



## 2<sup>nd</sup> Newsletter of NETHELIX

### Welcome to the second newsletter of NETHELIX

Dear Readers,

The consortium of **NETHELIX (Intelligent digital toolbox towards more sustainable and safer extraction of mineral resources)** is pleased to welcome you to the project's **second newsletter**. NETHELIX project focuses on **enhancing the efficiency of mineral extraction processes, improving the workers' safety, and reducing environmental impacts**. The project considers developing and integrating various advanced technologies, including eco-friendly machinery, precision drilling systems, autonomous mining equipment, smart sensors, as well as Artificial Intelligence (AI) and data analytics-based predictive maintenance tools.

Through two newsletters – the previous one (first; available [here](#)) and this one – NETHELIX consortium aims to keep you informed on the project's progress and share with you its main achievements until the end of its timespan. Specifically, this second issue of the newsletter is intended to provide you with research activities and key results from the second half of the project.

Stepping on the end-user requirements and the considered use cases, NETHELIX team worked effectively through the technical work packages of the project, reaching the main milestone of successful pilot demonstrations. These pilots enabled the validation of NETHELIX technologies under real operational conditions, demonstrating the project's strong potential to enhance safety, operational efficiency, environmental monitoring, predictive maintenance, and decision-making in mining environments.

In parallel, the NETHELIX consortium continued to make significant scientific progress, resulting in strong international contributions. NETHELIX partners also actively represented the project at major conferences and events across Europe and beyond, further strengthening the project's visibility within the global raw materials and mining innovation community.

As NETHELIX was progressing towards its completion, the consortium remained committed to **delivering innovative solutions that support a safer, smarter, and more sustainable future for the European mining industry**.

We wish you a pleasant read,

NETHELIX Consortium

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### NETHELIX at APCOM 2025 Conference in Perth, Australia

On **10–13 August 2025**, the international [APCOM 2025](#) conference took place in **Perth, Australia**. Recognized as one of the leading scientific events in the field of **mining digitalization**, APCOM brings together researchers, technology developers, and industry professionals working on advanced computational methods, artificial intelligence, and data-driven solutions for the mining sector.





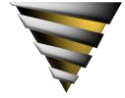
On behalf of NETHELIX consortium, **KGHM CUPRUM Research and Development Centre** presented research activities and results developed within the project, in terms of the development of intelligent monitoring systems, predictive maintenance approaches, and AI-driven operational optimization for underground mining environments. Participation in APCOM 2025 further strengthened the project's international visibility and reinforced collaboration between academia, research organisations, and industry stakeholders working towards the digital transformation of the mining sector.



### Fifth Project Plenary Meeting in Wroclaw, Poland

On **17–18 September 2025**, the NETHELIX consortium gathered in **Wroclaw, Poland**, for the project's **5th Plenary Meeting**, hosted by **KGHM** project partner. During the two-day meeting, representatives from across the consortium presented the latest achievements across the project's work packages, including advancements in digital monitoring systems, predictive maintenance solutions, operational safety technologies, ventilation optimization, and integrated decision-support tools. Particular focus was placed on the preparation and coordination of the upcoming **pilot demonstrations**, ensuring the readiness and interoperability of the developed technologies in operational mining environments.





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### NETHELIX Featured at Vision Zero Conference – Sustainable Mining 2025

On **14–15 October 2025**, the [Vision Zero Conference – Sustainable Mining 2025](#) brought together international experts, researchers, and industry leaders in **Bochum, Germany**, to discuss the future of **safe and sustainable mining practices**. During the event, **Technische Universität Bergakademie Freiberg (TUBAF)** represented the NETHELIX project, contributing to discussions on emerging technologies and innovation in the mining sector.

As part of the session “Future Technologies in Mining”, TUBAF researcher **Mr. Ali Erdesat** presented the project’s pre-pilot activities at the FLB mine site (Germany), where innovative NETHELIX technologies and methodologies were tested under realistic operational conditions. Particular emphasis was placed on the validation of green, remote, and automated mining machinery, indicating NETHELIX’s contribution to improving **operational safety, efficiency, and sustainability** – core principles promoted by the Vision Zero initiative.





## NETHELIX Presented at ÁRIDOS VII Congreso Nacional in Spain

On **23 October 2025**, the NETHELIX project was presented at the [ÁRIDOS VII Congreso Nacional](#) in **Córdoba, Spain**, one of the leading events dedicated to the **aggregates and raw materials sector**. As part of the workshop session entitled “European standards with project DNA: building the future through R&D – Standardisation Workshop”, NETHELIX contributed to discussions on the role of **research, innovation, and standardisation** in shaping the future of sustainable mining technologies.

Representing **the TUBAF**, researcher **Mrs. Esperança Bila** highlighted the importance of integrating standardisation activities into the development of next-generation mining technologies, ensuring that innovative solutions can support future industrial adoption, interoperability and long-term sustainability across the European extractive sector. The event provided an excellent opportunity for knowledge exchange, networking, and collaboration with experts, researchers, and industry stakeholders from across Europe, further strengthening NETHELIX’s contribution to the digital and sustainable transformation of the mining industry.



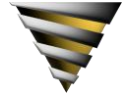


## NETHELIX Returns to Greek Raw Materials Community Dialogue

On **November 6, 2025**, in **Athens, Greece**, NETHELIX joined the [10th Greek Raw Materials Community Dialogue](#) which, this year, celebrated a decade of collaboration, innovation, and strategic growth in **Greek Raw Materials industry**. The event brought together policymakers, industry leaders, academia, researchers, and RTOs from across the value chain.

During the event, **Emphasis DigiWorld S.A. (EMPH)** presented NETHELIX's core system architecture and technological components, providing attendant researchers and industry experts with an in-depth look at how NETHELIX is advancing innovation in the mining sector with a strong focus on safety and sustainability.





## NETHELIX Represented at SPIE Photonics West 2026

On **17–22 January 2026**, the NETHELIX project was represented by project partner **ALPES Lasers S.A.** at [SPIE Photonics West 2026](#), one of the world's leading international events in the fields of photonics, optics, laser technologies, and advanced sensing systems. Held in **San Francisco, California, USA**, the conference brought together researchers, technology providers, industrial stakeholders, and innovation leaders from across the globe to discuss the latest developments in **photonics-enabled technologies** and their industrial applications. Through technical sessions, exhibitions, and networking activities, the event facilitated valuable exchanges of knowledge and expertise related to advanced optical systems, environmental monitoring, remote sensing, and intelligent data acquisition technologies – areas that are closely connected to several NETHELIX technological developments.





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### Successful Second Project Review Meeting in Delphi, Greece

On **12 February 2026**, the **Second NETHELIX Project Review Meeting** took place in **Delphi, Greece**, bringing together project consortium, the **European Commission (EC) Project Officer** and **external reviewer** to assess the project's progress and achievements. The meeting was **positively** received by the EC representatives, who provided **constructive feedback** and expressed strong support for the project's direction and outcomes to date.

A key highlight of the Review Meeting was the **live demonstration session** held on **13 February 2026** at **mine site of METLEN partner (end-user) in Greece**. During the specific session, the EC representatives had the opportunity to observe the practical application of innovative NETHELIX technological solutions operating under real mining conditions, and to engage directly with project partners and end-users involved in the demo implementation.





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### First NETHELIX Pilot at METLEN Mine Sites, Greece

From 9 to 13 February 2026, the first pilot of the NETHELIX project was successfully conducted at the mine sites of METLEN partner (end-user) in Greece, marking a major milestone in the validation of the project's innovative mining technologies under real operational conditions. The pilot activities focused on demonstrating and assessing advanced digital solutions designed to enhance safety, operational efficiency, environmental monitoring, and remote operations in both underground and surface mining environments. Several key NETHELIX technologies were validated during the pilot, including:

- Augmented Reality (AR) for training
- Laser-based Air Quality Analyzers
- Heavy-Lifter Drone
- Remote Control (RC) kit and capabilities
- Ventilation on Demand (VoD)
- Middleware for system integration
- Physical Security Information Management (PSIM) platform

Throughout the pilot week, training was provided to end-user's personnel, and Key Performance Indicators (KPIs) were systematically monitored in order to evaluate technological performance, operational effectiveness, and integration capabilities, while ensuring alignment with the project's technical and strategic objectives.



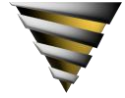


## Second NETHELIX Pilot at Hellas Gold Mine Site, Greece

From 16 to 20 March 2026, the NETHELIX project's second pilot was successfully carried out at the mine site of Hellas Gold (HG) partner (end-user) in Greece, representing another important step towards the validation of advanced digital technologies for the mining sector. The pilot focused on testing and evaluating a broad range of innovative NETHELIX solutions in real operational mining conditions, with the aim of improving safety, operational efficiency, environmental performance, predictive maintenance, and decision-support capabilities. The technologies validated during the pilot included:

- Augmented Reality (AR) for training and situational awareness
- Remote Control (RC) kit and capabilities
- Heavy-Lifter Drone
- Physical Security Information Management (PSIM) platform

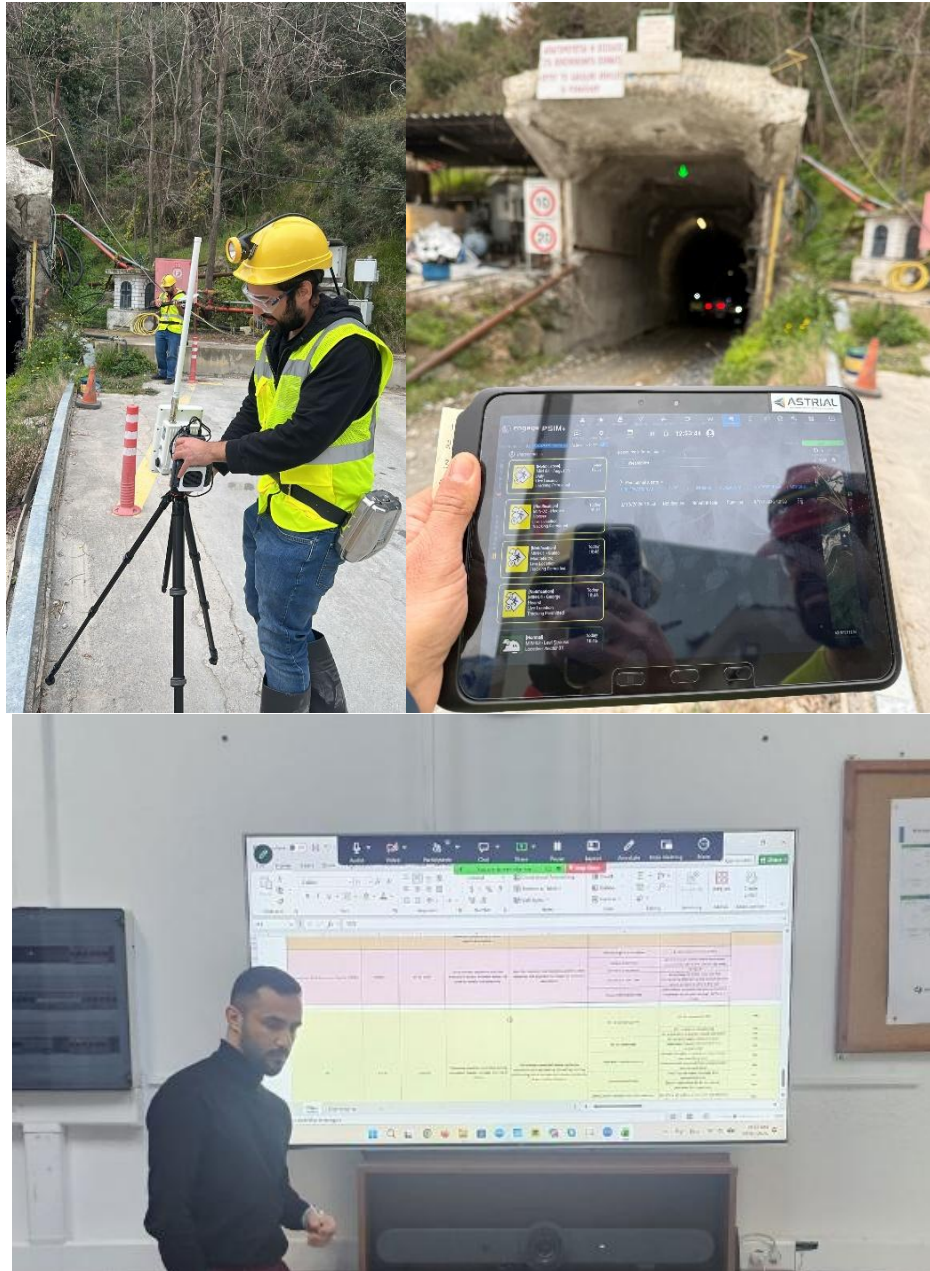




- Smart Insoles
- Acoustic Emission and Vibration Monitoring
- Energy and Machinery Health Monitoring
- Ventilation on Demand (VoD)
- Process Diagnostics and Optimization Algorithms
- Predictive Maintenance for Self-propelled Machines
- Operational Risk Assessment System (ORAS)
- Middleware for system integration
- Physical Security Information Management (PSIM) platform

Throughout the pilot week, training was provided to end-user's personnel, and KPIs were continuously monitored to assess system performance, operational benefits, technology integration, and overall effectiveness in supporting safer and more sustainable mining operations.





### Third NETHELIX Pilot at OMYA Mine Site, Austria

From 7 to 9 April 2026, the third and final pilot of the **NETHELIX project** was successfully conducted at the mine site of **OMYA partner (end-user)** in Austria, marking the completion of an important series of pilot activities across European mining environments. The pilot aimed to validate several NETHELIX technologies under real operational conditions, further demonstrating the project's contribution to safer, smarter, and more sustainable mining operations. During the pilot, the following technologies were tested:

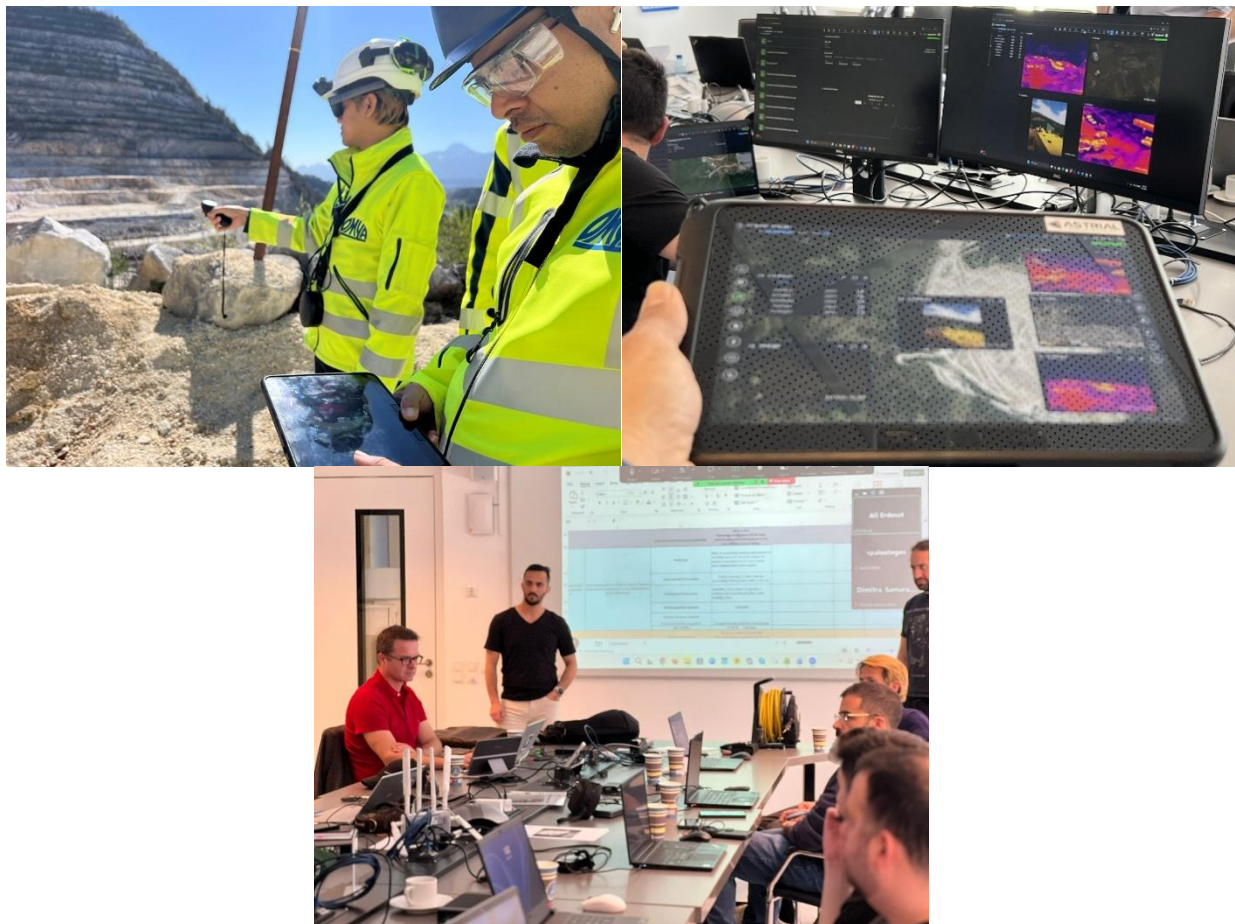




- Augmented Reality (AR) for situational awareness
- Smart Insoles
- Middleware for system integration
- Physical Security Information Management (PSIM) platform
- Mass Balance and Evaluation of Machine Performance
- Ventilation on Demand (VoD)

The pilot activities enabled the end-user's personnel – after training – to assess the operational performance, interoperability, and effectiveness of the developed solutions within a real mining environment. KPIs were monitored during the pilot demonstration, and evaluated throughout a respective closing workshop.

The successful completion of the OMYA pilot represents a major milestone for the NETHELIX project, concluding the validation phase of its developed technologies across multiple mining sites and operational scenarios in Europe.



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### NETHELIX Partners Strengthen Scientific Impact Through New Publications



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N. 101092365



The NETHELIX consortium continues to actively contribute to scientific excellence and innovation in the field of digital and sustainable mining technologies, publishing **four (4) additional scientific papers in international journals and conference proceedings**. Showcasing important research outcomes developed within the project, the published papers address key topics related to artificial intelligence, machine learning, monitoring systems, localization technologies, and anomaly detection for mining and industrial environments.

**KGHM** partner contributed a paper which explores the use of deep learning techniques and vibration analysis for monitoring ore haulage systems and improving operational efficiency and predictive maintenance capabilities. Furthermore, **National Technical University of Athens (NTUA)** and **METLEN** partners co-authored a paper that presents an innovative explainable Artificial Intelligence (AI) framework combining Unmanned Aerial Vehicle (UAV) multi-sensor data and machine learning techniques for improved stockpile mapping, classification, and resource management in mining environments. **Cyprus Research & Innovation Center Ltd. (CyRIC)** partner published a paper introducing an advanced algorithm for improving the accuracy and reliability of indoor localization systems using Bluetooth beacon technologies. Finally, **CSEM** partner contributed a paper focusing on advanced methodologies for detecting anomalous acoustic patterns in industrial systems, supporting predictive maintenance and operational safety applications.

The NETHELIX consortium remains committed to disseminating strong scientific and technological outcomes through high-quality research publications, fostering collaboration between academia, research organisations, and industry stakeholders across Europe and beyond.



Received 15 January 2025, accepted 7 February 2025, date of publication 14 February 2025, date of current version 24 February 2025.

Digital Object Identifier 10.1109/ACCESS.2025.3542192



## Deep Learning for Ore Haulage Monitoring: Vibrational Analysis Using a VGG16 Network

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This work was supported in part by European Union's Horizon Research and Innovation Programme under Grant 101092365.





# BauXAIt: An Explainable AI Framework for UAV Multisensor-Driven Bauxite Stockpile Mapping and Classification

Anastasios Temenos<sup>1</sup>, Nikos Temenos<sup>2</sup>, *Member, IEEE*, Margarita Skamantzari, Anastasios Doulamis<sup>3</sup>, Nikolaos Doulamis<sup>3</sup>, Efthymios Daradimos, and Nikolaos Christoforou

Conference on Advancements in Sustainable Engineering 2025

IOP Publishing

IOP Conf. Series: Earth and Environmental Science **1558** (2025) 012063

doi:10.1088/1755-1315/1558/1/012063

## Multi-Stage Cascaded Algorithm for Localization with Integrated BEacon Ranking (CALIBER) for Bluetooth-Based Indoor Localization

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### NETHELIX Presented at the EIT Raw Materials Summit 2026

On **20–21 May 2026**, the NETHELIX project was presented at the **EIT Raw Materials Summit 2026**, in **Brussels, Belgium**, one of Europe's leading events dedicated to **innovation, sustainability, and competitiveness in the raw materials sector**. During the summit, the project was showcased at exhibition booth, where **consortium representatives (TUBAF and EIT RM)** had the opportunity to engage with a wide range of stakeholders from industry, academia, research organisations, and European institutions.

The event provided an excellent platform for presenting the project's objectives, technological developments, and pilot activities, while fostering valuable discussions on the future of digital and sustainable mining. Participants showed strong interest in the NETHELIX approach, generating insightful exchanges, constructive feedback, and numerous questions regarding the project's innovative solutions and real-world applications. In addition to networking and dissemination activities, project materials and information were shared with many attendees, further increasing the visibility of NETHELIX within the European raw materials and mining innovation community.





We hope you enjoy reading this second edition of our newsletter and invite you to follow the latest NETHELIX updates through our project's [communication channels](#) and [project website](#).

