

MECHANICAL CUTTING DIVISION

TELE-REMOTE OPERATION



Product Management Roadheaders & Digitalization



SAFETY FIRST



Sandvik's objective is zero harm to our people, the environment we work in, our customers and our suppliers.



**PROTECTIVE
EQUIPMENT**



**FIRST AID
KIT**



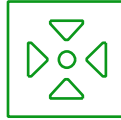
ALARM



**EMERGENCY
NUMBER**



**EMERGENCY
EXIT**



**ASSEMBLY
POINT**



**HEALTH &
WELLBEING**



**PSYCHOLOGICAL
SAFETY**



SITE ZELTWEG
← CLICK ICON FOR MORE DETAILS





COMPLIANCE

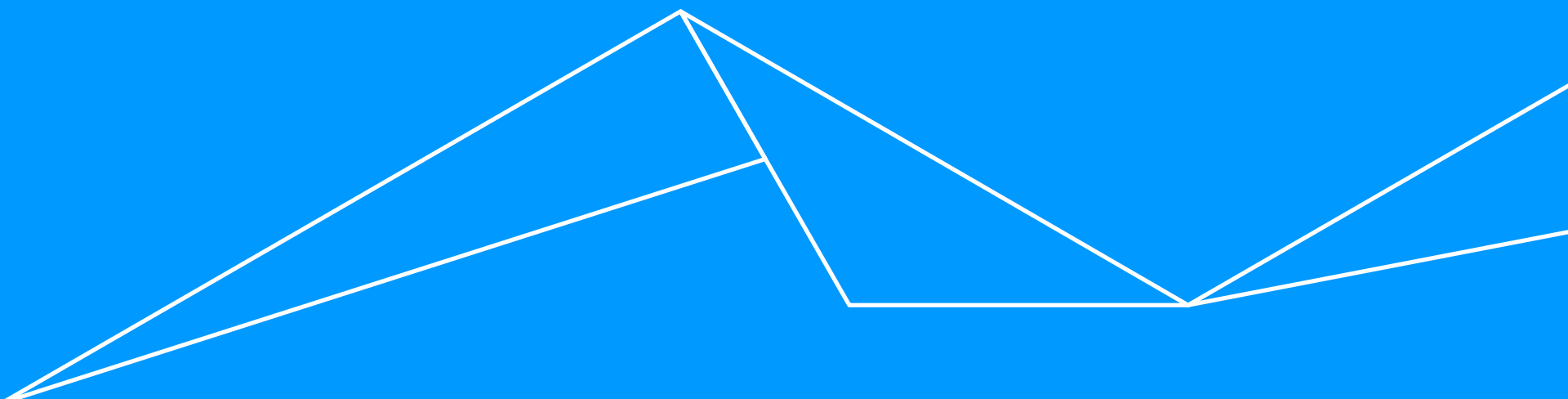
COMPLIANCE

We've always been committed to conducting business with high integrity and in a legal and ethical manner. We embrace our corporate responsibility to combat corruption.

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MOTIVATION & AMBITION

DEVELOPMENT OF DIGITAL FEATURES



MOTIVATION & AMBITION

- Strong demand raised by customers and coming from the global market
- Part of our strategy concerning our future digital offering
- Stepwise, intermediate development targets rolled out to the market as single products at defined dates
- Autonomously operating mechanical cutting machines controlled from surface with tele-remote assistance

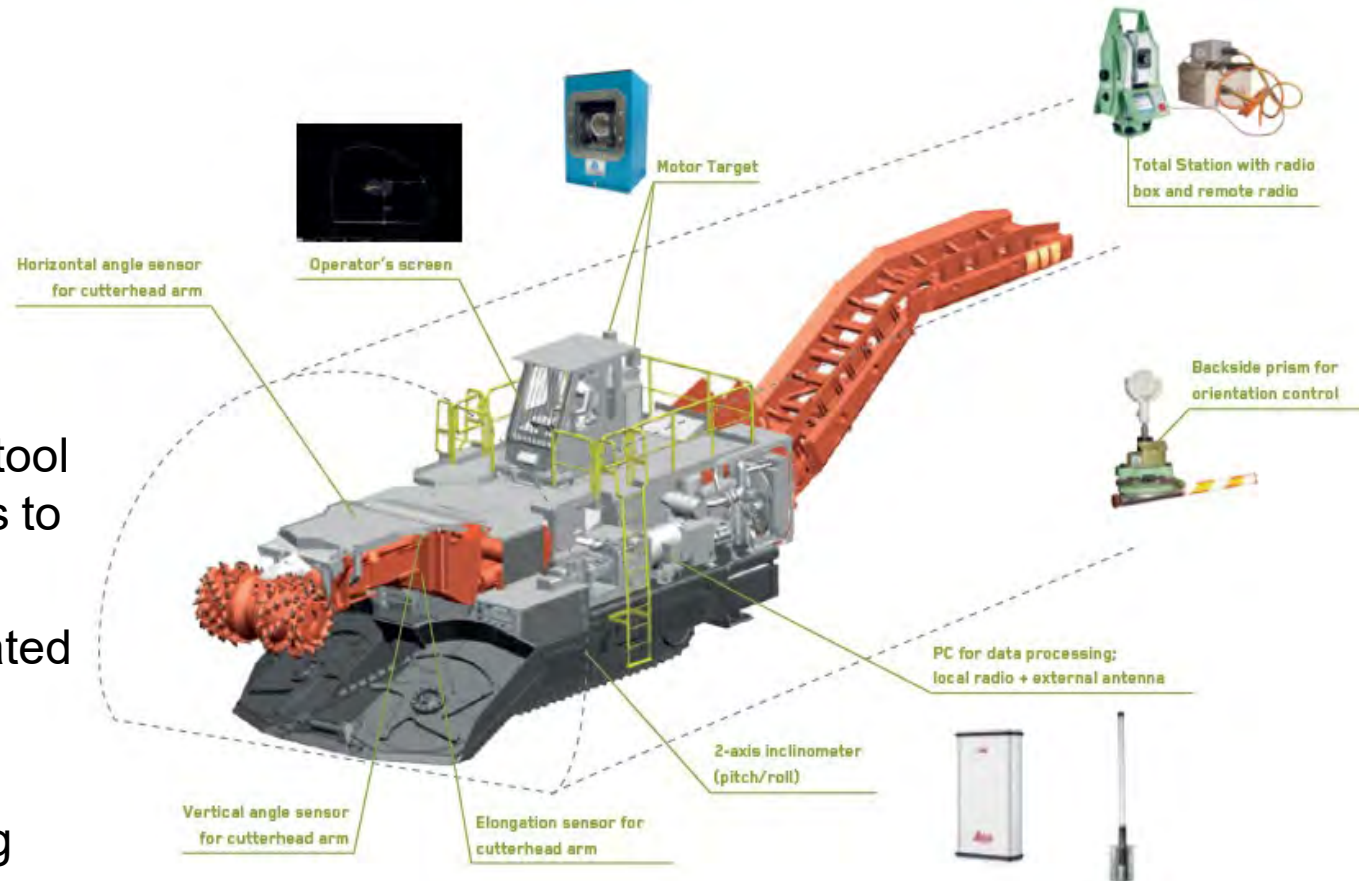
MAIN ADVANTAGES

- Bringing machine operators into a safer and more convenient working environment
- Significant gain in machine utilization as machine can be kept in operation during shift changing periods
- On-board artificial intelligence like Cutronic and off-board components like current tele-remote station

EXCAVATION CONTROL

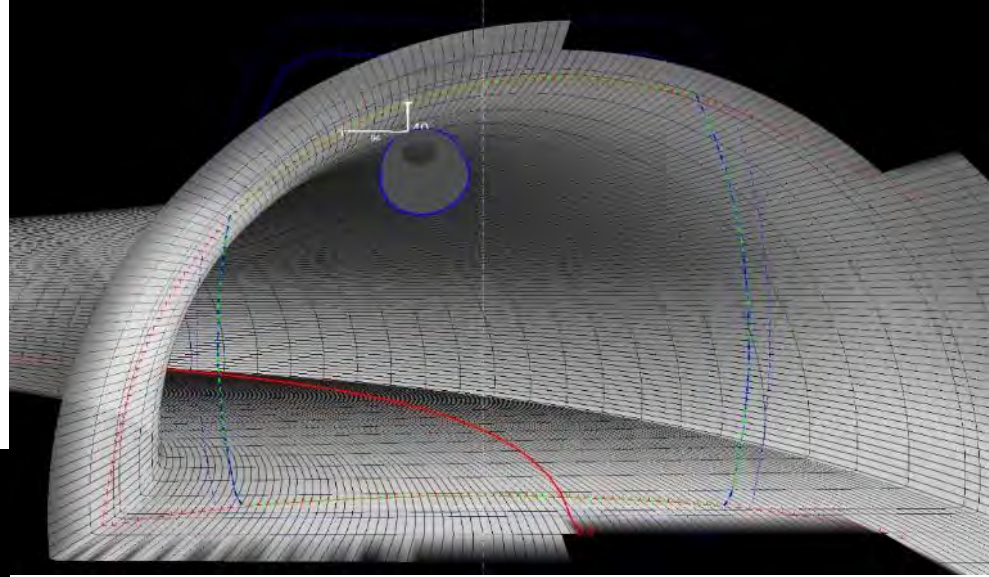
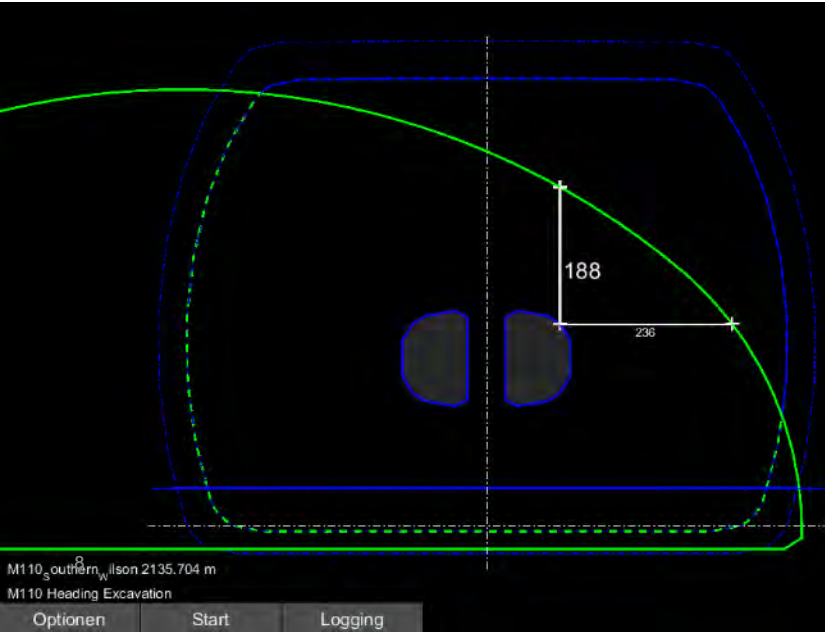
PROFILE CONTROL

- Profile and tunnel planning with office tool and transfer of plans to machine
- Solution fully integrated into machine control system
- Profile control during cutting operation



EXCAVATION CONTROL

PROFILE CONTROL

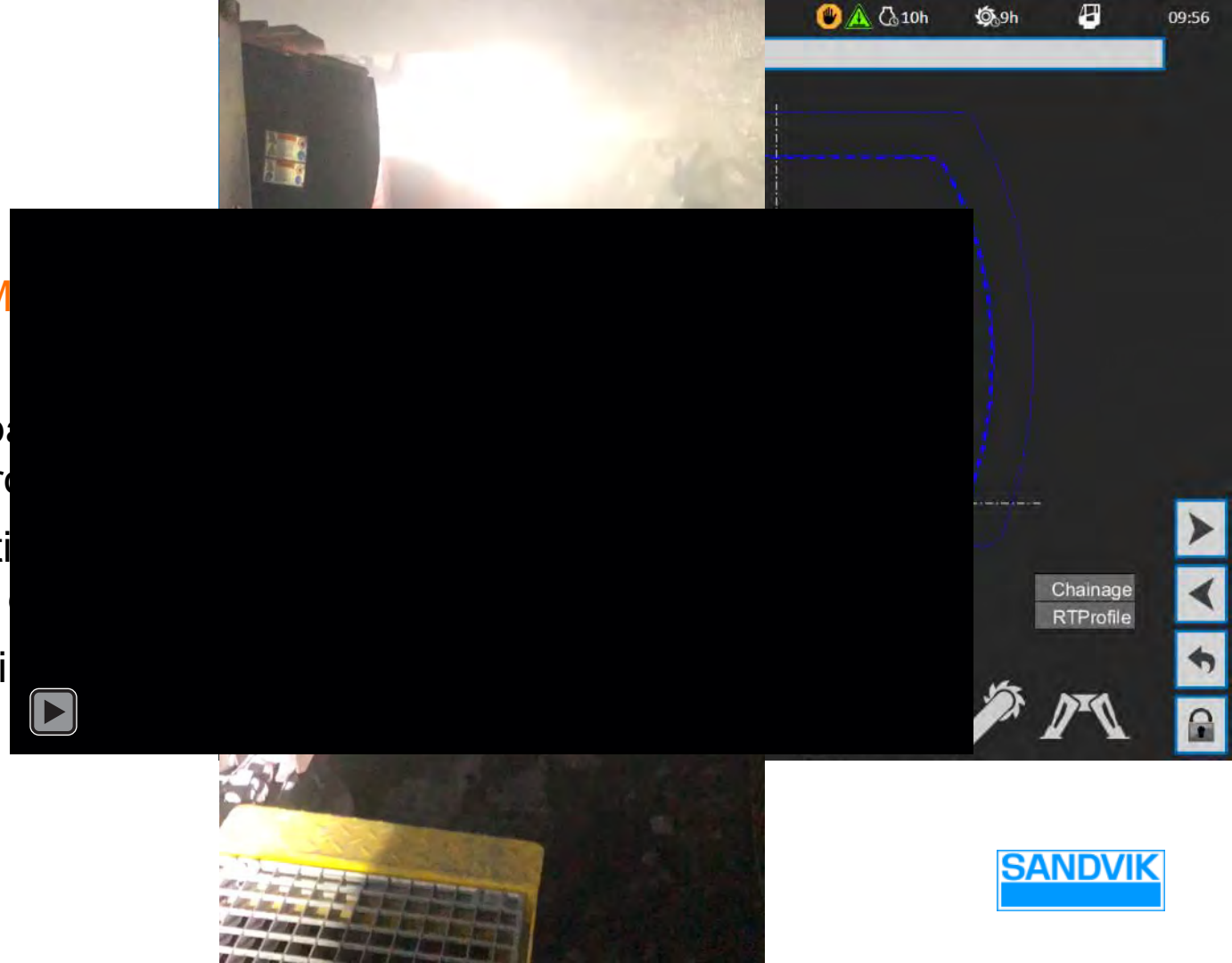


- Cutter head is kept within profile limits
- Visualization of cutting process for machine operator

AUTOMATED EXCAVATION

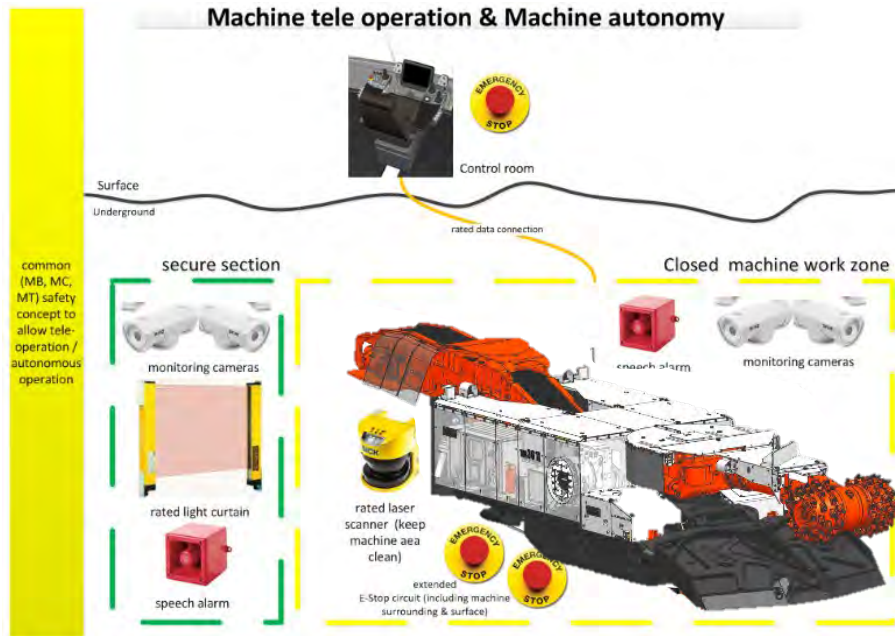
CUTRONIC – AUTOMATED CUTTING

- Planning of cutting path referring to tunnel profile
- Fully automated cutting round length / sump
- Automated profiling in speed



TELE-REMOTE OPERATION

AUTONOMOUS MACHINE WITH VISUALLY SUPPORTED TELE-OPERATION



TELE-REMOTE OPERATION FOR

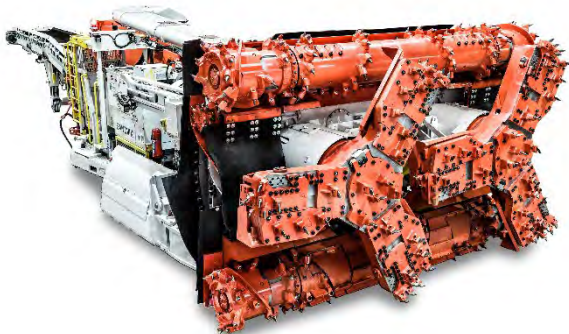
BOLTER MINERS



ROADHEADERS

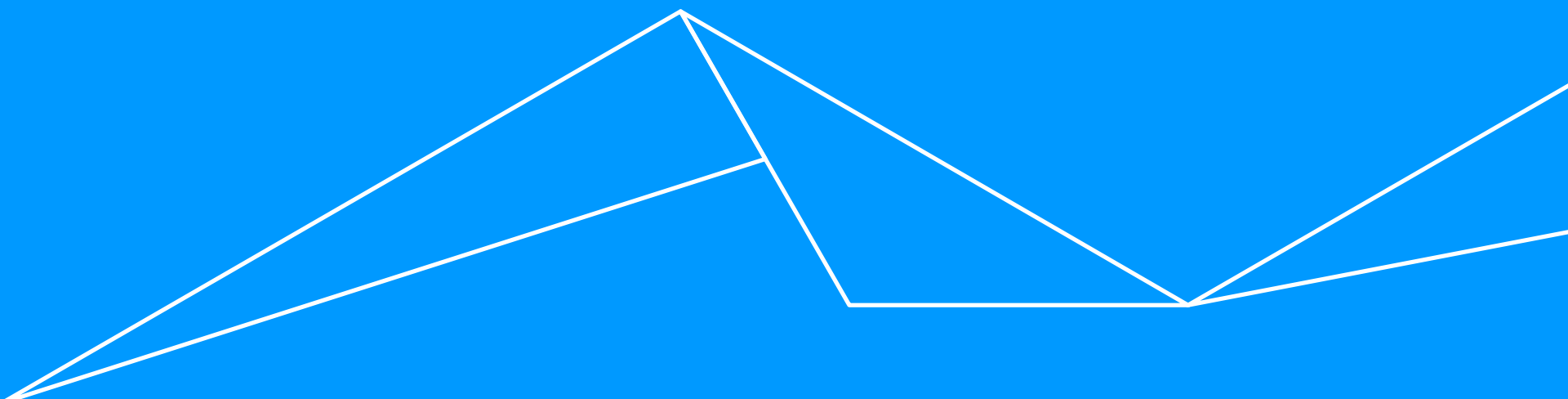


BORER MINERS



CONTINUOUS MINERS

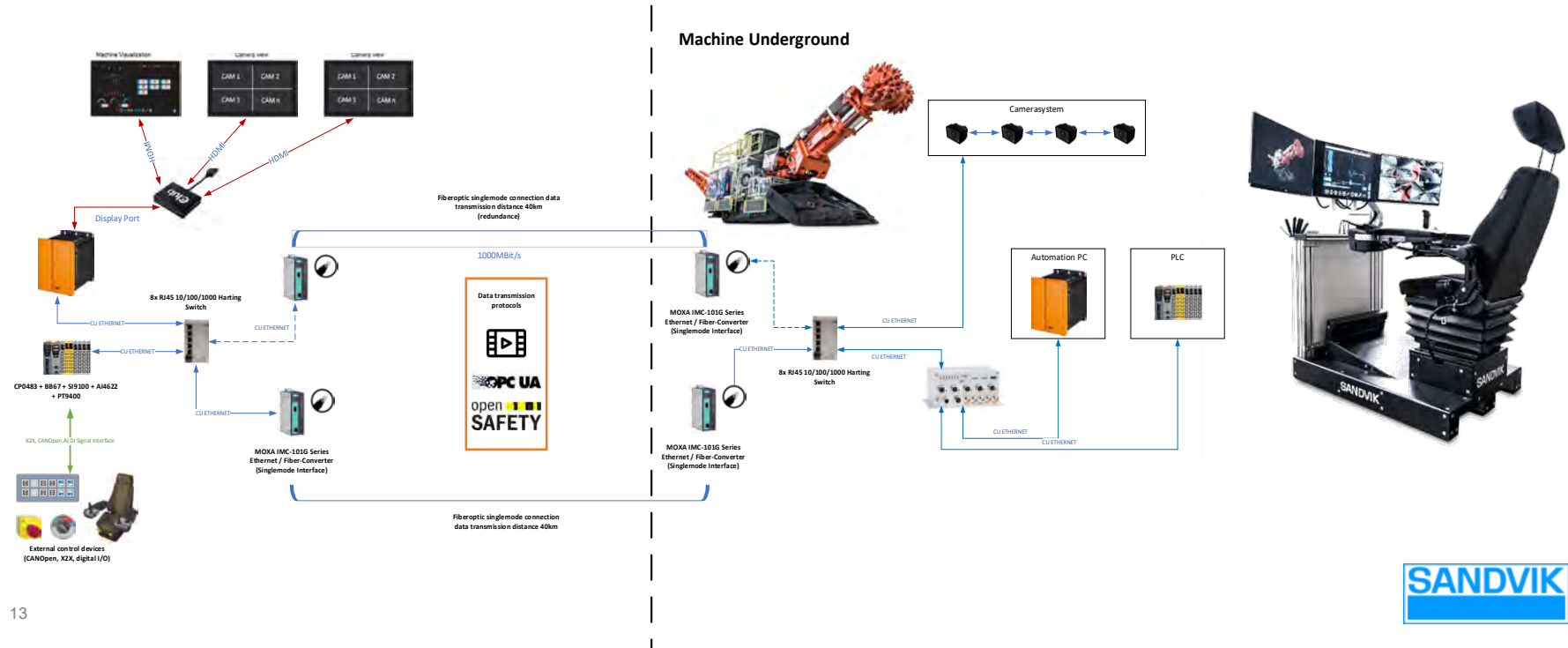




TECHNICAL OVERVIEW

PRINCIPAL SYSTEM LAYOUT

TELE-REMOTE OPERATION OF MACHINE IN SEMI-AUTONOMOUS MODE



TELE-REMOTE STATION

SURFACE HMI FOR UG MACHINE

- Platform surface installation in light and compact form for easy transport
- Latest generation of I-panels installed on ergonomic operator seat
- 3 screens for visual control
 - Underground bird view visualization
 - Machine operator screen
 - Underground camera views



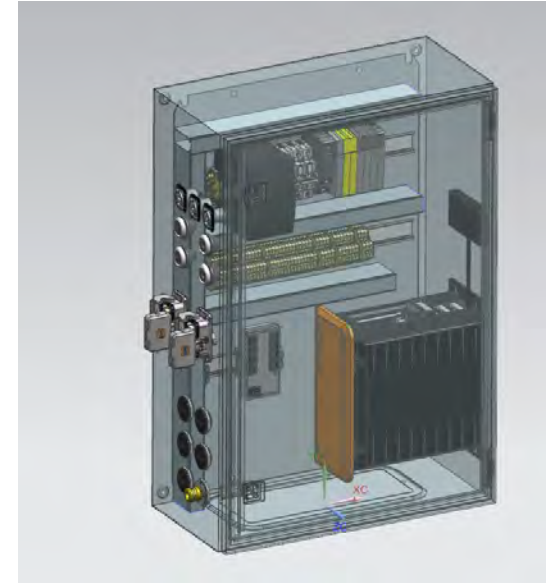
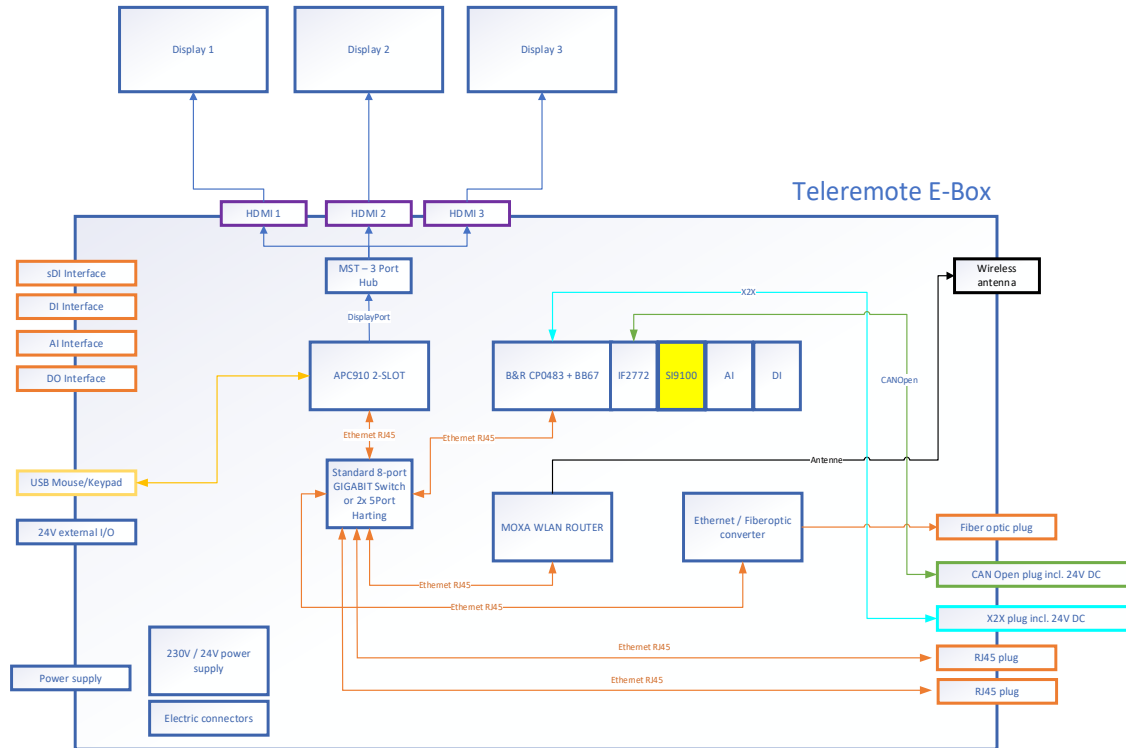
OVERVIEW TELE-REMOTE STATION

SURFACE HMI FOR UNDERGROUND MACHINE



E-BOX

STANDARDIZED REMOTE INTERFACE TO UNDERGROUND MACHINE



SENSING TECHNOLOGY FOR MECU TRO

MACHINE POSITION AND ENVIRONMENT CONTROL DURING TRAMMING

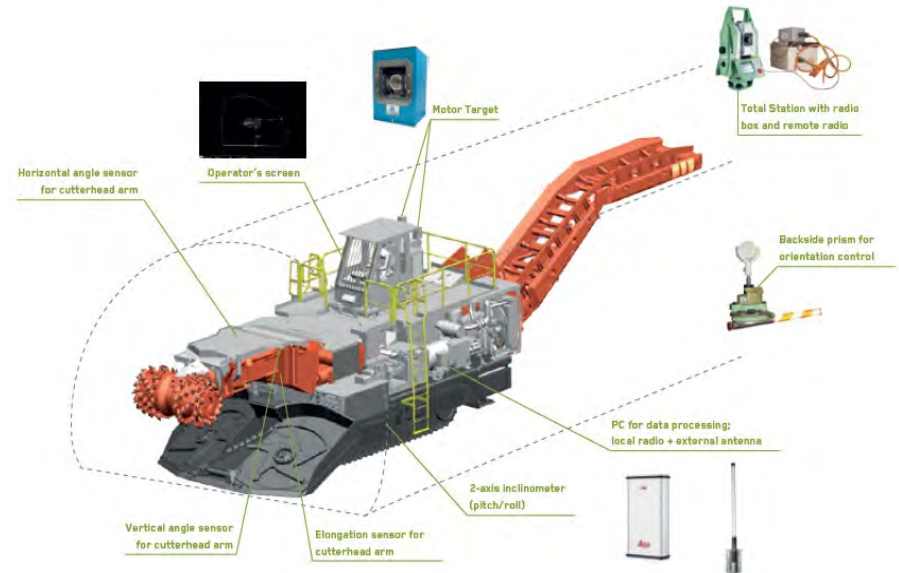
- Displaying machine position in bird view in the underground environment including walls of underground excavations
- Sensors for keeping correct distance to walls of underground excavations
- Proximity detection system creating safe working area around machine

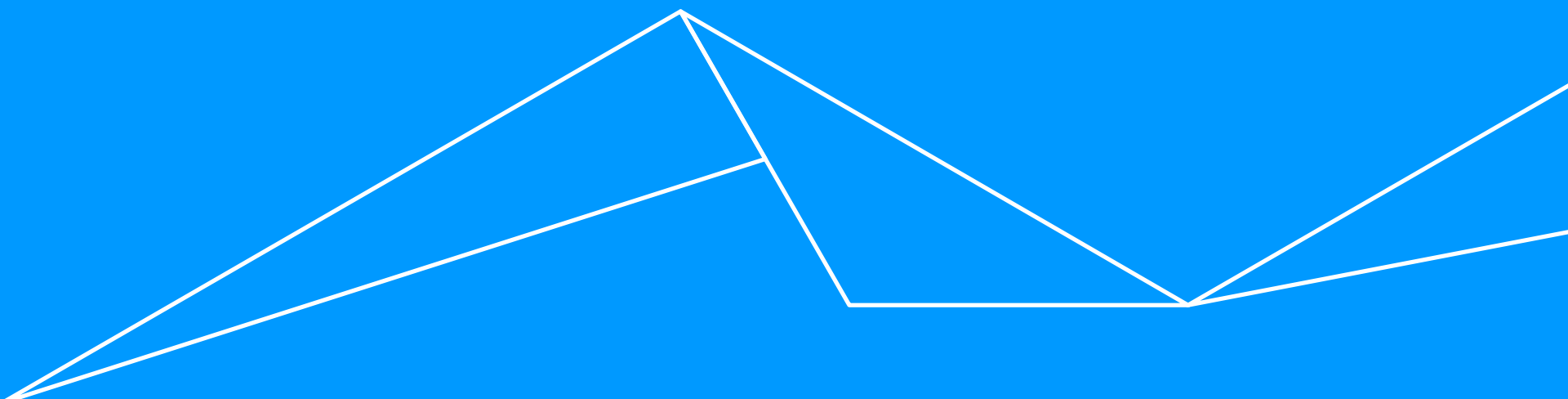


SENSING TECHNOLOGY FOR MECU TRO

MACHINE POSITION AND ENVIRONMENT CONTROL DURING CUTTING

- Absolute machine position control during entire cutting cycle cut by Cuttronic® system
- Absolute machine position control during machine repositioning and setup at the face for initiating next cutting cycle





STAGED DEVELOPMENT APPROACH



Q1 / 2022



STAGE 1

NEW GENERATION OF CONTROL SYSTEM AND 360° VISUAL SURVEILLANCE

- Easy plug & play surface operator panel including integrated E-box as add-on to machine control system
- Robust and smart underground camera set including lens cleaning system for visual surveillance of underground environment
- Underground network infrastructure in responsibility of customer (minimum requirement 100Mbit/s)





Q2 / 2022



STAGE 2

FULLY AUTOMATED HANDLING OF SUPPLY LINES (E-POWER AND WATER)

- Fully automated, controlled handling of electric power cable during machine maneuvering
- Fully automated, controlled handling of water hose/s during machine maneuvering





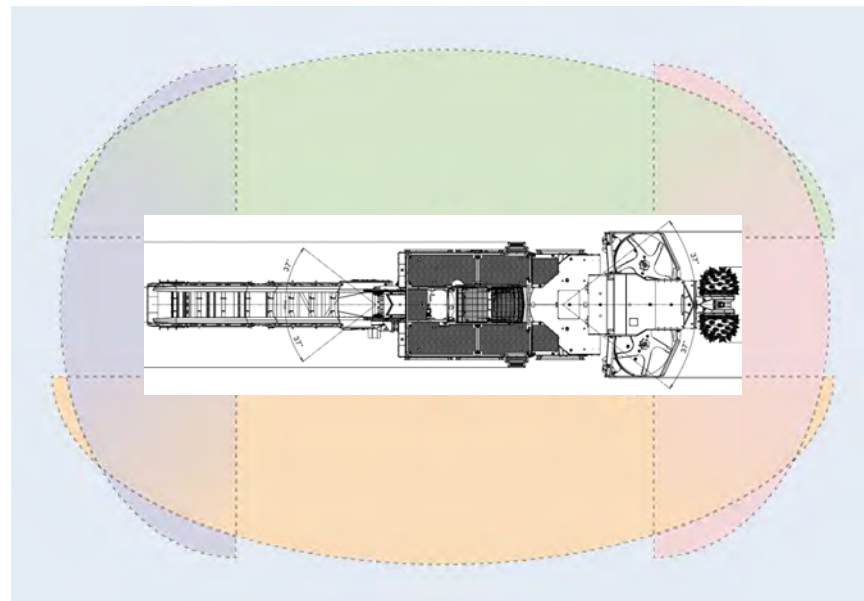
Q3 / 2022



STAGE 3

3D MACHINE POSITION AND 3D ENVIRONMENT CONTROL / VISUALIZATION

- Displaying machine in bird view and/or in 3D view in the underground environment including walls of underground excavations
- Machine connected to underground survey system for absolute 3D machine position control
- Sensors for keeping correct distance to walls of underground excavations during machine maneuvering

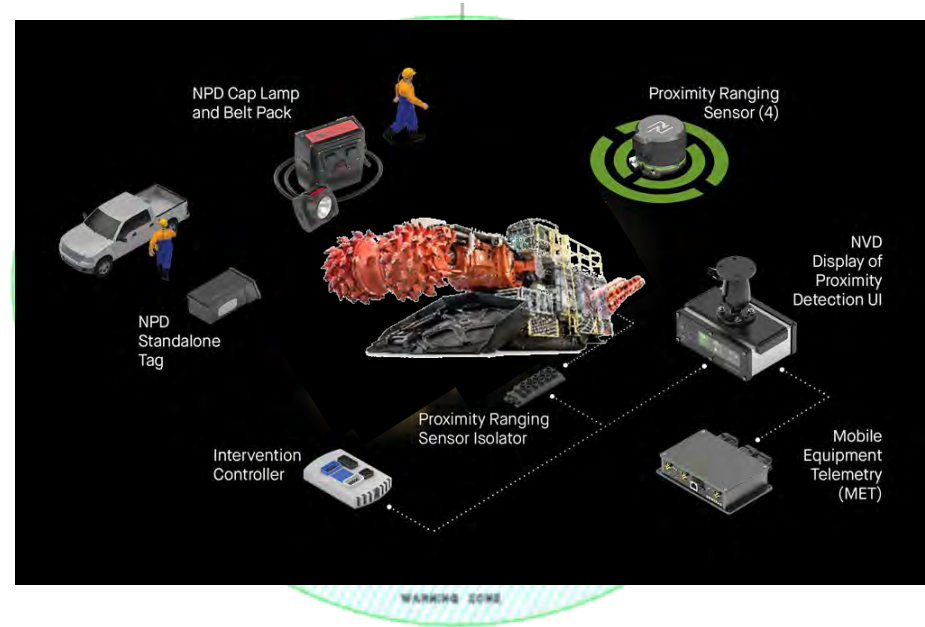


STAGE 4



UNDERGROUND SAFETY CONCEPT FOR INTERACTION IN OPERATION

- Proximity detection system creating safe working in area on and around machine for persons and vehicles
- Closed-off operating area in combination with autonomous load & haul vehicles possible
- General interface for customized, site specific working area protection systems, proximity detection systems and collision avoidance systems

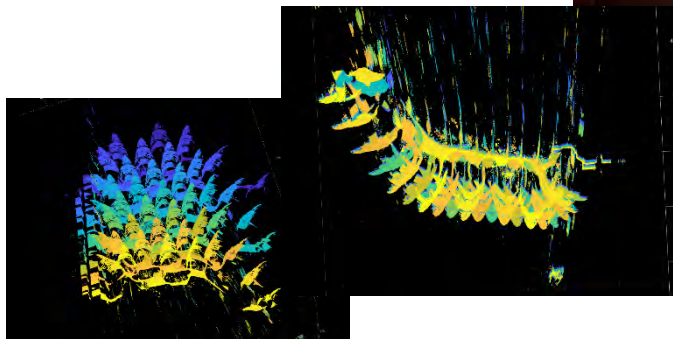




STAGE 5

AUTOMATED SURVEILLANCE AND EXCHANGE OF CUTTING TOOLS

- Automated check of cutting tool wear
- Automated replacement of worn cutting tools
- Automated documentation of cutting tool exchange and specific tool consumption



SANDVIK MINING AND ROCK TECHNOLOGY

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