

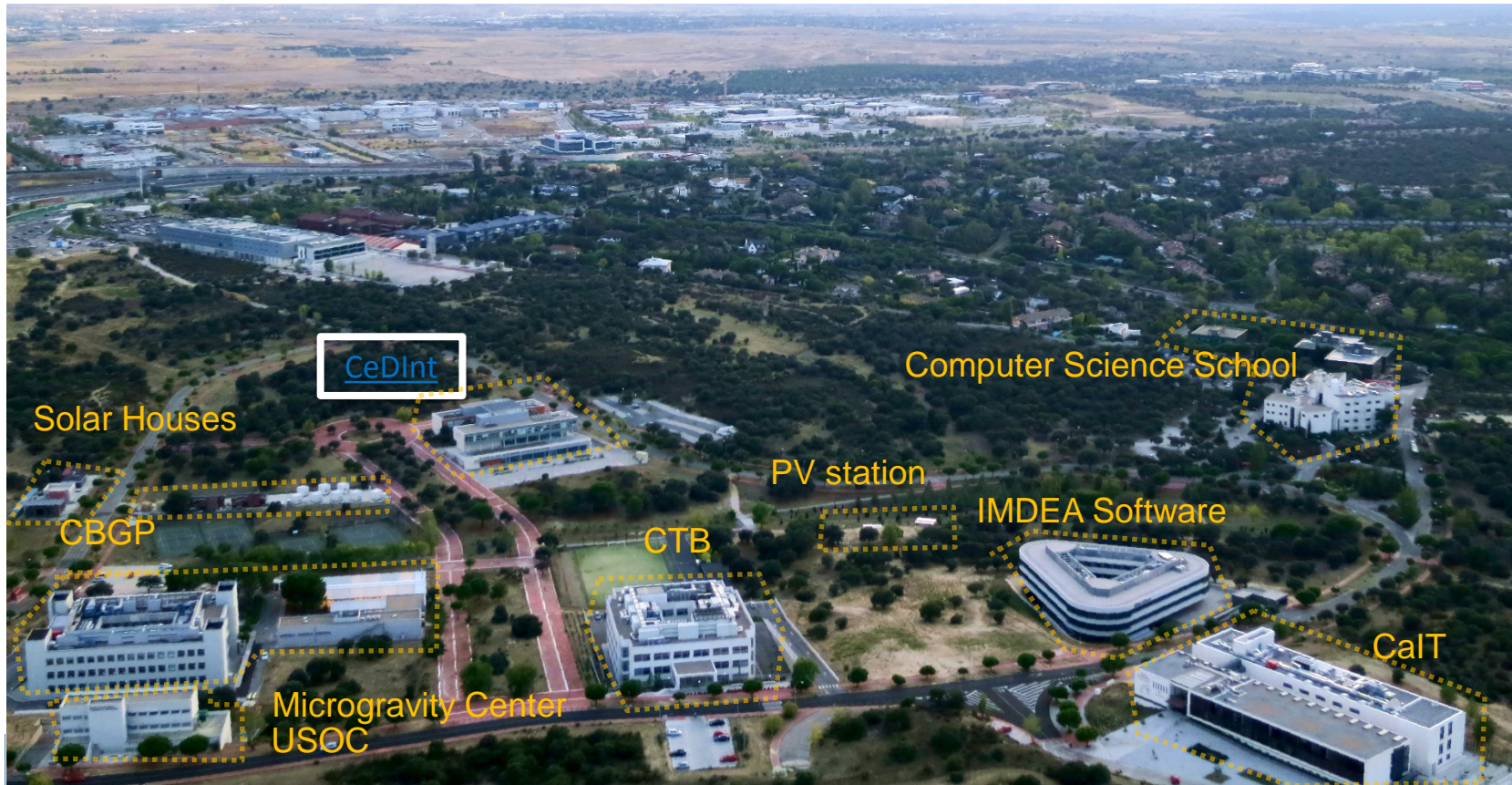


# Virtual and Augmented Reality experiences in mining and other fields

Raw Materials University Day 2017 – MADRID

November 16, 2017

## Montegancedo: International Campus of Excellence



- Virtual and Augmented reality (VR / AR)
- Information Visualisation and Visual Analytics
- Smart Environments and Energy Efficiency
- Security and Biometry
- Optical Engineering



# VR / AR today

VR



AR



## VR

- **Computer-generated** simulation of a three-dimensional image or environment that can be **interacted** with in a seemingly real or physical way by a person using special electronic equipment.
- User's **immersion** (a.k.a. fooling the brain)
- **Realism**



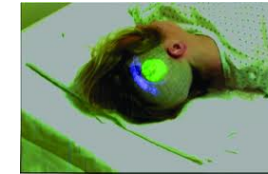
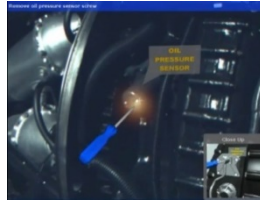
## AR

- Live (in)direct view of a **physical real-world** environment whose elements are **augmented** by virtual **computer-generated** sensory input (e.g. sounds, 3D models, ...);
- **Interactive** and in **real time**;
- Takes into account the depth / registered in **3D**

- Not really a brand-new concept but currently on the hype
- Factors of success:
  - Faster processors and more powerful graphics;
  - Cheaper technology;
  - Technology giants high investments;
  - Moving outside the traditional niches
- Next steps:
  - Plateau of production (adoption ~20-30% of market potential);
  - Routine / Standard in business within 5-10 years;
  - Market value ~\$80 billion within 10 years

# VR / AR fields of application (short list)

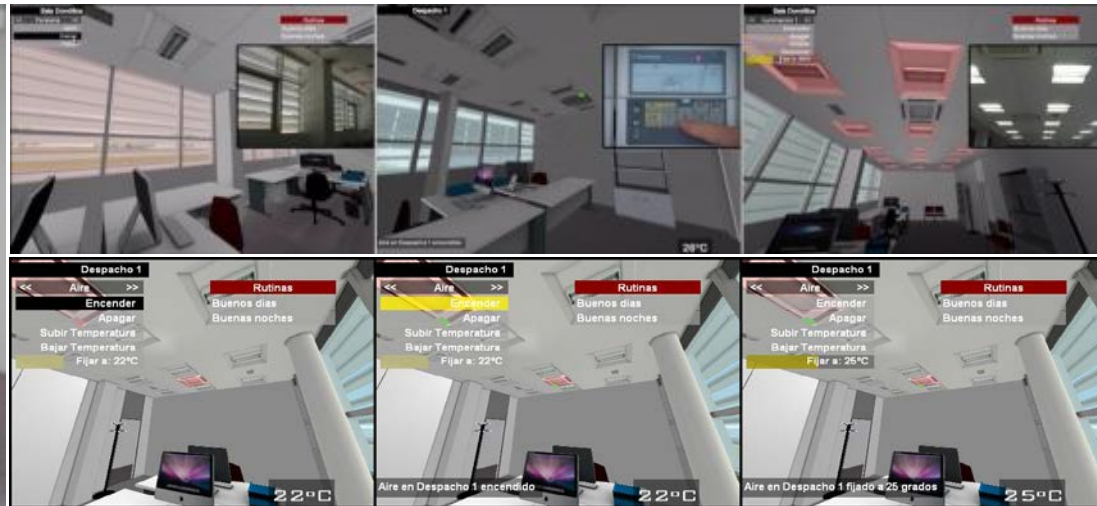
- Advertising
- Medicine
- Navigation devices
- Industrial applications
- Military and emergency services
- Sport
- Art
- Architecture
- Entertainment and education
- Tourism
- Mining and prospecting



- Training and formation
- (Difficult) environments model
- Interaction with the env.
- Simulations
- Support for complex tasks
- Generation of added value

# VR for domotic applications

- Facilitating user interaction with building elements;
- Two-way communication;
- Especially thought for disabled users





# VR for outdoor sensor monitoring

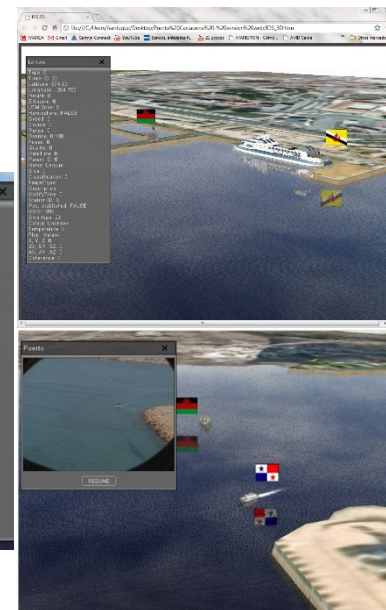
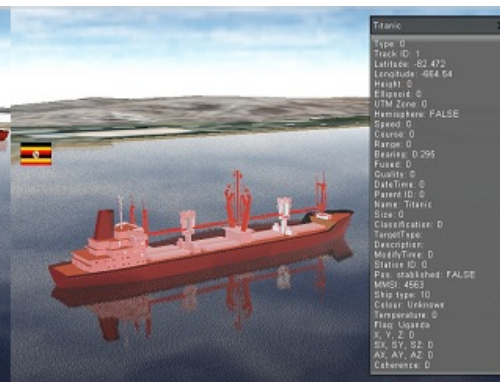
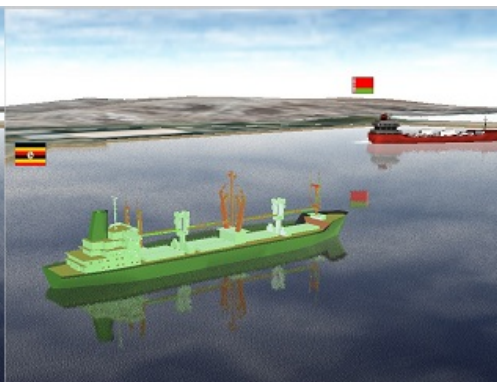
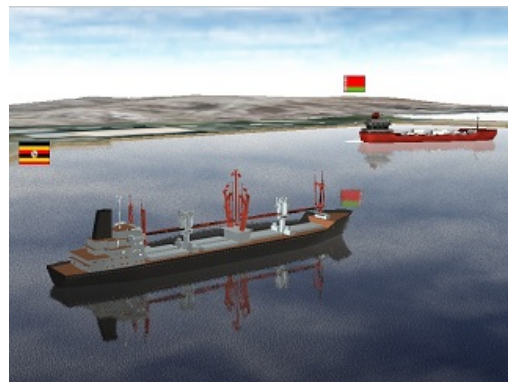
- 3D modelling of a real environment;
- Two-way communication with a sensor network:
  - Performance and function monitoring;
  - Scenarios simulation
- Representation of environmental conditions;
- Possible integration with visualization techniques



# VR for monitoring environments

## Integrated platform for:

- an intuitive and realistic real-time representation of targets (e.g. ships and cargoes) and events;
- increasing the situational awareness of security operators over the monitored area



# VR for indoor environments

Mixed reality platform to provide value-added services during real events or situations:

- Route planning for indoor environments;
- Show information in AR;
- Case studies:
  - tourism exhibition;
  - emergence handling

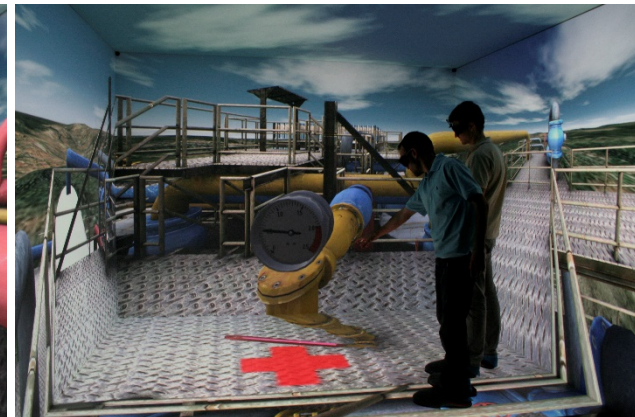
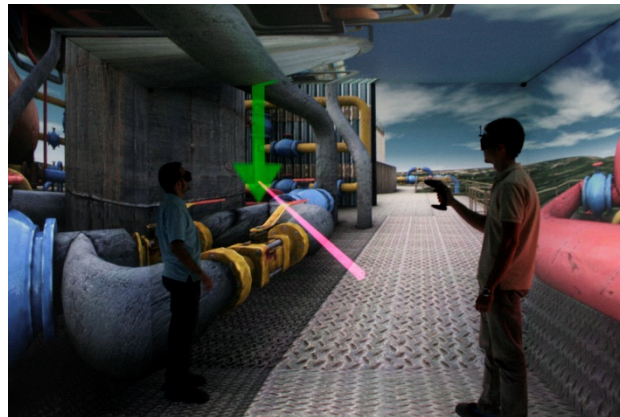
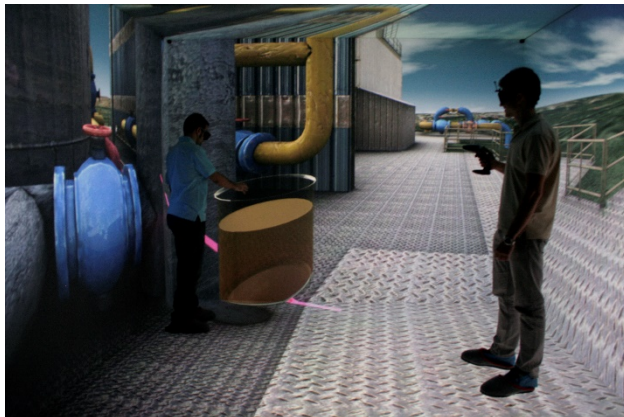




# VR for training

## Simulation of real environments / tasks:

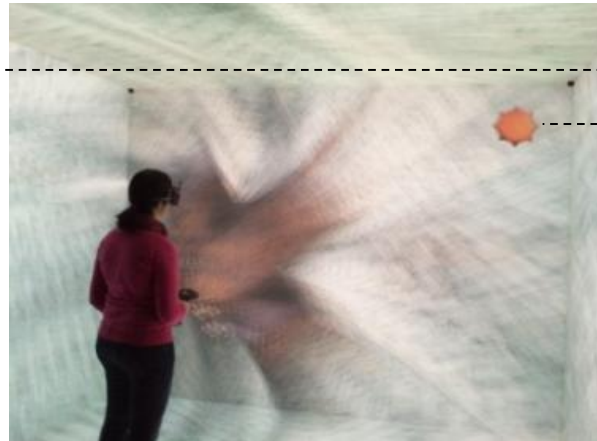
- (Highly specialized) personnel training;
- Virtual mock-ups for concurrent engineering;
- Collaborative sessions;





User interaction in Virtual Environments dynamically adapted to the physiological response of the individual:

- Monitoring & processing physiological signals: Heart Rate (HR) and Galvanic Skin Response (GSR);
- Real time stress detection from HR & GSR;
- Dynamic response of the VE to the level of stress



**Biofeedback Sphere:**

- Size → HR
- Color → GSR
- Shape → Stress

- 3D content, virtual environments and AR applications:
  - VR/AR-based interfaces facilitating situation awareness, understanding and control in complex environments or critical infrastructures
- User experience in VEs and immersive and interactive apps:
  - Objective (physiological signals, EEG, facial expressions, body language, user performance) and subjective assessment of presence, attention and emotional response

# VirtualMine – VR and 3D apps



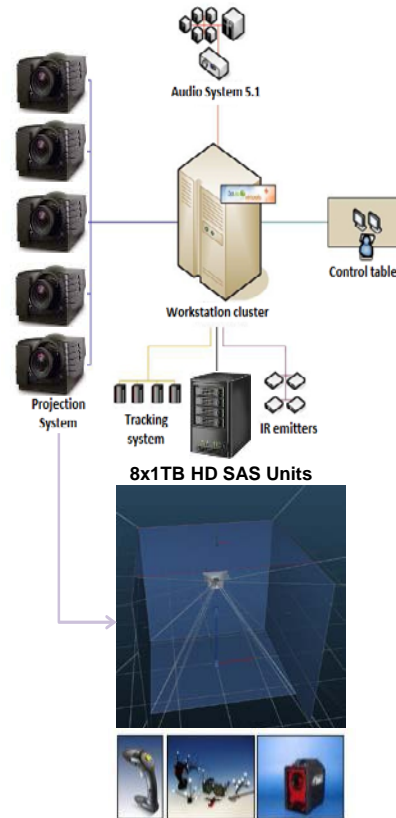
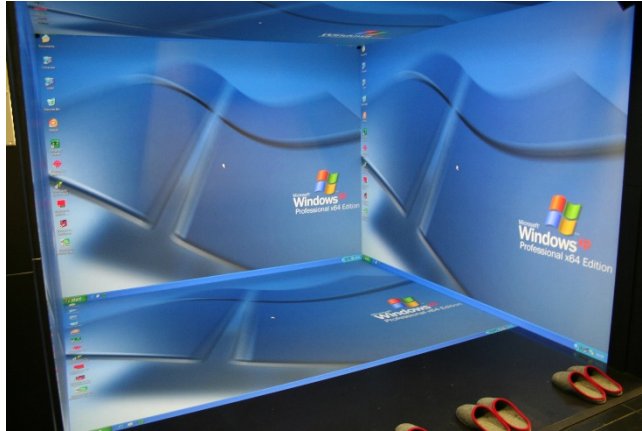
## Possible ideas:

- Simulation of:
  - Crushing machine;
  - Copper extraction;
  - Life and work of a miner in the past
- Educational games (gamification):
  - Discovering the distribution of raw materials on the Earth;
  - Game for children to deliver the miner to its workplace underground;
  - Virtual mirror to dress people in different mining garments;
  - Discovering the importance of raw materials by unveiling their presence in daily-used objects



# VR Lab Equipment

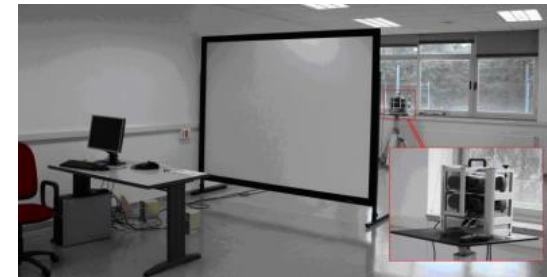
## I-Space (CAVE™)



## 3D stereo wall



## Portable VR system





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