UNEXMIN CULTURAL HERITAGE:
A NEW WAY TO EXPLORE, MAP AND OBTAIN INFORMATION OF CULTURAL HERITAGE OBJECTS FROM FLOODED UNDERGROUND MINES

TECHNOLOGY
• Autonomous underwater geo-exploration
• 3D Structural mapping
• Cultural heritage data

TARGET GROUPS
• State institutions (ministries, institutes, archives, museums)
• Regional and local institutions and municipalities
• Public institutions
• Cultural heritage societies

During its missions, our robot UX-1 will use its tailor-made scientific instrumentation to record: pH levels, water qualities, electrical conductivity, multispectral imaging, UV fluorescence imaging, magnetic fields, sub-bottom profiles and natural gamma ray activity.

The instruments are designed to obtain the maximum possible geoscientific data from flooded mines. Their operation is fully synchronized with other sub-systems, such as batteries, computers and thrusters.   Laser scanning is a key part of the navigation subsystem and it will enable highly detailed 3D maps with mm to cm accuracy geometry to be produced.

UX-1 characteristics:
• Shape: spherical
• Size (diameter): 0.6m
• Autonomy: 5 hours
• Max operational depth: 500m
• Operating speed: 1-2 km/h

General layout of the UX-1 robot (CAD models)

Post-processing and data analysis tools are being prepared specially for UX-1. These will collate and interpret the recovered geological and spatial data. They will also increase our understanding of the cultural heritage long-lost in mines and produce information that can be used in education and archaeological research. A unique outcome will be in the form of 3D visualisations of the recorded data.

Pre-operational tests will be held in four mines across Europe: Kaatiala pegmatite mine (Finland), Idrija mercury mine (Slovenia), Urgeiriça uranium mine (Portugal) and Ecton copper mine (England). These mines will present progressively more challenging environments within which the UNEXMIN technology will be tested. Tests intend to prove that the robot can deliver useful and relevant geo-information from different flooded mines.
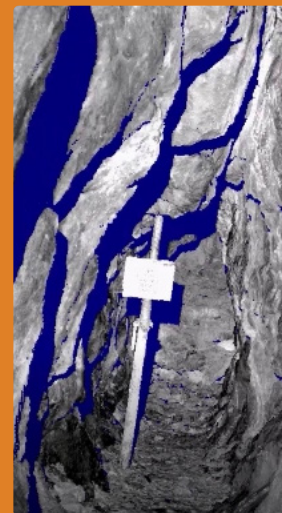
UX-1 developers

Our new multirobotic system will be able to explore and map flooded mines, obtaining data of cultural heritage that remained after mine closure. By using non-invasive methods UX-1 will be able to fully operate without damaging the environment or any structure or object of historical/archaeological importance.

All professionals working with the preservation, protection and presentation of cultural heritage on local, regional and national level could benefit from the technology being developed in the UNEXMIN project. The UNEXMIN technology offers reduced exploration costs for archaeological missions in underwater environments, opening up new domains for European cultural-heritage protection and scientific research.

Possible applications of the UNEXMIN technology in the field of protecting cultural heritage:

• Bringing information about historic evidence of the mine

• Filling gaps on data of development of historical mines which cannot be achieved in archives

• Laser scan point cloud image (accurate 3D maps)

• Proofing and reconstruction of archive data to prove the existence of a historic mine

• Obtaining data evidence data to confirm or refuse historical data of a mine

• Bringing information about mining artefacts and tools

• Providing information about mines accidents and possible mortal remains of miners

• Obtaining data for reconstruction of mines maps (e.g. galleries, shafts)

• Bringing images from historical and abandoned mines

• Obtaining data for 3D mine modelling and virtual reality

• Supporting information for other areas such as civil engineering, energy effiency, waste management and water supply

Laser scan point cloud image