INTERNATIONAL MINES RESCUE BODY CONFERENCE 2021

Solving Problems
Sharing Knowledge

Hosted by Queensland Mines Rescue
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THE WIRELESS COMMUNICATION SYSTEM FOR MINES RESCUE IN HAZARDOUS AREAS

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THE MILESTONE SOLUTION IN THE FIELD OF COMMUNICATION TOOLS FOR RESCUE OPERATIONS…. AND MORE

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World Trends: Does underground mining keep up?

- the increasing use of wireless networks
- integration within the network of voice, video and data transmission services
- construction of backbone networks with open access
- applying wireless networks to monitor places where the methane sensors are used and the fast data transmission is vital

All above targets lead to… the increasing of work safety

For this reason we designed ReSys

To improve communication!

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Underground Communication Data Transmission Systems

1. Forms of wired transmission

- Copper wires
- Optical fibers

2. Most common forms of wireless transmission

- VHF (dispatcher systems) 150–159 MHz and 165–174 MHz bandwidth
- UHF (ranking systems) 410–420 MHz and 420–430 MHz bandwidth
- 20 – 120 MHz bandwidth (video signal transmission)
- 868 MHz
- 2,4 GHz

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Basic hardware devices with customized software in a RESYS system:

Personal Communicators – the equipment for each member of underground rescue teams

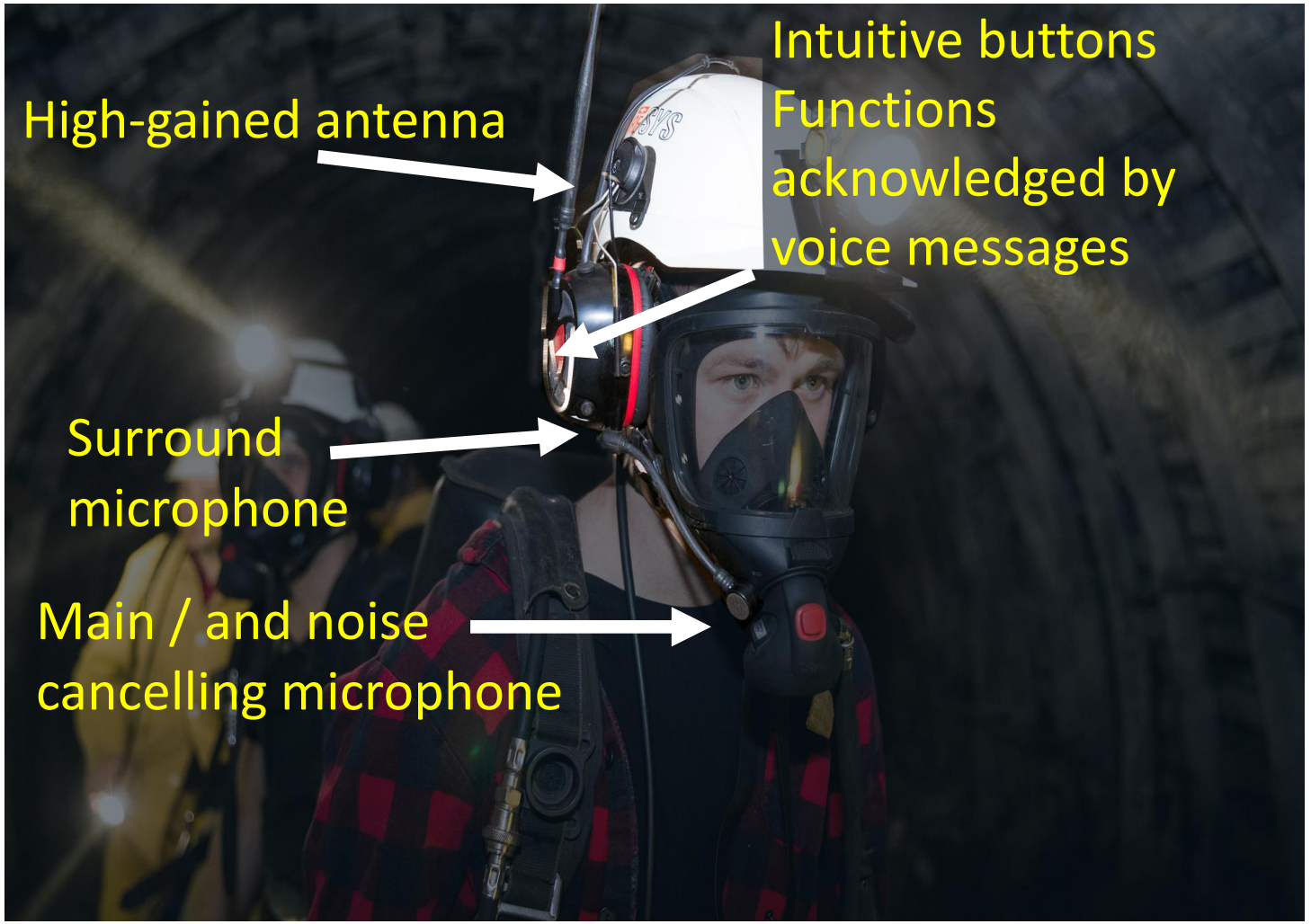
Repeaters – the components forming a wireless backbone network

Base Unit – the device supporting managing communication (optionally with PC/tablet and large monitor), it's an equipping of the Manager; the tool for leading underground operations

Mediaconverters - convert electrical signals from repeaters into wired networks

Patented: Europe (EP 3400658), RSA (ZA 201900169), USA (US 10,749,621)

Personal Communicator features



- Usable as a standalone communication system
- Dual source/ways of voice activity detection
- Sensors checking moving and falling of user
- Allows to hear sounds of surrounding ambient
- Noise-cancellation button

Works up to 12 hours

Repeaters, network nodes

Powered by intrinsically safe power supply or battery. **Batteries can be replaced in an explosive atmosphere**

- Allow to extend ReSys network range
- Spacing 50 -150 m between repeaters (depends on underground conditions)
- Connectable to any local transmission system; fiber optic, copper wired
- Allow tracking of rescuers positions
- Large number of repeaters does not reduce network bandwidth
- Up to **20 hours** of continuous work
- 440 g weight from this 140 g battery

Base unit

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Base Unit: connection between FAB and team captains

- Allows to set up conference calls
- It also let to monitor work parameters of all devices and supervise from outside telemetry data of each rescuer
- Allow tracking teams/rescuers
- Recording the course of rescue action (capturing IP packets with their timestamps) for future analysis

McEth device allows to access to ReSys network sources (Repeaters, Base Unit) from surface command room

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- Wireless communication („inside" team members / FAB oficer / The commander)
- Simple and fast network building, a single network shared by all new rescue teams joining the operation

- Simple to use (can be used by any miner)
- Complies with intrinsic safety requirements (European ATEX and International IECEx)

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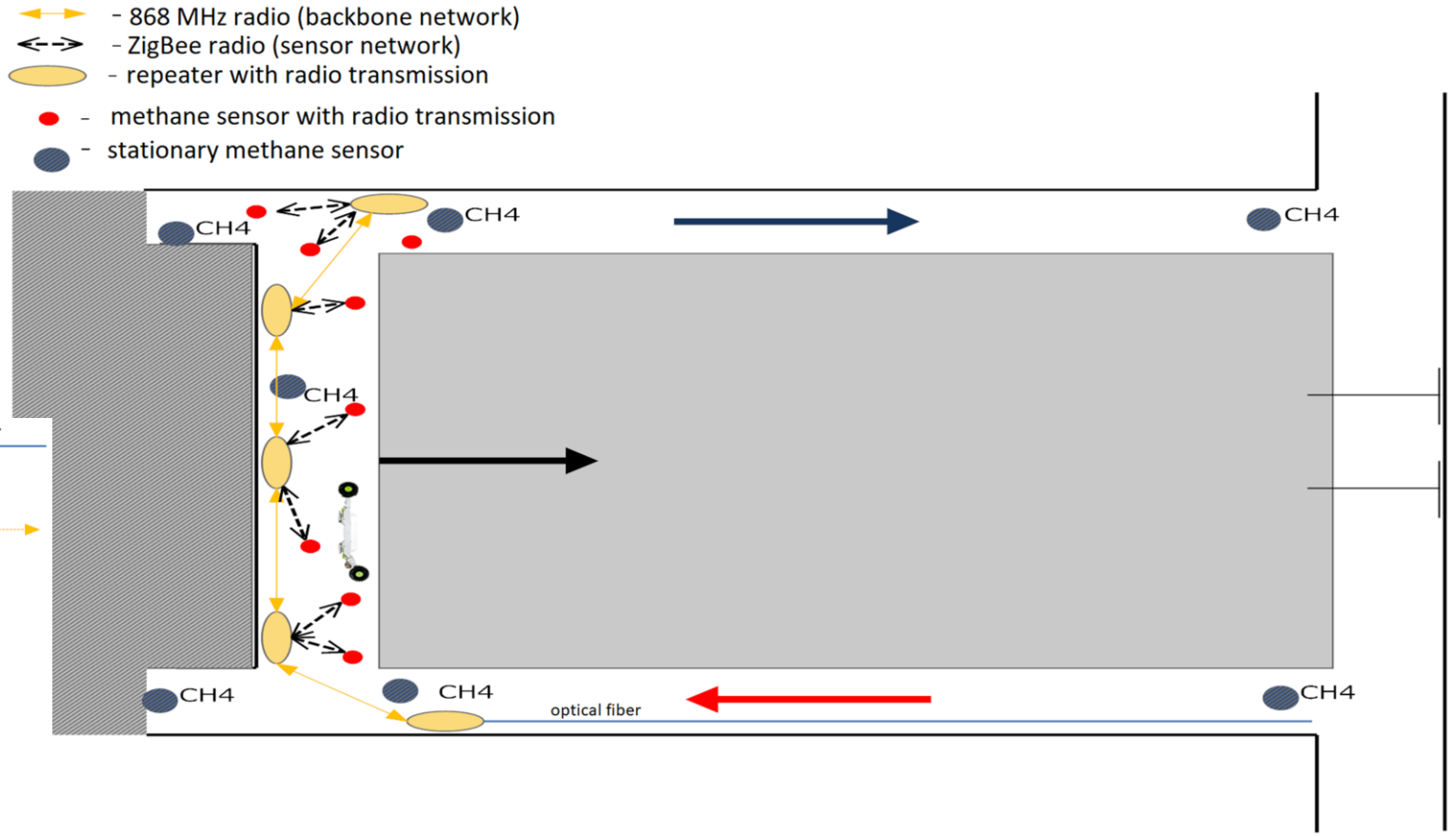
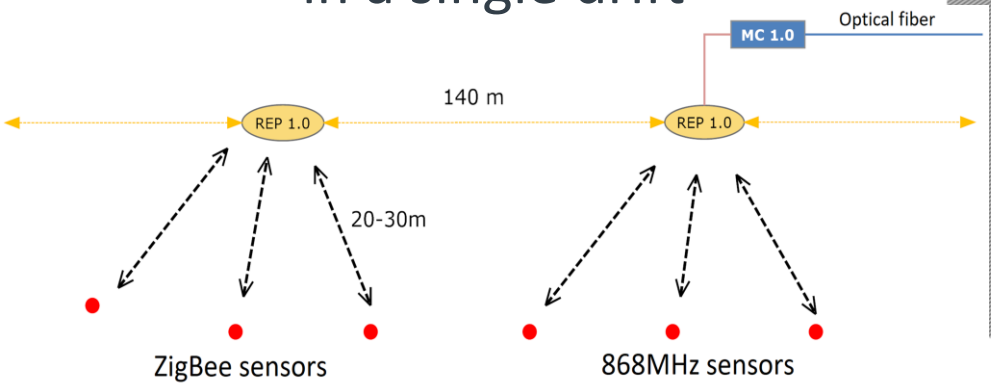
Scheme of longwall distribution interaction with sensors



Samples of backbone network nodes (repeaters) distribution in a single drift



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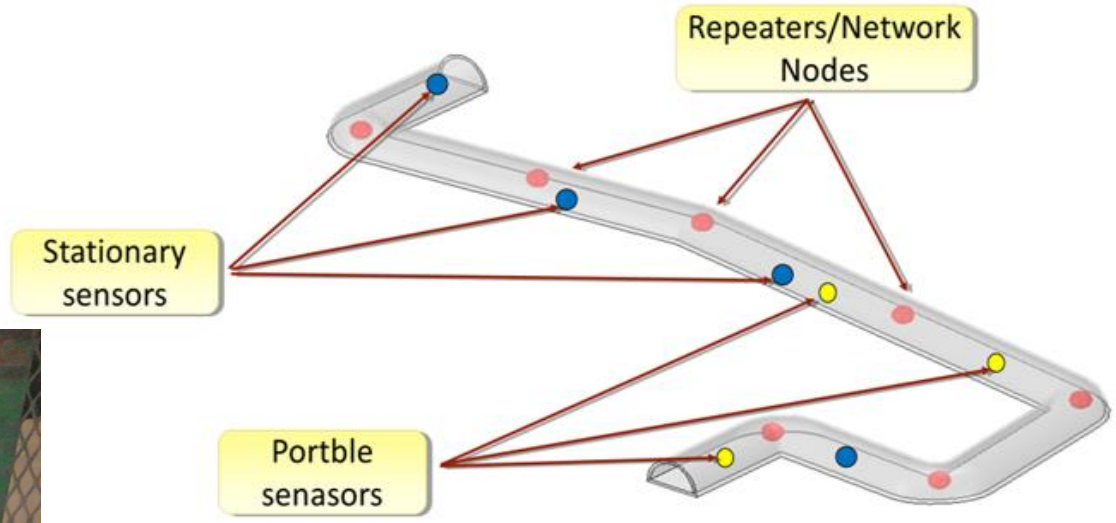
TESTS RSA: Distance between rail switch n.1 to n.13 repeaters positioned inside the loco cabins still working



Distance between two loco cabins 135 m

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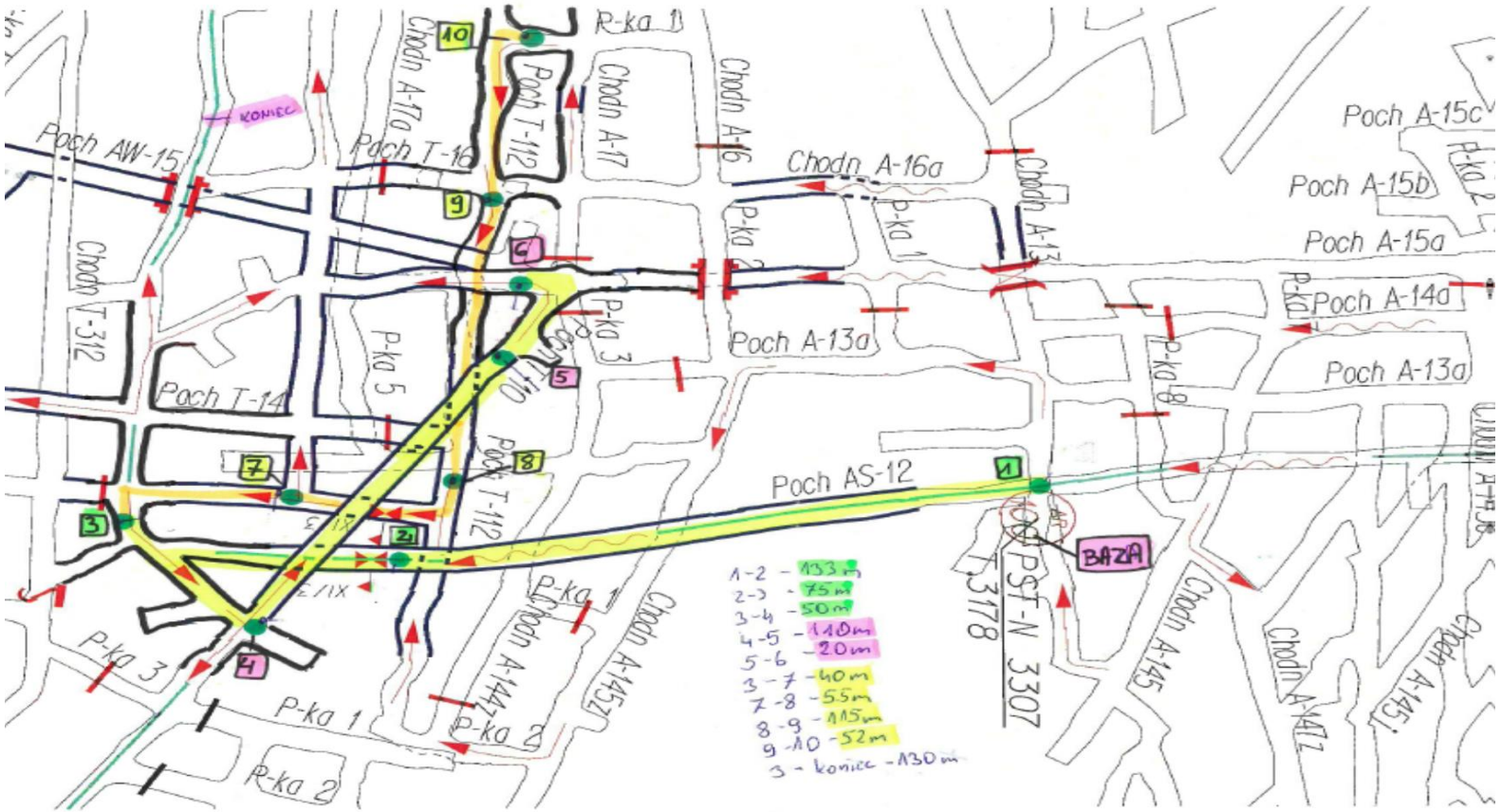
TESTS: LOGGING DISTANCES BETWEEN REPEATERS IN COMPLICATED TWO LEVEL STRUCTURE OF GALLERIES



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Monitor in the command room

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WE HAVE A TOOL, WHAT NOW? TRAINING AND TEST GOALS; WORKING ON RESCUE TECHNIQUES/TACTICS UNDER DIFFERENT CONDITIONS

- Checking maximal distances of secure and stable connection between each logged repeater in rescue net system
- Checking the range of personal communicator's secure audibility
- Checking optimal distances between repeaters at different working conditions like occurrences of obstacles; sealings, roof falls, rock pillars, confine areas, etc.
- Solving case when the network is interupted and restored
- Tracking rescue teams and team's members on the route based on uploaded mine maps, valuation method of time necessary for operation tasks and physical preparation of rescuers

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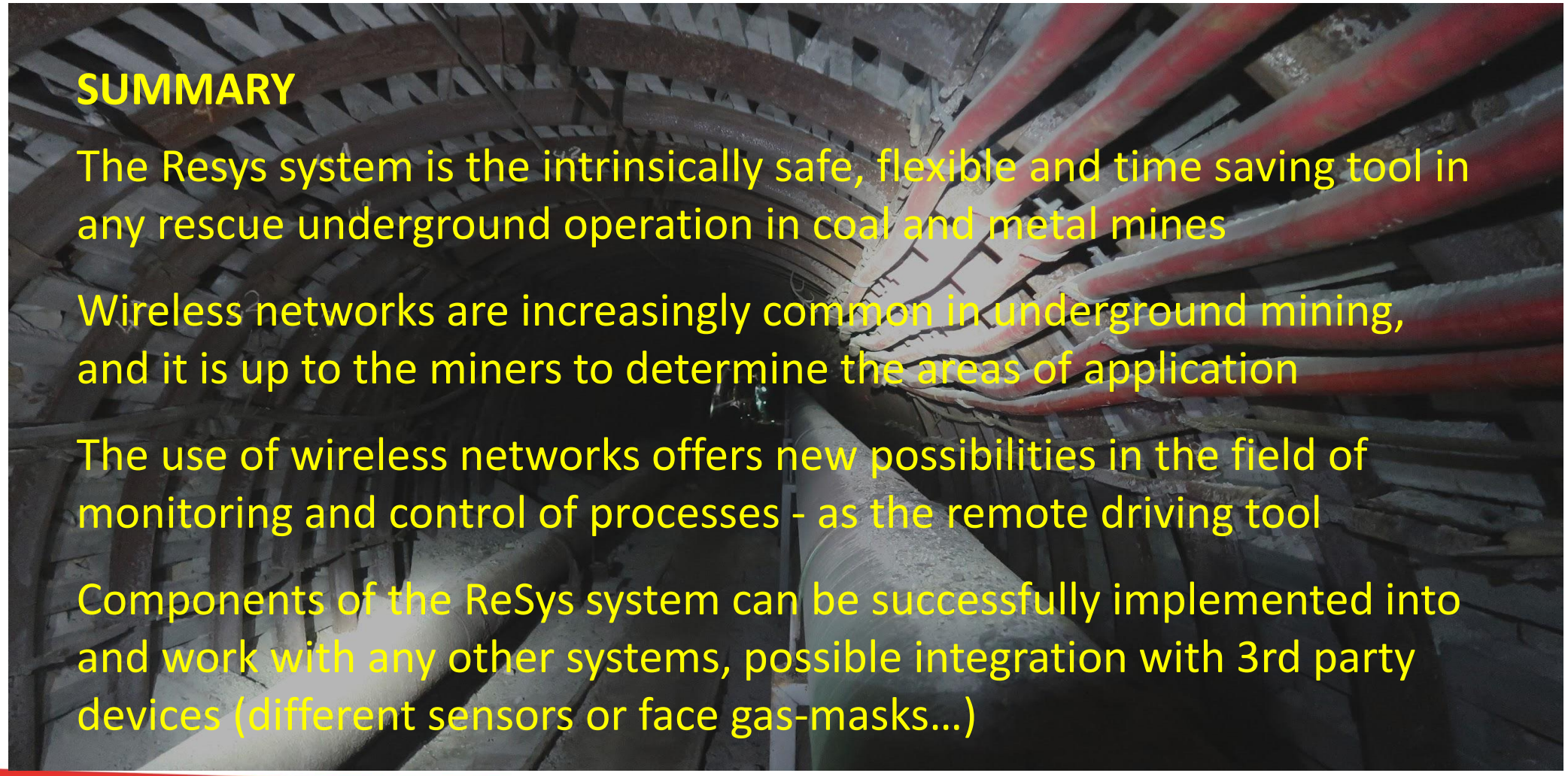

SUMMARY

The Resys system is the intrinsically safe, flexible and time saving tool in any rescue underground operation in coal and metal mines

Wireless networks are increasingly common in underground mining, and it is up to the miners to determine the areas of application

The use of wireless networks offers new possibilities in the field of monitoring and control of processes - as the remote driving tool

Components of the ReSys system can be successfully implemented into and work with any other systems, possible integration with 3rd party devices (different sensors or face gas-masks…)

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Future?

Future will be written by you, Gents responsible for safety in mining

Our goal will be more and more to understand operating environment and identify practises and solutions that can assure a safer workplace.

What we are working on:

- Continuous powering of the repeaters using mine's electricity system
- Repeaters' batteries allowing for **72 hours** of continuous work
- Integration of 3rd party devices with our system
- Personal communicator in the radiotelephone housing
- Localization of persons/devices (integrated into the miner's lamps)

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STAY SAFE AND HEALTHY

THANK YOU FOR ATTENTION

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RSA GOLD MINING

Training for loco drivers with the ReSys use

Siyaphambili

Network working effectively on the galery bends/curves, etc.

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Monitor in the command room

First Rescue Brigade's Captain: First rescue brigade's captain reporting in

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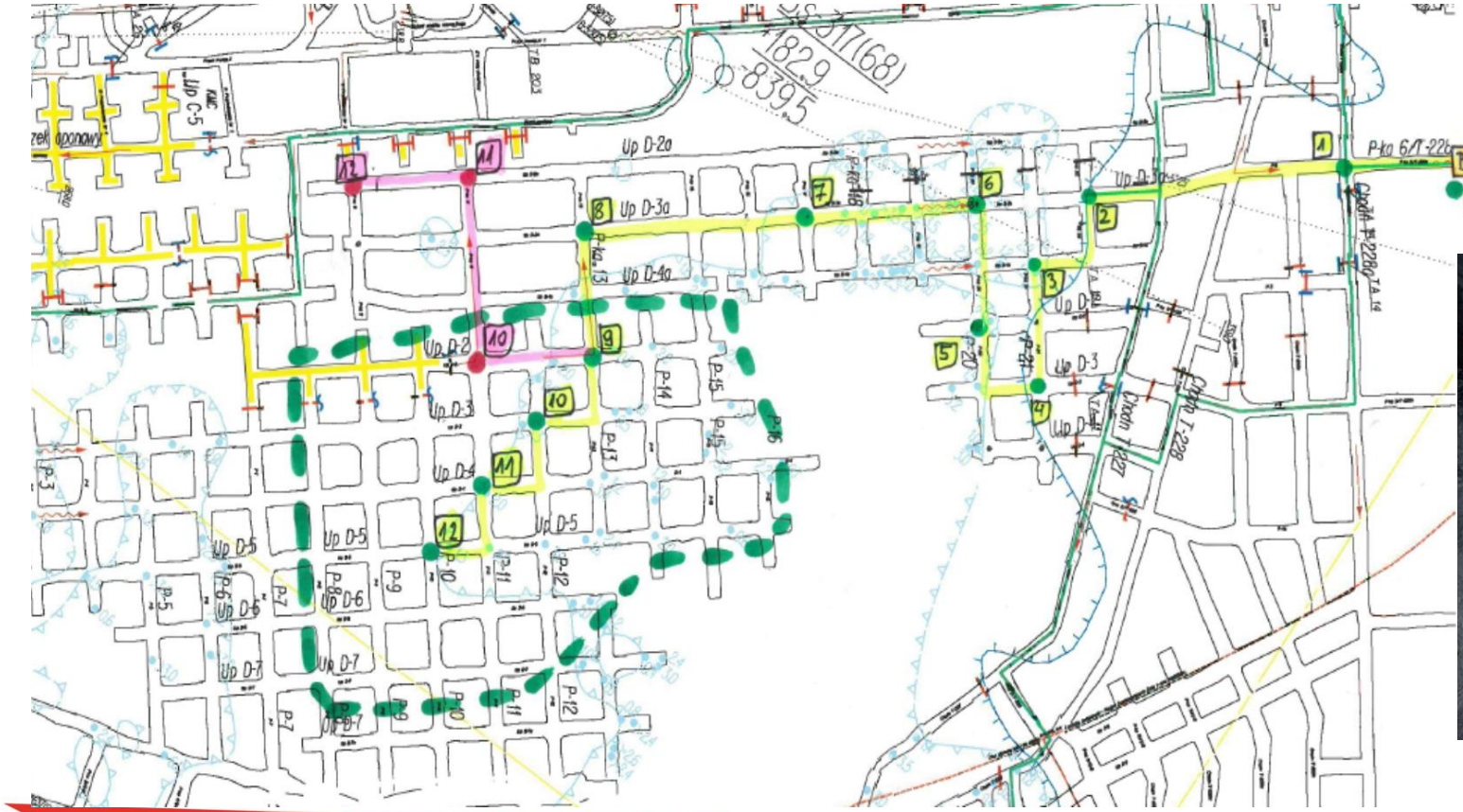
TESTS: CHECKING THE EFFECTIVE LOGGING DISTANCE BETWEEN THE REPEATERS CONNECTED „THROUGH PILLARS”, ROCKFALLS



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New application of the RESYS system:

Company GGT Solutions S.A. asked if ReSys would run inside large diameter pipelines (confine space). They were looking for communication tools working inside steel pipelines. GGT applies Direct Pipe technology using remote controlled drilling method.
In the event of a breakdown, it is necessary to introduce service (rescue) services into the pipeline.
The safety of people working inside and the assessment of failures requires constant voice communication.
Connectivity tests using the RESYS system were carried out inside a pipeline with a diameter of 1000 mm and a length of 0.5 km. ReSys did an excellent job of providing voice communication inside the pipeline and importantly, it also made it possible to track the location of the test group inside the pipeline.