

# AF3

## Advanced Forest Fire Fighting

### D5.3.1 – Training methodologies specification

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## ABBREVIATIONS AND ACRONYMS

ABBREVIATION / ACRONYM	DESCRIPTION
VTE	Virtual Training Environment
UME	Emergency Military Unit (Spain)
DOS	Director of Operations
ASA	Advanced Situation Awareness
HMD	Head Mounted Displays
AAR	After-Action-Review

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## 1. SCOPE

**AF3** project proposes the **creation of a multi environment training methodology** for improving the new training needs and current skills of both first responders and commanders who participate in the AF3 final exercise.

This improvement will be achieved by **providing to the target end users the AF3 new training tools and realistic scenarios in two different Virtual Training Environments (VTE) and a Real Training Environments (RVE)**, for being capable of using AF3 system new features. In addition, AF3 will **develop innovative training curricula according to the new training needs expressed by the end users** for managing the new AF3 features and procedures.

These **innovative training curricula will be composed by several combinations of different scenarios played in some of the three Training Environments** proposed by AF3 training methodology. This way the end users' skill acquisition and practice for managing new AF3 features will be improved for facing new situations in a more realistic manner.

## 2. TENTATIVE TRAINING TARGET PROFILES

### 2.1 TENTATIVE TARGET PROFILES

The main potential actors to be trained (target profiles) in AF3 will be classified into five overall categories according to the end users participants in the project: basic-skilled positions, basic command-chain positions, middle range positions, high range positions, and observation, communication and dispatch positions.

Some of the members of these five target categories, those involved in the AF3 final exercise, will be trained with the training *curricula* and training material developed in T5.3.2 and the training tools selected in T5.3.3. Each *curriculum* developed will be designed for teaching the new advantages provided by AF3 to the selected fire fighting members. Table 1 includes some examples about personnel categories, target profiles and skills to be improved.

**Table 1 End users potential categories for being trained in AF3**

CATEGORY ROLE	TARGET	SKILLS
Type 1 Basic skills Crewmember/firefighter positions	Helitack specialist Brigade specialist Engine operator Heavy Machinery operator UME troop member	Fire suppression methods Fire behavior assessment Team working Firefighting tools use and care Proceedings and protocols
Type 2. Basic command-chain positions Senior firefighter/Squad boss/ Leader/ Low range/ Leading role	Brigade Foreman Helitack foreman Helitack pilot Aircraft pilot Helicopter pilot Engine foreman	Fire suppression methods Fire behavior assessment Firefighting task planning and assessment Firefighting resources coordination Proceedings and protocols Team management Tools and equipment maintenance and control Radio Mapping and guidance Safety management Information interpretation

Type 3 Chief/Captain/ Middle range	Helitack chief Brigade chief UME official Chief of firemen brigade	Fire suppression methods Fire behavior assessment Firefighting task planning and assessment Firefighting resources coordination Information generation and interpretation Team(s) management Radio Safety management
Type 4 Commander / Decision maker/ High range	Director of Operations DOS Assistant Air coordinator	Fire behavior assessment Decision making Inter-teams management Operations planning Firefighting resources coordination Data & information generation and processing Radio Safety management
Type 5 Communications and resources dispatchment, meteo, technical support	Lookout observer Members of mobile units for communication and weather observation Operational center officer	Radio Data & information generation and processing Firefighting resources coordination

For the selected profiles there are three different types of training environments to be used depending on the concrete AF3 capabilities to be trained.

## 2.2 DEMANDED SKILLS

**Use case1 (Proposed by TRAGSA): Virtual training on basic skills required for firefighter and crew member positions.**

**Aim:** to train firefighting crew on firefighting tasks in emergency situations. Develop a safe and operational work in cooperation with the rest of the team. Understand fire behavior, and be able to assess fire spread, and risk circumstances for a safe and efficient performance of fire suppression tasks. Understand and correctly use the terminology used in firefighting operations, transmit commands and alerts adequately. Safe use and maintenance of tools and safe application of attack methods with different resources (handtools, heavy equipment, air support, fire management).

**Target:** Helitack specialist, Brigade specialist, Fireman, Engine operator, Heavy Machinery operator, Spanish UME troop member.

### Training content:

- Fire suppression methods
- Fire behavior assessment
- Team working
- Firefighting tools use and care
- Proceedings and protocols
- Prevention of occupational risks

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### **Use case 2 (Proposed by TRAGSA): Virtual training for basic command-chain positions.**

**Aim:** to train on organizing, controlling, and supervising fire fighting tasks. Give support in the operations within the team: adequate allocation of tasks, positions and tools for the efficient and safe performance of work. Train on the use of radio and communications. Be able to interpret information such as maps and weather forecast. Transmit commands, alerts adequately.

**Target:** Brigade Foreman, Helitack foreman, Helitack pilot, Aircraft pilot, Helicopter pilot, Engine foreman.

#### **Training content:**

- Fire suppression methods
- Fire behavior assessment
- Firefighting task planning and assessment
- Firefighting resources coordination
- Proceedings and protocols
- Team management
- Tools and equipment maintenance and control
- Radio
- Mapping and guidance
- Safety management
- Information interpretation

### **Use case 3 (Proposed by TRAGSA): Virtual training for intermediate command-chain positions.**

**Aim:** to train on further team management, supervision and support. Develop decision making capabilities. Be able to plan tasks and assign them to crew members and teams. Coordinate and assign objectives to teams or units in a safe way. Complete an attack plan: reconnaissance, assessment and planning, and coherently establish strategy, tactics, and schedule. Lead the fire fighting tasks of units under his/her responsibility (ground brigades, helitacks, aircrafts, machinery teams, engines, etc). Estimate the performance of on-going fire suppression tasks, formulate alternative plans, and request additional resources, if required. Provide relevant accurate information to the Director of Operation and Operational Center when needed.

**Target:** Helitack chief, Brigade chief, Spanish UME official, chief of firemen brigade.

#### **Training content:**

- Fire suppression methods
- Fire behavior assessment
- Firefighting task planning and assessment
- Firefighting resources coordination
- Proceedings and protocols
- Information generation and interpretation
- Team(s) management
- Radio
- Mapping and guidance
- Safety management
- Information interpretation

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#### **Use case 4: Virtual training for high command-chain positions.**

**Aim:** to train on planning design, decision making, and management of teams and resources. Analyze and communicate relevant data and information. Operate radio communications with air and ground units to coordinate them and assign objectives. Mobilize units to the fire scenario and in the scenario.

**Target:** Director of Operations, Assistant of the DOS (logistics, communication, sector boss), Air coordinator

##### **Training content:**

- Fire behavior assessment
- Decision making
- Inter-teams management
- Operations planning
- Firefighting resources coordination
- Data & information generation and processing
- Radio
- Safety management

#### **Use case 5: Virtual training on detection and alert, communications and resources dispatchment positions.**

**Aim:** Train on communication, logistics and other support task skills involved in firefighting from operational centers and fire prevention infrastructure.

**Target:** Watchtower observer, members of mobile units for communication and weather observation, operational center officer.

##### **Training content:**

- Radio
- Fire behaviour and fire spread assessment
- Mapping and guidance
- Location, availability and capacities of fire fighting resources (response times, etc)
- Data & information generation and processing
- Firefighting resources coordination

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### **3. MULTI-ENVIRONMENT TRAINING METHODOLOGY**

The AF3 multi-environment training methodology follows an end user approach. The consortium end users will define what members will participate in the AF3 final exercise during T5.3.2. Each selected member will be trained in some of the training environments stated in the methodology in order to be able to use the AF3 features during this final exercise.

This list of skills/training necessities (Use cases) expressed by the end users will be the main guide for building the **multi environment AF3 training methodology**. This will ensure that the training methodology results are both useful and usable by the target end users.

In order to cover the different skills/training necessities stated by the end users, different virtual training scenarios will be defined (one scenario could cover or address more than one skills/training necessities).

Once the scenarios are defined they will be adapted to train the new AF3 features and the different interactive training tools and interfaces will be adjusted for use in the interactive AF3 training environments.

In addition, the consortium will develop several tailored training curricula and training material for helping the end users in their training process for using AF3 system. Each training curricula will be composed by several training subjects with their corresponding scenario played in some of the different interactive AF3 VTE in order to optimize the learning process according to the skill to be trained.

At the end of this process, AF3 will offer to the end users a complete set of training curricula for covering their training needs for managing AF3 system, along with a multi-environment training methodology for performing the necessary training and evaluation beyond their current training capabilities.

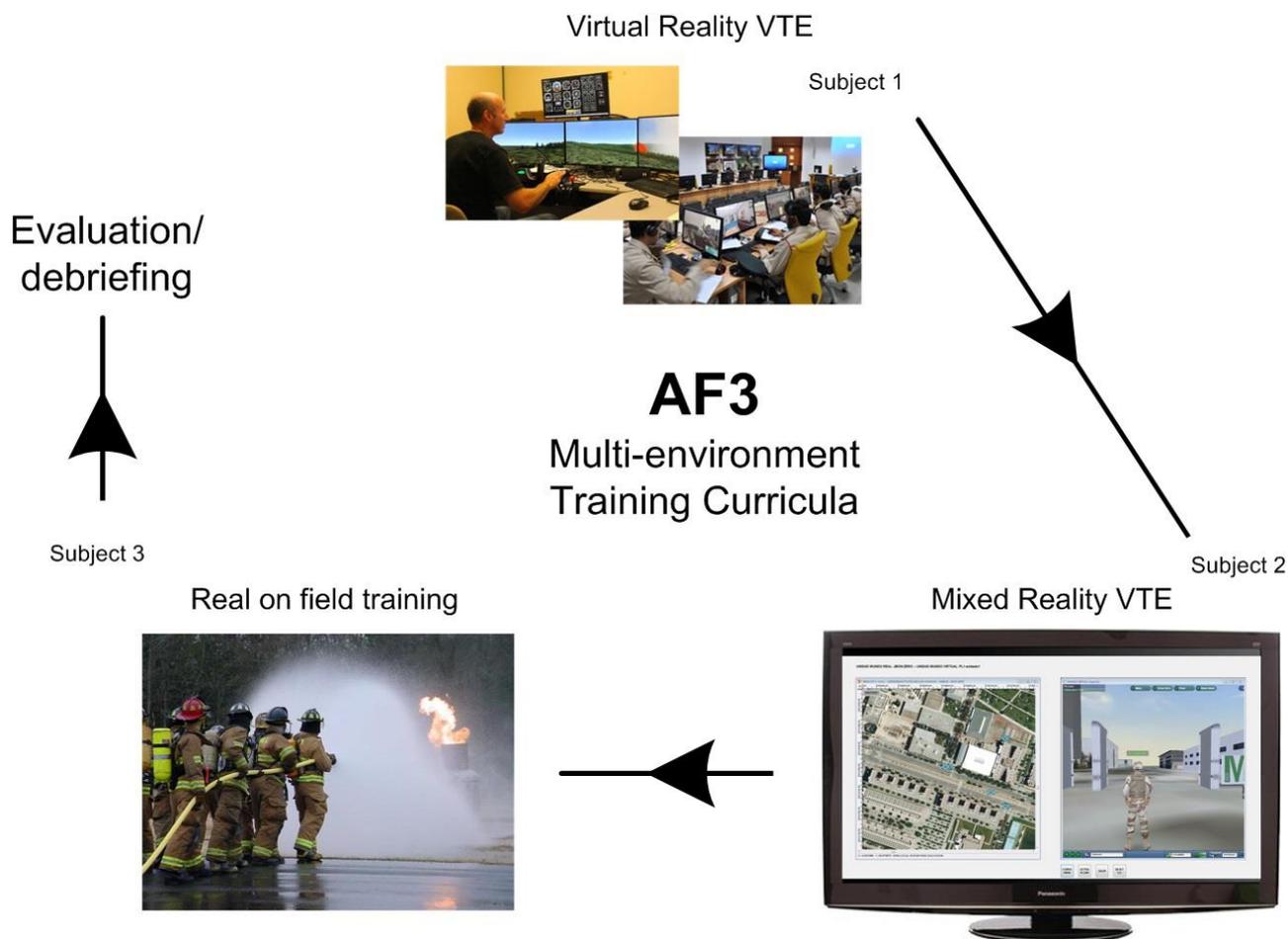
**The AF3 training curricula will be developed and also tailored for covering the skill/training needs stated by the end users who participate in the AF3 final exercise.** The AF3 training curricula will be composed by suitable combinations of subjects (learning pieces supported in a determined training environment) depending on the skills to be trained. Each subject will be trained in one of the VTEs that the AF3 methodology will provide.

In Figure 1, a generic example of the AF3 multi-environment training methodology is applied to the performance of a curricula composed by several subjects.

As can be seen in the figure, each subject that composes this curriculum will be trained in a different VTE in order to make the example more generic and understandable.

In this example, the trainee will perform his/her first subject in a virtual environment where a concrete situation/scenario has to be solved; the second one will be performed in a mixed reality VTE along with other trainees deployed in the real world and its final subject will be performed in a real training environment using AF3 Advanced Situation Awareness (ASA) tools and equipment.

Finally the training process is evaluated and a debriefing on the training curricula results is performed.



**Figure 1 AF3 generic training curricula example**

Once the trainee has passed all subjects of his/her training curricula the training process will be evaluated in order to verify that the skill has improved. After-Action-Review (AAR) methodologies and tools that support the AAR process will be used to capture how the operation plan was followed with a focus on mission goals, tasks and responsibilities, performed tasks, etc. Debriefing sessions will complement this evaluation.

Other potential curricula developed in AF3 might use a different number of subjects and/or training environments. The design and development of the AF3 multi-environment training curricula will be adjusted in terms of the number of subjects that compose the curricula and virtual training environments used to ensure improvement of each specific skill.

The different training environments proposed by AF3 for covering the above mentioned end user training needs and the foreseen AAR activities are listed in the sections below.

### 3.1 ON-FIELD TRAINING

Training on-field (see Figure 1) is critical for some of the AF3 target end users who will participate in the final exercise such as; firemen brigades commanders or brigade members. AF3 proposes the use of advanced situation awareness tools and equipment in order to provide these end users with an enriched experience that leads to new training scenarios beyond the ones currently used in their training.



**Figure 2 On-field training environment.**

With the on-field training the units deployed will be able to face real scenarios representing complex situations such as;

- To train different kind of coordinated deployments/formations and firemen groups mobility when facing a large wild fire.
- To train the response to command orders, which imply the coordinate movement of several firemen or brigades.

By using this on-field real training environment a reduced number of firemen along with a commander (if necessary) can train a complex scenario/exercise in an outdoor training facility using the whole personal equipment/ASA applications provided by AF3.

This real training environment would be linked with WP5.2 and WP6.3 activities.

### 3.2 MIXED-REALITY TRAINING

Many times training a large number of units deployed in the field in large-scale exercises or threat management simulations is very expensive in terms of economy and logistics. These kinds of exercises involve several agencies consisting mainly of first responders (e.g. fire brigades and police units), including a large deployment of vehicles and equipment. For this reason these large and complex training exercises can be performed only once or twice a year as a maximum.

For covering this clear training gap stated by some of the end users participant in the consortium, AF3 proposes a mixed-reality training tool. Through this tool a large number of units (including brigade members and decision makers for agencies from different countries) will be able to train virtually with a reduced number of real units deployed on the field playing the same scenario.



**Figure 3 Mixed reality training environment**

Figure 2 shows a representation of this mixed-reality environment where a large number of units in lab manages their own avatars and virtual vehicles and/or devices to train together with a reduced number of real units deployed in the field using their real sensors and devices. In addition, decision makers will be able to train operation coordination in the same scenario.

On-field units will be seen as avatars by in-lab training units and the avatars managed by the units in the lab will be represented through augmented reality techniques in the on-field deployed units Head Mounted Displays (HMD). This way all units will be able to train large scale disaster scenario(s), coordinated maneuvers of large number of units and so on several times over, with a significant reduction of costs.

This virtual training environment would be linked with WP33 activities.

### 3.3 VIRTUAL TRAINING

Some of the parts of the training performed during AF3 will be done in an in-lab virtual training environment (VTE), where either individuals or cooperative teams will be able to face the specific game-based assessment and learning scenario(s) generated within this VTE, depending largely on the specific skill (set) that needs to be trained. An example of in-lab VTE can be seen in Figure 5, where first responder team along with a aircraft pilot held a virtual training session



**Figure 4 Virtual training in lab**

This VTE will be based on a single virtual environment composed by different training tools, which could be used as a stand-alone solution or in an integrated way depending on the training performed. Its purpose is to train first responder commanders, fire brigades and extinction teams members and aircraft pilots on operational and tactical levels. Some of the tools that form the in-lab VTE are the following:

Flight simulators (VIR3X) oriented to firefighting aerial assets, where pilots can develop their work through highly loyal reproduced command consoles. A decision support tool: This tool will assist the in-game decision-maker (player) by providing “rational” advice based on actors, actions, and utility theory. This decision support tool should help the decision-maker to list actors, potential courses of action, possible outcomes, and their associated probabilities. The tool will also allow trainees to experiment with various dynamic decision-making strategies allowing for multiple outcomes and various performance assessments for feedback. This tool would be linked with WP5.2 activities

A situation awareness tool (SIMTAC): Through this tool the decision makers could be trained in complex virtual scenarios in which the coordination of large number of units, the decision making process, along with a quick response to events/changes in the situation are critical. This tool will be potentially capable of using multiple simulation engines to simulate various technical, physical or social phenomena. The decisions taken by trainees will have impact on the dynamics of events simulated by simulation engines, but these engines will be also capable to run in no-wait mode, where results of lack of decision or late decision can be also simulated. This tool would be linked with WP5.2 and WP3.3 activities

A firefighting simulator (EMERCATO) oriented to firefighters covering the roles included in the whole command chain of generic forest fire emergency plans (focused in the extinction Group). Through the simulator, trainees perform previously assigned roles according to curricula, being obliged to put in practice all the skills (communication skills, command transmission, safety protocols, etc) required to fulfill the subject goals of each one. The simulator will be easily and quickly accessible for trainees, who will be able to attend the training actions from their own work premises or minimizing long travels. High spatial resolution of the scenarios, high levels of interaction between trainees, scenario, fire and extinction measures, escalability, tailored interfaces, are foreseen as starting fundamental requirements too. This tool would be linked with WP5.2 and WP3.3 activities.

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### 3.4 AFTER-ACTION-REVIEW ACTIVITIES

After-Action-Review methodologies and tools that support the AAR process will be used to capture how the operation plan was followed with a focus on mission goals, tasks and responsibilities, performed tasks, etc. The goal is to connect the AAR process to high-level concepts such as command spaces, resilience, and agility. The AAR tool should be based on the data logged by the decision support and monitoring tool developed in WP 5.2.

The After-Action-Review methodologies should be based on quantitative data from the information logged in the monitoring tool and on qualitative data obtained through questionnaires.

The After-Action-Review tool should capture aspects concerning:

- Mission goals
- Tasks and responsibilities
- Performed tasks

The After-Action-Review questionnaires should capture aspects concerning:

- The used command spaces
- How to increase resilience, and agility

The AAR support will be based on the operation plan, mission analysis performed in WP 2, and the training scenario. One important goal with the high level AAR support is catch if the commanders have the necessary knowledge and skill to command and control the new fire fighting organization and needed strategies. The high level AAR questioners should also catch information that supports future preparedness and mitigation phases of a crisis situation. The goal is that the AAR support should be able to be used in the real system and in the online virtual training.

## 4. TRAINING SCHEDULE

In order to perform the AF3 training schedule for providing the necessary curricula to the fire fighting services members at the end of the project the following factors have to be taken into account:

- Training methodology completed (Month 8)
- Training scenarios and training material completed (Month 30)
- Training tools selected (Month 36)
- Training centre operative (Month 28)

In addition, training the different categories of end users participants in the final AF3 demonstration pilots have to be finished before these events (Month 36).

With all these factors in mind the training workshops and sessions cannot start before month 24 in order to have enough training material, the scenarios, the curricula and the different training tools almost ready.

On the other hand, the number of online/virtual training sessions will depend on the virtual training subjects that compose the training curricula of the different categories of end users. For example, a fireman can have only one virtual training subject in his/her curricula and three live training subjects and an operations commander can have all the subjects of his/her curricula in a virtual training environment.

Taking into account all the factors listed above, the schedule of AF3 end user training would be as follows:

1. Training workshops in each AF3 pilot for describing the training process the end users (tools, curricula, training material available, etc) (Month 25)
2. Virtual training tools for all end users categories ready (Month 26):
  - basic-skilled positions,
  - basic command-chain positions,
  - middle range positions,
  - high range positions
  - observation, communication and dispatch positions
3. AF3 advanced distributed learning (ADL) platform ready (Month 26)
4. Workshops for real training in all AF3 pilot sites, including AAR (Month 30, 33)



**Figure 5 AF3 training schedule**

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During the two scheduled training workshop a complete team of fire fighting members (from brigades to commanders) belongs to the end users partners of AF3 will train a complete scenario in order to prepare better their participation in the AF3 final exercise.

#### **4.1 TRAINING MENTOR**

Each pilot site will appoint a training mentor who will be available through e-mail, chat, or phone depending on the ADL platform capabilities, for helping and motivating the end users for improving their training with all AF3 training tools available. In addition if some training tool needs additional mentoring an ad hoc mentor could be appointed for supporting the end users.

The mentor will publish his/her availability in order to be able to help the trainees with their doubts or problems with the subjects of their curricula and the use of the training tools.

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## 5. CONCLUSIONS

This document encompasses the training methodology that will be used in AF3 project for training the different kind of end users categories that will participate in the AF3 final exercise according to the selection made by the AF3 end users partners.

This training methodology will be taken into account in both Task 5.3.2 when the training contents and project scenarios are developed and Task 5.3.3 when the different training tools that will be used in AF3 are selected.

In addition, in this deliverable the AF3 training scheduled has been described taking into account all tasks and factors that could affect the mentioned schedule. This schedule includes the distributed virtual training period, the real training workshops (including also mixed reality training). With the scheduled training the end users participants in the AF3 final exercise will be able to use the new features developed during AF3 demonstrating its effectiveness.