

Rugged Terrain

Testbed Site Field Guide

Headwaters Tech Hub (HTH) Testbeds offer distinct environments, including varied terrain, controlled settings, and advanced connectivity, designed to help partners test and demonstrate near-commercial products in real-world conditions. These testbeds specialize in smart photonic sensing systems with applications in natural resource management, national defense, precision agriculture, wildfire resilience, and disaster prevention.



Subterranean Robotics



Wi-Fi-Enabled Underground Zones



Autonomy & Navigation Testing



3,000 Feet of Tunnels



Testing of Onsite Critical Mineral Feedstocks



Critical Mineral Sensing



150°F Temp Swing Range



Photogrammetry in GPS-denied conditions



Scheduled Blast Testing

FIELD GUIDE HIGHLIGHT

Where earth meets tech, UMEC is a rare, real-world mine setting offering direct access to hard-to-find conditions perfect for robotics and sensor testing.

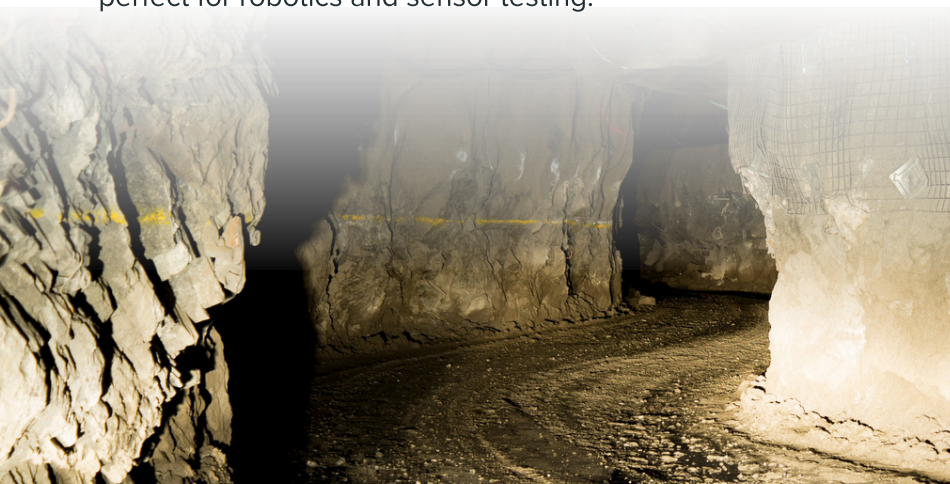
UNDERGROUND MINE EDUCATION CENTER (UMEC)

- GPS-denied testing
- Subterranean robotics
- Controlled detonations
- Critical minerals pilot plant facility
- Underground Mine Education Center (UMEC)
- Open-pit mine operations training
- Controlled & confined space
- Montana Technological University campus, Butte, MT
- Underground access: 3,000+ feet of tunnels
- Above-ground terrain: 150 acres of rocky, elevated land (5,400-6,100)



KEY CAPABILITIES

- GPS-denied mapping
- Submerged tunnel testing
- Vertical UAV flight in confined spaces
- Ample power (electric and diesel) underground
- Wi-Fi and sensor connectivity
- Geothermal mine waters
- Critical mineral pilot plant testing
- Surface testing on abandoned mine lands and open quarry
- FAA class E airspace overhead
- World-class researchers available to assist in: drone and sensor testing, mine operations, metallurgical and materials, environmental management, & safe operations



Underground Mine Education Center (UMEC) GPS-Denied & Subterranean Testing

Montana Technological University



3,000+ Feet of Underground Mine Tunnels

Ideal environment for testing sensors, autonomy, and robotics in GPS-denied, real-world conditions.



Wet, Dry, and Submerged Tunnel Sections

Validate sensors and navigation systems across varied underground environments with different moisture levels and mineral compositions.



Wi-Fi Connectivity Throughout the Tunnels

Enables data streaming and remote monitoring even in deep, complex underground settings.



Scheduled Blasting Access

Test robustness of hardware and software during high-stress, real-world events like controlled explosions.



Testing of Onsite Critical Mineral Feedstocks

Conduct validation studies and develop mineral sensing systems using real ore bodies and tailing environments.



150 Acres of Rocky Surface Terrain

Above-ground elevation changes and mixed vegetation provide additional real-world field conditions for multi-environment systems.

FIELD-TESTED VALUE

UMEC is a one-of-a-kind subterranean testbed designed for the development and validation of technologies in GPS-denied, physically extreme conditions. With more than 3,000 feet of underground tunnels and 150 acres of rocky surface terrain, UMEC offers a high-stakes, real-world environment for testing autonomy, navigation, and sensor systems.

The site features scheduled blasts, Wi-Fi-connected tunnels, and access to critical mineral samples—providing an unmatched platform for commercial-ready robotics, mine tech, and environmental sensing solutions. From submerged tunnels to abandoned mine lands, UMEC pushes innovation where other testbeds can't reach.



Cost offsets available for projects that benefit the regional photonic sensor ecosystem.

JOHN BELTRONE

Testbeds Development Lead
Headwaters Tech Hub

406-868-8764

Johnbeltrone@headwaterstechhub.us



@HeadwatersTechHub



headwaterstechhub.us