

FLYABILITY

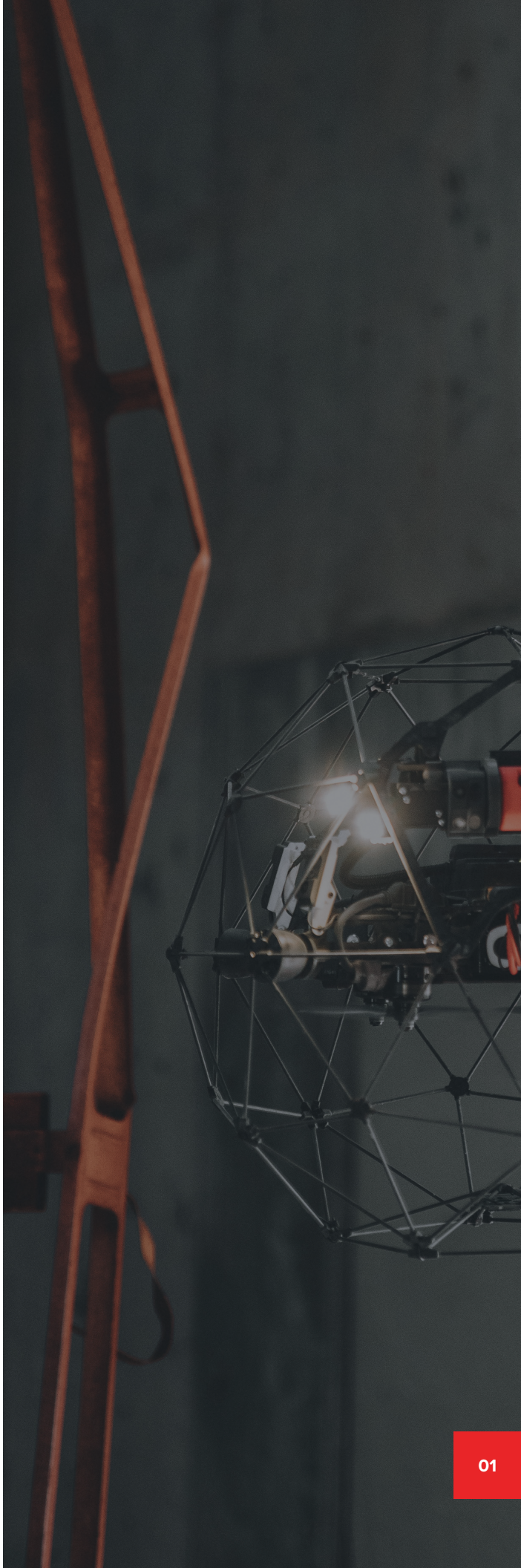
The 2022 Guide to Intrinsically Safe Equipment for Industrial Inspections

WE SHARE THE NEWEST, BEST, AND SAFEST EQUIPMENT FOR INDUSTRIAL INSPECTIONS AND DISCUSS WHAT THE FUTURE MAY HOLD. INSPECTION EQUIPMENT HELPS INSPECTORS GET ACCESS TO DATA OR SUPPORTS DATA COLLECTION.

Most industrial spaces require periodic inspections to maintain operations and safety. And many industrial environments include a mix of hard-to-access and hazardous areas that require special tools or equipment for safe inspections.

Locations designated as classified areas or hazardous locations (HazLoc) require equipment incapable of producing heat or sparks that might cause an explosion. This equipment is generally referred to as "intrinsically safe" (IS) because it is specifically designed to prevent an explosion in potentially explosive atmospheres and hazardous areas.

These "accident-proof" devices are considered intrinsically safe because they are incapable of causing an explosion. The types of environments that require the use of intrinsically safe equipment have been defined by a system of class divisions and zones, which people working in those industries must follow to ensure safe operations.



THE PATH TO INTRINSICALLY SAFE EQUIPMENT

With their methane gas and coal dust mix, coal mines were the first industrial locations understood as hazardous.

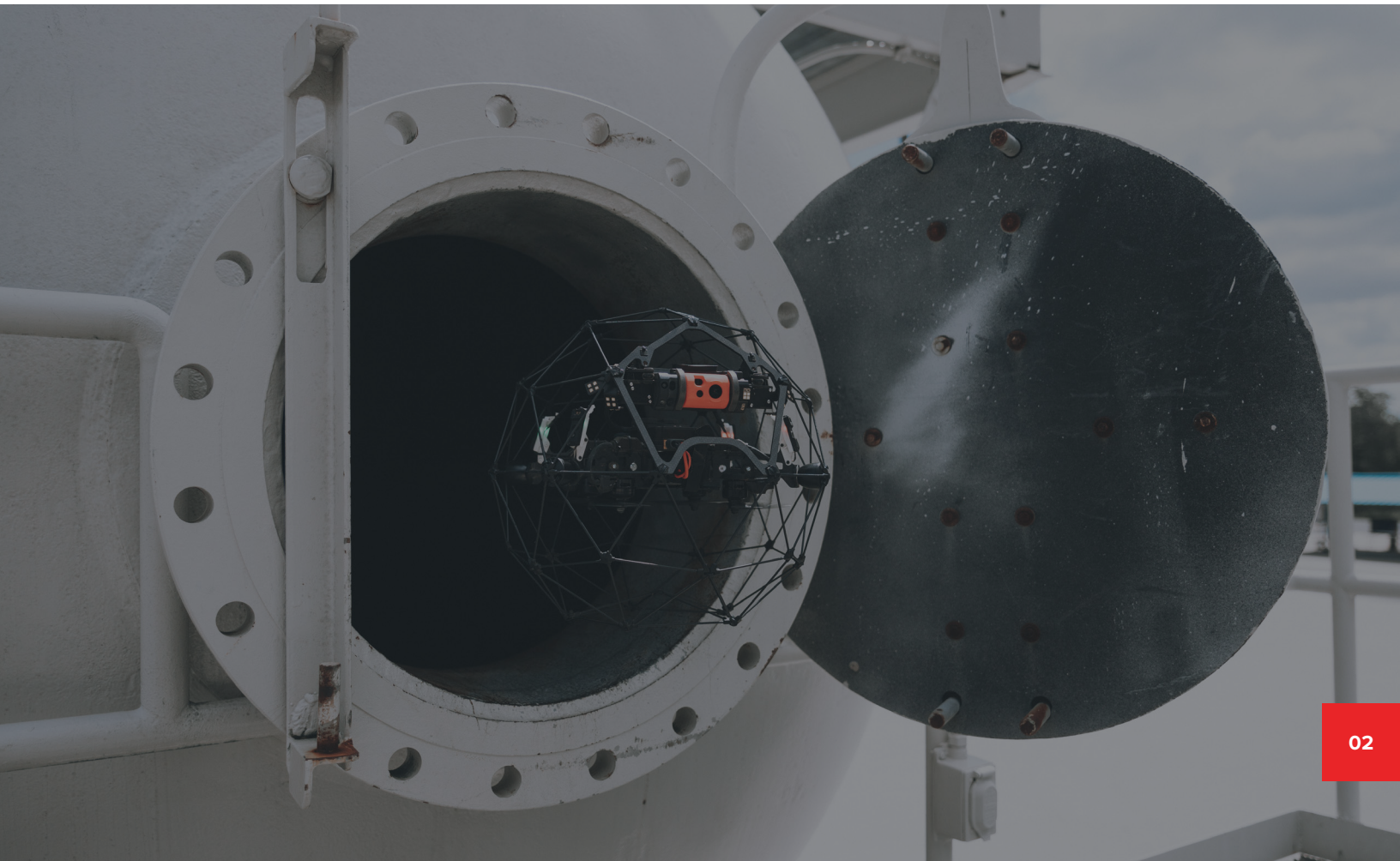
Early protective measures in these mines included igniting the gasses to dissipate them, which was just as dangerous as it sounds. Dilution of the environment was the first protective hazard, which reduced the gasses by pumping fresh air into the atmosphere. Various forms of dilution are still used today as a risk mitigation method.

Explosion-proof motors and enclosed electrical equipment also helped reduce explosion risk, but the analysis of mine explosions in the early 1900s provided the first concept of "intrinsically safe" equipment.

MODERN RULES FOR INTRINSIC SAFETY

While industrial equipment needs have changed over the years, the need to prevent explosions in hazardous areas remains of serious concern.

As industrial technology has advanced, so too has the need to maintain and inspect industrial equipment. The increased focus on industrial safety continues to spur innovation in the area of intrinsic safety.



ADVANCES IN INSPECTION AND SAFETY EQUIPMENT

These days more devices than ever before have been designed for use in hazardous environments, including tools for inspecting equipment. Devices certified as intrinsically safe have undergone extensive and rigorous testing to ensure they are completely accident-proof.

This list includes examples of intrinsically safe tools to benefit human inspectors and their inspections in hazardous areas in 2022 and beyond.

- **Smart PPE**
  Smart PPE monitors provide data on human workers in hazardous areas, such as body temperature and heart rate. These wearables help identify whether a worker may be at risk for heat stress. And because workers isolated behind protective doors or airlocks can't be seen, smart PPE monitors can also provide location data, which can be vital in an emergency. In the future, monitors could include tilt detection or blood oxygen levels, further ensuring worker safety.

- **Portable Radios**
  Communication is critical for human beings inspecting hazardous areas. Designed to account for gloved hands, intrinsically safe **portable radios** offer connectivity in extreme conditions and dangerous places. A single-button emergency notification with location information for easy use should a carrier need it is an option on some devices, and modern devices can even offer data encryption. Some mobile devices exist that use either cellular or radio communication, as available.

- **Communication Devices**
  Part walkie-talkie, part PPE, these **communication devices** help ensure workers' wellbeing in classified areas. In addition to regular two-way communication, these IS devices offer alert features like fast SOS buttons, tilt and inactivity detection, and can be used for timed check-ins. Companies offering these devices may even provide monitoring services.

- **Mobile Devices**
  The need to collect and share data in real-time has brought several intrinsically safe, **high-performance tablet devices** (and smartphones) to the market. These devices provide the same power and functionality as their "civilian" counterparts but boast features like touch glove and wet hand modes, extra-rugged housings, and long-lasting batteries. In the future, these devices will likely offer a wider variety of operating systems, increased memory and power, and seamless connections to other equipment being used to monitor and inspect equipment in hazardous locations.

- **Cameras**
  Lightweight, high-resolution digital imaging **cameras** can provide detailed visual and radiometric thermal images and an array of storage options for use in areas requiring intrinsically safe equipment. Unsurprisingly, many intrinsically safe cameras are also incredibly rugged, having been tested in extreme environments.

- **Fiberscopes**
  The borescope, a visual inspection tool consisting of a tube with an eyepiece at one end and a lens at the other, is not a novel inspection tool in and of itself. However, advances in optics now allow exceptional visual inspection of hard-to-reach areas, like natural gas lines or fuel tanks, casings, and small chambers. Flexible articulating **fiberscopes** and videoscopes can conduct remote visual inspections in incredibly small spaces that previously required the equipment's disassembly for inspection.

- **Multimeters**
  Intrinsically safe digital **multimeters** measure electrical current and troubleshoot power issues in gas and dust-filled environments safely. Someone wearing PPE can easily see the backlit buttons and larger displays. Additionally, the things that make them usable in hazardous environments make them outstanding in non-hazardous ones, as they're waterproof, dust-proof, drop-proof, and have a long battery life.

- **Infrared Thermometers**
  Safely measuring the temperature in hazardous environments typically requires non-contact temperature measurement. Modern **infrared thermometers** provide laser accuracy and digital readouts for temperatures -40° to 1472°F (-40° to 800°C) and have a long distance-to-spot ratio. They can record data for later download and be programmed to alert the user to abnormal readings with audible and visual alarms.

- **Inspection Magnets**
  Magnetic particle inspection or magnetic particle testing are used in nondestructive testing to identify cracks or defects in ferromagnetic materials. **Intrinsically safe magnet sets** are available for this purpose, providing a visible indication of surface and near-to-surface defects, as well as approximate size and shape. **IS magnet probes** for solenoid valve activation assessment are also available.

- **Ultrasonic Thickness Gages**
  Ultrasonic thickness gauges use echoes to measure metal thickness for **UT testing**, even through painted surfaces, to determine if there has been a shift in the wall thickness due to corrosion or wastage. Some use a combination of RFID and specialized software to tag locations and their measurements, providing an organized view of the data and the health of the inspected equipment.

REMOTE INSPECTION TOOLS

Advanced remote visual inspection (RVI) and sensing equipment is used across many industries and in hazardous areas, though meeting requirements for intrinsic safety can be a challenge for such tools.

Remote inspections can be conducted with static monitoring systems, though each wireless sensor network must include electronics that meet intrinsic safety requirements.

- **Robotic Inspection Tools**
  The goal of all remote, robotic inspection devices is essentially the same: to avoid putting human beings into harmful situations, collect and provide data, and minimize the time equipment is off-line. Due to the very nature and construction of most remote-controlled devices, few will ever be suitable for environments that require intrinsic safety.

  However, a few intrinsically safe robots do exist for specific inspections, and engineers developing new products strive toward intrinsic safety. Designers have to consider the kinds of explosive atmospheres a robot may encounter and how those affect the robot's ability to work. Whether inspectors can use a robot safely in a given environment ultimately depends on the area designation and intended use.

- **Intrinsically Safe Inspection Bots**
  One area where several intrinsically safe **robotic inspection tools** are regularly used is the inspection of oil and fuel storage tanks. These intrinsically safe and explosion-proof bots use nondestructive examination **(NDE)** sensors to monitor tank health. Like underwater rovers and submarines, these robots inspect fluid-filled tanks for corrosion. Some require a human operator, and others are automated.

- **Robotic Inspection in Non-IS Hazardous Areas**
  Various robotic inspection tools operate in specific HazLoc zones, including unmanned areas with hazardous conditions, like offshore and onshore oil and gas facilities.

  Autonomous robotic tools use sensors to detect issues, like leaks or emissions, raising an alert when their sensors identify something abnormal.

  Remote-controlled devices may use sensors to alert a vehicle operator, who can then use sophisticated optics to provide visual data for further investigation when necessary. These crawlers and other rover-like devices manage various tasks, including track inspections, mine search and rescue, and confined space exploration. **Aerial drones** can also provide visual inspection in confined spaces and at heights typically requiring scaffolding or climbing.

OPTIONS IN HAZARDOUS ENVIRONMENT MITIGATION

Using cost-effective and efficient remote inspection tools is an appealing prospect for those who oversee the maintenance of many facilities with classified areas. Fortunately, as in the early days of hazard mitigation, additional inspection solutions are available when the classified areas are rendered safe.

Though time-consuming and expensive, intensive cleaning and degassing can make a space safe for humans (and robots) to inspect equipment with any tools.

However, some of the world's largest and most innovative chemical companies embrace another method: the nitrogen purge.

Nitrogen, when pumped into an enclosed space, renders the hazardous environment inert. With the explosive environmental conditions eliminated, even if the atmosphere isn't safe for humans, inspections can be conducted using remote-controlled inspection robots.

This form of risk mitigation is worth considering, as it makes many options available that increase efficiency and safety while decreasing cost. It's less time-consuming and expensive than degassing and cleaning the location for human entry. Inspectors can use tools with technological superiority, like drones and crawlers, to identify and detect issues that may otherwise require significant effort, downtime, and cost. And human inspectors can avoid the environment unless a discovery is made that requires human involvement, such as a maintenance issue.



INNOVATOR EDUCATION

The ever-growing desire for increased safety and reduced downtime will continue to inspire engineers to push the envelope to create the next generation of intrinsically safe inspection tools.

In response, classes focused on the latest advances in intrinsic safety are available for engineers and equipment creators. Equipment designers are considering intrinsic safety in their advanced designs, resulting in new products in the marketplace.

THE FUTURE OF INTRINSIC SAFETY

As intrinsic safety is the primary technique used to prevent explosion and fire risk, so long as there are classified areas, there will always be a need for intrinsically safe products.

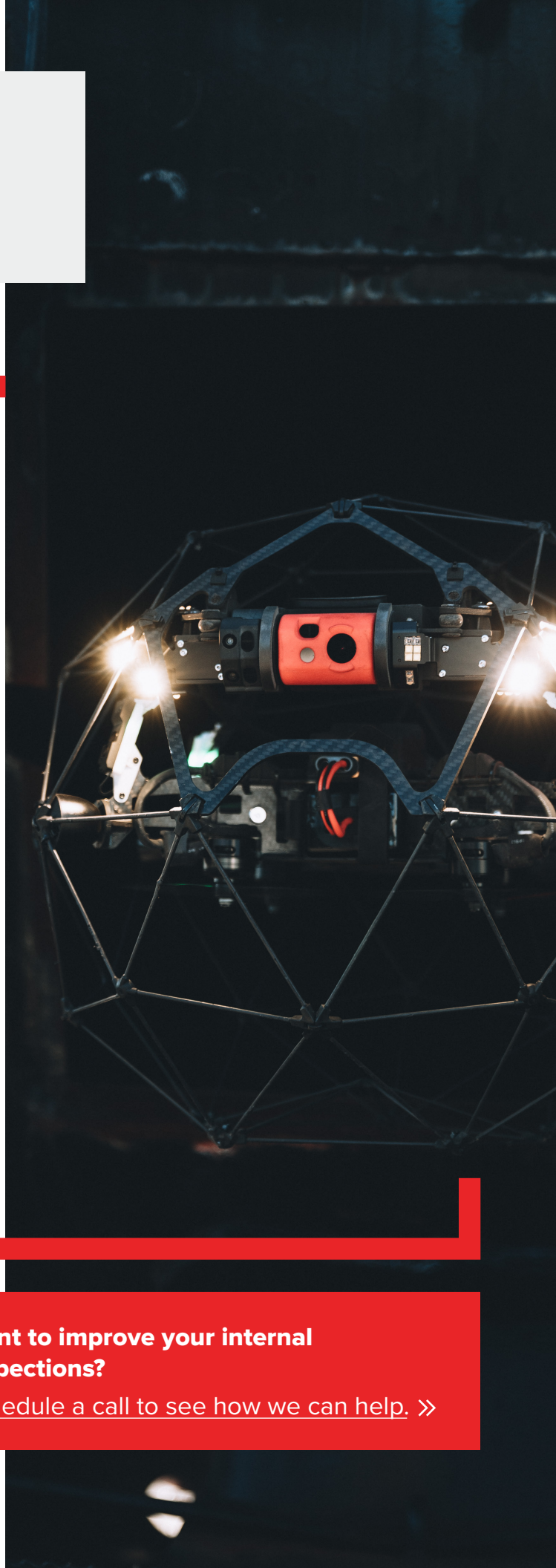
And some areas are expanding quite quickly.

For example, there's a market for intrinsically safe electronics that support the interconnection required for remote monitoring and the Industrial Internet of Things. Tablet computers and other data-gathering devices need to keep up with non-industrial technologies. And there will always be an interest in intrinsically safe inspections tools that work better, faster, and from greater distances.

The industry is a capital-intensive and highly competitive one. In 2020, industry analysts estimated the sales volume of intrinsically safe equipment at 2.71 billion dollars.

As safety standards continue to evolve and energy demands increase, the role of intrinsically safe equipment in every area, including inspections, will continue to innovate and grow. And we'll continue to keep this list up to date, providing you with the most comprehensive list of intrinsically safe tools you can find.

ABOUT FLYABILITY



TIME – COSTS – SAFETY

Flyability builds safe drones for the inspection of inaccessible, confined, and complex places. Focusing on the Energy, Oil & Gas, Chemicals & Maritime industries, Flyability enables end-users to save time, costs and reduce risks during visual inspections.

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