RTLS Buyers Guide

For companies operating in hazardous areas, RTLS accurately locates personnel and assets in real time while improving worker safety and productivity.

This guide is designed to help you decide on the best RTLS option for your application. It looks at the main environmental and operational challenges facing the process industries and highlights key technologies used to address the ranges of challenges present on site.

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A note from our CEO
John Hartley

Firstly, thank you for downloading a copy of our RTLS Buyer Guide.

We've been providing RTLS solutions to the process industries since 2006, with a particular focus on hazardous areas and harsh industrial environments. Over that time, we've worked on a wide variety of global projects to deliver greater visibility and improve worker safety for our customers and the end user.

Our collective experience of the industry, the relationship we have with our customers, our global partner network, and the range of inhouse engineering capabilities we have has uniquely positioned us to share our knowledge of the RTLS landscape.

A lot has changed since those early days and now as the process industries adopts more IoT and digital solutions, we recognise the need for more clarity about what is available to the end user. We believe very strongly in enabling our customers to work smart, stay safe, and remain connected when going about their work.

This guide aims to help you in your research for the right RTLS solution. We don't offer everything we talk about in this guide as part of our own product family, but we feel it is our duty to share the knowledge we've gained to help serve anyone who has an RTLS requirement.

We also encourage anyone looking to gain further information about their RTLS options to get in touch. Our team of dedicated experts are here to help in anyway they can.

Enjoy!

What is RTLS?

Real Time Location Systems, or RTLS, monitors the location and status information of personnel and assets in real time. For companies operating in hazardous areas and harsh industrial environments, RTLS helps customers around the world to work smart, safe and connected.

Improve worker safety, increase operational efficiency, and reduce costs with access to the latest business intelligence through RTLS, informing everything from crisis decision-making to route planning and work schedules. It can also integrate with existing solutions as part of site wide Internet of Things connectivity.

Technologies used:

| Active RFID | Wi-Fi | Bluetooth Low Energy (BLE) | Global Positioning System (GPS) | Ultra Wide Band (UWB) | LoRa |

Active RFID

- Radio-frequency identification (RFID) RTLS uses battery-powered tags that emit an ID signal at regular intervals.

- There are a wide range of RFID tags suitable for personnel and assets, with added functionalities like emergency call buttons, tamper proofing and environmental condition monitoring available.

- The signal is picked up by readers across your site, either dedicated RFID readers or standard Wi-Fi access points, with the information shown in a software platform.

Wi-Fi

- Wi-Fi access points can be used to detect signals from an active RFID tag transmitting at 2.4 or 5GHz, but they can also be used to pick up on the presence of other Wi-Fi enabled devices.

- Using standard Wi-Fi networks as a framework can provide greater flexibility, as the wireless network can be used for other communication applications and towards digitising your site while providing a quicker return on investment without ties to proprietary technology.

- If your application involves hazardous areas, you will need to consider Wi-Fi devices that are certified to the level required for your hazardous areas or an enclosure system suitable of housing your chosen access point.

Bluetooth Low Energy (BLE)

With reduced power consumption compared to classic Bluetooth, BLE devices can be detected when in proximity to a BLE beacon or BLE gateway, similarly to an active RFID tag and reader.

Global Positioning System (GPS)

- GPS is a satellite-based location system that provides geolocation and time information to a GPS receiver anywhere where there is an unobstructed line of sight to four or more GPS satellites.

- Obstacles like buildings may obstruct or reflect the GPS signals, reducing connectivity and accuracy.

- The GPS receiver does not need to transmit any data and it operates independently of any telephone or wireless signal, but if the GPS data is to be used in an RTLS then either cellular or Wi-Fi signal is needed to link and access the information.

Ultra-Wide Band (UWB)

- UWB is a radio technology that uses a low energy level to transmit high bandwidth communications for a short distance over a wide range of the radio frequency spectrum.

- UWB is well-suited to short range indoor applications, such as "see-through the-wall" radar imaging, sensor data collection, and precise location tracking.

LoRa (WAN)

- LoRa WAN standards for Long Range Wide Area Network. It is a low power wireless wide-area network modulation technique. It is based on spread spectrum modulation techniques derived from chirp spread spectrum technology.

- The main application is to provide connectivity for battery powered sensors over long distances that have relatively low transmit rates but it can also be used for geo-location.

Typical Safety Devices

Worker tracking tags

- Small wearable devices that transmit location signals picked up by a wireless infrastructure such as a Wi-Fi network, cellular network, or proprietary location receivers.

- They can often be worn in different configurations, such as on a lanyard, epaulette, belt clip, or around the wrist.

- Some tags include additional functionality like emergency call buttons and fall detect.

Gas detectors

- Portable gas detectors for flammable and toxic gases.

- Some modern gas detectors can also included location detection, BLE, Wi-Fi, or cellular connectivity.

Vital life signs/ biometric monitors

- Wearable devices that monitor life signs like heart rate, temperature, and breathing.

- Used to identify workers in need of medical assistance or monitoring human factors like worker fatigue, reducing the risk of accidents.

Smart safety equipment

- Includes workwear like hard hats, eyewear, gloves and more.

- Embedded with sensors like life signs monitors to detect brain activity, breathing, perspiration, and other stress indicators and provide alerts in order to prevent accidents.

- Can reduce errors including the number and severity of workplace accidents and injuries.

Geolocation technologies

Technology	Typical Accuracy	Typical Range	What's it Suitable For?	Battery Lifetime	Things to Consider	
GPS	<5m				Minimal infrastructure, good accuracy.	Battery consumption is high. Indoor location not reliable.
Wi-Fi Beaconing	5 to 25m	<200m			Use existing Wi-Fi infrastructure.	Dense infrastructure may be required for 5m accuracy.
Wi-Fi IP Connectivity	5 to 25m	<100m			Use existing Wi-Fi infrastructure.	Dense infrastructure may be required for 5m accuracy.
802.15.4 RSSI	5 to 25m	75m			Battery life.	Dense infrastructure required.
LoRa 2.4GHz	<10m	5km			Little infrastructure required.	Low cost, good battery life
LoRa sub GHz	50 to 100m	10km			Little infrastructure required.	Low cost, good battery life
UWB	<1m	<150m			Great accuracy and battery life.	Dense infrastructure required.
BLE - RSSI BLE - AOA	10m <1m	<75m			Battery life, beacons battery powered.	Maintaining beacons. Dense infrastructure required.
Passive RFID	<3m	<3m		---	Low cost, no battery.	Choke point location only, read reliability not suitable for personnel safety.

Hybrid location tracking. What is it?

Workers in process industry environments face a wider variety of risks and hazards than their counter parts in other industries. One technology alone cannot address these risks practically or at a feasible cost to the end user.

- Delivers wider coverage with reduced infrastructure
- Adds greater tracking accuracy in certain areas
- Provides additional functionality
- Reduces total cost of ownership

Considerations: Environmental Challenges

The environment of your process facility plays a huge role in determining what technologies you should use for wireless networking solutions.

How do I choose the appropriate technology for my site?

The first step is to identify what types of areas you have on site and how workers and assets move between them. There are a variety of area types to identify including indoor, outdoor, open, dense, flat or multilevel areas. These factors directly affect the type of wireless technology you will employ.

For indoor areas with existing WiFi access points and a dense array of processing equipment, the best solution may be to employ a multiple technologies for high levels of accuracy including BLE and LF location data.

In less built up outdoor areas such as such as tank farms or storage yards, GPS location systems can track across large geographical areas while requiring fewer access points to accurately locate personnel. The WiFi in these areas are only used to provide the backhaul of the location data to tracking management systems.

CASE STUDY

A major oil and gas company needed a solution for worker safety, workforce productivity and quality management on one of their refineries. At any given time, thousands of workers and contractors are on-site and have access to the facility, and numbers can fluctuate greatly from day to day.

Solution overview

- The company installed RFID tags for personnel tracking, an industrial WIFI network and ATEX compliant Exciters to push updated configurations.
- iTAG 100 RTLS tags were issued to all on-site personnel.
- Tags included an emergency call button.
- MobileView allowed the client to track workers to ensure worker safety, productivity and quality management.

Outcomes

- Control room could track worker location in real time with MobileView, and respond to workers in need of rescue quickly.
- Significantly reduced mustering times.
- The refinery can identify which contractors are on-site from over 150 companies.
- Reduce mobilisation time by 30 percent.

How do I avoid interference from metallics or liquids in process environments?

In applications without line of sight, reflective materials can cause issues with WiFi performance. A common issue is multipath interference, where metals and liquids reflect or scatter signals, causing them to arrive at receivers out of phase and resulting in data loss or delayed signals.

Along with careful positioning of antenna, the latest 802.11 standards and Multiple Input Multiple Output (MIMO) functionality has also helped overcome these problems. 802.11 is the international protocol for WiFi found in homes and offices, with standards in the technology progressing to allow for multiple antenna MIMO systems that greatly improve wireless systems ability to cope with multipath reflections caused by industrial environments.

What is a hazardous area and how can I use equipment safely in these areas?

Industrial facilities may contain hazardous areas where there is flammable gas, vapours or liquids, combustible dust or even ignitable fibres present. As such, equipment housed in these areas are subject to additional legal requirements to reduce the risk of explosion.

These hazardous areas can be separated into designated Zones dependent on how present the hazards are.

The main standards for hazardous area equipment globally are ATEX, IECEx, and North American NEC 500/505. For ATEX and IECEx, covering most of the world, the IEC 60079 series of standards are typically used for the approval of equipment for Hazardous Areas. These standards are generally split into the following parts:

- Part 0 - General Requirements
- Part 1 - Explosion Proof enclosures
- Part 11 - Intrinsic Safety
- Part 15 - Type n

Any RTLS used on such sites would require certified equipment to provide full site coverage.

GAS Classification

Zone 2	Class I Div. 2
Zone 1	Class I Div. 1
Zone 0	Class I Div. 1
Zone 20	Class II Div. 1
Zone 21	Class II Div. 1
Zone 22	Class II Div. 2

DUST Classification

How can I house equipment in hazardous areas safely?

While certain certification requirements still need to be met for electrical equipment in hazardous areas, including contactors relays, power supplies, transformers and radio devices, enclosures like an Ex d enclosure are designed to contain an explosion and stop any flames, sparks, and hot gases from escaping into the surrounding atmosphere should an internal explosion occur.

This means standard electronics, including wireless technology, can be placed within hazardous areas without the need for further extensive and costly certifications, provided the hardware meetings the conditions of the enclosure solution.

How important is ingress protection and durability?

Personnel are often working outside in variable weather conditions with roles involving a higher proportion of physical labour where equipment can be exposed to varying temperatures or damaged during use.

Your RTLS should have strongly built components with high ingress protection (IP) ratings to prevent damage from the elements. They would need to be durable enough to withstand a normal work usage, small enough to not hinder workers, and flexible enough to be mounted in a practical way.

How do I ensure an RTLS can grow with business needs and demand?

Industrial sites have many workers moving around, potentially in and out of hazardous areas. The number of personnel on site can also fluctuate, for example as contractors are brought in to increase production or to accomplish a turnaround. Any RTLS would need to be scalable to cope with growing head counts or assets while incorporating the ability to view the site at macro and micro levels. When looking at the scalability of the system, you need to consider how to:

- Track a large number of tags at the same time in the same location for personnel and assets
- Provide sufficient coverage across the entirety of the site and different environment areas
- Add more trackable objects and increase coverage with growing needs without reconfiguring the current network
- Customise tag types to identify variations more easily in personnel and assets being tracked

Business and Operational Considerations

How to plan your RTLS solution

There are **3 core areas** to consider when choosing the technology for your RTLS.

Aims: What problems are you trying to solve?

Site type: What use cases are most important to your business?

Budget: Do you already have communication infrastructure, and can that be leveraged for RTLS?

Identifying key planning considerations:

Solution scalability: Ensuring your chosen solution can grow with your business.

- Number of workers and visitors tracked, size of site or multiple sites, implementing additional functionality.

High availability architecture: Redundancy requirements.

- A solution that keeps worker safety solutions running in emergencies.

Solution functionality: What problems need addressing.

- Mustering, emergency call, fall detection buttons, alerts, reporting and analysis.
- Productivity.
- Finding things.
- Asset utilisation.

Integration with existing systems: Streamlined safety solution.

- Mitigate wasted time duplicating efforts to raise alarms or monitor evacuations.
- Identify if chosen solutions can integrate with existing technology (like PAGA systems or ventilation fans).
- How many systems are required to incorporate access control for security and site management.
- Data analytics and ERP systems.

Identifying key concerns for worker safety:

Enhanced worker safety
- Identify where workers are
- Current level of risk
- Account for them
- Emergency call buttons to request aid or alert control room to developing situations
- Automatic mustering of workers during emergency evacuations

Lone worker safety
- Higher risk than those in pairs or team
- Require quick ways to call for help
- Tools to warn them of potential hazards like gas
- Automatic alerts should the worker become incapacitated before they raise the alarm

Confined space entry
- Specialised area of higher risk work
- Less labour intensive that traditional management methods
- Doesn't require watchmen for each entry and ongoing monitoring

Worker accountability
- Accurate recording of workers and contractors on site at any given time
- Improve compliance, invoice management and security
- Should an emergency occur, every worker can be mustered or located

Worker productivity
- Streamline work flow to keep projects on track
- Reduce time spent searching for tools and materials
- Improve site wide communication and tools available (like Voip)

RTLS can inform everything from crisis decision-making to route planning and work schedules.

Existing communication infrastructure

It is a good idea to separate what you need from what you want, to get the best value for your investment.

- Do you already have a communication infrastructure?
- Could that be leveraged for RTLS?

The classic example is an existing Wi-Fi network that could be adapted to reduce your installation time and cost.

An RTLS is a major capital investment, and you want to be sure that you can balance the cost of deployment against the value to the business.

Education and adoption for workers

It is not uncommon for workers to object to their location being monitored as a potential invasion of privacy.

Good employee education on the system ensures that the facts and benefits of improved worker safety and productivity are conveyed clearly to employees. RTLS can be tailored to show a greater or lesser extent of individual information depending on the application, so education on the benefits of the system is important for employee uptake and acceptance.

Grouping worker data for productivity analytics

Many customers using Extronics RTLS are concerned with improving workflow rather than tracking a specific worker. They will have worker data grouped for productivity analytics, with individual workers only needing to be identified in the case of site emergencies and evacuations.

Workers are often in favour of RTLS safety systems when they have seen how the involvement of RTLS has prevented or mitigated an accident or have been through a serious incident in which RTLS made an important difference. Educating workers on these points is key to encouraging greater visibility in the workplace.

How to maintain an RTLS

Successful RTLS is tailored to suit the site and applications it is used for. This includes considering how to configure future changes, such as training in-house personnel or liasing with a vendor or system integrator to ensure the system works at optimal capacity in the immediacy and in the future.

3 important maintenance considerations are:

- How much maintenance will the system need?
- How easy is the system to configure?
- What support is available?

Much of this comes down to the reliability and redundancy of both hardware and software and how issues are addressed when either of these facets stop working.

Use Case Examples

Automatic Mustering and Emergency Call

A major oil and gas company in Asia Pacific wanted to locate workers and automatically muster them in an emergency situation.

Customer Requirements

They wanted to track everyone on the site to reduce the time taken to locate distressed workers or contractors in need of help.

They also wanted to improve their mustering process, making it easier to check that all workers are safe and identify anyone missing in emergency situations.

The Solution

Workers were assigned intrinsically safe iTAG100 Wi-Fi RTLS tags with call buttons, so they could request help if needed. Contractors were also given iTAG100s when on site.

The MobileView software showed worker location in real time, and the Instant Notifier software provided quick alerts whenever a call button was pressed.

Exciters were used at designated muster points, detecting employees gathered in each area.

Solution Benefits

Workers and contractors can quickly request and receive help when needed, with rescue teams dispatched without delay to their location.

In emergencies, everyone can be mustered automatically, reducing the potential for error. Anyone missing can be easily identified and found.
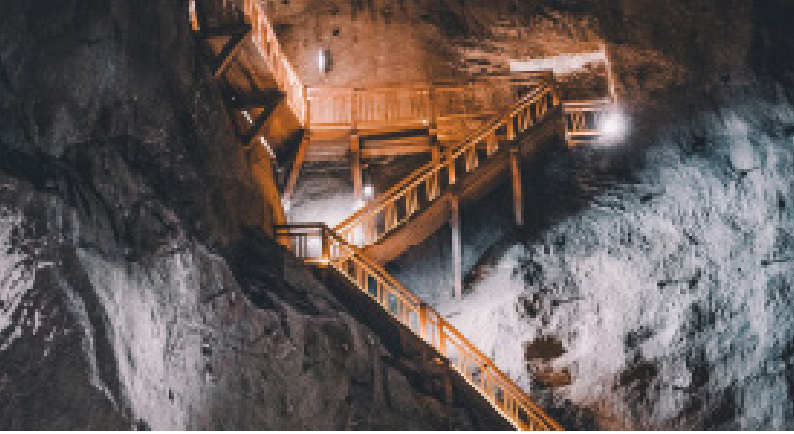
Ventilation On Demand (VOD)

An underground liquid hydrocarbon storage facility in Asia Pacific wanted to locate their workers and reduce the cost of ventilation.

Customer Requirements

Their ventilation fans had to be kept running at all times to ensure worker safety, as they couldn't reliably identify where everyone was.

They wanted to locate workers throughout their cavern system in real time, so they could only run ventilation fans when workers were nearby. They also wanted to make sure everyone was accounted for in emergencies.

The Solution

Intrinsically safe iTAG100 tags with call buttons were issued to all workers and their location was picked up by the Wi-Fi network. Exciters added further accuracy wherever needed.

An event set up in the MobileView software automatically turned ventilation fans on when workers entered the area, and turned the fans off when the last worker left. The Evacuation Monitoring module in MobileView also provided automatic mustering.

Solution Benefits

The ventilation cost is hugely reduced, as fans are only running when needed for worker safety. This also means that maintenance costs for the fan lifetime can be reduced.

Workers can be sure of a suitable work environment, can call for help using their tag buttons, and can be quickly located in emergencies.

Turnaround: Contractor Tracking

A large petrochemical company were working with a management consultancy to ensure efficiency and profitability during their turnaround.

Customer Requirements

During a turnaround, they had thousands of additional contractors on site - as well as their own workers. They wanted to locate everyone on the site to ensure safety, but also to ensure that contractor invoicing was accurate.

They also wanted to identify areas where processes could be improved, to ensure the turnaround finished on time and on budget.
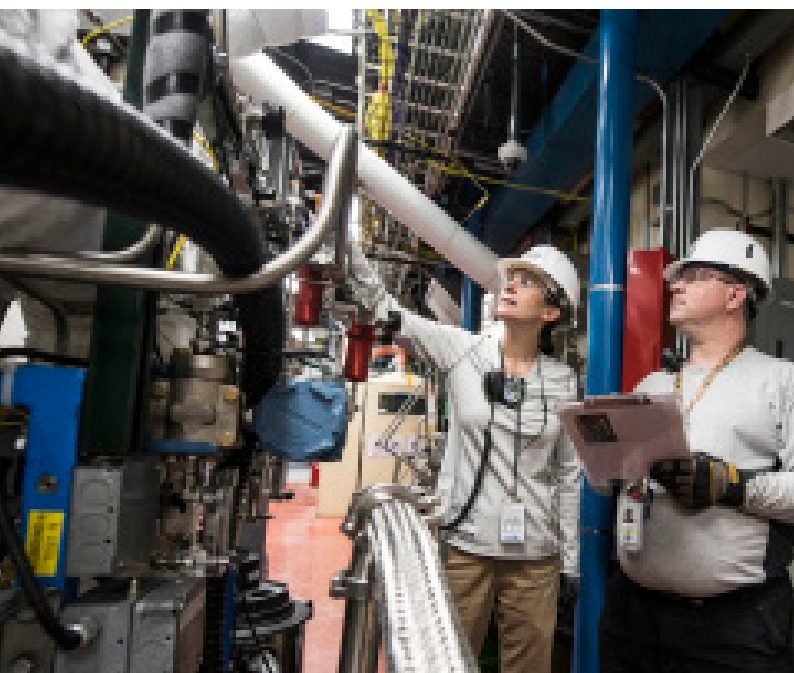
The Solution

Intrinsically safe iTAG100 tags with TGUARD tag protectors were issued to all workers and contractors and were to be worn at all times.

Using a Cisco Wi-Fi infrastructure that was also used for communications and data transfer, everyone's location was relayed to the MobileView software, where it could be visualised. The management consultancy also offered additional analysis using RTLS data.

Solution Benefits

They could analyse the data gathered by the RTLS to see exactly who was on site, and when. They could then ensure no invoice leakage for the contracted work. They could also identify bottleneck areas and mitigate the delays by improving their processes.

The turnaround was completed without serious safety incidents, on time, and on budget.

Critical Area Management

A European marine operator wanted to control access to key locations and ensure worker safety in the event of a fire.

Customer Requirements

They wanted to control access to critical locations, particularly the ship's engine room, so that only authorised personnel could enter.

In the event of a fire, they also wanted to quickly ensure that the engine room was clear of personnel before operating the CO_2 fire suppression system, which is hazardous to people.
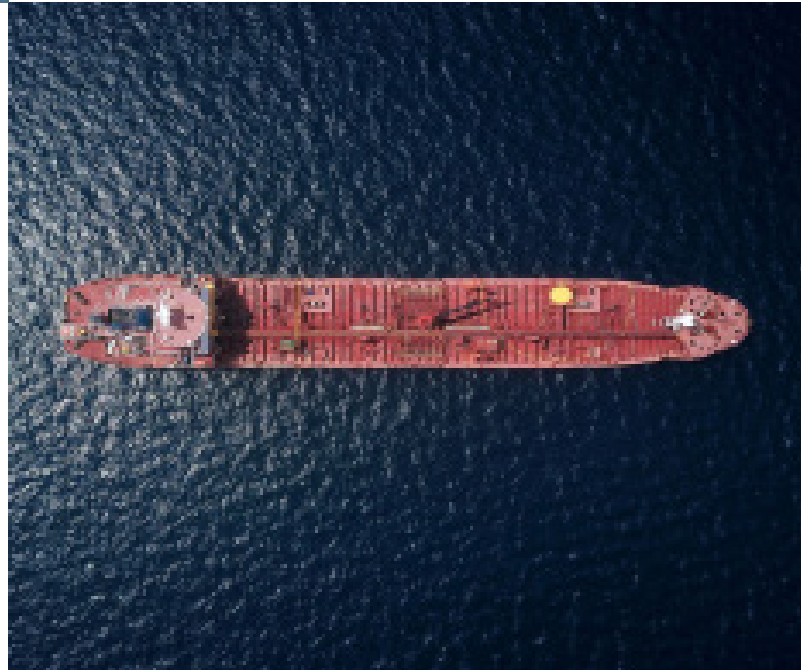
The Solution

Leveraging the existing Wi-Fi infrastructure, exciters were placed at key chokepoints, such as the doors to the engine room, for gate access control. T3 tags were assigned to crew members authorised to be in the engine room, which allowed them to open the doors.

The MobileView software showed whether any workers were in the engine room before the CO_2 fire suppression system was operated.

Solution Benefits

The safety of the ship and crew is improved, as fires can be dealt with promptly and safely.

This also minimises the likelihood of damage to key equipment in the event of a fire, reducing the financial and operational impact of any fire incidents.

Have You Considered a Hybrid Solution?

With variable environments according to size, hazards and infrastructure, as well as a range of operational and safety challenges to overcome, it is unlikely that any one location technology ticks all of the requirements you need. In fact it is likely that at least 3 or 4 location technologies are required for an optimal system in respect to overall cost of ownership and system functionality.

A hybrid location system is the only practical solution to the complex and numerous challenges the process industry can pose to worker safety and productivity.

These hybrid systems use two or more location technologies in the same solution to:

| Provide additional functionality | Reduce total cost of ownership | Deliver wider coverage with reduced infrastructure | To add greater accuracy in certain areas |

Using multiple devices or purpose-built, multi-technology devices, hybrid location systems can solve the diverse nature of use cases in a most cost-effective solution. It has long been acknowledged in the industry that one technology alone cannot provide solutions for the range of physical and technical requirements of process environment operations.

Since the inception of hybrid technologies over a decade ago, the progression of geolocation technologies and improvements in implementation techniques over that time now make hybrid location and attainable solution for modern process environments.

About Extronics

Founded in 1992, Extronics has years of experience serving the process industries and we pride ourselves on understanding the requirements of each customers environment.

We specialise in developing and manufacturing ATEX, IECEx, and North American certified equipment for use in hazardous areas, and rugged industrial products for harsh environments. We serve customers around the world from industries such as oil and gas, chemical, pharmaceutical, and mining. We're dedicated to delivering world-class products and solutions that help our customers work **smart, safe, and connected**. Working hard, doing right by our customers, and taking responsibility are at the core of Extronics.

Your processes are complex, highly dynamic, and cost sensitive, operational efficiency is key. We help our customers protect their workers whist increasing productivity.

Global Partner of STANLEY Visibility Solutions

Extronics is a global technology partner of **STANLEY Visibility Solutions**, delivering worker safety and asset visibility solutions to the process industries.

STANLEY AeroScout technology and Extronics have partnered since 2005, with STANLEY MobileView platform at the core of Extronics WiFi-based Real-Time Location Systems. Extronics serves customers in all parts of the world as an authorised solution provider of the AeroScout RTLS products through a network of partners as well as developing hazardous area certified products using AeroScout technology.

Contact Us

Our experienced team is on hand to answer any questions you have

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