor sites: the Indoor navigation is based upon two separate sensors maximizing accuracy. The data from the Indoor navigation system has been fully integrated into a GUI, allowing easy use of the system in a command centre

- **Advanced Sensors** – Based on the requirements gathered from the end user group at the beginning of the project, and the functional specification for the INFRA system, UOL has researched and developed a number of advanced sensors and supporting tools. These sensors monitor a specific F, or location, and report their data over the INFRANODE communication module to the command centre. At the command centre the information is conveniently displayed along with the location of the FR or sensor. The sensors include:
    - Hazardous Gas Sensors
    - Biometric Sensors, measuring parameters such as heart rate and blood O2 levels.
    - Radiation Sensors

- **Video Annotation** – The broadband communication infrastructure will provide the ability to send enriched annotated video from any first responder the command centre. In order to greatly enhance the clarity of communications video streams are annotated by symbols removing language barriers. Graphical components are available through dedicated authoring tools and short textual descriptions which aim at focusing the attention of the FR on a specific part of the picture. Video annotation technologies specific to the FR requirements have been researched, developed and demonstrated, coupled with efficient media-rich video packaging, streaming and distribution technologies.

- **Thermal imaging** – Research and development of two new applications based on hand held thermal imaging cameras: Gas Leakage detection and Hidden Fire detection. Both applications are of specific value to FR in CI sites, as it warns users of potentially life-threatening hazards.

Main results and achievements of the INFRA project:
At the end of the second and last project period we are pleased to note that the project has achieved all of its overall technical objectives. All the applications (with one exception) have been successfully tested and demonstrated, both in lab environment and in the field.

During the first project period a **"Proof of Concept" (POC)** deployment carried out; an event not originally part of the project plan, which the consortium decided to conduct based on early prototypes. The POC was held on March 4th 2010 in the tunnels of the M-30 ring road in Madrid, Spain. A group of First Responders (FR) were invited from several countries to observe the POC, as well as to contribute with important and useful comments for the future development within the project.

However, the most important indication of the INFRA project's success is the **final field trial** held in Madrid on the 27th of January, 2011. Roughly 40 representatives of First Responders from across Europe were present, as the consortium explained and demonstrated the INFRA system in the tunnels of the M-30 ring road in Madrid (same location as POC).

The Demonstration was held in several stages:

1. The entire INFRA system was installed in one of the tunnels of the M30 and tested exhaustively.

2. The INFRA command centre applications were located in the M30 Command and Control Centre (C2) located approximately 5 KM's away. The two sites were linked using INFRA equipment.

3. Approximately 40 observers from across Europe were shown a demonstration. Initially the system was demonstrated to the participants located inside the command centre, with FRs deploying the equipment inside the tunnel, together with INFRA partners.

4. Following the demonstration the observers were invited to the tunnel itself, allowing them to observe the equipment from "close up", and get a clear idea of its mode of deployment. And its usability.

5. The observers were finally invited for a feedback session where they got to complete a questionnaire describing their impressions of the system and possible future. The impressions collected were generally very positive, and can be found in the public INFRA deliverable D5.2 "Field trials results report".

The Field Trial has successfully proven that the INFRA concept is feasible. It also showed that the main features, though far from complete at the time of the test, nevertheless are functional and deemed very useful by FRs.

The field trial owes much of its success to the POC test, held under similar conditions a year earlier (using partial prototypes) and the intensive integration scheduled executed during the reporting period.

INFRA consortium

The INFRA consortium brings together 9 partners from 6 countries, each partner brining its own unique expertise to the project. The partners have built a strong and balanced consortium, including academic partners, research centres, SMEs and large industries. In addition to the consortium members the INFRA project has involved a number of relevant end-users within a Scientific Advisory Board. The board members have participated with input through requests and discussions from the beginning of the project, and were also invited to take part in the Proof Of Concept session as well as the Final Field Trial.

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1.3 Main S&T results

At project level

Following the second and final year of the INFRA project the consortium has achieved all of its stated overall goals and developed a system consisting of a number of applications which have been integrated, tested and demonstrated within the project, proving the feasibility and success of the INFRA project:

1. **Communications Infrastructure –** A portable module called the INFRANODE was produced (4 samples), tested extensively, and demonstrated in the final field trial. This was achieved despite the loss of a critical partner in the first year, resulting in the identification of an alternative solution

2. **FR technologies–** All planned applications were proven to work with one exception (gas leak detection), and were successfully demonstrated in the field.

3. **Relative Locations –** The INFRA team has been able to demonstrate non-GPS based location systems. Movements by a FR were successfully tracked in a host PC application and displayed on a building floor plan.

4. **Wireless Heat and gas Detection** - Using infra-red video cameras we have managed to monitor temperature differences and report them to the command centre application.

5. **Video Annotation and enhanced communication with Rich Media Alerts** – We have successfully transmitted pre-annotated video streams with highlights on areas of interest from FR PDA devices to the Command Post application and received text-based alerts to FR PDA devices.

6. **Integration –** Integration has been a primary focus of the second reporting period, with several integration sessions taking place throughout the year:
    - The integration activity (WP4) was moved up from M17, with some tasks done as early as M9.
    - All the FR applications have successfully transmitted their data of the communication infrastructure created by the project.
    - During the first year we realized that we lack a task for creating a control centre application for monitoring the FR remotely. This was changed and added to WP4 as task 4.6 in the Modified DoW (dated July 25th 2010). This application was developed by the partner AIT and used effectively in both integration testing, and the field trial.

7. **Field Trial –** A field deployment of the INFRA system was executed in the M30 tunnel in Madrid in January 2011.
    - All applications functioned in a satisfactory manner in the field trial.
    - Several FR organisations from across Europe were invited to observe the demonstration and visit the trial site. The participants also their input through questionnaires, which show mainly positive impressions and reactions (D5.2).

The product

INFRA´s product is a novel solution for FR which is designed to revolutionize the market in two areas:

- **Communication area:** INFRA provides an unprecedented level of interoperability for voice and data communications. All FR teams, FR command posts and the CI control centre are able to communicate each other, and transfer digital data at high bit rates – enough for live video.
- **Critical Infrastructures:** INFRA provides an infrastructure in critical situations which make possible the communication in all kind of CI and undergrounds infrastructures.

In the applications, INFRA provides novel technologies and applications for use of FR in CI sites. These are:

Communications

INFRA has developed a robust ad-hoc mesh topology broadband wireless network which will enable interoperability between the standard radio equipment of the First Responders who attend the emergency.

Biometric Sensors

INFRA consortium has developed a number of sensors to monitor a number of biometric parameters relating to the individual FRs themselves.

The non-invasive sensor developed is fully integrated into a wearable finger clip and an early prototype ear-clip version.

Vital signs sensors measurement parameters:

- Blood haemoglobin (cHb)
- Blood oxygen saturation (SpO2)
- Pulse – beats per minute
- Temperature

Optical Gas and Radiation Sensors

Novel light weight radiation and gas sensors have been developed which are fixed point as well as wearable by the First Responders. Their principle of operation is based on light absorption spectroscopy and radiation-induced attenuation in the transmission properties of optical fibre respectively.

The sensor is based on a Polymethyl Methacrylate (PMMA) plastic optical fibre (POF), and materials which fluoresce when exposed to ionising radiation.

- The gas sensors are able to detect O2, C02 and methane (natural gas)
- The radiation sensors are able to detect (depending on the scintillation material used) x-ray, γ-ray, fast neutron, alpha and beta.

Video Annotation

INFRA has advanced the state-of-the-art in enriched media authoring and video annotation for emergency situations, by implementing a system for the bi-directional exchange of annotated video streams to enhance visual communications among FRs and the control centre. INFRA has developed an interface to the wireless network and a pre-annotated video data exchange system, through which and successful exchanging of media data was achieved.

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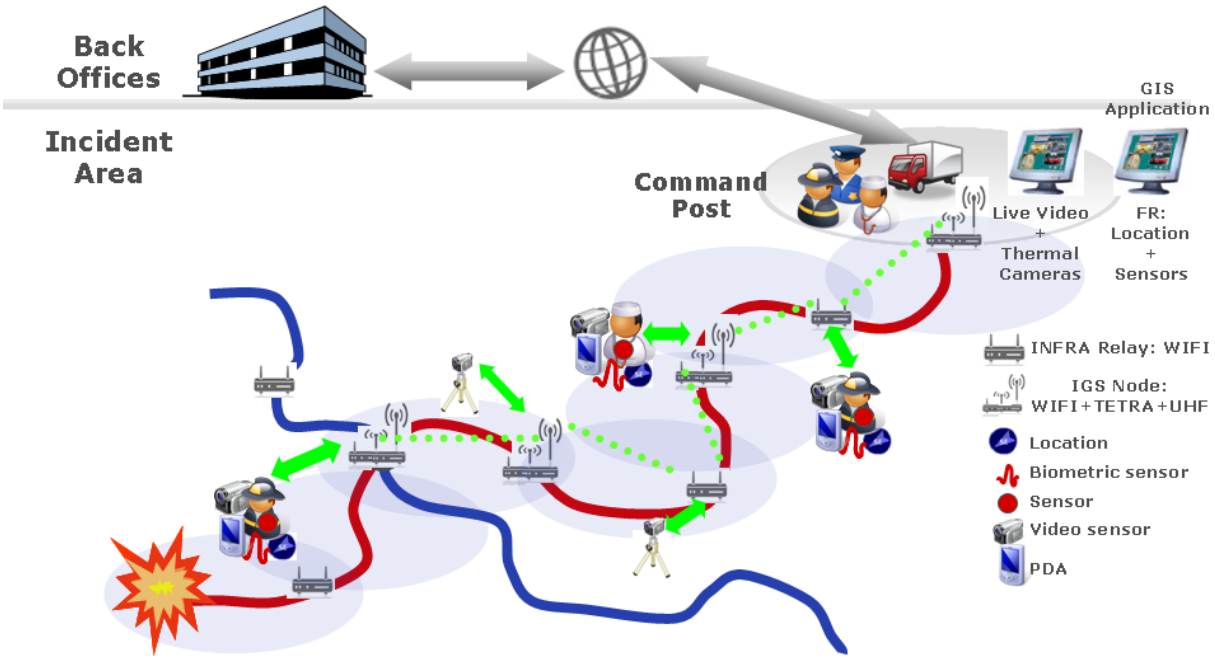
Hidden fire detection camera

An Un-Cooled IR camera running sophisticated embedded algorithm for hidden fire detection was integrated into the INFRA system.

Command post and user interfaces

A central PC based application was developed and deployed Command & Control Post. The application was built on a client-server architecture whereby embedded web servers on the FRs respond to requests for data from the central application.

The following picture shows the high-level functionality and scope of the product:



1 Functionality and scope of the product

At WP level

WP1

The objectives for work package 1 have been to set consolidated INFRA user and technology requirements as reference throughout the whole project and consolidated INFRA functional and technology specifications used for system specifications in the technological work packages. To achieve this goal the following tasks were performed:

- User requirements collection by having interaction with end user to collect info from them using questionnaires elaborated to get info regarding the systems and protocols already existing and their needs, personal interviews and user requirements collection forum.

- Elaboration of a set of functional requirements came from the compilation of needs articulated by end users and the first technology requirements and translated them into functional and technological specifications in D 1.2.

- Delivery of D1.1 End User Workshop Conclusions and D1.2 INFRA system functional and Technology Specifications.

WP2

Work package 2 has been of a very high importance to the whole project as it was responsible for providing the backhaul of communications (via the INFRANODE system) to all applications being developed and integrated into the prototype system. The developed communication system has exceeded expectations in terms of range covered in non-line-of-sight environment and data throughput.

Despite the loss of a critical technical partner early on in the project the work was re-evaluated and redistributed, extensively affecting WP2, resulting in the creation of a different technical solution than originally planned, the INFRANODE. Despite these difficulties the work in the work package has been carried out to the extent that exceeded expectations set in the start of the project.

- Prototypes of the INFRANODE have been built in cooperation between ATH and RC, tested at integration sessions and demonstrated at the final field trial. This device is a stand-alone, battery powered, device which creates a meshed broadband communication system wherever it is deployed. The INFRANODE device includes the ability to connect to up to 2 different Voice Devices – allowing voice communications with remote locations, as well as interoperability between different voice networks (i.e. TETRA and Analogue Radio).

- The developed prototype system has shown to be highly reliable and interoperable with most standards used in First Responder applications today, and it can therefore be used as an evolution of the current system with minimum change in infrastructure.

- The system has shown to be fully interoperable with all equipment from project partners and has been successfully tested during field trials.

- Rinicom has finalized the Standard for Open Interoperability and made contacts with standardization bodies for approval.

WP3

Work package 3 focused on the development of the FR applications, with the objectives for to develop the following applications:

- Site Indoor Navigation – providing novel methods for indoor navigation
- Thermal imaging applications – providing gas leakage detection and hidden fire detection
- Video annotation – providing a most efficient integrated set of tools for visual communication by annotating video images, packaging and streaming enriched annotated video to other FRs
- Advanced sensors – providing advanced fibre optic sensors for the use of FR teams

The common denominator for all these diverse technology building blocks is that they are to be used by an FR in the field where there is no infrastructure. All the applications have met or exceeded the following requirements:

- The applications are deployable in the field by a FR, requiring no infrastructure (i.e. comm., or power) – this was generally achieved by using rechargeable devices that were either purchased or designed into the system.
- Utilize wireless (WI-FI) communications to access the nearest INFRANODE device.
- Utilize the INFRANODES' backhaul to maintain continuous wideband information flow with a remote command centre application.

Along the way, it was realized that another application, not included in the original DoW was called for. We needed a PC-based application which allows us to demonstrate the system's ability by presenting the information provided through the above sensors and applications, in easy-to-understand and monitor Graphical User interface. The Partner AIT agreed to undertake this task in collaboration with DUTH.

The applications must all comply with the overall communication framework of INFRA and respond to the needs of the First Responders. Therefore they were all grouped into this single work package.
Athena (coordinator) was selected as the leader of this work package since, as the project coordinator and system integrator, and as expert on FR needs and CI sites ATH has the best overall view on the functional requirements of these applications.

WP4

The Objective of this work package was to ensure that the components and application prototypes being developed in WP2 and WP3 work effectively together. This was considered to be a mandatory first step, prior to progressing to a field trial.

The Integration was led by ATH and consisted of the following steps:

1. Creation of an integration plan , approved by all partners and submitted as D4.1
2. Execution of 6 separate integration sessions
    a. November, 2009 in Tel Aviv

b. March, 2010 in Madrid (included a proof of concept test – see below)

c. June 2010 in Lancaster, UK

d. July, 2010 (virtual over the web)

e. August 2010, in Xanthi, Greece

f. and October 2010 in Limerick, Ireland

3. In each Integration session some or all of the technical partners met either physically or on-line in order to perform a set of tests called for by the integration plan intended to verify both progress of individual subsystems, and successful interworking between the applications. A report was issued after each integration report and distributed to all partners. A final integration report was submitted to the PO as Deliverable 4.3.

4. The final test (in October 2010, held in Limerick Ireland), included a full system test, and was considered to be the final preparation for the field trial.

5. Deliverables D4.2 and D4.3 summarized the Integration activity and reported on the final status of the application prototypes.

Two insights were made by the project team at a very early stage:

1. In order to be effective, the integration had to be moved up in the schedule. Although originally planned to begin in M17, it in fact started in M12, upon the delivery of the integration plan (D4.1), with some activity occurring as early as M9

2. To ensure field performance, a preliminary "live" trial must to be done. This was termed a POC ("Proof Of Concept") – and was executed in Madrid in March, 2010. End-users from the project advisory board were invited to observe and provide comments. The POC was summarized in Deliverable D4.4

WP5

Objectives for work package 5 were:

- To validate the system components in a real time environment scenario
- To evaluate the system performance vs. the project objectives
- System evaluation by real end users

In order to achieve these objectives the following work was carried out:

- To establish a test plan and preparation procedures including test scenarios, trials procedures as well as logistics issues, according to the requirements set in WP1. The field trials preparation included three steps:
  - Actions coordination with FRs and CI site.
  - Orientation and training sessions with CI and FR. During one of the field trial sessions previous to final demo event, FRs who were in the tunnels carrying systems during demo event has the opportunity of using all the systems and asking all their doubts and exchanging opinions with technological partners.
  - Field trial protocol preparation, detailing all the activities per test. Various tests were developed to demonstrate communications, interoperability and applications functionalities.

- The field trials were conducted in a real infrastructure with cooperation of command centre of Madrid M-30. This was done by all the consortium partners and under supervisions of the Spanish partners who work in close coordination with end-users. It involved the following elements:
    - Deployment of broadband communications backbone.
    - Interoperability between the M-30 control centre and FRs legacy communications systems
    - Underground navigation
    - Thermal imaging applications testing.
    - Testing of the fibre optic sensors
    - Testing the video annotation technology.
    - Observers monitored the final field trial session.
- At the end of the field trial results from the system tests were revised and cross examined with project goals and objectives. A results report of the field trial has been prepared.

Significant results: Successful organisation and carrying out of the final INFRA field trial in M22 or the project, and the delivery of D5.1 Field trials plan and specifications and D5.2 Field trials report.

Deviations: It was not possible to perform demo activities in Metro tunnels and it was selected other similar infrastructure and agreed with security department to perform demo sessions in this place (M-30 tunnels). It has not a significant impact in the project.

1.4 The potential impact

The INFRA project consortium has established and maintained a close connection with potential end-users of the INFRA solution throughout the project, and their input and requirements have been taken into account during the development process. This was done in order to ensure a result well in line with the requirements from the future users of the product, and has proven very valuable for the project.

In addition these connections have shown to be excellent with regards to the dissemination and exploitation of the INFRA project and its results. Several Spanish public organizations that has shown their potential interest on acquire the INFRA solution, such as the M-30 who hosted the POC and the final field trial, and a number of potential clients informed of the INFRA system have already expressed their interest.

1.4.1 Competiveness

INFRA has developed an ad-hoc, mesh topology broadband wireless network, specifically adapted for the needs of FRs in CI sites. On top of the communications layer two “spaces” will be supported:

1. Communication space, enabling full interoperability of voice and data communications between FR with incompatible equipment.

2. Application space, enabling plug and play functionality of applications for FR, such as the applications that are researched and developed in project INFRA.

The main priority of the INFRA consortium is to profit from **providing customers with unparalleled solution of emergency respond and management at unrivalled costs**. INFRA provides several **key competitive advantages** over competing solutions, including:

- Transportable and easy-deployment system by FR
- Innovative and novel applications for FR
- Holistic approach
- Low cost
- Full Europe-wide partner program (installation, service operation model, support & maintenance).
- Information system integration experience + holistic approach enables turnkey offering of integrated products depending upon client needs + truly open standards enable seamlessly integration into any existing security system solutions.

1.4.2 Socio-economic impact and the wider societal implications

When the INFRA project comes up, the social objectives which were conceived the project were very ambitious. These objectives are summarized below:

1. Reducing the number of fatalities and the number of severity injured people in disaster events in CI sites, by providing faster help and evacuation for those who are wounded at the site.

2. Faster restoration of the site to normal operation, thereby reducing the impact of the disaster on the associated energy or transportation network.

3. Improving the effectiveness of the public security forces has a deep emotional effect on the society in general, an effect that is very difficult to measure but that is felt by every citizen that knows that his/her chances of survival in a catastrophe have improved thanks to the efforts invested by the EC.

Summarizing, the main goal of the INFRA project was to help first responders to perform their rescue operation in a more efficient way. The same idea applies for the recovery of the energy or the transportation networks that are affected by the damage to a specific node of the network.

With this ambitious purposes the INFRA project began, involving on it to relevant European First Responders, and FR's from Israel (like Madrid SAMUR, or Magen David Adom from Israel), and relevant infrastructures like Madrid M30 or Kavala airport. All the end users and stakeholders involved gave their inputs on different stages of the project contributing to the development of the INFRA solution.

Along the project two tests were done on the M30 emergency tunnels. The M-30 is the motorway around the most central districts of Madrid. In 2007 the M-30 south bypass was opened with a total of 7.5 kilometres being the longest urban tunnel in Europe. This tunnel is used by over 80,000 vehicles per day.

Since the first Proof of Concept done, was demonstrated that the INFRA project would be able not only to fulfil the main goals planned for the project and abovementioned but to go far beyond these initial goals.

As has been mentioned before, the INFRA project will help FR's on his work and using the 100% of functionalities not only would resolve communication problems among the FR's inside a tunnel and the command and control centre but would be able - through the different sensors that makes up the INFRA solution - to send and receive vital information of what is happening inside a tunnel regarding three relevant aspects:

1. What is happening on the location where the FR's are working?

2. What happens to the own FR's- through the information gather by the biometric sensors carried by the FR's.

3. If something happens where the communications nodes are distributed.

In addition the INFRA solution can help on a previous stage in order to avoid emergency situations or major disaster in the event of an emergency might occur.

In this sense, for instance the M30 security manager Mr. Santiago Vilariño saw the results of the INFRA project as determinant not only on emergency situations where FR's have to take part, but on any previous situations when normal communications falls down. On that moments the INFRA solution might help managers of infrastructures like the M30 to know where the workers are or if they have any problem carrying out their work to restore normal communications loss and in this way avoid a potential major disaster in the event of an emergency might occur on that facilities.

With this conception of the INFRA solution used on previous situations of a potential emergency that in many occasions could be solved easily, any infrastructure would save a huge amount of money derived from avoid the high cost (social and economic) that any disaster carry. Of course not all the potential risks or disaster can be prevented beforehand, but many times small accidents or disasters inefficiently treated have become major disasters with relevant socio-economic impact, not only for a specific infrastructure but for the whole society where the infrastructure is located.

Finally, last 28th April the INFRA project has been recognized by the Spanish magazine "Actualidad Económica" as one of the greatest innovations of the year in Spain which will serve to contribute to First Responders like SAMUR or Fire Fighters or to carry out their work on a safety way.

In this sense, these First Responders along the project were able to see by first-hand the operation and advantages of the solution INFRA.

These FR's were able by the workshops done to suggest in what kind of situations they would like to use the INFRA solution and which kind of functionalities that would want for a solution of this kind.

1.4.3 Dissemination & Exploitation in INFRA

Along the INFRA project the activities in work package 6, Dissemination and Exploitation, have aimed to fulfil two ambitious general objectives which have both been successfully completed.

Objective One – Dissemination: In order to fulfil this objective, everis has defined a methodology for dissemination and exploitation in order to support creation of awareness and information to security service providers, first responders, critical infrastructure' sites and, public authorities, standards bodies concerned by the INFRA research and facilitate changes with these external groups. This objective has been achieved through:

- **Task 6.1 Public website** - A public website was created with the goal of disseminate the INFRA project among different stakeholders. This website is capable to serve INFRA members and the public, and provide the means to share project data and files between partners and users, by secured login access procedure.

- **T6.2 Preparation of Dissemination and exploitation plan -** The Dissemination and Exploitation Plan was created with the goal to build awareness of the INFRA project and it results and with the objective of maximize its commercial exploitation potential. Its objective is to lay down the foundations for effective external communication of INFRA's concept and potential benefits to interested stakeholders at an international level, focusing primarily in Europe.
- **T6.3 Dissemination activities** - During the development of the project several dissemination activities of the INFRA project has been done in concordance with the established planning. Since the beginning of the project most of the channels identified has been used for the dissemination of the project.

Objective Two - Exploitation: Analyze the economic impacts of INFRA products and services and explore possible implementation models which could help finance large scale deployment of INFRA through involvement of public authorities, regulators and private business. This objective has been achieved through the development of the following:

- **Emergency Industry Survey Report (EISR)** - Explores the key factors driving market growth and identifies emergency response systems trends in the field of Critical Infrastructure Protection (CIP) within the marketplace.
- **D6.3 Exploitation Model** - The objective of this exploitation model is to lay down the guidelines that are needed in order to bring the INFRA solution into the market.
- **Exploitation pipeline** - An excel based tool where information regarding potential clients, security product resellers or experts has been identified. Potential competitors include product providers which are key players and can influence INFRA's technological and business development.

<u>Significant results:</u>

- Active involvement of a large number of end-users has been achieved, such as CISEM, fire fighters, medical staff and police from several countries, METRO Madrid, M30 etc.
- Representation of the INFRA project has raised a big interest in the solutions developed during the project among existing customers of INFRA partners, which are also potential clients for the INFRA solution.
- Attendance of several major conferences and events, such as the SRC10 and HOMESEC 11, resulted in formal dissemination of INFRA solution, building and increasing interest in the work of the project amongst relevant stakeholders.
- INFRA's Field Trail, in addition to being a successful integration and test even was also an important dissemination activity
- INFRA's solution has been awarded by "Actualidad Economica" as one of the 100 most innovative ideas of the year 2010 of the Spanish Market - The awards ceremony will take the 28th of April at the Ritz Hotel, Madrid, Spain.

1.4.3.1 Dissemination activities

A project start, a dissemination plan was set up by the consortium and contained a planning of information dissemination actions to be carried out in the course of the project. The present section provides a summary of the main dissemination activities carried out within the project, in accordance with the original plan set out.

Project presentation material

Target audience	All
Means	• Project logo and corporate look • Standard PPT lay-out • Standard INFRA presentation (PPT) • Leaflets and poster
Objective	• Provide basic presentation material to support information dissemination actions • Make the target audience aware about the INFRA innovation in the field of communication between FRs in critical infrastructures, and the benefits of the INFRA project • Generate interest from potential professional users • Get support from technical experts and decision makers who may play a role in the adoption of a new communication system for FRs
Impact	Consistent and professional image of the project

Scientific publications

Target audience	Technical experts
Communication channels	Based on the research carried out within the scope of the INFAR project the partners have contributed to about 10 publications in scientific journals and conference proceedings.
Objective	• Make the target audience aware about the INFRA innovation in the field of communication between FRs in critical infrastructures, and the benefits of the INFRA project • Generate interest from potential professional users • Get support from technical experts and decision makers who may play a role in the adoption of new solutions for communication and collaboration at disaster sites
Expected impact	Accelerate the take-up of the INFRA solution in various applications requiring communication and management system in critical infrastructures

Type of Activity	Specific Activity	Objectives	Channels	Results
Meetings with groups of interest	• End-users: ▪ Madrid Metro ▪ Madrid M30	• To build awareness of the project. • To communicate research findings to stimulate ongoing interest in the work of the project. • To maximize exploitation opportunities. • To lay the groundwork to establish and reinforce a wide network of potential customers.	Formal face to face Small meetings	Madrid M30 let INFRA consortium their facilities to develop the Proof of Concept and the final demonstration. Madrid M30 it's interested on the INFRA solution
	PSCE Forum		Informal face to face Small meetings	Effective communication of the INFRA project. Establish contact with related projects Communication of finding results among stakeholders Stimulate ongoing interest in the work of the project.
Participating events as exhibitors	SRC10 Conference in Ostend, Belgium, 22-24 September 2010		Formal face to face Informal Face to Face Poster Session presentation	
	HOMESEC 2011, Homeland Security Fair March 15th – 18th , 2011 - Madrid, Spain		Stand Formal face to face Informal Face to Face Poster Session presentation	
Attending events as visitors	SRC09 Conference in Stockholm 29-30 September 2009	• To communicate research findings to stimulate ongoing interest in the work of the project. • To build awareness of the project	Formal face to face Informal Face to Face	Effective communication of the INFRA project. Establish contact with related projects Communication of finding results among stakeholders. Stimulate ongoing interest in the work of the project. Analyze the competitive & complementary market
	ISBC 2010 - Malaysia			
	SRC10 Conference in Ostend, Belgium, 22-24 September 2010			
Organising seminars	End Users workshop	• First approach to final users	Formal face to face. Define User requirements.	Effective demonstration of the INFRA solution. Gather feedback from end users Stimulate ongoing interest in the work of the project.

Type of Activity	Specific Activity		Objectives	Channels	Results
Demonstrations	Proof of Concept 04/03/2010 Madrid, Spain. M30 emergency tunnel		-----	---	
	Field Trail 27/01/2011 Madrid, Spain. M30 emergency tunnel				
Updating the project's website	Non-scientific publication: "Innovation in critical Infrastructures" – Spanish.		• To build awareness of the project • To communicate research findings to stimulate ongoing interest in the work of the project. • To maximize exploitation opportunities. • To lay the groundwork to establish and reinforce a wide network of potential customers. • To communicate research findings to stimulate ongoing interest in the work of the project. • To build awareness of the project • To communicate research findings to stimulate ongoing interest in the work of the project.	• Pending of Publication	
Writing Non-scientific newsletters	INFRA solution Press Article			• Press Article	• Publication of an article on Actualidad Económica.
				Actualidad Economica innovation contest	INFRA has been awarded as one of the 100 most innovative ideas of the 2010 year in Spain
Releasing news (Scientific)	Researchers developing Emergency Services Response Equipment of the Future	UoL		• *Professional Publications*	Effective communication of the INFRA project. Establish contact with related projects. Communication of finding results among stakeholders. Stimulate ongoing interest in the work of the project. Analyze the competitive & complementary market
Contributions and advertisements on professional publications and web portals					
Optical fibre radiation dosimetry for low dose applications		UoL			
Advanced Optical Sensors Computing Platform Specifications					
Optical Fibre Sensor System Configuration					
Novel Communications Infrastructure and Sensor for Emergency Service					
A Fuzzy Multi-Sensor Architecture for Indoor Navigation		DUTH			
White Paper – Video Annotation Component		AIT			
White Paper – Communications Interoperability Standard, CI Open Interoperability Standard and CI Broadband Communications Base.		RC			
Camera Paper		AIT		*ISCRAM 2011 (8-11 May)*	

1.4.3.2 INFRA dissemination material

Project brochure

Infra

Innovative & Novel First Responders Applications

The Project is partialy funded under the European Community's Seventh Framework Programme (FP7/2007-2013), Grant Agreement nº 225272

Project objectives

The fundamental objective of the INFRA project is to research and develop novel technologies for personal digital support systems, as part of an **integral and secure emergency management system to support First Responders in crises occurring in Critical Infrastructures under all circumstances.**

The specific objectives of the project fall under the following categories:

- **Communications objectives**, which involve the research and development of an integral and interoperable wireless communications system that will allow First Responders to have reliable means of communications as they enter subway tunnels and buildings with thick concrete walls.
- **First Responders objectives**, which entail the research and development of a robust indoor site navigation system based on three location sensors (an inertial sensor, a wireless sensor and a video sensor), a video annotation system for First Responder PDAs, sensors for real time identification of radiation exposure and hazardous materials, and applications for gas leakage and hidden fire detection.
- **Standardization objectives**, which includes R&D of a European level proposal for the standardization of the framework of communications and applications as proposed by INFRA.
- **Demonstration objectives**, which consist on the demonstration of the validity of INFRA's standards, communications and First Responder applications being developed.

Description of the work

The work to be developed is comprised of the following areas:

The **Critical Infrastructure Broadband Communications Base** area will cover advanced wireless broadband network technology that is specially adapted to the needs of First Responder teams in Critical Infrastructure sites. The network shall support video, data and voice communications, and it will consist of multi-radio mesh topology with self adaptive and self healing functionality.

The **Critical Infrastructure Open Interoperability Standard** area will cover the development of a highly dynamic system of systems made up of elements that interact with each other in unplanned and spontaneous ways. It will also cover the development of a First Responder oriented network-programming platform that will implement the systems-of-systems nature of First Responder applications and communications.

In addition, the abstraction level provided by this communication layer will be able to support future applications that will conform to the INFRA specifications, aiming to lay the foundation for a European First Responder interoperability standard.

The **Communications Space** will provide an unprecedented level of interoperability for voice and data communications. All First Responder teams, First Responder command posts and the Critical Infrastructure control centre, regardless of their radio technology, will be able to communicate with each other. Furthermore, First Responders will be able to use their legacy equipment inside buildings with thick concrete walls and in underground tunnels where typically radio RF propagation is impaired.

The **Application Space** will provide novel technologies and applications for the use of First Responders in Critical Infrastructure sites. These shall be Site Indoor Navigation (based on inputs from three independent tracking sources for increased reliability and accuracy), Thermal imaging (including gas leaks detection and hidden fire detection), Advanced Sensors (robust and lightweight fibre optic based sensors for the detection of hazardous materials), and Video Annotation (annotated with symbols and graphical components through dedicated authoring tools and short textual descriptions that aim at focusing the attention of the First Responder on a specific part of the picture).

Expected results

To create an open, standards based interoperability layer that will allow:

- Broadband access for high bandwidth applications (i.e. live video).
- Autonomous wireless broadband in underground tunnels and concrete buildings, a severe problem in Critical Infrastructure sites such as Subway tunnels, targeted by terrorists.
- Full voice and data communication interoperability between all First Responder teams, their command posts and the Critical Infrastructure site control centre.
- Full interoperability of First Responder applications in use by the First Responder teams.

To provide practical and useful novel applications for First Responder teams, all integrated within the open interoperability layer, including:

- Thermal imaging applications.
- Video annotation.
- Advanced fibre optic sensors.
- Indoor navigation system.

Project partners

Athena GS3 Security Implementations Ltd.	Israel
Halevi Dweck & Co. ARTTIC Israel Company Ltd.	Israel
University of Limerick	Ireland
ISDEFE Ingeniería de Sistemas S.A.	Spain
Democritus University of Thrace	Greece
Rinicom	UK
Everis Spain S.L.	Spain
Hopling Networks B.V.	Netherlands
Opgal Optronic Industries Ltd.	Israel
Research and Education Laboratory in Information Technologies	Greece

Project website: www.infra-fp7.eu
Grant Agreement nº: 225272

Starting date: 01/04/09
Duration: 24 months

Total cost: 3,820,811 €
EU contribution: 2,642,895 €

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INFRA project poster

http://www.infra-fp7.com

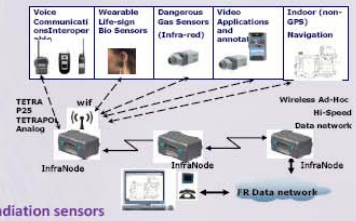
Innovative & Novel First Responders Applications

Project objectives

The fundamental objective of the INFRA project is to research and develop novel technologies for personal digital support systems, as part of an integral and secure emergency management system to support First Responders in crises occurring in Critical Infrastructures under all circumstances

Communications — INFRA has developed a robust ad-hoc mesh topology broadband wireless network which will enable interoperability between the standard radio equipment of the First Responders who attend the emergency.

- High-speed, Data communications to remote command posts, which is Ad-Hoc deployable as they enter subway tunnels, mines and buildings with thick concrete walls ("the Target site"). The system uses MESH topology.
- Self-configuring, self-powered, Ad-Hoc coverage in difficult environments (i.e. Tunnels, and destroyed buildings)
- Full voice and data communication interoperability between all FR teams, their command posts and the crisis control centre
- Communications interoperability. FR's enter target sites with their personal Communicators (TETRA, TETRAPOL), which can interoperate on site.
- Standard bases



Applications

Biometric sensors

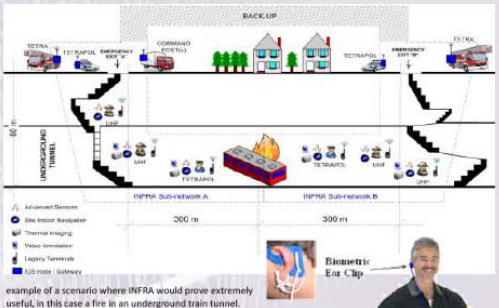
INFRA has developed wearable non-invasive biometric sensors which monitor the blood oxygen level, pulse rate and the total haemoglobin level of an emergency responder

Optical Gas & Radiation sensors

Novel light weight radiation and gas sensors have been developed which are fixed point as well as wearable by the First Responders. Their principle of operation is based on light absorption spectroscopy and radiation-induced attenuation in the transmission properties of optical fibre respectively.

Video annotation

INFRA has developed an interface to the wireless network and a pre-annotated video data exchange system, through which and successful exchanging of media data was achieved.



example of a scenario where INFRA would prove extremely useful, in this case a fire in an underground train tunnel.

Indoor navigation

An indoor navigation system based on sensor data from first responder wearable modules has been developed. The proposed system integrates data from an inertial sensor, a digital camera and a radio frequency identification device.

Command Post and User interfaces

A central PC based application was developed and deployed in the M30 Command & Control Post. The application was built on a client-server architecture whereby embedded web servers on the FRs respond to requests for data from the central application

Hidden Fire detection Camera

An Un-Cooled IR camera running sophisticated embedded algorithm for hidden fire detection was integrated into the INFRA system. Also the ability of transferring live video over IP / Wi-Fi was tested.

INFRA Proof of Concept (POC)

A Proof of Concept demonstration of the INFRA Solution was performed in Madrid, Spain. The Critical site chosen for this test was the M30 tunnel, specifically the emergency tunnel of the M30 bypass south, under Manzanares River.

On March 4th, 2010, a Prototype of the INFRA system was deployed in the emergency tunnels of the M30 road. The M-30 is the motorway that surrounds the most central districts of Madrid. In 2007 the M-30 south bypass was opened with a total of 7.5 kilometers, being the longest urban tunnel in Europe. This tunnel is used by over 80,000 vehicles per day. On this privileged location the INFRA Prototype was demonstrated to Several FR organisations from Across Europe.

POC objectives

The fundamental objectives of INFRA´s proof of concept demonstration were:

- test the feasibility of the project by installing prototypes in a live environment and observing the overall system performance
- to demonstrate the achieved work to FR organizations aiming to collecting their input.
- evaluate the progress of the project.

Organization attending

POC results

The results of NFRA´s proof of concept demonstration have revealed the added value of an innovative and low cost emergency handling solution as the one INFRA provides.

Athena GS3 Security Implementations Ltd.	Israel
ARTTIC Israel International Management Services 2009 Ltd.	Israel
University of Limerick	Ireland
ISDEFE Ingeniería de Sistemas S.A.	Spain
Democritus University of Thrace	Greece
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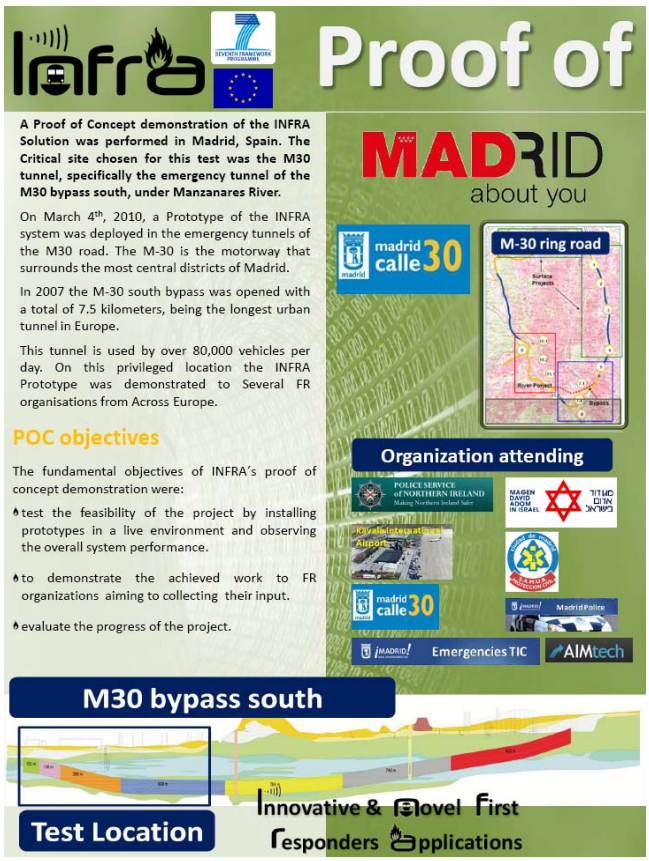
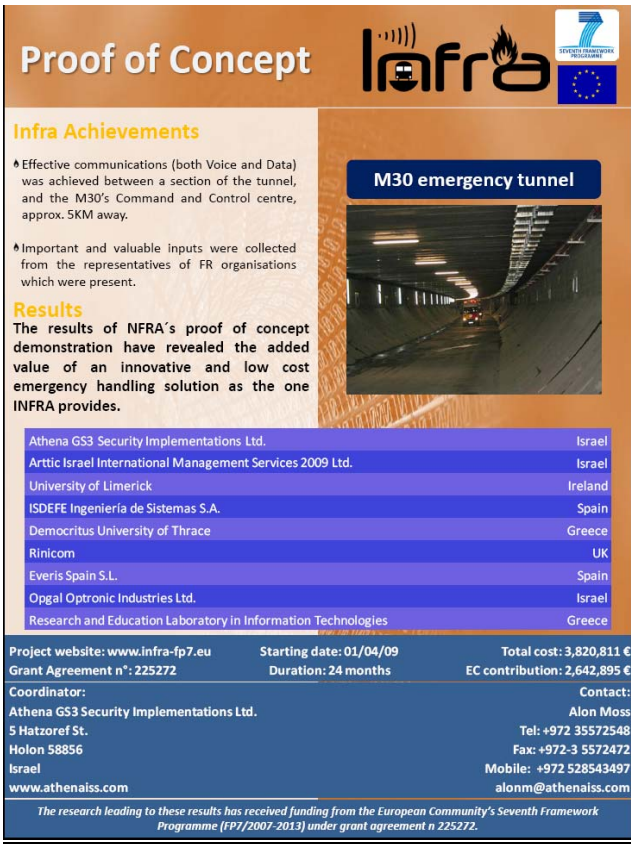
The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n 225272.

INFRA POC brochure





1.5 Public project website - www.infra-fp7.eu

INFRA's website constitutes one of the main communication channels within the project's Dissemination and Exploitation Plan. It provides complete external visibility as it contains general information on project goals, scope, focus and work progress, as well as on consortium partners. Moreover, it is used to share information (news, events, brochures, etc.) produced throughout the project. It consists of static data, which shall remain relatively unchanged throughout the dissemination phase of the project, and dynamic data, which requires constant updating. This updating is coordinated by the project's dissemination & exploitation partner - everis.

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