CONNECT YOUR MINE AND YOUR PEOPLE.

INTEGRATED SYSTEMS.
INTEGRATED SOFTWARE.
SINGLE PLATFORM.

VOICE COMMUNICATIONS
TEXT COMMUNICATIONS
TRACKING
ATMOSPHERE MONITORING
UNDERGROUND EQUIPMENT MONITORING & CONTROL
DATA RETRIEVAL
### Functionality

**Communications:**
- Two-way voice, text and data communications
- Compatible with any standard IEEE 802.11b/g/n Wi-Fi device and CommTrac protocol device
- Voice
- Data
- Video

**Tracking:**
- Personnel & asset tracking

**Monitoring:**
- Atmospheric conditions
- Gas detection
- Proximity detection systems
- Belt & drive operations

**Control:**
- Gas monitors
- Fans
- Belt drives
- Pumps

### Installation & Maintenance

- Fiber and power required
- Certified electrician required at install
- A-Nodes installed along existing fiber to create Wi-Fi "hotspots" with up to 6,000 ft (1,800 m) of coverage in each direction
- No external antennas
- 4/8/24 hour battery back-up pack optional
- B-Nodes installed to wirelessly extend coverage without running additional fiber
  - Installed at distances up to 4,000 ft (1,200 m) apart
  - Capable of data speeds of up to 300Mbps
- Stable hotspots requiring low ongoing maintenance
- Strata Wi-Fi is 100% recoverable
- No hard-wired infrastructure required
- No external power – boosters, barriers or outstations
- No external antennas
- No certified electrician required
- Suspend CommTrac C-Nodes at specified distance apart. Up to 1,000 ft (305 m).
- No line-of-sight between nodes required
- Self-forming mesh network
- Commercially available D-cell batteries with battery life 9-12 months
- Self-monitoring, self-healing
- Node damage or battery loss does not cause system failure or network interruption
- Automated network health checks
- Strata CommTrac is 100% recoverable
- Lowest cost of ownership

### Cost Comparisons

<table>
<thead>
<tr>
<th>Cost Comparisons</th>
<th>CommTrac Wireless</th>
<th>Strata WiFi Fiber</th>
<th>Text-Based Wired</th>
<th>Leaky Feeder Fiber</th>
<th>WiFi Voice Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installations in 2 sections</td>
<td>$</td>
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STRATA WI-FI IN YOUR OPERATIONS (Fiber)

Incorporate Strata Wi-Fi into your existing fiber-optic network to achieve powerful underground “hotspots”. Strata A-Node access points are installed in desired locations along fiber and establish up to 6,000 ft (1,800 m) of Wi-Fi coverage in each direction. To extend coverage, mines can utilize the Strata B-Node Wireless Backbone to establish wireless connectivity for distances up to 4,000 ft (1,200 m).

Strata Wi-Fi is compatible with any 802.11 device for voice calling, texting and high-speed data access, such as VoIP phones, smartphones, tablets & laptops.

Strata Wi-Fi A-Nodes are interoperable with CommTrac C-Nodes, enabling completely wireless expanded coverage of tracking, monitoring and control capabilities into areas not requiring voice communications.

STRATA COMMTRAC IN YOUR OPERATIONS (No Infrastructure)

CommTrac is a truly wireless and battery-powered underground communication system that eliminates the expense and heavy maintenance associated with wired infrastructures. CommTrac can be installed with as few as one or two people, and completed in a fraction of the time it takes for traditional wired systems. Installation includes simple suspension of battery-powered C-Nodes from the underground ceiling and the mesh network is automatically self-forming.

STRATA CONNECT™ SERVER & GUI

At the heart of Strata communication networks and systems are the StrataConnect™ Server and Graphical User Interface (GUI). These facilitate communication between surface and underground operations.

The StrataConnect™ Server application provides the background processing that enables the data from the wireless, sub-surface network to be displayed at the surface. It integrates all underground systems into a single GUI. This Strata developed GUI is a multi-layered, easy to navigate user interface that incorporates a map/floor plan of the live facility. The fixed locations of all nodes and devices are marked, and the dynamic locations of all mobile tracking devices are tracked and displayed in real-time.

By toggling between system displays, surface operators can:

- Track all tag-equipped personnel & machinery
- Monitor atmospheric conditions underground
- Send and receive individual and broadcast messages & alerts
- Monitor and control all electrical/battery-powered devices that are integrated with the system
- Monitor and manage activities & incidents with proximity detection
- Manage all network and component health and status – including battery voltage
- Manage activity and operating status of the underground Wi-Fi system

StrataConnect™ GUI enables system level monitoring, or high-resolution zoom into individual people and equipment. Data is stored for later reference and reporting.
Private, direct and group calling
Push-to-talk
Compatible with any standard IEEE 802.11b/g/n Wi-Fi enabled device
- Strata offers robust, low-cost VoIP phones as well as ruggedized, IP68 rated smartphones for voice, data and camera capabilities

High bandwidth capabilities
Enable access and transmission of digital documents on location underground
Stream-line operations and minimize down-time
- Daily performance log & progress reports
- Annotate actual mine map
- Equipment maintenance, repair and troubleshooting
- MSDS sheets
- Service manuals
Compatible with any standard IEEE 802.11b/g/n Wi-Fi enabled device
- Strata offers ruggedized, IP68 rated Wi-Fi tablets for data and camera capabilities

Standard mobile phone text messaging
Hand-held Miner Communicator with LED screen
Two-way canned & free-form text messaging
- Worker to Worker
- Worker to dispatch
Broadcast Alerts/Emergency notifications
- Sent by worker
- Sent by dispatch
Personnel Identification
**Personnel and Asset location and activity tracking in real-time.**

Strata’s tracking system utilizes multiple communication nodes simultaneously to calculate the location and direction of travel of personnel and/or machinery equipped with a tracking device.

- Multi-node architecture provides overlapping coverage and disruption mitigation.
- Surface operators can track and monitor all personnel and machinery in real-time.
- Tracking accurate to within 200ft/60m*
- Capable of handling up to 1000 tracking devices

<table>
<thead>
<tr>
<th>STRATA WIFI – NON-IS</th>
<th>STRATA COMMTRAC – FULLY IS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personnel Tracking:</strong></td>
<td></td>
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</tbody>
</table>
- Tracking Tags  
  - Hardhat or belt worn tracking devices  
  - Rugged, light-weight & low-cost  
  - Two-way alerts, worker & dispatch  
  - Flashing location light  
  - Broadcast panic alert  
  - Commercial battery-powered  
- Tracking Cap Lamp  
  - Cordless or corded LED cap lamp options  
  - Two-way alerts, worker & dispatch  
  - Flashing LED notification light  
  - LiOH rechargeable battery  
| **Tracking Tags** |  
- Hardhat or belt worn tracking devices  
- Rugged, light-weight & low-cost  
- Two-way alerts, worker & dispatch  
- Flashing location light  
- Broadcast panic alert  
- Commercial battery-powered  
| **Tracking Cap Lamp** |  
- Cordless or corded LED cap lamp options  
- Two-way alerts, worker & dispatch  
- Flashing LED notification light  
- LiOH rechargeable battery  
| **Miner Communicator** |  
- Hand-held tracker device with LED screen  
- Pouch with belt-loop  
- Breadcrumb tracking with direction of travel  
- MSHA Intrinsically Safe approved  
- NiMh rechargeable batteries  
| **Asset Tracking:** | 
- Track all mobile equipment underground  
- Monitor production  
- Eliminate excessive time and money spent locating equipment  
- Tracking tag permanently or magnetically mounted onto vehicles  
- Transmits data at pre-set intervals and location pin-pointed to within 200ft/60m*  
- AAA-cell battery-operated  
| **Track all mobile equipment underground** |  
- Monitor production  
- Eliminate excessive time and money spent locating equipment  
- Tracking tag permanently or magnetically mounted onto vehicles  
- MSHA Intrinsically safe approved and low cost, non-IS options available  
- D-cell (IS) and AAA-cell (non-IS) battery-operated  

*Variable depending on underground environment and node layout.*)
Leveraging the utility and flexibility of the Strata/Trolex Sentro Wireless, surface operators can wirelessly monitor underground environments and control electronic devices during real-time operations.

**The Sentro Wireless Unit**
- Truly wireless, battery-powered and completely IS
- Two-way communication for remote command and control
- Utilizes commercially available D-cell batteries with battery life 40-60 days
- Dual-wall housing provides maximum impact strength and protection against dust and moisture
- IP65 rated
- MSHA IS approved
**The Sentro eModule for gas detection**
- Intelligent standardized gas sensing
- Various available for detecting different gases at different concentrations
- Simple exchange of eModules and/or D-cell batteries, safely performed underground
- eModule calibration performed on the surface or underground every 31 days

**The Sentro Vortex Wireless for air flow and ventilation monitoring**
- Measures air flow and ventilation
- Air flow sensor responds to the velocity of the air or gas being monitored and generates on output signal that is linearly proportional to the actual flow velocity
- Backlit LCD with flow velocity information and diagnostic data
- Two (2) user-programmable alarm set points (Alert/Alarm)

<table>
<thead>
<tr>
<th>STRATA WIFI – NON-IS</th>
<th>STRATA COMMTRAC</th>
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</thead>
<tbody>
<tr>
<td><strong>Wireless Gas &amp; Fire Detection:</strong></td>
<td><strong>Wireless monitoring of toxic and explosive gases during operations</strong></td>
</tr>
<tr>
<td>Wireless monitoring of toxic and explosive gases during operations</td>
<td>Measures levels every second and reports status at pre-set intervals to dispatch</td>
</tr>
<tr>
<td>Measures levels every second and reports status at pre-set intervals to dispatch</td>
<td>Enter Alert/Alarm mode if levels rise &amp; data is streamed continuously</td>
</tr>
<tr>
<td>Enter Alert/Alarm mode if levels rise &amp; data is streamed continuously</td>
<td>Gas level status &amp; incident location identified</td>
</tr>
<tr>
<td>Gas level status &amp; incident location identified</td>
<td>Fully operational post-accident and in the event of power or ventilation loss.</td>
</tr>
</tbody>
</table>

| **Wireless Airflow & Ventilation:** | **Air or gas flow measured and status reported at pre-set intervals to dispatch** |
| Air or gas flow measured and status reported at pre-set intervals to dispatch | Enter Alert/Alarm if air flow drops and data is streamed continuously |
| Enter Alert/Alarm if air flow drops and data is streamed continuously | Air flow/Ventilation status & incident location identified |
| Air flow/Ventilation status & incident location identified | Fully operational post-accident and in the event of power or ventilation loss—AIR FLOW MONITOR NOT MSHA IS APPROVED. |

| **Atmospheric Monitoring:** | **Wireless Sentro or powered PLC** |
| Wireless Sentro or powered PLC | Real-time monitoring of air temperature, humidity and pressure |
| Real-time monitoring of air temperature, humidity and pressure | Report data to dispatch |

| **Remote Control:** | **Gas Detectors** |
| Gas Detectors | On/Off |
| - On/Off | - On/Off |
| - Reading and setting I/O | - Reading and setting I/O |
| - Manipulate thresholds | - Manipulate thresholds |
| - Alarm On/Off | - Alarm On/Off |
| Fans & Pumps | On/Off |
| - On/Off | - On/Off |

**Combustible eModules:**
- CH4 0-100% LEL
- CH4 0-5% v/v
- CH4 0-100% v/v
- IR LED Technology
- Low Power Consumption

**Toxic Gases eModules:**
- CO: 0-500ppm
- H2S: 0-50ppm
- SO2: 0-20ppm
- NO2: 0-20ppm
- Cl: 0-10ppm
- O2: 0-25%
- NO : 0-200ppm
- H2: 0-1000ppm
StrataConnect™ Monitor & Control

**BELT & BELT DRIVE MONITORING**

Strata can replace traditional belt controllers with the StrataConnect™ controller that enables real-time, remote monitoring and control of the mine belt lines and drives during operations.

- Wide variety of sensors and control points can be monitored simultaneously
- Real-time wireless data transmission to user interface
- Data storage for analysis and reporting
- Minimal maintenance
- Operation and update performed by mine personnel

<table>
<thead>
<tr>
<th>Monitor:</th>
<th>STRATA WIFI – NON-IS</th>
<th>STRATA COMMTRAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Belt speed</td>
<td>Belt speed</td>
</tr>
<tr>
<td></td>
<td>Belt motor &amp; bearing temperature</td>
<td>Belt motor &amp; bearing temperature</td>
</tr>
<tr>
<td></td>
<td>Coal flow-rate over main scale</td>
<td>Coal flow-rate over main scale</td>
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<tr>
<td></td>
<td>Pull cord</td>
<td>Pull cord</td>
</tr>
<tr>
<td></td>
<td>Plugged chute</td>
<td>Plugged chute</td>
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<tr>
<td></td>
<td>Belt slip</td>
<td>Belt slip</td>
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<tr>
<td></td>
<td>Belt stoppage</td>
<td>Belt stoppage</td>
</tr>
<tr>
<td></td>
<td>Misalignment</td>
<td>Misalignment</td>
</tr>
<tr>
<td></td>
<td>Tension</td>
<td>Tension</td>
</tr>
<tr>
<td></td>
<td>Local lock-out</td>
<td>Local lock-out</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Remote Control:</th>
<th>STRATA WIFI – NON-IS</th>
<th>STRATA COMMTRAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start/stop belt (with option to local override)</td>
<td>Start/stop belt (with option to local override)</td>
</tr>
<tr>
<td></td>
<td>Alarms &amp; alarm horns on/off</td>
<td>Alarms &amp; alarm horns on/off</td>
</tr>
</tbody>
</table>
PROXIMITY DETECTION DATA RETRIEVAL

Strata’s HazardAvert® proximity detection system is continuously monitoring interactions and incidents between machinery, and between miners and machinery during operations. This information is logged and stored on the machinery, and can be wirelessly transmitted to dispatch for monitoring and reporting purposes.

<table>
<thead>
<tr>
<th>STRATA WIFI – NON-IS</th>
<th>STRATA COMMTRAC – FULLY IS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monitor:</strong></td>
<td></td>
</tr>
<tr>
<td>• Individual identity of machinery</td>
<td>• Individual identity of machinery</td>
</tr>
<tr>
<td>• Worker and machinery interaction</td>
<td>• Worker and machinery interaction</td>
</tr>
<tr>
<td>• Warning and/or Hazard zone breaches and duration of breach</td>
<td>• Warning and/or Hazard zone breaches and duration of breach</td>
</tr>
<tr>
<td>• Remote stop</td>
<td>• Remote stop</td>
</tr>
<tr>
<td>• Emergency, Hazard zone stop</td>
<td>• Emergency, Hazard zone stop</td>
</tr>
<tr>
<td>• Duration of inactivity</td>
<td>• Duration of inactivity</td>
</tr>
<tr>
<td><strong>Reporting:</strong></td>
<td></td>
</tr>
<tr>
<td>• Safety Reports</td>
<td>• Safety Reports</td>
</tr>
<tr>
<td>- Worker and machinery operator safety practices</td>
<td>- Worker and machinery operator safety practices</td>
</tr>
<tr>
<td>- Zone breaches – frequency and duration</td>
<td>- Zone breaches – frequency and duration</td>
</tr>
<tr>
<td>• Productivity reports</td>
<td>• Productivity reports</td>
</tr>
<tr>
<td>- Machinery tracking</td>
<td>- Machinery tracking</td>
</tr>
<tr>
<td>- Travel time</td>
<td>- Travel time</td>
</tr>
<tr>
<td>- Stop time</td>
<td>- Stop time</td>
</tr>
<tr>
<td>- Interactivity time</td>
<td>- Interactivity time</td>
</tr>
<tr>
<td>- Duration of inactivity</td>
<td>- Duration of inactivity</td>
</tr>
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