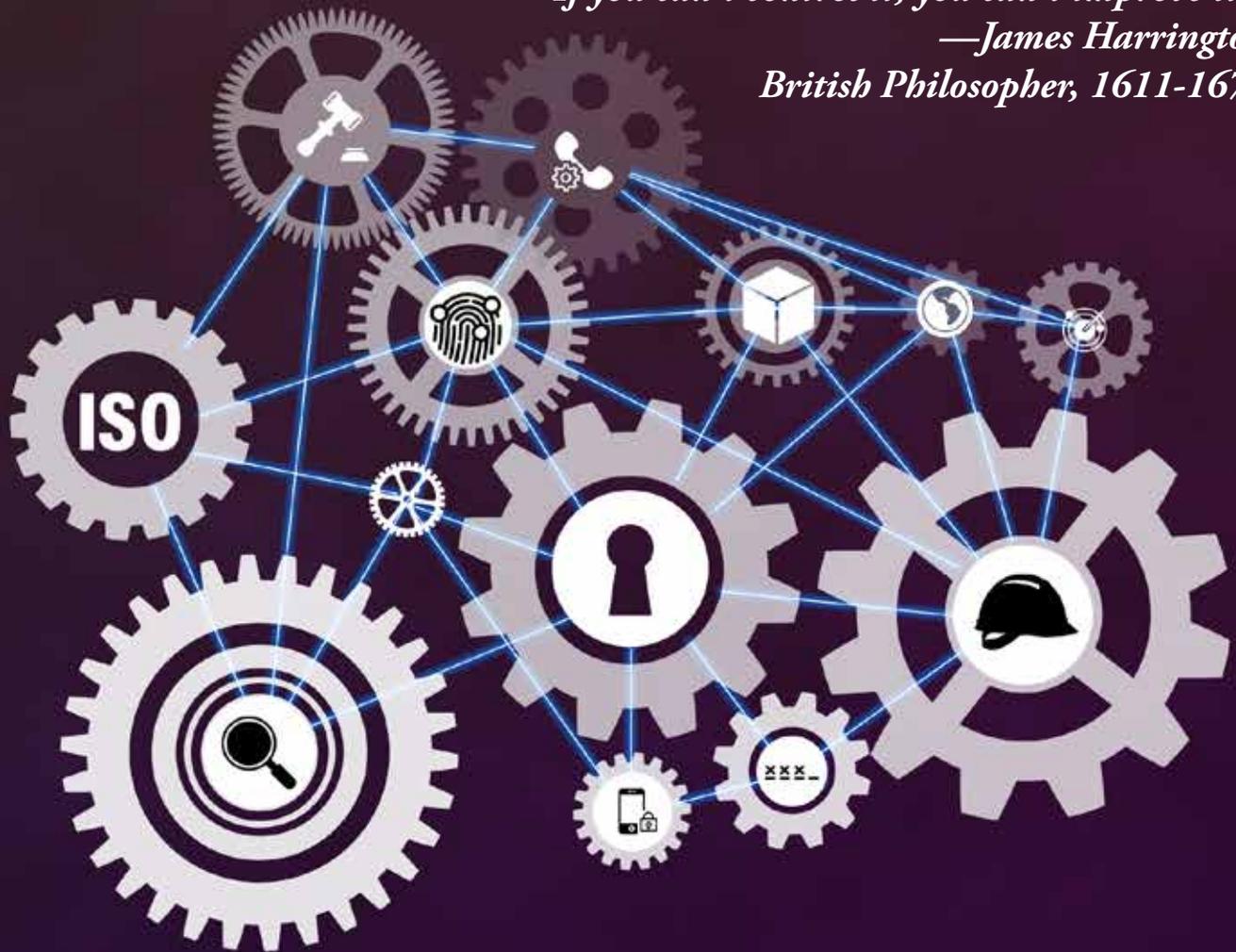


# Robo FYI

A Robolliance Publication

*“If you can't measure something, you can't understand it.  
If you can't understand it, you can't control it.  
If you can't control it, you can't improve it.”*

*—James Harrington  
British Philosopher, 1611-1677*



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# InsideFYI

Welcome to RoboFYI, the Roboalliance newsletter that highlights trends and topics with particular relevance to the security robotics community. In this issue, we turn our focus toward standards, and the organizations that govern them, as we examine the valuable role each are playing in support of our growing industry. We also provide a wrap up of ISC West, a premier security industry event, which takes place every April and, for the first time in 2017, featured a dedicated section for Robotic Products.

The traffic and buzz surrounding the inaugural Unmanned Security Expo at ISC West was a visible testament to the growing traction this technology is gaining within the security space. In addition, it is a mark of maturity that the products on display at the Expo now have many applicable standards that can help guide their development and assist consumers in making better buying decisions.

Standards are typically not legal requirements. Even UL (Underwriters Laboratories) certification, which most consumers look for on electric products as a NRTLs (Nationally Recognized Testing Laboratory) validation of safety, is not federally mandated. However, **standards and certifications instill a degree of confidence in consumers** as they evaluate the performance, compatibility, reliability and safety of what they buy. In this issue, we explore several categories of standardization pertinent to automation and robotic technology products.

**The National Institute of Standards and Technology (NIST) is one of our country's oldest standards organizations.** Though federally funded to promote national innovation and industrial competitiveness, it is a non-regulatory agency of the U.S. Department of Commerce. Noteworthy is NIST's sponsorship of the ASTM (American Society for Testing and Materials) F45 for Driverless Automatic Guided Vehicles with a focus on performance and safety. NIST also supported the voluntary, global efforts to standardize the Internet. Engineering Project Manager and NIST member, Roger Bostelman, will provide his perspective of NIST's impact on the unmanned robotic vehicle industry and share insights on what to watch for from a government standard perspective.

**ISO (International Standards Organization)** is the only global standards entity that is featured in this issue. It is well-known and respected in the technology space with facilities all over the world, which vary in focus and expertise. "ISO Ensures Security Robots are Safe Robots" is a 'must read' for anyone shopping robotic technology to operate around people.

**"MIL-SPEC-810 Isn't Just for the Military"** takes a look at a category of standards developed for the military, but widely used by commercial manufacturers to validate the durability and reliability of COTS (Commercial Off the Shelf) products. Given there are not a lot of standards in the security robotics realm, it is worth looking closely as to the importance of non-military product performance within a range of challenging climate and environmental conditions.

Carole Franklin is the Director of **Standards and Development at the Robotic Industries Association (RIA)**. From her leadership role within the only trade group in North America organized specifically to serve the robotics industry, Carole provides a wonderful insider's view of what standards are coming and which technologies are driving those standards.

Finally, as a means to put the state of the industry in perspective, we share dialogue from a **roundtable of Roboalliance 'Expert' Sponsors who gathered to share their take-away from the first Unmanned Security Expo** event. In "Making the USE Case for Robotics in Security", we learn how these experts see the future impact of automation, robotics and AI on the industry, and discuss examples of collaboration between technology and industry that are leading to breakthrough innovations.

As you enjoy these articles, keep in mind that new technology categories are typically not yet mature enough to have many standards. The fact that we have been able to dedicate this entire RoboFYI issue to applicable standards not only says much about how far our industry has come, but portends an exciting future trajectory.



'Inside FYI' is an Open Letter from Cliff Quiroga  
Vice President, Sharp Robotics Business Development  
Founding Sponsor of Roboalliance

# ISO Ensures Security Robots are Safe Robots

If you work in any business with an international clientele, there's a good chance you've heard of ISO 9000 – the international standards that define best practices for quality management and quality assurance. Compliance with ISO 9000 is required to do business within the European Union, across many industries, and soon it will be required for suppliers working with the U.S. Military. For companies going through the process of compliance and certification, it can feel like a time-sucking barrage of paperwork, but these standards and the certification process exist for good reason. In a global economy, they create a shared understanding of what businesses can expect from each other, making for more satisfying partnerships and mutually beneficial outcomes.

If you do know about ISO 9000, what you may not know is that these standards are really just the tip of the iceberg of what ISO – the International Organization for Standardization – does. ISO creates standards for almost every product and service under the sun. Headquartered in Geneva, Switzerland, ISO delegates are experts from around the globe, representing a huge range of technologies and industries. As of September 2016, the organization reported that there were 21,350 ISO standards in place, with 100 new standards being issued every month.<sup>1</sup>

Some standards pertain to very specific, simple products like light bulbs or staplers. Some are for products that are much more complicated and have greater variation, like digital cameras or medical supply packaging. Some are for systems or services, like electronic communication protocols or traffic safety. And some standards apply to categories of products that are so diverse, like “robots,” that it's hard to imagine how the folks at ISO tackled the job of creating meaningful standards. But they did.

Think about the variation of robots. There are as many

different types of robots as the jobs they've been created to do. Industrial robots have been around for quite a while, assisting with the manufacturing process, but now robots are being used to provide a huge range of services to humans in their daily lives. Robots are replacing bellhops to deliver room service at hotels. Robotic cats are providing pet therapy to Alzheimer patients. Robots are diagnosing diseases, delivering groceries, trading stocks, foster parenting orphaned animals, escorting visitors within large office buildings, and, of course, providing security services.

ISO creates standards based on need. As new categories of products and services come to market, its members work together to assess what aspects would benefit most from common standards and proceed where they feel there is sufficient need. It then assembles a team

of experts in the specific field or technology to create guidelines for those standards that will best serve all stakeholders. When it comes to robots that support security needs, there are several different categories in which ISO has identified enough common features and functions to allow for the creation of standards. One of these is how personal care robots can safely interact with humans. While this category is not exclusive to security robots, it certainly applies to them – especially as security robots are increasingly being used in environments where humans are present. Security robots now patrol shopping malls, parking lots, office parks and warehouses, just to name a few. The last thing we want is for a robot to inadvertently cause harm or danger to the very people that it's trying to protect.

Gurvinder Virk, who heads the group responsible for ISO 13482 – safety requirements for personal care robots – explained in a 2014 interview with Robotics Business Review that “If such an accident did happen, it's up to the company to prove to a court of law that they have carried out the risk assessment for their product in a sufficiently logical and thorough way. For a small company with limited resources, that's quite difficult to prove without an ISO standard.”<sup>2</sup>

ISO recognizes that the hazards humans might encounter when interacting with a robot will vary tremendously depending

upon the physical construction of the robot, the specific environment in which it's deployed and the ways in which it interacts with humans during operation. Hazards are also a function of how the robot is installed, programmed, operated and maintained.<sup>3</sup> Even so, there is still plenty of room for common standards that can help manufacturers engineer safer designs, assure companies that that buy them that their use incurs minimal risk, and make the general public feel confident interacting with them, up close and personal.

What are some of the areas that ISO might ask manufacturers to address? A most obvious question is how well a robot is equipped to avoid collisions. Equally important is an evaluation of the safety mechanisms in place so that if a collision between human and robot does occur, the risk of human harm is low enough to be acceptable.

If a robot is required to have physical contact with humans in order for it to do its job, ISO wants to make sure that the manufacturer has thought about the mechanics of these interactions from a safety standpoint. Depending on the robot, some issues they might address are: How quickly and predictably do the robot's parts move? Are sensors located in all the

right places? How much pressure can it exert when it encounters resistance? The point of ISO isn't to regulate specifically how robots are designed, but to make sure that the right questions have been asked and appropriate measures taken to meet consistent standards of safety.

There are also safety concerns that aren't quite as obvious. How much radiation does a robot emit? How loud is it? Can it overheat and, if it does, what happens? Does it have lights or reflectors to make it visible in the dark? When most of us come in contact with a robot, we're focusing on all the amazing things it can do. Organizations like ISO help to make sure that less glamorous considerations, like safety, don't get overlooked.

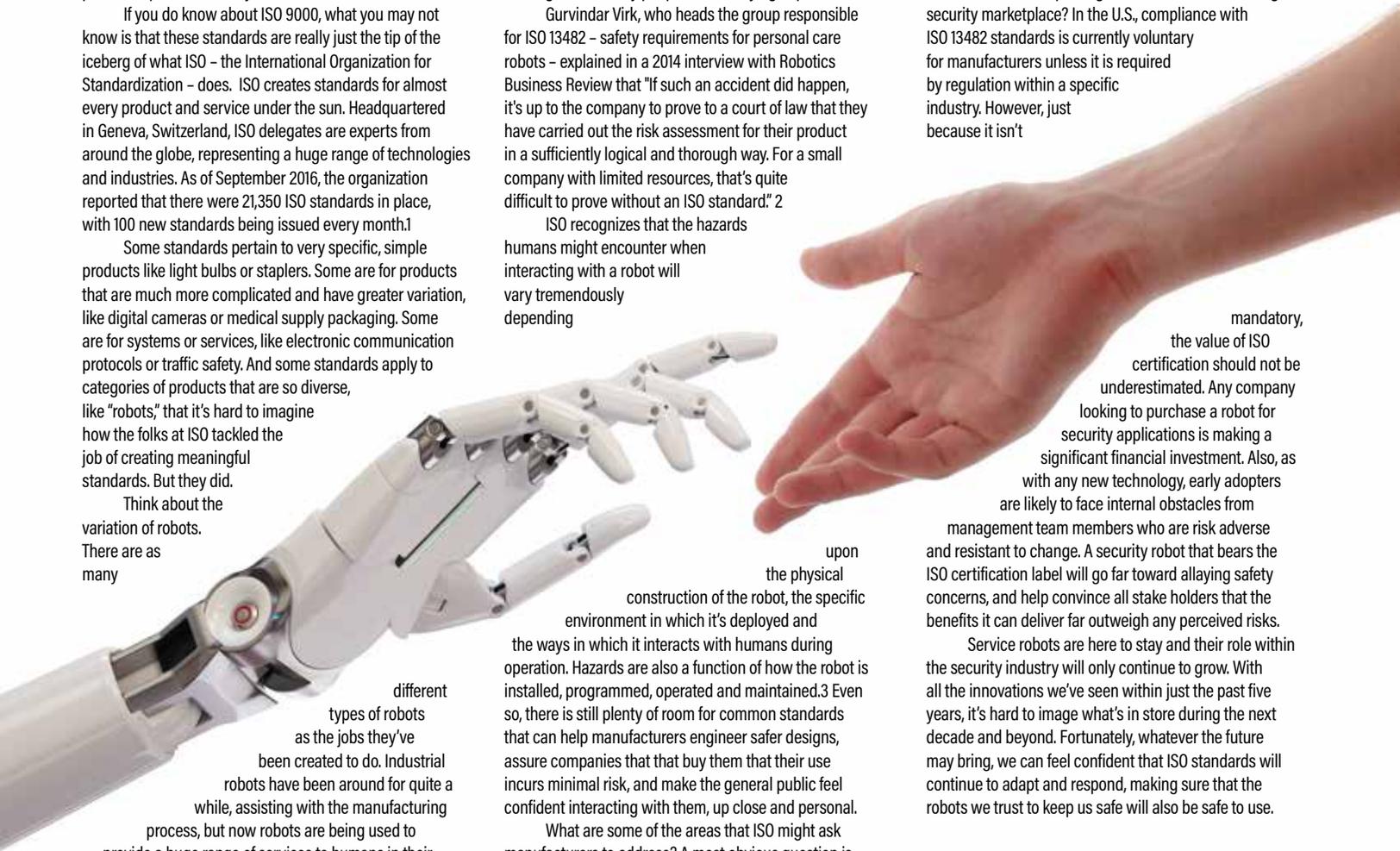
How is ISO impacting the robots we see entering the security marketplace? In the U.S., compliance with ISO 13482 standards is currently voluntary for manufacturers unless it is required by regulation within a specific industry. However, just because it isn't

mandatory, the value of ISO certification should not be underestimated. Any company looking to purchase a robot for security applications is making a significant financial investment. Also, as with any new technology, early adopters are likely to face internal obstacles from management team members who are risk adverse and resistant to change. A security robot that bears the ISO certification label will go far toward allaying safety concerns, and help convince all stake holders that the benefits it can deliver far outweigh any perceived risks.

Service robots are here to stay and their role within the security industry will only continue to grow. With all the innovations we've seen within just the past five years, it's hard to image what's in store during the next decade and beyond. Fortunately, whatever the future may bring, we can feel confident that ISO standards will continue to adapt and respond, making sure that the robots we trust to keep us safe will also be safe to use.

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1. ISO.org website at: <https://www.iso.org/standards.html>
2. Robotics Business Review – January 9, 2014 <https://www.roboticsbusinessreview.com/consumer/new-international-standards-boon-to-personal-care-robotics/>
3. ISO.org website at: <https://www.iso.org/obp/ui/#iso:std:iso:13482:ed-1:vi:en>



# Making the USE Case for Robotics in Security

**Five Robolliance Expert Sponsors, who participated in the inaugural Unmanned Security Expo at ISC West in Las Vegas, hold court on myriad robotics' topics. A prominent common thread is the huge upside for these emerging technologies to gain a foothold in security.**

**By Scott Goldfine**

The first-ever Unmanned Security Expo (USE) successfully debuted at the International Security Conference & Expo (ISC West) in Las Vegas (April 2017) — helping the electronic security industry's already highest profile trade show soar to a record number of more than 30,000+ participants. With a focus on unmanned aerial vehicles (UAVs), unmanned ground vehicles (UGVs) and various systems to support robotic technology, the show within a show included a fully functional flight cage and robotics demonstration area, booth exhibits and free education sessions.

Robolliance, a forum for technology partners and industry experts in robotics, surveillance and security, created to advance the understanding and awareness of the autonomous robotics marketplace, served as one of the four primary USE supporters. Robolliance sponsors, comprised of technology companies, security integrators, guard services and industry thought leaders, were on hand to welcome attendee inquiries and address the greater questions of "Why Robotics? Why Security? Why Now?" Directly across from the Robolliance Sponsor Showcase was the Expert Corner, where experts spoke one-on-one with attendees.

Among the Robolliance Sponsors onsite at the inaugural USE were Experts from the Coalition of UAS Professionals, Genentech, IGM Creative Group, MiB Mediaworks and RF-MOON. To ascertain what the first-hand reaction and response was to that event, and expand into what it means for the security industry moving forward as well as other trade shows, RoboFYI conducted a roundtable involving representatives from each organization.

**ERIC MORSE**

**Robolliance**

**NATHAN RUFF**

**JAY STACK**

**MARK BRODIE**

**TOM DIETZ**

*Why did you participate in the USE at ISC West? What did you hope to gain from the experience, and how did it work out?*

**ERIC MORSE, Senior Security Manager, Genentech:** "It was an opportunity to dialog with peers on the upcoming advancement in robotics and how the technology can be used now with the right equipment and services to augment your security program. Robotics can be a force multiplier and allow for additional layers of security protection for your people, property and information. I learned from subject matter experts in many industries and within specific niches, which was very helpful. There was great dialog and partnership between different companies and industries. Overall, it was overall a great experience."

**NATHAN RUFF, Director, Coalition of UAS Professionals:**

"The Coalition of UAS Professionals worked in concert with [ISC organizers] Reed Expositions to orchestrate the USE. Our hypothesis was, that although unmanned robotics is still a bleeding-edge technology, the security industry would recognize the potential and be interested in better understanding how drones, droids and underwater robots could be leveraged successfully. We initially planned to have the educational area provide seating for 25-30 attendees, but we quickly doubled that capacity after the first session. Reed placed pressure sensors under the entire expo floor carpet to conduct heat-mapping, which provided better intelligence on foot traffic patterns, high volume areas, etc. The USE area ended up being the hottest spot on the show floor. With 30 companies exhibiting their technologies, two days of educational sessions and the demo area where folks got to see drones and droids in action, USE gave attendees a real glimpse into the future of security and unmanned robotics. The experience was a big success."

**MARK BRODIE, President, MiB Mediaworks:** "We thought this was a great way to get involved in the latest advances in security technology. ISC West offered me an opportunity to meet with various companies in the security industry, that support the UAGVs [unmanned automated ground vehicles], giving me access to thought leaders in an area I have not worked with before. Through my conversations with individuals I met at the conference, I gained new contacts and created relationships with some very passionate and insightful individuals. Through these relationships, I see quite a few opportunities that will become available creating great collaborative efforts in the future around robotics."

**TOM DIETZ, Owner, RF-MOON:** "I was at ISC West to assist Sharp's Robotics Group. To be effective, the robot requires a fair amount of reliable bandwidth to support the streaming video from six cameras. My goals at the show were to be an informed source for information about outdoor wireless networks that enable mission-critical applications. Additionally, USE provided a way to introduce myself to Sharp's customers and to make sure that future robot owners knew where to go for the wireless network installation, integration and support."

I was surprised at the level of interest in a security-focused robot and was able to provide information to quite a few prospects."

**JAY STACK, President, IGM Creative Group:** "The Robolliance kiosk at USE was quite impressive as it too was demonstrative of people interacting with technology. Booth visitors were able to use the touchscreen to dynamically swipe through topics, read articles, peruse through a multitude of experts and their profiles, plus contact all of the Robolliance sponsors. It was amazing. The large interactive touch monitor really made the booth and its products stand out. It's great that the Robolliance had so many sponsors attend as it offered USE patrons the ability to gain expertise on a variety of robotic related topics."

*Are there any aspects of USE that could have been better and/or could be improved for future?*

**RUFF:** "The one area we didn't leverage well enough was the drone cage/demo space. Originally, our goal was to set the drone cage up as a "near-to-real" demonstration of competing technologies. The idea was to pit offense technologies, such as infrared sensing from a UAV platform, against counter-UAS technologies, like RF tracking and discouragement. Effectively, the space would have been a scrimmage of sorts between offensive and defensive tech. This would have likely been a more defining experience for attendees, who at this point have already seen drones buzz around and ground robots drive themselves without human intervention. Alas, perhaps next time."

*What were some of the comments/questions you overheard or fielded in and around the USE regarding robotics' role in and relationship to security?*

**STACK:** "There are so many companies, who have focused their attention to security and new innovation, that it's hard to sift through those that have a viable product."

**DIETZ:** "Most comments about robotics and security were focused on the cost savings model. One security guard for the show brought up the safety benefits. Apparently, a colleague of hers, another security guard, was killed when he investigated something suspicious. The woman at the show pointed out that the robot helped to keep human security guards out of harm's way."

**RUFF:** "Comments and questions were many. . . What can this technology do in a real-world scenario? Are autonomous/semi-autonomous robots safe? There seems to be a meaningful convergence between autonomous vehicles and unmanned robotics. Can a drone utilize machine vision and learning to independently navigate around obstacles? How do unmanned robots employ predictive analytics to provide advanced security? I'm amazed that a combination of acoustic and visual anomaly detection algorithms can be employed that provide a security robot capabilities beyond traditional sentry patrols. I understand that unmanned robots can



provide advanced situational awareness, but what are the legalities involved with weaponizing a robot so that it can take "interdictory action" if necessary?"

**BRODIE:** "One main concern seemed to be the displacement of security workers or employees. This question is one the industry will struggle with as other industries have, such as automotive and hospitality. Technological changes forces the evolution of occupations. I think events and groups, like USE and Robolliance, create a place for dialogue and help steer that conversation."

**MORSE:** "There was a great conversation about the future of robotics within the prison industry that I thought was fascinating. The prison industry relies heavily on personnel to conduct a lot of the dull, dirty and dangerous activities that robots can do without the cost and potential risk of life. The prison industry also relies heavily on recurring activities that take place 10 to a hundred times a day. These very repetitive types of activities could be done with the use of robotics, which could free up staffing and may be more accurate."

*What were your takeaways from the experience?*

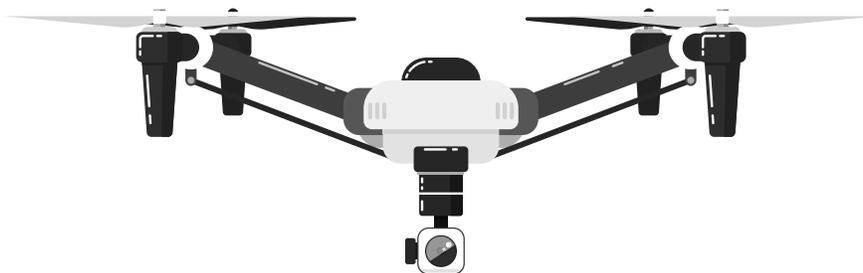
**BRODIE:** "The security business is a lot larger and more expansive than I ever imagined. The technology being used today seems to have changed a great deal over the last few years, adding new and exciting opportunities for many companies in the security space."

**STACK:** "Innovations are changing every three years now. You don't want to fall behind."

**RUFF:** "Unmanned robotics are going to play a tremendous role in the future of security."

**MORSE:** "The importance of finding the right person, who has accurate information, so you can learn from the source directly and not rely on third-party insights. This makes you a more knowledgeable customer and end user. Everyone has areas of strengths and/or special skill sets. By tapping into a network of individuals, who provide you a wide selection of various knowledge base, makes life easier. You benefit from smarter transactions and an end state that is constantly raising the benchmark."

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*How fast do you see the robotics tie-in to security growing and why?*

**DIETZ:** "There will be a lot of interest immediately, but some hesitation to implement the rest of the system due to cost and good ole resistance to change."

**BRODIE:** "The possible long-term cost savings in using robotics is a real incentive for many companies looking to lower their labor costs. This cost savings will need to be analyzed by real-world business practices, but logic tells me using robotics will save those, who need this type of security, a lot of money."

**RUFF:** "Unmanned ground robots are already patrolling office complexes, malls, etc. But the technology still has some wrinkles to work out as we are seeing in the headlines. Mishaps will get worked out, but erode industry confidence in the near term. I'd suggest 18-36 months before we see widespread implementation of ground-based, autonomous security robots. With regard to airborne unmanned robotics, that is likely to take a bit longer simply because the FAA needs to come up with a plan on how to certify and regulate autonomous flight within the national airspace. That's more likely to be three years out, but once those regs are in place, drones will be able to zip off to inspect triggered alarms without any human intervention providing a rapid response capability currently unavailable. The end result will be a greatly improved level of situational awareness from a security perspective."

**MORSE:** "I see robotics fading in over the next two to four years and really being present in every aspect of security within a decade. Security is part of the life-safety industry, so when there is life at stake innovation takes a backseat to robust operations that are repeatable regardless of the time of day, weather or existing circumstance. Because of this, robotics may be a bit delayed to really become ingrained, but there is no doubt that it will someday. The real question is in what form will it arrive in and how will it be used?"

*What are some of the best opportunities in this area and why? Likewise, what are some of the top challenges in this area and why?*

**DIETZ:** "The best opportunity will be in showing the end user the technologies, that are put in place to support the robot, will also support a wide variety of other voice, video and data applications. Convincing people that a reliable network can be provided using unlicensed frequencies can prove to be difficult. Conversely, convincing people that outdoor wireless networks are significantly different animals than the simple Wi-Fi access point most are familiar with."

**MORSE:** "The best opportunities are ones that do not replace human activity, but enhance it and create a force multiplier where one human plus one robot is a lot more than two. If we argue to enhance our current staffing model with this additional tool, I think it makes a lot of sense to embrace robotics and use them to increase the security of your organization. Counter to that, if you are looking

for robots to reduce your security budget by eliminating the human aspect I believe we are several decades from that being a reality, and it may be even longer than that."

*Who do you see being some of the earliest adopters of robo-security and why?*

**MORSE:** "I see a lot of advancement in the AUGV platform, which can be used now to monitor and patrol fence lines, parking lots and exterior areas. Add to this security perspective is the safety component, such as the capability to monitor air quality."

**RUFF:** "Large campuses that require legions of traditional patrols to maintain security are likely early adopters. Also prisons, government installations, anywhere that manned security is dangerous or dull, provides a great opportunity to allow robots, in the air or on the ground, to provide significant value."

**DIETZ:** "The earliest adopters are going to be those who can bring in the supporting technologies without having to do a forklift upgrade of an existing system. Often, this will be new businesses. Next will be those who can show clear financial losses due to criminal activity. And finally, with the focus on worker safety, locations that have extreme weather conditions will see the benefit in not having a human guard walk the perimeter when it is 120° F or 0° F."

*What other trends and growth are you observing of late regarding robotics awareness and interest, including tradeshow, publications, news, media, etc.?*

**DIETZ:** "I see a general trend toward automation in the outdoor operation. This is being facilitated by the same thing that drove the dotcom boom. Technology, that is founded on IP packets, offers not only the opportunity to optimize processes, but also an opportunity to reduce costs by converging outdoor voice, such as Push2Talk, LMR, video and data onto a single network. The Internet of Things and machine-to-machine communications is all about automation. A robot focused on security is a natural outgrowth of a population that is looking to automate repetitious or dangerous jobs."

**STACK:** "News coverage for robotics is doubling rapidly. You can't watch the daily reports or open the paper without some kind of article or video about robots. Owning an ad agency, I can tell you the cost of a PPC [pay per click] ad is higher than it's ever been for robotics. We are looking at the future."

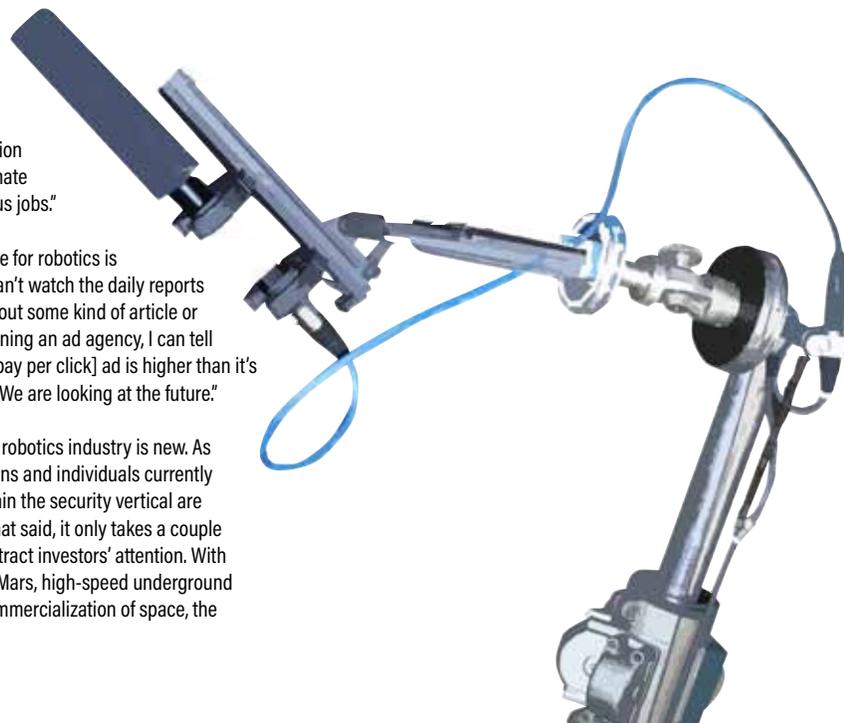
**RUFF:** "The unmanned robotics industry is new. As such, those organizations and individuals currently pushing it forward within the security vertical are still out on the edge. That said, it only takes a couple of success stories to attract investors' attention. With talks about colonizing Mars, high-speed underground hyperloops and the commercialization of space, the

excitement of high technology and the future is captivating imaginations again. Our country went through a period where dreaming big technologically went out of fashion, replaced by the idea of the Internet start-up millionaire. It's a great thing to see how unmanned robotics is playing a role in this new era and getting folks excited again.

One interesting area in the future will be when drones start acting as true IoT devices. With 7 million drones estimated to be operating in the U.S. airspace alone by 2020, imagine the amount of information that will be collected as these devices automatically report back to central databases. This information can be used productively, such as real-time weather capture, or for less altruistic reasons such as tracking what time of day you leave for the office and return in the evening. Food for thought."

**To see more images from USE and read the original article publication, visit [Security Sales & Integration](#).**

**Author Info: A 20-year industry veteran, Scott Goldfine is Editor-in-Chief and Associate Publisher of Security Sales & Integration, a leading security industry trade publication and Robolliance media sponsor.**



# Robo Q&A

## Inside NIST with Roger Bostelman, Engineer Project Manager

**Q:** What is the National Institute of Standards and Technology (NIST) and how do they help industry?

**A:** The National Institute of Standards and Technology (NIST) [<http://www.nist.gov/>], one of the nation's oldest physical science laboratories, was founded in 1901 and is now part of the U.S. Department of Commerce. Congress established the agency to remove a major handicap to U.S. industrial competitiveness at the time. NIST measurements now support the smallest of technologies—nanoscale devices so tiny that tens of thousands can fit on the end of a single human hair—to the largest and most complex of human-made creations, from earthquake-resistant skyscrapers to wide-body jetliners to global communication networks.

The Engineering Laboratory (EL), one of seven NIST laboratories, promotes U.S. innovation and industrial competitiveness in areas of critical national priority by anticipating and meeting the measurement science and standards needs for technology-intensive manufacturing, construction, and cyber-physical systems in ways that enhance economic prosperity and improve the quality of life. The EL Intelligent Systems Division (ISD) works closely with industry to develop, advance, and deploy measurement science and standards to speed development, adoption, and integration of leading-edge intelligent technologies to advance U.S. manufacturing performance. One of several programs within ISD is the Robotic Systems for Smart Manufacturing program which develops and deploys advances in measurement science that enhance U. S. innovation and industrial competitiveness by improving robotic system performance, collaboration, agility, and ease of integration into the enterprise to achieve dynamic production for assembly-centric manufacturing.

**Q:** What is NIST doing in the areas of safety and performance of autonomous vehicles?

**A:** NIST ISD has played an important role in the safety and performance of autonomous vehicles for more than 25 years. Several military, transportation and industrial vehicle projects have progressed the area of autonomous vehicles, from providing one of the first autonomous off-road vehicles for the US Army, to measuring run-off-road and crash avoidance warning systems now used in cars, to developing a generic solution to autonomous on-road driving, and to transferring technology to industrial vehicles for their safe and advanced performance in factories. I am an Electrical Engineer a member of the ANSI/ITSDF B56.5 Driverless Automatic Guided Industrial Vehicles safety standard, and Chairman of the ASTM Committee F45 on performance of industrial vehicles. My team and I develop, verify, and validate test methods for inclusion in safety and performance standards.

**Q:** What is ASTM Committee F45 and how does it affect the autonomous industrial vehicle industry?

**A:** ASTM Committee F45 on Driverless Automatic Guided Industrial Vehicles [<http://www.astm.org/COMMITTEE/F45.htm>] was formed in 2014. The Committee has 5 technical subcommittees and working documents:

- ✿ F45.01 on Environmental Effects currently developing working document WK54576 "Practice for Standard Practice for Recording Environmental Effects for Utilization with A-UGV Test Methods";
- ✿ F45.02 on Docking and Navigation currently developing working document WK48955 "Test Method for Navigation for Driverless Automatic Guided Industrial Vehicles";
- ✿ F45.03 on Object Detection and Protection currently developing working document WK54662 "Test Method for Standard Test Method for Grid-Video Obstacle Measurement";
- ✿ F45.04 on Communication and Integration currently developing working document WK54431 "Test Method for A-UGV Communication and Integration";
- ✿ F45.91 on Terminology currently developing working document WK48954 "Terminology for Driverless Automatic Guided Industrial Vehicles".

These standards will play a preeminent role in all aspects of driverless industrial vehicle performance. Vehicles types covered include traditional automatic guided vehicles, as well as mobile robots for use in other domains, such as service applications (e.g., security, hospital, and mail delivery), manufacturing and defense. ASTM F45 develops standardized nomenclature and definitions of terms, recommended practices, guides, test methods, specifications, and performance standards for driverless automatic guided industrial vehicles. The Committee encourages research in this field and sponsor symposia, workshops, and publications to facilitate the development of such standards. For more information on how to become a member of ASTM F45, visit [<https://www.astm.org/MEMBERSHIP/index.html>]

**Q:** What techniques is NIST researching to measure the performance of industrial vehicles?

**A:** NIST leverages measurement technology developments and uses the latest measurement methods being developed or available. Laser trackers and optical tracking systems (OTS) are just two of the systems being used at NIST to measure performance of industrial vehicles in both static and dynamic situations. In fact, NIST has also recently led the ASTM 3064 standard development called:

"Standard Test Method for Evaluating the Performance of Optical Tracking Systems that Measure Six Degrees of Freedom (6DOF) Pose". This new standard provides the test method to measure how well optical tracking systems work so that they can be used for measuring, for example vehicle performance. These and other high performance measurement systems are used to support the measurement science basis of smart manufacturing research ongoing at NIST that includes industrial vehicles and robots.

However, more simplified and lower cost test methods are also being developed, through use of these high performance systems, for rapid and cost effective adoption by industry. Methods such as the utilization of testbeds and artifacts that mimic general capabilities found in industrial settings are being designed and developed at NIST. For example, recently two reconfigurable mobile manipulator artifacts (RMMAs) were developed and are being used to measure the performance of mobile manipulators (a robot arm mounted onboard an automatic guided vehicle (AGV) in the traditional sense and a robot arm mounted onboard a mobile robot in the advanced sense) to perform assembly tasks. The two RMMAs can support both static and dynamic performance measurement of mobile manipulators at 20 times less cost than an OTS if machined, and 200 times less if 3D printed.

**Q:** Are there opportunities for industry to participate in this NIST research and if so, how can they participate?

**A:** Approximately 3400 people work at NIST along with approximately 2700 guest researchers annually. NIST's Technology Partnerships Office (TPO) [<http://www.nist.gov/tpo/index.cfm>] works with regional, state and local economic development organizations, technology incubation centers, public-private business development initiatives and other organizations and partnerships to facilitate the transfer of technologies developed within NIST laboratories. NIST scientists conduct research, create technologies and make discoveries in nearly every scientific and technological field. The NIST TPO encourages the commercialization of these results through:

- ✿ Cooperative Research and Development Agreements (CRADA);
- ✿ Material Transfer Agreements (MTA);
- ✿ Facility Use Agreements (FUA);
- ✿ NIST Associates and Guest Researchers;
- ✿ Intellectual Property (inventions, patents, licenses, trademarks); and
- ✿ Small Business Innovation Research (SBIR) Program.

# Robotics Aspires to Higher Standards

**The Robotic Industries Association's director of standards development discusses the organization's pivotal role in the standards process, and key trends affecting the industry's tactics, trajectory and traction.**

**By Scott Goldfine**

Founded in 1974, the Robotic Industries Association (RIA) is the only trade group in North America organized specifically to serve the robotics industry. Member companies include leading robot manufacturers, users, systems integrators, component suppliers, research groups and consulting firms. According to RIA's mission statement, the organization's objective is to "drive innovation, growth and safety in manufacturing and service industries through education, promotion and advancement of robotics, related automation technologies and companies delivering integrated solutions."

One of RIA's most active participants is Carole Franklin, who serves as the director of standards development, including activities to advance ANSI and ISO Robot Safety Standards. Before joining RIA, she spent more than four years with the management consulting firm Booz Allen Hamilton, and her background also includes 10 years in the Ford Motor Co. market research department. The University of Michigan MBA degree-holder is keenly adept at translating the needs of end users into actionable guidance for engineers and leaders — and vice versa.

RoboFYI spoke with Franklin to get her perspective on current trends in robotics as well as an update of where industry standards are heading and why.

*What role do you and your organization play in robotics standards, and why is it so important?*

**Carole Franklin:** Voluntary standards are important and beneficial to their industries. The more widespread the use of the standard, the bigger the potential market for goods or services that comply with that standard. In other words, standards help create and stabilize markets. RIA plays a leading role in the development of standards in the industrial robotics world. We provide leadership, coordination, and administration of robotic standards development efforts in both ANSI and ISO. We also provide communication and education that promotes awareness and use of the standard and related documents.

Our current standard is the ANSI/RIA R15.06-2012, Safety Requirements for Industrial Robots and Robot Systems [R15.06]. We developed this standard because ensuring the safety of people working near industrial robots is a foundational requirement for success of the robotics industry. We are also working on a new, related standard for safety of industrial mobile robot systems. RIA led the development of the first version of this standard in the 1980s. Since then, we have ensured its periodic updating as technology advances; and we also successfully promoted its adoption by ISO. The current R15.06 is a U.S. National Adoption of ISO 10218:2011, which is itself an adaptation and update of the 1999 version of R15.06.

Although we started our standards development efforts decades ago in the U.S., since then it became clear that our industry has a global reach, with multinational robotics suppliers and customers. As a result, RIA

adopted a philosophy that says, "Do the standards development work in the international sphere first, then bring it back as a U.S. national adoption." And so that's what we've done for at least the past 10 years.

The first step in the standards process, then, is to work within the ISO Technical Committee 299, Robotics [TC 299]. Within TC 299, the Working Group [WG] responsible for industrial safety of robotic systems is WG 3, of which RIA has long served as an officer. It's a great group of people dedicated to industrial safety, and they apply their considerable robotics expertise in the cause of worker safety.

*What are a few of the most noteworthy robotics advances the past couple of years that are changing the game?*

**Franklin:** Collaborative robotics is still a new technology and people are still working on how to use it most effectively. And the technology is still improving. Most "collaborative robot" solutions today are really what we call "power- and force-limited" [PFL] robots. They are limited in the size of payload they can handle and may also be limited in the forces they can exert, with the goal that they physically cannot hurt a human, should contact between human and robot occur. But according to the ISO Technical Specification 15066-2016 [TS 15066], on the safety of collaborative robot systems, power- and force-limiting is only one of four possible modes of safe collaborative operation. There is also hand guiding, speed and separation monitoring, and safety-rated monitored stop. And a number of companies are working on sensor solutions that will enable effective speed and separation monitoring, going forward.

Another advance that will impact the robotics industry is the development of mobile robot systems. These are different from the traditional AGV [or automated guided vehicle] in the sense that mobile robots typically have a higher degree of autonomy. In other words, the mobile robot can enter a dynamic environment and make decisions "on the fly" about the path it will take to its goal, and what it will do when it gets there; whereas the AGV can only follow its predefined path no matter what is happening in its environment.

We are working on a new ANSI standard, R15.08, to set safety requirements for mobile robot systems in the industrial setting. In this document our goal is to provide guidance for areas currently not covered in existing industrial safety standards, primarily ANSI B56.5 on AGV safety, and our own R15.06 on industrial robot safety. Although the R15.06 does not preclude the existence of a mobile robot system, the R15.06 is primarily concerned with traditional industrial robots, where the robotic equipment is permanently mounted, and generally, safeguarded to keep humans out of its operating space. So, in R15.08, we are asking, what happens when the robot is mobile? How do we keep humans safe in that scenario?

The difference between R15.06, Industrial Robot Safety, and R15.08, Industrial Mobile Robot Safety, is just one little word, "mobile." But we are finding that one little word opens up a whole world of complications. It's a big challenge, but it's important. And our committee members are dedicated to getting the job done.

In our R15.08 standard development committee, we are focusing first on mobile robotics within an "industrial environment," broadly defined as manufacturing and adjacent economic sectors such as warehousing and

delivery. In fact, the main defining characteristics of this operating environment are 1) a structured or semi-structured environment, as compared to an unstructured one, and 2) the system is working around people who can be broadly classed as having some kind of "employment" relationship with the facility. That might be contractor or supplier, of course, not only employees strictly speaking; but the point is that it is controlled access, not public access. The people who interact with the system can be expected to be of working age and health (that is not a child or frail elderly), and to receive training in how to interact with the system safely.

This is not to say that someone implementing a mobile robot system in a situation where public access is permitted could not use the standard; but that they would need to take additional precautions to keep untrained and possibly nonworking-age people safe around the mobile robot system. So we would expect that, for example, a system of mobile security bots patrolling a closed campus at night, or whenever the public is expected to be absent, would find much useful guidance in the standard. And we certainly welcome participation by any security companies, who may be interested in helping with this effort. So if any of your readers would like to join our committee, feel free to contact me.

*What are the three leading challenges facing robotics today and how are solutions being addressed?*

**Franklin:** One growing challenge we're monitoring carefully is cybersecurity. In the past, cybersecurity in the industrial setting has been nearly a non-issue because the robot and its controller were not connected to the outside world in any meaningful way. Essentially, someone had to be physically on the plant floor to make a change in this machine's programming. Now that's changing.

There's been a push to connect these machines to the internet; the Industrial Internet of Things is coming. In the future, a robotic technician might be able to adjust his machine from his own couch, using his smartphone as the interface. But before we go connecting everything, and making that smartphone-interface possible, we need to take a very close look at how to protect that system from malicious code. With mobile robot systems, this is going to be even more important. Will those mobile robots communicate with each other and their fleet manager by Wi-Fi? If so, will that Wi-Fi coverage extend beyond the facility wall at any point? And how can we prevent those Wi-Fi signals from being hacked?





# MIL-SPEC-810 Isn't Just for the Military

The use of robotic vehicles in civilian security applications is still somewhat novel, but their use in military applications has been visible to the public for quite a while. Who can forget the opening scene of the Oscar-winning movie *The Hurt Locker*, which featured the view from a remotely controlled unmanned ground vehicle (UGV) navigating the streets of Baghdad? That was filmed almost a decade ago.

Some of today's non-military UGVs look like the cleaned-up cousins of *The Hurt Locker* robot. Shiny, streamlined bodies have replaced the camouflage and mounted weaponry, but they still feature rugged construction and are equipped with telescoping arms, cameras and sensors. And, like their military counterparts, they need to perform consistently and reliably in a wide range of environments. Our global economy makes it an almost certainty that any manufacturer sophisticated enough to develop a high-performance UGV intends to market it to a world-wide audience, and these vehicles will face very different environmental challenges depending on where and how they're deployed. These can be a function of climate - such as extreme temperatures, humidity and altitude, as well as man-made, applications-specific conditions such as dust, vibrations and proximity to explosive materials.

Like all things military, UGVs (and UAVs - unmanned aerial vehicles or drones) used by the Department of Defense conform to a variety of specifications designed to ensure consistency and reliability. One of these standards is MIL-SPEC-810, which defines testing procedures to establish the "ruggedness" of a product -- in other words, how well it will stand up to the challenges posed by extreme environmental conditions. For the safety of its people and the missions these vehicles support, the military relies on MIL-SPEC-810 to be certain that the performance of its UGVs and UAVs won't be hampered by freezing rain, sand storms, flooding and whatever else comes their way.

How can manufacturers of civilian UGVs and AGVs provide similar assurances to the stakeholders who rely on their products? They, too, can test to MIL-STD-810. That's right ... MIL-STD-810 isn't just for the U.S. military. In fact, these guidelines are widely used in the design of commercial products, and are respected worldwide as validation that a product is a "tough" as it claims to be. For example, some smartphone manufacturers have recently begun citing MIL-STD-810 relating to their phones' ability to pass "the drop test."

So what, exactly, is MIL-STD-810?

MIL-STD-810 encompasses an array of different categories for testing. These include how a product

performs when exposed to prolonged high and low temperature extremes, temperature shock, solar radiation, rain, fungus, salt fog, sand and dust, explosive atmospheres, immersion in liquids, acceleration and vibration. Manufacturers need not test against all conditions in order to claim MIL-STD-810 status in their specifications - just the ones that are relevant for their product. That's how smartphones manufacturers can test just against shock (a subset of the acceleration tests), while makers of security robots might consider testing against a much broader set of conditions. After all, the more environments in which a security robot can safely and reliably perform, the wider the global market will be.

Unlike certain other MilSpecs that define the standards of how well a product must perform or specific manufacturing requirements like weight and dimensions, MIL-SPEC-810 defines the processes for testing. How well a product performs when subjected to that process, and whether it is considered satisfactory, is left to the manufacturer, and ultimately the market, to decide. The Department of Defense describes the purpose of MIL-STD-810 as "tailor testing to a material items environmental design and test limits to the conditions that the specific materiel will experience throughout its service life, and establishing laboratory test methods that replicate the effects of environments on materiel, rather than trying to reproduce the environments themselves." In other words, the point of MIL-STD-810 is to provide guidelines of how to simulate the stresses of extreme, prolonged environmental conditions over a shorter period of time and in a controlled setting so as to ascertain how the product would perform under real world conditions over the products' actual lifespan.

When it comes to certifying "ruggedness," the global marketplace views MIL-SPEC-810 testing as the gold standard. What could be more rigorous than meeting the requirements imposed by the U.S. military? Companies that test to MIL-SPEC-810 demonstrate to all stakeholders the high value they place on performance and reliability, as well as the seriousness with which they make any related marketing claims.

The new generation of civilian security UGVs and AGVs may be operating under very different conditions than their military cousins, but the range of environments they encounter may be just as broad and just as extreme. And the lives they are protecting, by securing our airports, utilities, private and public spaces, are equally valuable. MIL-SPEC-810 testing can help ensure these robots are fully up to the task, regardless of the environment.

1. Department of Defense Test Method Standard for Environmental Engineering Considerations and Laboratory Tests, Part One ii, <http://snebulos.mit.edu/projects/reference/MIL-STD/MIL-STD-810F.pdf>

## SOME OF THE CONDITIONS COVERED BY MIL-SPEC 810



**EXTREME TEMPERATURES**



**ALTITUDE**



**SOLAR RADIATION**



**RAIN**



**SAND AND DUST**



**CONTAMINATION**



**VIBRATION**

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