# D6.1 Report on Pilot Plans

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<tr>
<td>Work package No.</td>
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EXECUTIVE SUMMARY

The following deliverable provides the high level plans for the three pilots scheduled to support the AUGGMED development and evaluation process.

The plans describe the design methodology which is being followed and provides a brief description of each of the components which are being developed.

The AUGGMED platform is being developed in three modes:

- **Mode 1**: Basic Mode (Basic VR)
- **Mode 2**: Intermediate Mode (Immersive Multimodal VR)
- **Mode 3**: Full Mode (Immersive Multimodal MR On-Site)

These modes will be evaluated in three pilot sites which are representative of critical European passenger terminal infrastructures. The plans describe the sites and the evaluation scenario along with the expected evaluation of each component and how this will feed into the design and development process.

At this stage the plans are high level, as the development of the components progresses and the results of each pilot inform the design process, updated trial plans will be added to this document in the annex.
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<td>Jenny Rainbird</td>
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<td>03/12/2015</td>
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LIST OF ABBREVIATIONS AND DEFINITIONS

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<tr>
<td>2D</td>
<td>2 dimensional</td>
</tr>
<tr>
<td>AFO</td>
<td>Authorised Firearms Officer</td>
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<tr>
<td>CCTV</td>
<td>closed circuit television</td>
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<tr>
<td>DoA</td>
<td>Description of Action</td>
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<tr>
<td>FCG</td>
<td>Ferrocarrils de la Generalitat de Catalunya</td>
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<td>Fire Safety Engineering Group</td>
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<td>GeoMobile</td>
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<td>Graphics Processing Unit</td>
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<td>Head mounted display</td>
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<td>Integrated Control Centre</td>
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<td>Integration Power</td>
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<td>KPI</td>
<td>Key performance Indicator</td>
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<td>MR</td>
<td>Mixed reality</td>
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<td>OSVR</td>
<td>Open-Source Virtual Reality</td>
</tr>
<tr>
<td>PPA</td>
<td>Piraeus Port Authority</td>
</tr>
<tr>
<td>SEM</td>
<td>Sistemes D’Emergencies Mediques</td>
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<tr>
<td>SHU</td>
<td>Sheffield Hallam University</td>
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<td>UOB</td>
<td>University of Birmingham</td>
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<td>Virtual Training Environment</td>
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1. **INTRODUCTION**

The purpose of this report is to provide plans for the three AUGGMED platform pilots. This first report provides the initial planned approach and further updates will be made at key stages as the pilots are completed. The updates will include design considerations arising from the previous testing phase which inform the subsequent pilot. These detailed plans will be attached as annexes which will serve as updates to this plan.

AUGGMED is following an iterative development cycle that will be used at each stage of the pilot development.

The report will provide details of the components which are included at each pilot and the schedule of development necessary to meet that requirement.

It will also provide details of how the components will address the user requirements at each pilot. The end users will have an opportunity to test the system and feedback will be used to adapt and develop the components before the delivery of the next pilot. These updates will be included as appendix documents.

The pilots will take place in different locations with each of the end users identified in this report. Table 1: AUGGMED Pilot Schedule below, shows where and when these pilots will take place.

**Table 1: AUGGMED Pilot Schedule**

<table>
<thead>
<tr>
<th>M</th>
<th>Pilot</th>
<th>End user</th>
<th>Test site</th>
<th>Mode</th>
<th>Trainer?</th>
<th>Trainees?</th>
<th>CYBER</th>
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<td>Airport</td>
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<td>Handheld device (windows tablet)</td>
<td>Firearms trainers (WYP)</td>
<td>Leeds Airport Police (WYP)</td>
<td>Basic elements</td>
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<tr>
<td>(M11-12)</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Nov–Mar</td>
<td>2</td>
<td>Rail</td>
<td>ES</td>
<td>Immersive VR Oculus and vest (on site)</td>
<td>FGC, SEM</td>
<td>FGC security staff Unarmed private security guards If possible</td>
<td>Simulated injects</td>
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<td>(M18-22)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Local police, if possible</td>
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<tr>
<td>Dec–Mar</td>
<td>3</td>
<td>Port</td>
<td>GR</td>
<td>MR, Oculus and vest (on site)</td>
<td>PPA, IP, WYP, SEM</td>
<td>WYP, Port security officers If possible, Port Police (armed), if possible, SEM</td>
<td>Simulated injects Communications (IP)</td>
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<td>(M 31-34)</td>
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<td>MR</td>
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2. DESIGN METHODOLOGY

The AUGGMED project has chosen to follow a user-centred, component based and iterative approach to the design and evaluation of the AUGGMED technologies. This approach follows the six guiding principles laid down in the ISO 924 standard, part 210 as follows:

- The design is based upon an explicit understanding of users, tasks and environments or contexts of use.
  - Users are involved throughout design and development.
  - The design is driven and refined by user-centred evaluation.
  - The process is iterative.
  - The design addresses the entire user experience.
  - The design team includes multidisciplinary skills and perspectives.

This approach depends heavily on participatory involvement on the part of the potential end user population and regular cyclical evaluation. The subsequent chapters identify the components for evaluation, the evaluators and an intervention schedule for evaluation.

![Figure 1: AUGGMED Design Process](image)
2.1 AUGGMED Components

The AUGGMED platform is comprised of a number of constituent components which will be brought together in WP5 integration. Before the integration task takes place each of the component modules will be developed and evaluated following the iterative methodology described in section 2. A short description of each component follows. The detailed design architecture can be found in D1.4.1 Report on first and second version of platform specifications and architecture.

2.1.1 Serious game scenario and game play

The aim of the project is to provide the means to allow a serious game platform to be used for single and team-based training of end-users (e.g. police, counter-terrorism officers, medics, firefighters) responding to terrorist or organised crime threats. This platform utilises VR and MR technologies to create an immersive Virtual Training Environment (VTE) offering a unique opportunity to train blue team members in conditions that are not possible otherwise to train in: e.g. fully occupied, by civilians, airport transport terminal that is under attack. The ability to “enter” the VTE is part of the core requirements of the project and integral part of the virtual training tool.

The back end of the VTE and most game logic is provided by the EXODUS pedestrian navigation simulation tool developed by the Fire Safety Engineering Group (FSEG) of the University of Greenwich (UOG). EXODUS is responsible for allowing the simulation of the civilian population where their movement, behaviours and some interactions are determined by EXODUS. At the same time it is also the component that will allow the blue and red team members to participate in the VTE.

EXODUS is complemented by SMARTFIRE, which is responsible for determining the spread of fire hazards within the simulated environment. Due to the nature of these calculations any fire simulations need to be completed at some time prior to the running of the exercises. EXODUS uses the SMARTFIRE data to determine the effect that the fire hazards will have on the simulated agents within the model.

The AUGGMED platform will operate at bronze level i.e. only the first responders to an incident will be able to directly interact with the system and enter the VTE. Silver and gold level responders, while not being represented within the VTE, can communicate with bronze level users. Communications between members of bronze level will take place using voice technologies implemented within the VTE, as will communications between bronze level and silver/gold level.

The layout of the pilot geometries is primarily modelled within EXODUS. The EXODUS geometries define the area that the simulated civilian population as well as the blue and red team members can occupy and navigate. EXODUS will allow the user to take control of a particular simulated agent representing either a member of the blue or red team. The user will thus be able to implement during the exercise their agenda. In the three pilots that will be developed during AUGGMED the red team members will enter a particular structure and attempt to cause as high number of casualties and damages as possible. The blue team members on the other hand who are also the trainees of the system will attempt to intercept and eliminate the red team. During the exercise the users of the system are able to interact with the civilian population as well as other users using voice commands or hand gestures.

If a pilot geometry incorporates fire products then EXODUS will determine the effect of fire hazards or detonations on the simulated agents as well as the users of the system (i.e. blue or red team members). The first pilot geometry incorporates fire hazards modelled by...
SMARTFIRE. For EXODUS to determine the effect of hazards on the simulated agents this data needs to be exported from SMARTFIRE and then imported into EXODUS. Furthermore, data exported from SMARTFIRE will also be imported into Unity3D to visually represent the fire and fire products.

The AUGGMED platform will allow for non-linear scenarios to be defined tailored to suit the needs of end-users to improve skills such as: problem solving, analytical thinking, quick and accurate reactions, sharing and reinforcing best practice in dealing with terrorist or organised crime attacks. The aim is to allow arbitrary what-if scenarios to be realised within the VTE.

2.1.2 Automated game scenario engine

The Design and development of a non-linear automated game scenario engine will incorporate end-user’s individual learning objectives. It will be based on the symbiotic use of Unity3D and EXODUS within one dedicated AUGGMED server. Both engines will work in close collaboration as AUGGMED server to generate and to manage a scenario. A trainer will specify a scenario and trainees can join this scenario via different interfaces and devices developed within the project.

To offer a game scenario, AUGGMED will implement a scenario setup for Unity3D and EXODUS. A model of the environment (e.g. airport) will be implemented and all responsible objects and elements used for this environment are added. After the scenario setup is done different scenario settings are added to influence the next training session. The trainer will select in advance parameters for the upcoming scenario to frame the training session and address the learning objectives for the trainees. After the scenario started the trainer can directly interact with the session by influencing scenario configuration like raising the visitors arriving at the airport or starting a fire at selected areas.
2.1.3 VR and MR environments

3D models of the proposed environments will be created along with virtual characters and appropriate animation and audio to present a visual and auditory simulation of the scenarios to the user. The environments and characters level of detail will be scalable to best fit with the three proposed interaction modes and the capability of hardware used. The created environments will also be interactive and adaptable to match the frenetic nature of the required scenarios.

2.1.4 Interfaces and devices for multi-modal interaction

For multi-modal interaction support AUGGMED will integrate various interfaces and different devices. A wide range of interfaces have to be addressed. Small displays like smartphones or even tables can only contain a reduced feature list or all selections have to be spread out over different views. If smartphones can be used as full training interfaces depends on the device performance; especially GPU performance of the smartphone. Bigger displays like monitors for desktop computers offer more space on a single view and also on the overall performance. Therefore the interfaces can be differently arranged and used. VR and AR can be used context sensitive. For trainers VR offers a huge range of choices, just by turning the head in different directions. This allows placing control elements next to the focus of the current view. Devices like vests, guns, and glasses are more complex, since there will influence the overall gameplay and will be evaluated and be integrated to fully support scenarios and training sessions.

2.1.5 Configuration interface for generating game scenarios

The configuration interface will enable trainers to generate a configurable scenario using predefined parameters. These could include, for example, the location, number of civilians, types of attacks (Cyber, explosive, gunmen etc.), number of trainees, as well as their physical and communication capabilities. It will be usable by trainers using both standard and virtual reality inputs using standardised control systems.

2.1.6 Interfaces for real-time view and intervention

The real time intervention interface will allow trainers to observe and interact with trainees, virtual agents and the environment during the course of an exercise. It will facilitate the capability for trainers to further configure the scenario to ensure trainees will meet their specific training needs. The interface will provide the capability for trainers to observer specific trainees from multiple positions, including from the trainees’ perspective.

2.1.7 Interfaces for assessment and evaluation

The AUGGMED platform will feature a dynamic interface for presenting feedback on training performance. The interface will have different configurations to accommodate the dynamic and real-time feedback needs according to the distinct requirements of trainers and trainees. The interface will be configurable to allow trainers to tailor the types of performance metrics being presented to trainees. Trainers will also be able to assess trainee performance after the completion of a training session, to define ‘lessons learned’, and construct a new training programme that will aim to cover the ‘learning gaps’ in subsequent sessions. The platform will take the performance metrics and statistics recorded during training and present the data relevant to the intended learning objectives in an intuitive manner.
The interface for assessment and evaluation will enable trainers to review a single trainee’s or group’s performance. This tool will record generic metrics about the user's performance as well as a live recording of the exercise from each trainee’s perspective. The trainer will have access to historical information about individual trainees including previous recordings of their performance and recorded notes.

2.2 Development schedule

The AUGGMED project follows an iterative approach to development, at key design gateways the AUGGMED platform components will be piloted to obtain essential end user and technical capability feedback.

At these gateways the AUGGMED components will be evaluated in phased pilots to obtain critical user feedback and analysis of technical capability.

Work packages two, three and four will be staged at month nine sixteen and thirty. This will coincide with the development of the pilot delivery.

2.2.1 Work package two Automated Game Scenario Engine for Training

The objective of this work package is to design and develop an engine that will automatically generate game scenarios on-demand to suit the individual training needs of the first responders and security personnel. The engine will adapt the generated scenarios to the different levels of VR and MR environments while maximising the training objectives and learning outcomes.

- D2.1 Report on first version serious game (model, algorithms and software) [GEO] M9 February 2016
- D2.2 Report on second version serious game (model, algorithms and software) [GEO] M16 September 2016
- D2.3 Report on final version serious game model (model, algorithms and software) [GEO] M30 November 2018

2.2.2 Work package three VR and MR Environments

The objective of this work package is to design and develop the VR and MR environments that will be used to deliver the serious game to the end-user. The physical and behavioural modelling and technologies of the VR environments which will support the gaming platform will be developed in this work package. In addition, the framework for interfaces and devices allowing effective interaction between the end-user and the VR/MR environments will be developed here.

- D3.3 Report on the third version of the simulation environment [UOB] M30 November 2018
2.2.3 Work package four Trainer Tools

The objective of this work package is to design and develop the tools that will enable trainers to improve the training outcome for all personnel involved in training programmes. The objective of this work package is to design and develop the trainer tools that will allow trainers to access the functionality of game scenario generation. This will also define the interface between trainer requirements when defining training scenario and the games generated, the interface to a running training session and the trainer involvement, the interface to assess trainee performance and put in place training programmes for individual trainee as well as teams.

- D4.2 Software game scenario definition interface [SHU] M16 September 2016
- D4.3 Software refined game scenario definition interface [SHU] M30 November 2018

2.3 Development modes

AUGGMED will include modes which will allow first responders to actively participate in training sessions using VR or MR environment with different levels of immersion and engagement. These modes will be suitable for both single- and cooperative team-based training. In addition, trainees can be in the same or different physical location:

2.3.1 Mode 1: Basic Mode (Basic VR)

In this mode Training will be provided via basic VR, that is to say anywhere using PC and/or portable devices with limited interactivity (e.g., no mobility or tactile feedback). Trainees can be in the same or different physical location. Trainees can interact with virtual and real agents (with avatar) who join the training session remotely.

- Unity3D features in close collaboration with EXODUS
- Support for mobile devices running OS and desktop PCs
- Crowd controlled by Exodus moving in Unity.
- Unity agents interacting with the crowd (gestures, shooting and shoving through the crowd)
- Trainer mode with screen for basic configuration for scenarios
- Trainer can select different camera perspectives.
- Trainee mode for joining a scenario
- Training with PC running Windows
- Training with a portable device (convertible, laptop) running a full version of windows

This mode will be demonstrated and evaluated in pilot one in the UK.
2.3.2 Mode 2: Intermediate Mode (Immersive Multimodal VR)

In this mode, training will be provided via immersive multimodal VR, that is to say training can take place anywhere using immersive VR (e.g., HMD with limited mobility and tactile feedback). Trainees can be in the same or different physical location. Trainees can interact with virtual agents and avatars of real agents who join the training session remotely.

Training On-Site can be carried out using projection-based immersive VR (limited mobility and tactile feedback). Trainees can interact with virtual and real agents (with avatar) who join the training session remotely.

- Oculus Rift Unity3D integration
- Supporting VR view with Oculus rift connected to PC
- Further OS support depends on the AUGGMED complexity

This mode will be demonstrated and evaluated in pilot two in Spain.

2.3.3 Mode 3: Full Mode (Immersive Multimodal MR On-Site)

In this mode, training will be provided on-site using immersive MR (full mobility and advanced tactile feedback). Trainees can interact with simulated avatars as well as avatars controlled by other trainees who join the training session remotely.

- Waiting for new hardware developed within AUGGMED and integrated on time
- No value without precise indoor positioning

This mode will be demonstrated and evaluated in pilot three in Greece.
3. PILOT 1

3.1 Overview

Pilot one takes place in a UK non-designated airport which does not have armed police patrols. Police officers from the counter terrorism unit are stationed at the airport all year round on a twenty four hour rota. All the security for the airport is maintained by private security personnel.

The Airport sits at the heart of the City region and over 89% of passengers originate from that City Region. It provides short and medium haul services to in excess of one hundred thousand passengers a year to mainland Europe and within the UK it serves both business and leisure markets. The volume of passenger differs from month to month with peak periods between July to September. In this period 50% of the annual passenger numbers travel from this location. During the day there are two main waves of passenger movements, these fall between 04.00hrs and 09.00hrs with 40% of daily passenger departing, 10% between 09.30hrs and 12.00hrs, and 40% between 13.00hrs and 16.00hrs with finally 10% between 20.00hrs and 00.00hrs. Inbound flights are opposite with peak time being 09.30hrs and 12.00hrs and 20.00hrs and 00.00hrs. The monthly average of passenger vacillates throughout the year with passenger number between July to September being around 40,000, November to March around 20,000, and April to July around 40,000.

The Airport is linked by public service bus and train routes both locally and nationally.

3.2 Infrastructure

The passenger terminal building consists of one floor sectioned into functional areas. Check-in points are located in the main terminal area, where passengers can queue to check-in luggage and boarding passes can be issued. Passenger security check points are manned by security personnel and metal detectors and explosive detection equipment is used. Metal detector wands are also used and physical pat-down search can be also implemented by security staff.

Border force control is a function in the UK where only arrivals are checked. Travel documents (e.g. passport, visa etc.) are checked manually against the national warning index. Access past this point can be denied by border force officers who are able to detain the person attempting to gain entry. Transit passengers do not go to border control and pass onto the next flight without checks. However, if a person has no connecting flight and is trying to stay in the UK they can be issued with a transit visa and be put on a return flight to their country of origin. These people will be detained by border force control officers.

Both domestic and international arrivals come out onto the ground level after passengers have gone through the baggage reclaim area. Departure gate can also be found on this floor. There are toilet facilities, drinks machines, kiosks, shops and food facilities in this area.
3.3 Components for evaluation

Pilot 1 focuses on evaluating the Mode 1 style of user interaction. Mode 1 is based on 2D displays and interaction through desktop PC’s and mobile devices. The components for evaluation will include but not limited to high definition displays (including 4k screens), gamepads, Windows based tablets and laptops with varying degrees of processing power. The background networking and Unity to Exodus interfacing will also be evaluated in terms of user interaction latency and maximum population count movement updates that can be supported to maintain a suitable frame rate.

Pilot 1 will offer the most basic form of immersion and engagement. The VTE is provided by a basic VR system displayed on standard Windows tablets or PCs.

Pilot 1 takes place in an airport terminal. What will be evaluated, in terms of the contribution from UOG is the EXODUS simulation tool and its effectiveness as the backend of the AUGGMED system. Indirectly, SMARTFIRE is also tested as its results are used by EXODUS and Unity3D to represent the fire hazards within the VTE. More specifically the following list describes what will be tested during Pilot 1:

- The user is able to setup a scenario by selecting the geometry, the population and positioning of blue and red team members.
- Trainees, i.e. end-users are able to participate in the exercise from the same physical or remote locations
- Circulation behaviour of civilians within airport geometry
- Ability of red team, controlled by end-users, to enter the airport geometry, move freely within the structure, setup a fire and/or detonation
- Red team tries for maximum impact shooting at civilians or internal blue team members in the area
- Ability of blue team, controlled by end-users, to enter the airport geometry, move freely within the structure and intercept and eliminate (e.g. shoot) the red team members
- The blue and red team members should be able to issue commands to the civilians
- Trainers are able to influence the scenario by issuing commands to the trainees, initiate fires, close doors, etc.
- Ability to determine the impact of fire hazards on population i.e. civilians, blue and red team members and to accurately represent the fire within the Unity3D environment
- System is able to record and later replay the scenario played for debriefing purposes

Early mock-ups and designs for some of the trainer tools will be evaluated during the first pilot. These could include virtual reality, PC and mobile specific designs. Alongside this input methods will be evaluated (e.g., Leap Motion, Myo, Kinect) for some of the trainer tools to discover discrepancies in usability of the interfaces based on the input device and method.

Early testing of the cross-device usability will also be evaluated, these could include use with a VR headset, mobile or standard PC.

A mix of methods for quantitative and qualitative for data gathering will be used (e.g., questionnaires, usability testing, eye-tracking and biometric data such as Galvanic Skin Response). Evaluation measures will include, for example, task completion times, error rates,
and user-satisfaction rates. Study designs and specific user-tasks for testing will be developed closer to the date for the 2nd pilot.

3.4 Scenario storyboard

A terrorist cyber-attack on none designated International Airport where a security operating system allows free and open access between ‘landside’ and ‘airside’ parameters of the terminal building. This terrorist action is designed to allow the entry of armed terrorists to facilitate their access to the central control tower, with the objective of gaining command and control of air traffic control systems to cause a critical chain reaction, impacting upon the safety of international air traffic. Once entry has been facilitated by the cyber-attack, several cells of armed terrorists shall enter the terminal building, firing indiscriminately at citizens as they make their way to the control tower to gain control of the air traffic system.

Scenario Overview:
- 3 terrorists attack a regional airport without warning
- Each enters via a different doorway, discreetly leaving a medium-sized bag containing explosives in the vicinity of the doorway
- Terrorists enter the check-in area and begin shooting passengers using assault rifles and handguns
- As passengers head towards the doors in an attempt to escape, the explosives are detonated, causing additional casualties and partially blocking the entrances
- Terrorists disperse into different parts of the airport building & continue to attack passengers & staff

Immediate Consequences:
- Many fatalities. High proportion of serious injuries & walking wounded
- Some ‘blue’ team members caught up in initial attack and either killed or injured
- Many of those uninjured suffering major stress reactions; not capable of rational response
- Limited structural damage to airport building fabric, but extensive debris spread, many shard / shrapnel injuries, hazardous environment and restricted access to the building
- Outbreak of fire as a result of the explosions; threat to life from heat & smoke
- Loss of some utility services as a result of the explosions
- Survivors begin to send images & messages via social media
- No immediate instructions given to suspend airport operations
- Number of casualties continues to increase rapidly
3.5 Partner roles

Due to the long duration of the project and the planning process the identification of which partners will attend and their roles and responsibilities will be added in January 2016. This will include logistics planning, equipment, personnel and venue.

3.6 End Users

The following end users are expected to participate in pilot 1:

- Firearm training Sergeant
- Firearm training Police Constable
- Authorised Firearms Officer (AFO) Sergeant
- Authorised Firearms Officer (AFO) Police Constable

3.7 Ethical considerations

As outlined in D.8.3.1 and D.8.3.2, as appropriate ethical reviews and approvals will be put into place before conducting the Pilots. Ethical considerations will include those relevant to conducting evaluations with humans, data gathering, storing and sharing with confidentiality and anonymity, as well as the scientific soundness of the pilot designs and data analysis.

3.8 Schedule

The following schedule based on the project Description of Action (DoA) Gantt is proposed for pilot 1. The schedule includes a list of pilot tasks with a weekly breakdown. Exact dates within the week periods will be decided nearer to the time to take into account operational constraints of the project partners involved.

![Figure 3 : Pilot 1 schedule](image)

3.9 Evaluation criteria

Relevant KPIs from D1.3 will be identified by key partners and included as an annex
3.10 Expected outputs

Expected outputs will include the achievement of the relevant KPIs identified in D1.3 and inputs to the next design phase. This will be expanded on in an annex update to this report.
4. PILOT 2

4.1 Overview

Pilot two takes place in a Spanish underground railway station where the operator is responsible for a network of 293 km of track with 97 stations, carrying over 80 million passengers annually with a fleet of 86 trains.

The two main stations are located in a city and the surrounding areas. One part of the infrastructure is underground, specifically 15 km from City One and 10km from City Two. The third line connects the cities and has 17 stations, 41 tunnels and 31 bridges. The terminal station is at the heart of the city one with more than 11 million passengers. The other terminal station is also at the heart of the city two with 5 million passengers.

4.2 Infrastructure

City rail network

The passenger terminal building in city one is laid out over two levels, with two main station entrances. On the ground level can be found the ticket machines and the control barriers to access the underground floor one for each station entrance, where can be found 5 platforms. Approximately 1,200 trains arrive and depart from this station every day between 5:00 a.m. and 2:00 a.m. next day. There are toilet facilities, drinks machines and kiosks in this area.

The ground floor can be accessed by mechanical escalator and lift. This is where catering facilities can be found. City two station has a similar plan to City one.

The issue of protection of passengers, material and rolling stock assets and, of course, of human resources is a fundamental part of the responsibility of the rail network provider.

The security of railways and all its assets is very difficult to protect. By their characteristics i.e. high volume of passengers, open spaces, easy accessibility, underground environments and valuable assets in remote sites, railway security measures are low tech and mainly rely on physical barriers, railway personnel and Closed Circuit Television (CCTV).

Many stations are open plan and easy to access on foot. The rail provider introduced its central headquarters. The Integrated Control Centre (ICC) controls the circulation of both city lines and supervises the stations’ operation and the CCTV control system. There is also more than 1,700 CCTV cameras on the interior of stations and trains.

4.3 Components for evaluation

Pilot 2 focuses on evaluating the Mode 2 style of user interaction. Mode 2 is based on head mounted displays with limited user mobility and feedback. The components for evaluation will fall into three categories: head mounted displays (Oculus DK2, Google Cardboard VR variants, Open-Source Virtual Reality (OSVR)), hand and basic body tracking (Perception neuron, Leap, Optitrack v120) and basic tactile feedback (KOR-FX Gaming Vest). The Unity to Exodus interface developed in pilot 1 will be extended to include additional user commands and methods for optimisation or layers of interpolation to support the greater need for a smooth low latency user experience required for head mounted displays.

Pilot 2 will offer the intermediate form of immersion and engagement. The VTE is provided by an immersive multimodal VR system where users enter the VR world through a Head Mounted Display (HMD) system. Optionally, users can view the VTE through standard PCs.
too, a useful function for trainers. Pilot 2 takes place in a rail terminal. What will be evaluated, in terms of the contribution from UOG is the EXODUS simulation tool and its effectiveness as the backend of the AUGGMED system. More specifically the following list describes what will be tested during Pilot 2:

- The user is able to setup a scenario by selecting the geometry, the population and positioning of blue and red team members. Trainees, i.e. end-users are able to participate in the exercise from the same physical or remote locations.
- Circulation behaviour of civilians within the rail terminal.
- Ability of blue team, controlled by end-users, to enter the rail terminal geometry, move freely within the structure, intercept any the red team members located within the terminal.
- The blue team members should be able to issue commands to the civilians.
- Blue team members wear vests that simulate bullet impact this information is imported from Unity3D to create a more immersive environment.
- Trainers are able to influence the scenario by issuing commands to the trainees, initiate fires, close doors, etc.
- System is able to record and later replay the scenario played for debriefing purposes.
- Sheffield Hallam University (SHU):

The 2nd iteration of all the Trainer Tools: configuration interface, real-time view and intervention interface and the interface for assessment and evaluation. The prototypes with some functional features will be evaluated using a mix of methods for quantitative and qualitative for data gathering (e.g., questionnaires, usability testing, eye-tracking and biometric data such as Galvanic Skin Response). Evaluation measures will include, for example, task completion times, error rates, and user-satisfaction rates. Study designs and specific user-tasks for testing will be developed closer to the date for the 2nd pilot.

4.4 Scenario storyboard

Storyboard one takes place at City one station where the Control Centre (ICC) receives a phone call from a known terrorist organisation claiming a bomb has been left on a train. The train identified is due to arrive at the underground station within the next fifteen minutes. The station must be evacuated before the train arrives to allow for better containment and management of the incident.

Steps
- Control centre informs station employees that all passengers must be evacuated from the station.
- Activated the alert level 5.

Storyboard two takes place at ‘City two’ station where a train has stopped in the underground station on platform three as scheduled. Passengers begin to disembark and embark the train. Explosive packages left in carriages A and F detonate leaving multiple fatalities and a high proportion of serious injuries & walking wounded. The ICC has lost the control over the CCTV system and does not receive any images.
Steps

- In accordance with the manual of communications and incidents, the ICC informs the police about the incident.
- ICC starts the self-protection plan approved by Civil Protection Department.
- ICC activates the forced ventilation system using the correct strategy according the standard process.

The police and medical services must attend on platform 3, but there is a lot of confusion and they do not know the direct way to the platform. The station staff explain to them how they can access platform one and risk assess the incident. Casualty evacuation begins.

**4.5 Partner roles**

Due to the long duration of the project and the planning process the identification of which partners will attend and their roles and responsibilities will be added as the project progresses. This will include logistics planning, equipment, personnel and venue.

**4.6 End users**

**Ferrocarrils de la Generalitat de Catalunya (FGC) main persons involved are:**

- **Operation Director.**
  - Responsible for the train and stations operation. Also manages de Control Centre.
  - Director of infrastructure.
  - Responsible for the determination of the critical infrastructures and its control.

- **Safety manager.**
  - Responsible for the railway security and coordination with the police

- **Director of Prevention.**
  - Responsible for the training process, design, contents of training and emergency drills

- **Manager civil protection.**
  - Responsible for the coordination with the Government regarding the self-protection plans

**FGC operations/stations staff**

**Sistemes D'Emergencies Mediques (SEM) persons involved are:**

- **Physician**
  - Communications, evacuation chain, advanced triage, basic triage, allocating AMP

- **Nurse**
  - Communications, evacuation chain, advanced triage, basic triage, allocating AMP

- **Technician**
  - Basic triage, victims ID, evacuation chain to AMP

- **Trainer/silver**
4.7 Ethical considerations

As outlined in D.8.3.1 and D.8.3.2, appropriate ethical reviews and approvals will be put into place before conducting the Pilots. Ethical considerations will include those relevant
1) Conducting evaluations with humans,
2) Data gathering, storing and sharing with confidentiality and anonymity, as well as
3) The scientific soundness of the pilot designs and data analysis.

4.8 Schedule

The following schedule based on the project DoA Gantt is proposed for pilot 2. The schedule includes a list of pilot tasks with a weekly breakdown. Exact dates within the week periods will be decided nearer to the time to take into account operational constraints of the project partners involved.

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre pilot site visit</td>
<td>1-2</td>
</tr>
<tr>
<td>Refinement of pilot plans</td>
<td>2-3</td>
</tr>
<tr>
<td>Pre pilot technical meeting</td>
<td>3-4</td>
</tr>
<tr>
<td>Pilot scenario meeting with end users and trainers</td>
<td>4-5</td>
</tr>
<tr>
<td>Installation and set up</td>
<td>5-6</td>
</tr>
<tr>
<td>Pilot run</td>
<td>6-7</td>
</tr>
<tr>
<td>End user evaluation and feedback</td>
<td>7-8</td>
</tr>
<tr>
<td>Technical wash-up, revision for design phase and dissemination of results</td>
<td>8-10</td>
</tr>
</tbody>
</table>

Figure 4 : Pilot 2 Schedule

4.9 Evaluation criteria

Relevant KPIs from D1.3 will be identified by key partners and included as an annex

4.10 Expected outputs

Expected outputs will include the achievement of the relevant KPIs identified in D1.3 and inputs to the next design phase. This will be expanded on in an annex update to this report.
5. PILOT 3

5.1 Overview

Pilot three takes place at an international seaport which is a destination for passenger cruise ships in the Mediterranean Sea. It is the largest passenger port in Europe and one of the largest passenger ports in the world with a total passenger traffic of 18,635,495 a year. It has 11 places for the simultaneous berthing of cruise vessels and can accommodate even the largest cruise ships.

The cruise terminal has two buildings laid over one level.

- CRUISE PASSENGER TERMINAL A
- CRUISE PASSENGER TERMINAL B

Each building has two main areas. One is for the departure and one for the arrivals.

5.2 Infrastructure

The arrivals passenger security check points are manned and metal detectors and x-ray equipment are used to examine baggage and items that are carried by passengers. Metal detector wands are used and physical pat-down search can be also implemented by security staff.

Travel documents (e.g. passport, visa etc.) are checked manually. Access past this point can be denied and port security officers would detain the person attempting to gain entry.

There are passenger services including duty free shops, Tourist Police, Customs Offices and other essential services in this area. Nearby there is an open parking area for tourist coaches, while the transportation of passengers from the anchoring areas to the Passenger Terminal is provided by bus and rail services. Also outside the terminal is a short stay pick up area.

The passenger terminal provides two separate halls – one for arrivals and one for departures.

5.3 Components for evaluation

Pilot 3 focuses on evaluating the Mode 3 style of user interaction. Mode 3 aims for full body tracking and advanced tactile feedback. The components under evaluations are much the same as pilot 2 with the additional requirement of a full body tracking rig (Optitrack camera capture system), video cameras capable of providing a real world view to the user in which data can be overlaid (Xemia IQx, OVR vision) and tactile feedback gun (Delta Six) and vest.

The evaluation will also address the practicality of using large scale motion tracking and augmented reality systems in the real world. The weight of equipment that the user is required to wear and the transmission of control signals over longer distances will be factors that will have to be evaluated along with the system's ability to maintain reliable body tracking in larger and crowded spaces.

Pilot 3 will offer the most advanced form of immersion and engagement. The VTE is provided by a Mixed Reality (MR) system where users enter the actual real pilot structure and the simulated civilian agents are projected through a Head Mounted Display (HMD) worn by the users. Optionally, the users can view the VTE through standard PCs too, a
useful function for trainers. Pilot 3 takes place in an actual port terminal. What will be evaluated, in terms of the contribution from UOG is the EXODUS simulation tool and its effectiveness as the backend of the AUGGMED system. More specifically the following list describes what will be tested during Pilot 3:

- The user is able to setup a scenario by selecting the geometry, the population and positioning of blue and red team members.
- Trainees, i.e. end-users participate in the exercise within the actual physical location i.e. the port terminal
- Circulation behaviour of civilians within the port terminal is simulated and projected through HMDs
- Red team enters the structure and tries for maximum impact shooting at civilians or internal blue team members in the area causing injuries and fatalities
- Blue team enters the port terminal and attempts to intercept and eliminate the red team members
- The blue team members should be able to issue commands to the civilians
- Blue team members wear vests that simulate bullet impact, this information is imported from Unity3D to create a more immersive environment
- Trainers are able to influence the scenario by issuing commands to the trainees, initiate fires, close doors, etc.
- System is able to record and later replay the scenario played for debriefing purposes

The 3rd iteration of all the Trainer Tools: configuration interface, real-time view and intervention interface and the interface for assessment and evaluation. The prototypes with all functional features will be evaluated using a mix of methods for quantitative and qualitative for data gathering (e.g., questionnaires, usability testing, eye-tracking and biometric data such as Galvanic Skin Response). Evaluation measures will include, for example, task completion times, error rates, and user-satisfaction rates. Study designs and specific user-tasks for testing will be developed closer to the date for the 3rd pilot.

5.4 Scenario storyboard

A car full of explosives and armed bombers passes through the barriers of the cruise terminal entrance without stopping for checking and heads towards a cruise ship, where passengers are walking and entering the ship. The armed bombers get out from the car and begin to shoot. The Special Forces are notified and all emergency services involved for management of the incident (fire brigade, ambulances etc.)

During this incident the port authorities implement crisis management procedure. Once the Coast Guard Special Forces attend they take control of the incident.

5.5 Partner roles

Due to the long duration of the project and the planning process the identification of which partners will attend and their roles and responsibilities will be added as the project progresses. This will include logistics planning, equipment, personnel and venue.
5.6 End Users

Due to the long duration of the project the staff will be identified by roles and ranks in an annex.

5.7 Ethical considerations

As outlined in D.8.3.1 and D.8.3.2, as appropriate ethical reviews and approvals will be put into place before conducting the Pilots. Ethical considerations will include those relevant 1) conducting evaluations with humans, 2) data gathering, storing and sharing with confidentiality and anonymity, as well as 3) the scientific soundness of the pilot designs and data analysis.

5.8 Schedule

The following schedule based on the project DoA Gantt is proposed for pilot 3. The schedule includes a list of pilot tasks with a weekly breakdown. Exact dates within the week periods will be decided nearer to the time to take into account operational constraints of the project partners involved.

![Figure 5: Pilot 3 Schedule](image)

5.9 Evaluation criteria

Relevant KPIs from D1.3 will be identified by key partners and included as an annex.

5.10 Expected outputs

Expected outputs will include the achievement of the relevant KPIs identified in D1.3 and inputs to the next design phase. This will be expanded on in an annex update to this report.
6. CONCLUSIONS

This report brings together and identifies the pilot sites, components and the mode that will be tested at each stage. An evaluation of the end users feedback will inform the further development of AUGGMED before the beginning of the next pilot. This report lays out the key design gateways of Work packages two, three and four that will start in December 2015 to be completed before January 2016.

The first pilot is scheduled to begin between April to May 2016 and will be held in the UK.

The following two other pilots are scheduled for November to March 2017 held in Spain and Dec to March 2018 held in Greece.

Due to the long duration of the project and the planning process other relevant information will be added as the project progresses. This will include logistics planning, equipment, personnel and venue.
7. ANNEX – PILOT PLAN UPDATE

In this section the detailed pilot plans will be added which will include logistics planning, equipment, personnel, additional details regarding the pilot venues and feedback from the previous pilots where appropriate.