Italian Ministry of Defence

Defence General Staff

Joint CBRN Defence School

67th Course of the

Advanced Radiation Protection School "Carlo Polvani"

The Use of New Technologies in E&T

A joint AIRP-EUTERP train-the-trainer event in collaboration with Politecnico di Milano

Milano, June 24-27, 2025

A "Study, Design, Building and Deployment of a CBRN XR Training Platform" experience…

Background and training relevance

- The findings of the “Long-Term Scientific Study on CBRN Defence” highlight an **evolving and increasingly complex CBRN threat** landscape.
- The LTSS highlights that **no VR military applications** have been so far specifically **dedicated to CBRN Education & Training (E&T)**.
- XR and AI are considered among the **most important developments** for training and simulation.

The added value of Extended Reality for CBRN Training

- Reduced **environmental burden.**
- **Lower health risk** for CBRN specialists.
- Broadening of the availability of **rapid training to all operational levels**.
- **Decreased** training **costs.**
- Expansion of available training to Partners that do not possess **adequate training/testing facilities**.

Overview of the Research Task Group

- **Chair:** ITALY, Andrea D'ANGELO (Fondazione SAFE)
- **Aim:** To study, design and deploy software and hardware designed to produce functional XR CBRN defense mission operator training scenarios using advanced elements of extended reality.
- **Participating nations**: BEL, CZE, DEU, ITA, USA, ESP, GBR, FIN, LVA
- **Partner nations participating**: AUT
- **Duration:** February 2022 – February 2025

Specific objectives

1. Identification of **scenarios** suitable for "virtualization" and simulation in an XR context

2. Assess the integration/creation of new technology, such as an **integrated CBRN XR mask**.

3. Investigating **Artificial Intelligence** applications for enhanced realism/immersive and evaluation features

4. Designing the first “**standard**" CBRN XR training module.

Expected achievements

- A comparative research paper on **state-of-the art in XR** applications for military (CBRN) training and the **identification of suitable scenarios** for a first standard XR training module.
- A research paper on **user experience / technical features** of an integrated CBRN XR headset.
- A research paper on **AI applications for enhanced realism and automation** of CBRN XR training.
- A **prototype** of the first standardized CBRN defence awareness XR training module.

Work Package 1 – Assessment of most suitable scenarios

1. Identification of CBRN Training Requirements
2. Study on State-of-the Art on the Use of XR for Military Training
3. Study on Cybersecurity Protocols
4. Identification of scenarios suitable for XR Simulations

Work Package 1 – Assessment of most suitable scenarios

Threat	Scenario
Chemical	T01 - Sabotage/attack of a large stationary TIC storage tank in an industrial facility
Biological	B09 - Clandestine biological laboratory/production site
Radiological	R01 - Release of a radiological dispersal device
Nuclear	N02 – Detonation of a nuclear weapon

Nuclear scenario selected for the development of the joint demonstrator

Work Package 2 – User experience

1. Survey of expectations and needs of major NBC Schools.
2. CONOPS for integrated CBRN XR Mask.
3. Demonstrator.

Work Package 3 – AI applications

1. Simulation of dispersion models
2. NPCs and AI integration
3. Evaluation module with AI support

Work Package 3 – AI Applications

- **Relevant Dispersion and Health Effect Models**
  - ✓ Transport and dispersion Models
  - ✓ Human Health Effect Model
- **AI Technologies for CBRN Trainings**
  - ✓ AI Technologies for NPC
  - ✓ Other applications
- **Evaluation Module and AI Support**
  - ✓ Effectiveness of XR and evaluation
  - ✓ Support in evaluation: ARR & Human performance Evaluation

Work Package 3 – AI Applications

- Creation of **realistic training environments** & simulate the **injury** to an individual or a group of individuals.
- **Realistic Reactions in Real Time** of the environment during the training.
- Realistic **interactions** with a variety of personnel for the immersion but also cost-effective.
- Real time feedback and **adjustment of the training environment** depending on the trainee's skills.
- Assistance in **planning and preparation** of CBRN training with generative AI.

Work Package 4 – Study on a first Standardised CBRN defense awareness XR training module

1. Preparatory study of module.

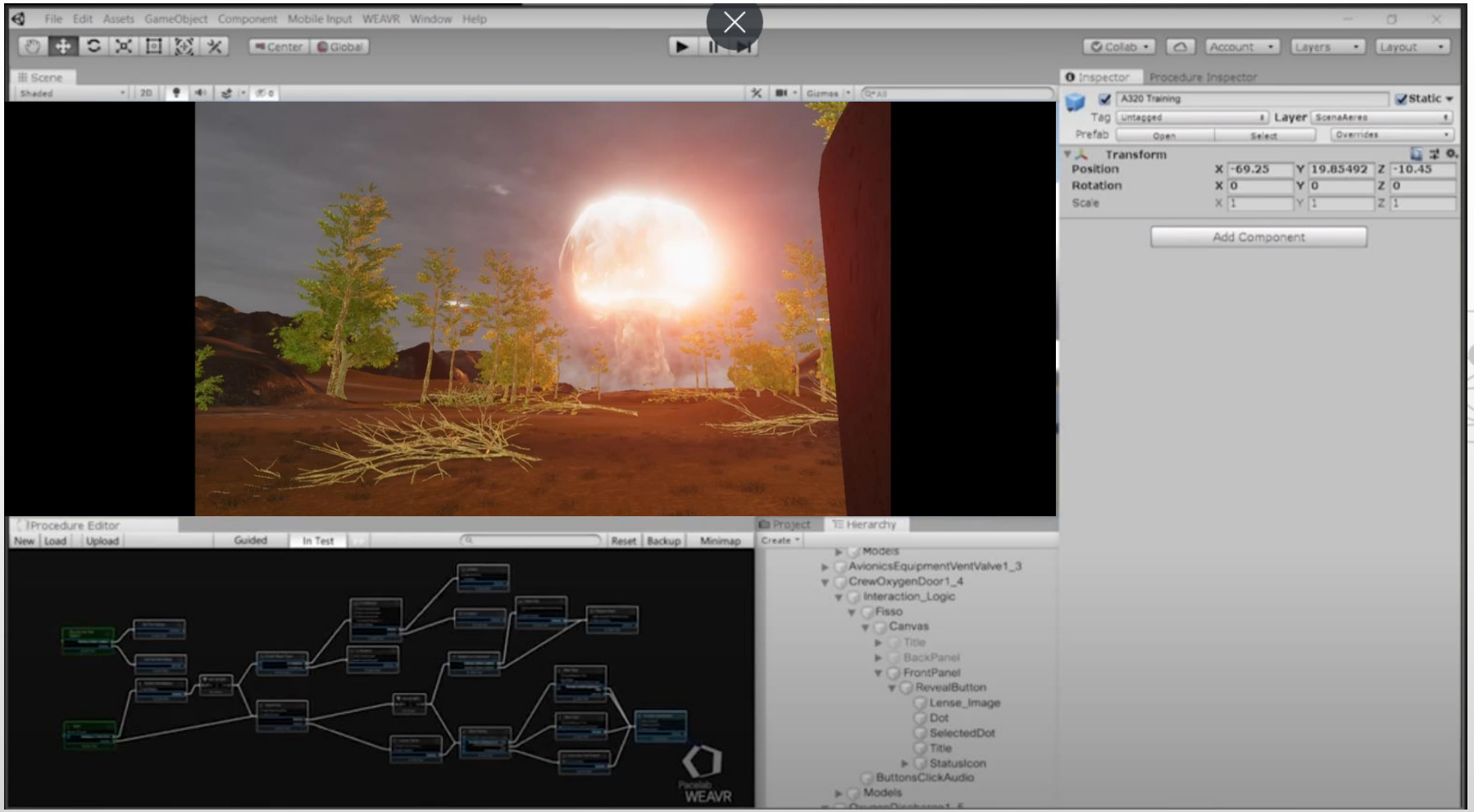
2. Software design and/or development of the platform integrating the identified scenario(s).

3. Considerations on possible future standardization.

Developments phases

- Collect information and reference material
- Environment developments – 3D modelling and texturing
- Explosion effects
- Procedure and events
- Interactions with objects and environments
- Test with final users

Developments software – Unity and WEAVR



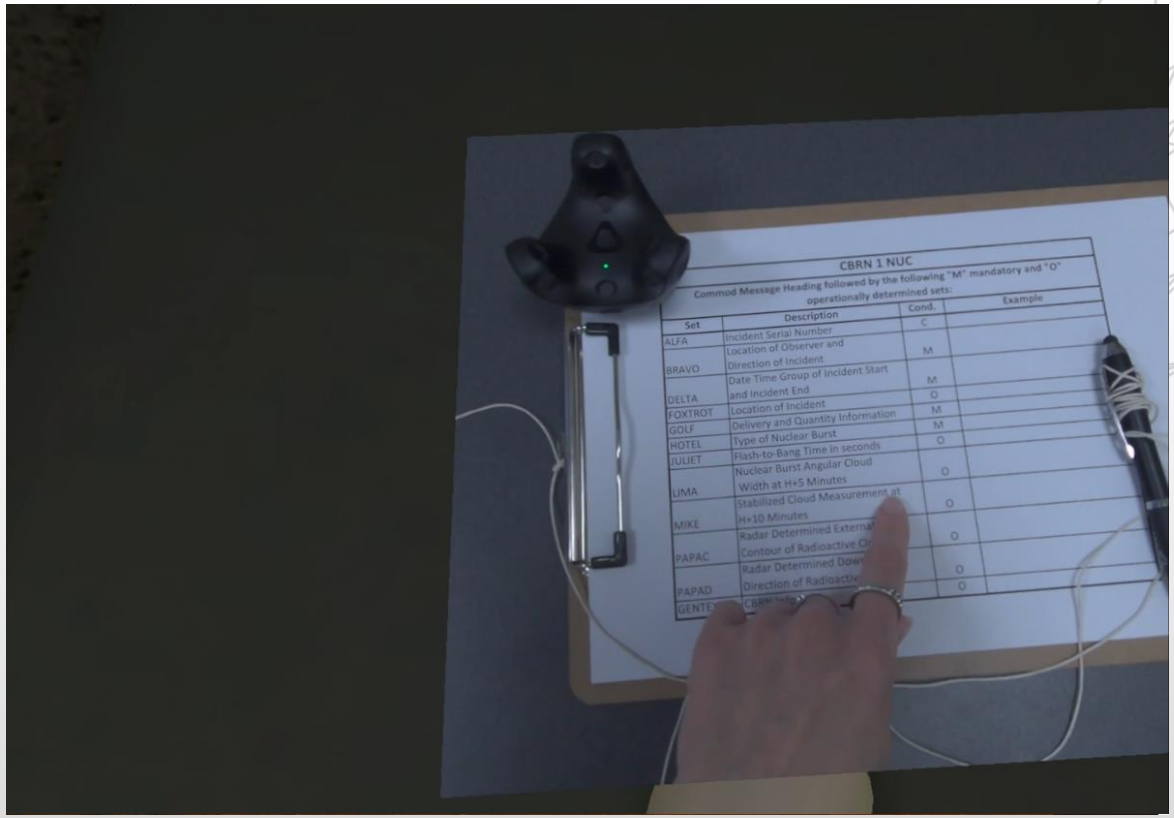
XR Headset – Varjo XR-3

- Professional headset for simulation use cases
- Mixed reality with frontal cameras
- Integrated hands tracking
- Peripheral displays: 2880x2720 per-eye
- Focal displays: 1920x1920 per eye
- Focal displays to enhance readability

- Base station tracking system

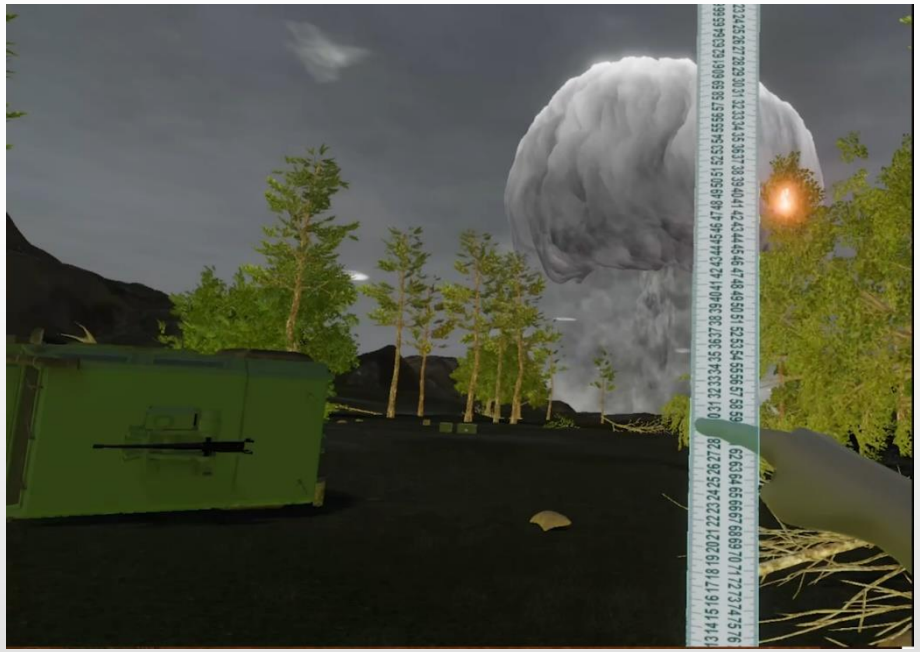
Virtual reality

Mixed reality



Hands tracking system

Realistic measurements with virtual objects



User experience evaluation study by a partner – Key results

- The XR system was considered **easy to use.**
- The study participants viewed the XR environment to be **interesting** for them.
- The study participants assessed the XR environment **to support their learning of the topic.**
- The **visual outlook** of the XR environment was praised.
- The study results **support the notion to use XR technologies** in the training of CBRN-relevant skills

Question?

Thank you!

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