An all-in-one modular turnkey solution

<table>
<thead>
<tr>
<th>Environmental Monitoring</th>
<th>Portable gas detection instruments with “reactive” communication up-links.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location Monitoring</td>
<td>Fully integrated system that can download gas readings, monitor assets &amp; vehicles, collect telemetry data, transmit paging messages and collect SCAS II - Collision Awareness logs.</td>
</tr>
<tr>
<td>2-way Paging &amp; Distress Call</td>
<td>New generation caplamps including wireless and digital communication, worn by the underground workers.</td>
</tr>
<tr>
<td>Collision Awareness Surface and Underground</td>
<td>SCAS II Collision Awareness System, providing early perimeter warning notification that gives vehicle operators and pedestrians a head start in deciding how to manoeuvre before a critical decision is required.</td>
</tr>
<tr>
<td>Lamp Room and Asset Management</td>
<td>The LMS/AMS is a comprehensive database and software suite that offers a total management solution ensuring compliance with DMR regulations regarding Lamp Room operations and its assets.</td>
</tr>
<tr>
<td>Schauenburg Advanced Technical Services</td>
<td>A Schauenburg, technical skilled, managed lamproom service – A unique customisable solution that manages all aspects of looking after the MIMACS brand deployed in the lamp room and underground.</td>
</tr>
<tr>
<td>Fixed Environmental Monitoring</td>
<td>MIMACS data communication systems provide pro-active solutions for the early warning of underground personnel before and during critical situations via environmental monitoring systems and fire detection systems.</td>
</tr>
<tr>
<td>Roxy 40 Self-contained self-rescuer</td>
<td>Self-rescuer ROXY 40 is a belt worn breathing apparatus to exit from the danger zone. Its is intended for use only to escape in case of accidents (smoke, toxic gases, oxygen deficiency). It is a ready-to-use device and is intended for constant wearing underground.</td>
</tr>
</tbody>
</table>
The mining industry has come under increased scrutiny over the safety of personnel in mines and the prevention of situations that contravene the requirements of Sections 54 and 55 of the Mine Health & Safety Act. The drive for enhanced safety in underground mining has initiated the advent of advanced products and information systems that have pioneered the era of underground intelligent mine safety systems.

Schauenburg Systems (Pty) Ltd, an original equipment manufacturer (OEM) for mine safety, offers the services of a system integrator with comprehensive turnkey solutions including a bouquet of multi-disciplinary services and programme management methods required to ensure a successful and cost-effective solution for the full spectrum of mine safety solutions and management.

Schauenburg’s successful design, manufacturing and implementation of products have given it the experience and assurance to offer real solutions at competitive prices. With great emphasis on all-in-one systems and solutions, they define their goals and introduce a world-class electronic product range for health and safety for underground mining.

Schauenburg’s ability to design innovative electronic products utilizing cutting edge technologies allows it to not only focus on products but also the integration of turnkey communication systems and solutions. The range of equipment supplied by Schauenburg includes intelligent instrumentation, gas detection, safety-enhanced caplamps, computerised radio relayed monitoring, safety systems, radio communication, anti-collision systems and more. Continuous research and development, state-of-the-art manufacturing capabilities as well as an international distribution and technical service network enables Schauenburg Systems to serve the international mining and tunnelling markets together with other industries to the highest professional standard. Regular interaction and liaison with clients as well as technology suppliers ensures that state-of-the-art products are of the highest quality. Schauenburg focuses on modern electronic technologies to set standards in international health and safety applications for underground mining.

Schauenburg’s acclaimed “MIMACS” System (Mine Wide Integrated Monitoring and Control System) addresses multiple safety concerns within the underground mining discipline. The integrated system typically offered consists of:

- New generation caplamps including wireless and digital communication, worn by the underground worker
- PTC miner’s caplamp (paging facility; communication between PTC caplamps and the control room)
- Portable gas detection instruments with reactive communication up-links
- Sentinel Handheld Gas Detection Instrument
- Lamproom and Asset Management System
- Reactive personnel location, distress call function and short text messaging
- Reactive asset management and control
- Verification and live reporting of vehicle-to-vehicle and vehicle-to-pedestrian systems deployment.

Schauenburg has designed and engineered its offering to the mines to be modular in concept and application. Any system can be easily modified to meet mine and site-specific requirements.

A key feature of Schauenburg’s MIMACS offering is its SCAS II Collision Awareness System, providing early perimeter warning notification that gives vehicle operators and pedestrians a head start in deciding how to manoeuvre before a critical decision is required. A distinct benefit of Schauenburg’s SCAS II Collision Awareness System module above other systems offered is that the system is fully compatible to integrate with all other MIMACS modules.

Another feature of the MIMACS System is its Lamproom and Asset Management System. The LMS/AMS is a comprehensive database and software suite that offers a total management solution ensuring compliance with Department of Mineral Resources’ regulations for all lamp room operations. The system enhances both safety and security of the daily operations. An extensive variety of reports is available that include, amongst many others, a daily exception report and backup shaft clearance report. The system configuration also offers remote client access that allows management staff to generate reports from the comfort of their offices.

Full maintenance agreements ensure that the equipment supplied to the mine remains in good working condition at all times. The technical support teams at Schauenburg Systems undergo stringent technical training to ensure the highest standard of workmanship especially where lifesaving equipment is involved.

Schauenburg Systems (Pty) Ltd is part of the Schauenburg International Group with more than 30 affiliated companies worldwide. The Group focuses on niche technologies of which the focal areas are in electronic technologies, machinery and equipment, plastics processing, and engineering products.

Enhanced safety in underground mining
MIMACS Overview

SURFACE

UNDERGROUND

PDS & LOCATION MONITORING
We innovate to make mines safer and more productive.
SCAS II – Collision Awareness System

Underground

Providing early perimeter warning notification can give vehicle operators and pedestrians a head start in deciding how to manoeuvre during or before the critical decision making period.

The SCAS II Collision Awareness System uses dual band RF Technology to warn a vehicle operator that a vehicle, pedestrian and/or a fixed hazard are in one of the three configurable warning zones. The system will also indicate the orientation of the potential hazard. SCAS II can also be configured to provide vehicle interface signals such as “crawl & stop” via CAN bus. The equipment is designed for underground trackless and track bound machinery.

Pedestrians in turn will be warned of approaching vehicles as well as possible hazard areas by means of an effective LED warning device and audible alarm.

Warning events are stored on the vehicle unit as well as the cap lamp radio and selected data events can automatically be transmitted to the control room from strategic locations while the vehicle is in transit. Should the mine infrastructure not allow for automatic data downloading, information can be manually uploaded through a manual wireless interface unit.

Key Hardware Components
Pedestrian PDS Functionality Testing

To ensure equipment is tested and functional before entering the underground mining environment.

Additional to the SCAS II peripheral hardware is the Multi Purpose Unit. The same Multi Purpose Unit can be configured for different applications/scenarios such as in areas that are deemed dangerous/hazardous, workshops where lots of nuisance SCAS II alarms can irritate workshop personnel, at brake test ramps where it is required for a vehicle driver to perform brake tests and at tip areas where tip attendants should not interfere with unnecessary PDS alarms in terms of the vehicle tipping process.

**Hazard Unit:** Warning beacon to other SCAS II equipment in areas that are deemed dangerous or hazardous

**Tip Exclusion Unit:** Is installed to create designated safe zone within a larger hazardous area, such as the area where a tip operator is allowed to stand

**Workshop Unit:** Can be configured to place SCAS II vehicle systems into a discreet mode to avoid nuisance alarms

**Brake Test Unit:** Utilised at a vehicle brake test ramp where it is required for a vehicle driver to carry out a brake test prior to vehicle shift operation and to acknowledge that the brake test took place
Surface Applications

The Schauenburg Systems Surface Proximity Detection System is a vehicle and personnel tracking and collision awareness system, compatible with SCAS II underground equipment that uses advanced detection technologies and algorithms designed to save lives and reduce costs.

Built to operate in a variety of rugged and demanding conditions, the surface PDS uses multiple technologies to create a failsafe system that increases accuracy over single technology systems.

Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>GPS</th>
<th>RF (TOF)</th>
<th>Risk covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental (Clouds, rain, etc.)</td>
<td>×</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Roof and structure coverage</td>
<td>×</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>No LOS for detection</td>
<td>✔️</td>
<td>×</td>
<td>✔️</td>
</tr>
<tr>
<td>Accuracy (&lt;1m)</td>
<td>×</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Satellite blind spot in pit</td>
<td>×</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Distance (long range)</td>
<td>✔️</td>
<td>×</td>
<td>✔️</td>
</tr>
<tr>
<td>Distance (close range)</td>
<td>×</td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>
Equipment Options

Personnel
(Impi)

Basic
(Light vehicles)

Premium
(Heavy duty vehicles)

System Reporting

The system reporting software is clear and easy to understand, using a simple dashboard or web based mobile application, to view information.

Data is stored on a cloud-hosted server, and information available includes vehicle tracking, vehicle trip analysis, near misses and possible collision event analysis as well as general tracking.

The result is accurate, comprehensive reports that include trip playbacks, giving precise details of speed, distance, trip duration, near misses and more, assisting in an accurate analysis of your operations.
MIMACS RF Technology will measure and report personnel and asset movement from the Lamproom or surface area to the underground place of work, as well as the movement of the pedestrians and assets in the actual underground workings.

Reactive Location Monitoring will provide:
- Shaft Clearance Reports
- Level Control
- Pedestrian Location to Proto/Rescue teams
- Reactive movement of people and assets

Operations utilizing the SCAS II Collision Awareness System can upgrade to a Mine-Wide Reactive Location Monitoring system by simply installing MIMACS Fixed Controllers in Strategic areas. The RF Data Radio in the caplamp is a common component for Tracking, Collision Warning and Paging/Distress Call function.

The MIMACS Reactive Location Monitoring infrastructure can be used to notify individuals/groups/sections/levels of dangerous or hazardous situations by means of a text message.

System Overview
Pro-active Early Warning of personnel by means of paging can save lives by providing personnel with additional time to evacuate or move from potentially dangerous situations or areas before disaster strikes.

The Schauenburg PTC Lamp is fitted with a dual-band data radio and LCD display module that allows for user configurable text messages to be dispatched from the control room to a specific user or group of users.

The control room operators can, from the MIMACS Environmental Monitoring Graphical User Interface, be warned of dangerous underground conditions like gas build up, fires or seismic movement and communicate the threat to underground personnel in real time. The lamp supports full two way communication and personnel that are trapped or that require assistance can inform the control room of their whereabouts by using the “Distress Call” feature. The PTC Lamp offers collision warning, location monitoring and paging functionality in a single device.

System Overview
The GDI Sentinel is the latest model in the renowned Schauenburg range of portable gas measuring instruments. Its small and robust enclosure is ideally suited for the harsh South African mining conditions.

The instrument was designed and developed to be part of the Mine Wide Integrated Monitoring and Control System (MIMACS) and has the ability to transmit gas intersections to the control room from the working face.

The instrument can also be used as a comprehensive stand alone product.

The Sentinel is also equipped with a passive RF Interface that makes fire patrol functionality possible based on locations being represented by unique passive tag IDs that do not require a power source. The instrument has 3 sensor ports and allows for a up to a four gas configuration with the use of a combination sensor. The 3-way alarm includes audible and visual annunciation as well as vibration alert. Capacitive touch buttons and inductive charging enhances the IP rating of the device and also eliminates ineffective battery charging due to poor contact. User testing, calibration and downloading functions are RF based and fully automated.

Based on the MIMACS interface capabilities of the Sentinel in terms of the common RF communication platform, the Sentinel can interface with SCAS II equipped vehicles in terms of interlocking mechanisms when gas is intercepted by the Sentinel.

System Overview
MIMACS Data communication systems provide proactive solutions for the early warning of underground personnel before and during critical situations via:

- Environmental Monitoring System
- Fire Detection System
- Belt Monitoring System

Data uploads from the various sensors and actuators deployed underground are routed to the control room and viewed on industry standard SCADA MMIC application, providing the user with a total Mine-Wide monitoring and control system.

System Overview
Schauenburg’s Advanced Technical Services (SATS), a division of Schauenburg Systems (Pty) Ltd, identified the need in the mining industry to overcome increased scrutiny over the safety of personnel in mines and the prevention of situations which contravene the requirements of Sections 54 and 55 of the Mine’s Health & Safety’s Act (MHSA). While safety is a key concern, mining authorities have started to realise that it is not always one of their core competencies, thus making outsourcing aspects of health and safety a viable and often far safer option. This drive has initiated the advent of advanced products and information systems that have pioneered the way for transformation of the Lamproom function, where it was traditionally used as an “issue of lamps centre” to miners going underground. The Lamproom has evolved into a verification and safety command centre for the control and monitoring/reporting of personnel, safety equipment, legislated requirements and best practices in the mining industry.

The traditional and modest Lamproom has developed into a sophisticated “Safety Control Terminal” (SCT).

Systems within the Safety Control Terminal verify that all safety critical equipment which are subjected to functional testing are in good working order before allowing access to the underground environment. Furthermore, a person can be contained in the Lamproom if he/she does not return all their equipment after a shift. The system therefore enhances both safety and security of the daily operations of personnel and equipment. An extensive variety of reports are available that include amongst others, a daily exception report on various pieces of equipment, a backup shaft clearance report as well as allocation and failure reports. The system configuration also offers remote or web-based access which allows management staff as well as mining regulatory bodies (DMR) to generate these reports from any location linked to the internet.

Schauenburg has designed and engineered its offering to the mines to be modular in concept and application. The system can be easily modified to meet mine and site-specific requirements. Schauenburg also offers a complete solution of the layout and design of the SCT. Production is of core value to the mine, and the SCT is designed in such a way that miners can start and end their shifts with no interference or hold up in the SCT.

The increasing complexity of South African mining, results in a greater need for skilled personnel in the management of the SCT and associated equipment. Schauenburg recognises the need for specialised skills in order to operate and maintain such systems. A trained workforce that leverages OEM expertise provides a competitive advantage in the marketplace and reduces the risk to the mine for operational safety. Skills development programmes have been established to ensure that site personnel are competent to accept ownership and responsibility of the requirements needed for the Safety Control Terminal.

Schauenburg’s footprint extends to all provinces locally in South Africa and provides the platform for which SATS can expand its services to cater for the specific needs of each client.

Schauenburg’s Advance Technical Services field of expertise includes:

- Full turnkey projects
- Lamproom infrastructure design and layout
- Complete Lamproom management solutions
- Operations and maintenance management
- Technical support
- Customised training solutions
- Auditing and compliance services
The LMS/AMS is a comprehensive database and software suite that offers a total management solution ensuring compliance with DMR regulations regarding all Lamp Room operations.

The system is integrated with the mine’s existing T&A database and a passive RFID solution. This allows for the implementation of business rules that would block a person from going underground if he does not have all his safety critical equipment with him.

The system can also verify that all safety critical equipment that are subjected to functional testing are in good working order before allowing access to the underground environment. Furthermore a person can be contained in the Lamp Room if he does not return all his equipment after shift. The system therefore enhances both safety and security of the daily operations. An extensive variety of reports are available that include amongst many a daily exception report and backup shaft clearance report. The system configuration also offers remote client access which allows management staff to generate these reports from the comfort of their office.

### Asset Management System Overview

<table>
<thead>
<tr>
<th>ASSETS</th>
<th>Passive RFID Tag Reader</th>
<th>Active Tag Reader Functionality Test</th>
<th>TNA Clocking Event</th>
<th>Rules</th>
<th>Result of Rule to TNA</th>
<th>Access Message</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assets present</td>
<td>Assets present</td>
<td></td>
<td>Assets Present</td>
<td>Access Allowed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Functional Test Passed</td>
<td>Access Allowed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Assets operational</td>
<td>Access Allowed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Calibrated in x Time</td>
<td>Access Allowed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Person ID &amp; Gate ID</td>
<td>Assets Present</td>
<td>Access Allowed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Functional Test Passed</td>
<td>Access Allowed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Assets operational</td>
<td>Access Allowed</td>
<td></td>
</tr>
<tr>
<td>MISC TOOLS</td>
<td></td>
<td></td>
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<td>Assets Present</td>
<td>Access Allowed</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Assets Present</td>
<td>Access Allowed</td>
<td></td>
</tr>
</tbody>
</table>

Person ID & Gate ID
MIMACS Software Suite Overview

FUNCTIONAL TESTING

PASS
- Access Allowed
- Asset Present
- Functional Test Passed
- Assets Operational

NOT TESTED
- Access Denied
- Asset Missing
- Functional Test Failed
- Assets Not Operational

FAILED
- Access Denied
- Asset Missing
- Functional Test Failed
- Assets Not Operational

CLIENT USER INTERFACE

FUNCTIONAL TESTING

ASSET MANAGEMENT

GAS MONITORING

ASSET MOVEMENT

GATE ACCESS

REPORT
The Roxy 40 Self Rescuer is a belt worn breathing apparatus to exit from hazardous zones. Its intended use is only in the case of emergency escapes in the event of smoke, toxic gas and oxygen deficiencies.

The Self-rescuer is a ready to use device for constant wearing underground on the waist belt or storage at the switching points placed on routes out of the danger zones.

Features 40 Unit:
- Duration time is 40 min and is therefore 33% longer than any other unit of its kind.
- It contains eye protection goggles
- It processes the New CSIR anti-irritating mouth piece
- Low breathing resistance
- Low inhalation temperature – below 50°C – lowest between all units
- Anti static, non conductive, durable, light plastic body – allows longer protection time
- Belt clips separated from the body casing – change clip – not casing
- Note: Depending on the intensity of breathing the effective time of protective action on exit from the danger zone can be increased to 50 minutes, and while breathing at rest – up to 120 minutes.
- Weight of Roxy40 unit – 2.38kg
With a passion for excellence, honest and ethical conduct, and uncompromising integrity, Schauenburg Systems achieves high-quality results and consistently meets its commitments to its clients.

Project Management, in a fast moving and highly complex technical world, implies an ever-present dilemma. If you restrict every stakeholder to stringent rules, you reduce project risk and keep a clear overview & control, but that comes at the cost of fast and flexible reaction to unexpected problems and opportunities.

The complexity of business requires processes beyond Project Management, making Program & Portfolio management more relevant than ever.

We believe that successful organizations maximize the benefit of uniform processes in Project, Program & Portfolio Management with the flexibility of adaptation in prosperous or turbulent times...

As the leading South African Mining solution provider we make these themes accessible as Best Practices in your organization, by transfer of knowledge, assistance in deployment, and support with the right tools.

Schauenburg Systems Project Department offers the client full documentation from the start of the project right to the hand over and sign-off.

A full list of documents includes:
- Customer Specification list
- User Requirement Statement (URS)
- Business Rules
- Risk Assessments
- Project Plans
- Equipment Certificate of Completion (COC)
- Training Material (Generic or Custom)
- Technical Manuals
- Service Level Agreement proposal