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JULY 2019

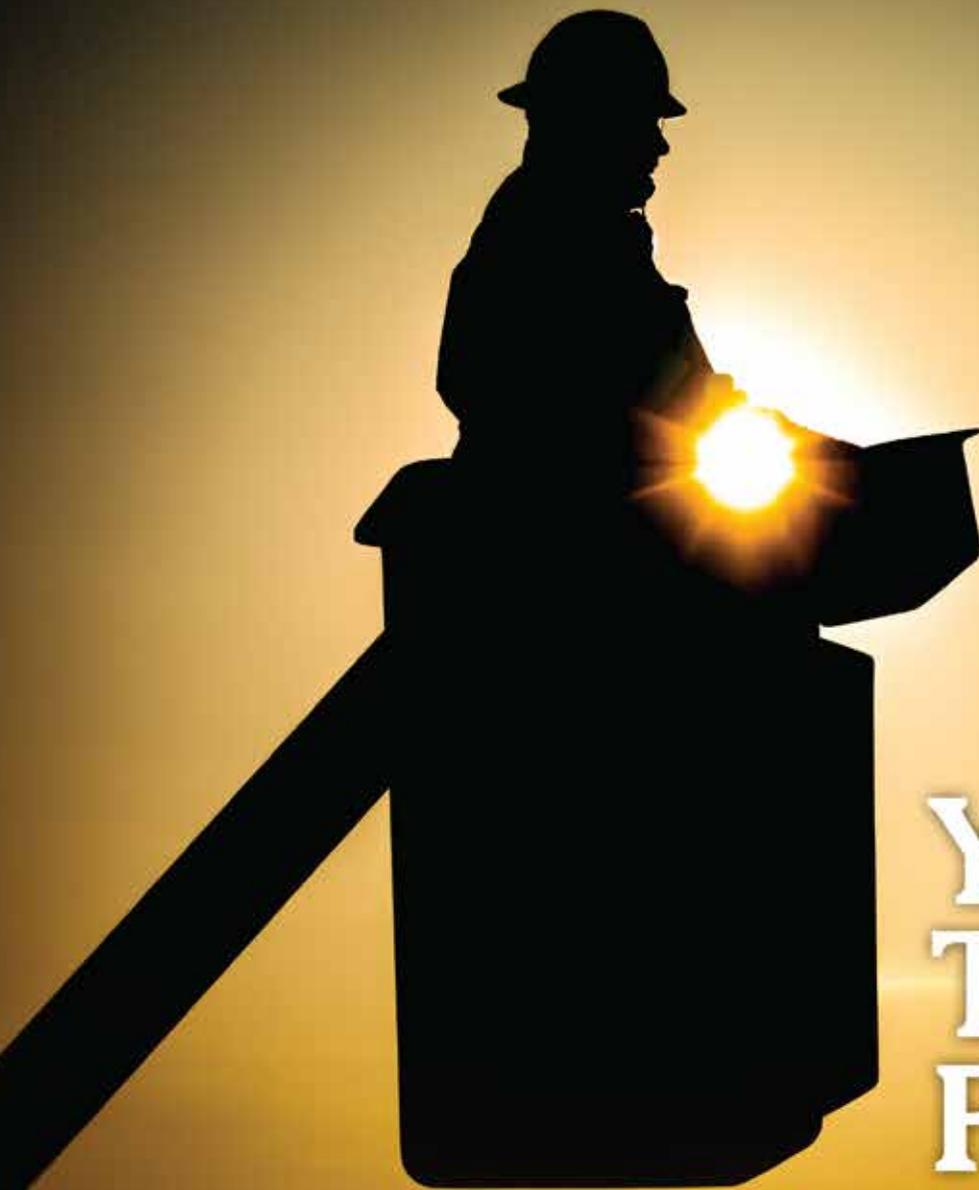
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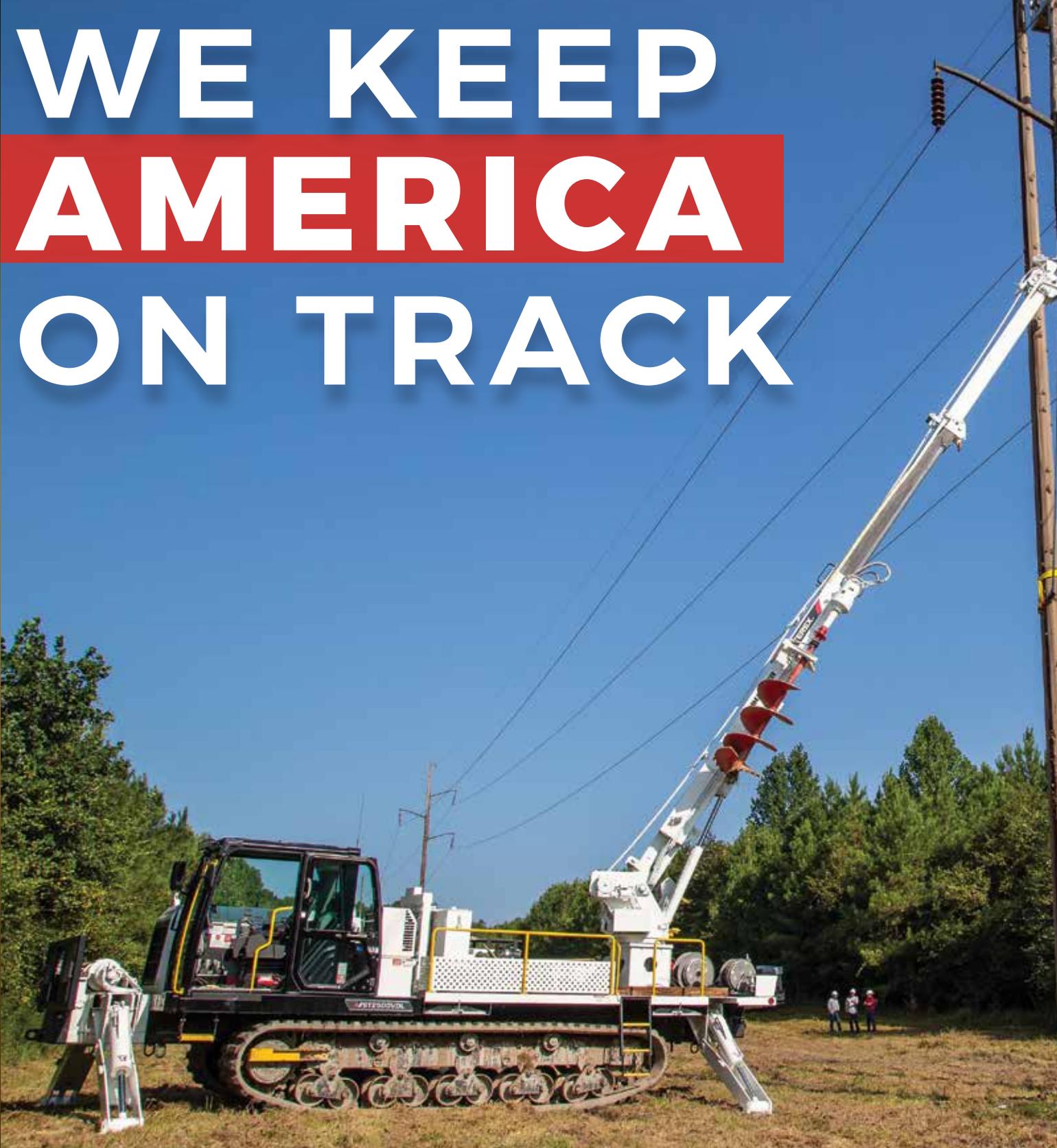
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TUS Contents • July 2019

PG 6 BURNDY® Announces the Release of the PATRIOT® PATCUT954HS Series Long Reach, Live Line, Cable Cutter

PG 8 A PAL in the Bucket for Lineworkers

PG 14 How to Report a Drone Incident at Your Company

PG 26 PVD Coatings Extend the Life of High-Value IGT and Steam Turbine Components

PG 32 Ad Index



Pg 8

THE UTILITYSOURCE

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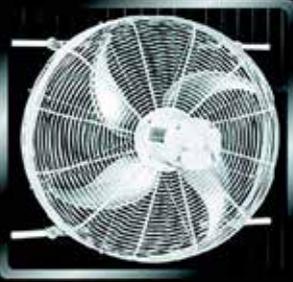


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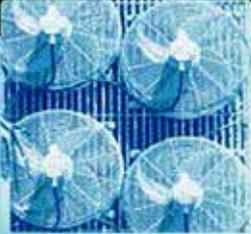
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By Joe Caywood,
Director of Marketing

A PAL IN THE BUCKET FOR LINEWORKERS

Cass County Electric Cooperative serves more than 50,000 members in 10 counties in southeastern North Dakota. The electric co-op maintains a fleet of more than 100 pieces of equipment, including about nine digger derricks and 13 aerial devices manufactured by Terex Utilities. Most of their aerial devices are under 50 ft. platform heights, frequently used for servicing nearly 3,000 miles of overhead lines.

“In August 2018, we were contacted by Terex Utilities to see if we would be interested in piloting the new positive attachment lanyard device,” said Steve Cossette, Fleet Supervisor. The warning system is designed to reduce the chance of an operator elevating the bucket without a safety harness lanyard attached.

“Terex Utilities has a history of pioneering innovations in the utility market. The Positive Attachment Lanyard (PAL) device is one such example,” said Ted Barron, Vertical Market Manager for Terex Utilities. By involving Cass County Electric Cooperative in giving us user-focused feedback early in the process, Terex Utilities was able to be nimble in the product development of the PAL device, he explained. “We engaged with Cass County Electric Cooperative through the various stages of the development, which allowed us to test how it supports safe work practices in the field,” he said.

Several of the co-op’s core values, including safety and innovation, align with the principle behind the new positive attachment lanyard (PAL) device, which was installed on one of Cass County’s LT40 telescopic aerial devices.

“We continually make investments in safety. It’s our top priority,” said Jodi Bullinger, VP of Engineering and Operations.

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"The attachment system offered us another tool in our tool box" to remind line workers to follow safety protocols, explained Bullinger. The electric co-op has a policy of 100% tie off in aerial devices, but sometimes a worker might be focused on the work at hand. On the off-chance that he or she forgets to clip into the harness, an alarm sounds as a reminder.

"I like that the device is easy to use. It's not bulky and doesn't require any extra equipment to deploy," said Mike Mahlke, a Cass County lineman who used the PAL device over a period of about six months. "When you are called to work in the middle of the night and focused on urgent work to be done, you might forget to clip in. This is a great reminder to properly use fall protection," he said.

Barron further explained that feedback from Terex Utilities customers contributed to the development of the PAL device. When talking to customers, their response was that most of the time when a worker fails to attach the lanyard, it's an honest mistake. "The worker was concentrating on the job and just forgot. We hope that linemen will consider the PAL device as a friendly reminder in the bucket. It's there to promote safe work practices. Ultimately, we want to eliminate non-attachment events," he said.

When considering the implementation of the device in their fleet, Bullinger said it was critical that the device be simple and not impede the work. "Because it is an integrated feature like a seatbelt in a car and it doesn't prevent the bucket from moving, it got buy-in from the crew," she said.

According to Terex Utilities' research, a small percentage of operators intentionally attempt to thwart the system. To address this, Terex Utilities is working on developing a Smart PAL, one that uses telematics data to time and date stamp every lanyard attachment and detachment, as well as activation and deactivation of the boom. "In the future this information could be used for corrective behavior, as well as for determining utilization in order to guide preventative maintenance and inspection," said Barron.

However, Bullinger reported that it was more important to the co-op to get full support from their field workers to use the device, so they chose to not collect any data through telematics. In addition to using it in the field, Cass County Electric Cooperative also participated in several rounds of testing of the device with Terex Utilities. "It



always worked as expected," said Cossette, who remarked that he wonders why lanyard system reminders aren't standard across the industry.

For now, PAL is an option available on Terex LT unit orders beginning in the second quarter of 2019. "Customer interest will determine how quickly we adopt the device to other Terex aerial device models, whether we will make it available as a retrofit to units in the field, and our adoption of it as a standard feature," said Barron.

About Terex

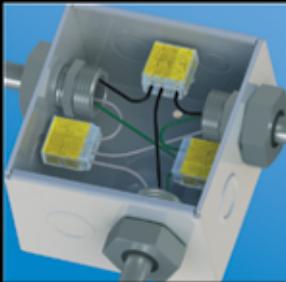
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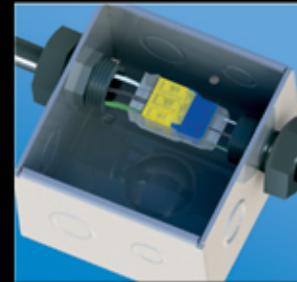
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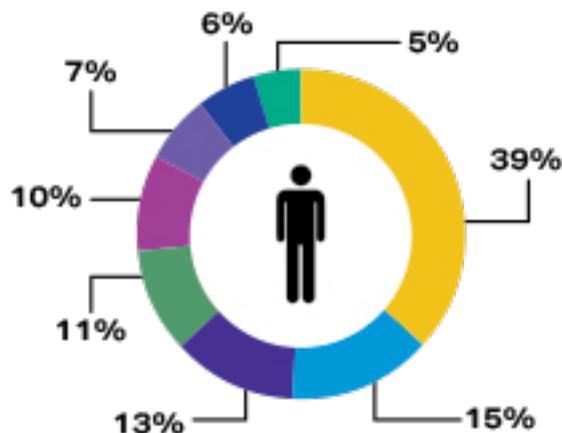
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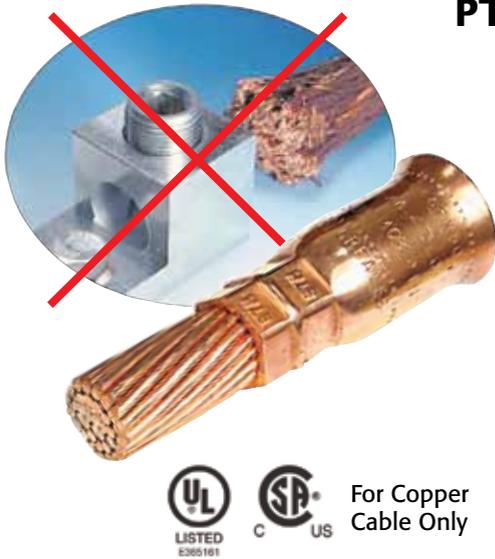
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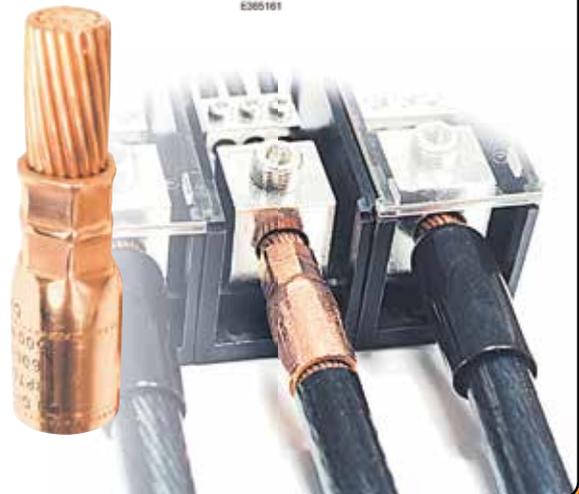
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By Diego Barrera
Director of professional services
for Skyward, A Verizon company

How to Report a Drone Incident at Your Company

Drones have become an essential tool for energy companies and utilities, used for everything from pipeline inspections to 3D mapping to volumetric calculations to stringing wire to repair downed power lines. Improved workforce safety and risk reduction are two key factors driving the rapid adoption of drones in the energy sector.

But it's likely that even the best-run corporate drone programs will one day have a ground or flight incident: an equipment failure, a close call, a collision, a pilot injury, or maybe even a trespass into restricted airspace.

Does your company have internal reporting procedures to follow when it does? Every large energy enterprise flying UAS needs a policy that spells out what happens when there's an incident, just as airlines have reporting protocols for any breach of normal flight operations.

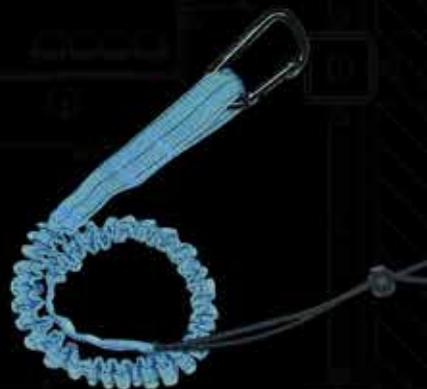
As the head of aviation at Skyward, I've defined four best practices to help companies report commercial drone incidents within their organizations. This article outlines optimal procedures to implement and follow:

- Create clear guidelines on instances that require reporting.
- Define the incidents that don't need to be reported.
- Specify who gets notified when there's an injury.
- Create actionable reports, so your UAS program can continually improve.

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Why it's important to document and report drone incidents

A spirit of transparency around incident reporting starts with UAS managers. These leaders set the drone culture—for better or for worse—and it's their job to make sure that people feel comfortable coming forward if something happens and the UAV team learns from any mistakes. Start by making sure the full team understands why reporting flight incidents is essential:

- The company can't protect itself—from embarrassment or liability—if management doesn't know what happened. It's smart to head off surprises, and it will help you retain executive support for the program.
- Unreported mistakes make it difficult to uncover any systemic flaws with equipment or operations. Pilots condemn their colleagues to repeating the same errors if managers can't identify patterns. Sometimes, the remedies are a question of simple fixes, like better battery management, better pilot training, or an extra step in a pre-flight planning checklist.

- Record what happened and allow for honest fact finding to enable continual improvement.
- Honesty is also important to protect the employees involved. If something happens and people in authority find out about it only after it's become a real issue, this jeopardizes the program's success.

Best practice 1: Develop guidance on what should be reported

There are both ground and flight incidents to consider in terms of internal reporting, including:

- Battery fires in the office
- Significant drone hardware failures (faulty propellers, early wear)
- Collisions with any structures
- Crashes
- Complaints due to flights that occur over people
- Wildlife disturbance (e.g., nests of endangered bird species)
- Injuries to your UAS team or bystanders caused by drone equipment

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A typical reporting policy may read something like this:

Any accident or incident which meets the following criteria must be reported to the UAS Manager within 72 hours:

- Any injury to a third-party
- Any injury requiring more than first aid to a participant in the operation
- Any noticeable damage to property other than the UAS
- Substantial damage to or loss of company-operated or company-owned UAS

Best practice 2: State what type of incidents don't need to be reported

No one likes a fuss over nothing. So tell your team which incidents don't need to be reported. Also include guidance on what should go through your existing occupational safety reporting system, for example, a car accident on the way to the flight area. But if a propeller breaks, the drone is still air-worthy, and you can repair it in the field, higher-ups probably don't need to be bothered.

The UAS manager or responsible person should be the one who determines whether or not higher level reporting is required either to the FAA or to company leadership. Threshold limits for mandatory reporting vary by company. Incidents involving less than \$1,000 of damage may not be worth it for some organizations to report internally. As you're deciding on your policy, make sure it encourages full reporting whenever there's a possibility that there may be an underlying operational issue at play. Just log the issue in your flight software (e.g., Skyward) so maintenance can be tracked as usual.

Best practice 3: Document who to notify when there's an injury

It goes without saying, but I'll say it anyway: If the drone incident involves an injury that requires more than first aid, call 911.

If your company has a safety or compliance office with an existing policy for reporting company



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accidents, that policy should be uploaded to your drone operations software for easy reference when there's an injury. If no such protocols exist, check your software for an accident response checklist as a starting point.

Your company policy should also specify who needs to be notified about drone-related injuries, for example:

- The site supervisor at the client job site, if there is one
- The chief pilot or UAS manager at your company
- The occupational safety or compliance department at your company
- The FAA, if the incident has caused a serious injury to any person or any loss of consciousness, or more than \$500 in property damage other than the UAS
- Others who make sense; for example, if the police or fire department is involved

Best practice 4: Use reporting to prevent future incidents

Reports that only describe what happened without pinpointing the causes and creating accountability for fixes aren't productive. Here's how an incident report can serve as a tool for heading off recurring problems:

- The incident report should attribute the accident to specific factors. Each factor should have a recommendation for how to improve and to whom it's assigned, along with a due date for taking action.
- Divide responsibilities for cre-

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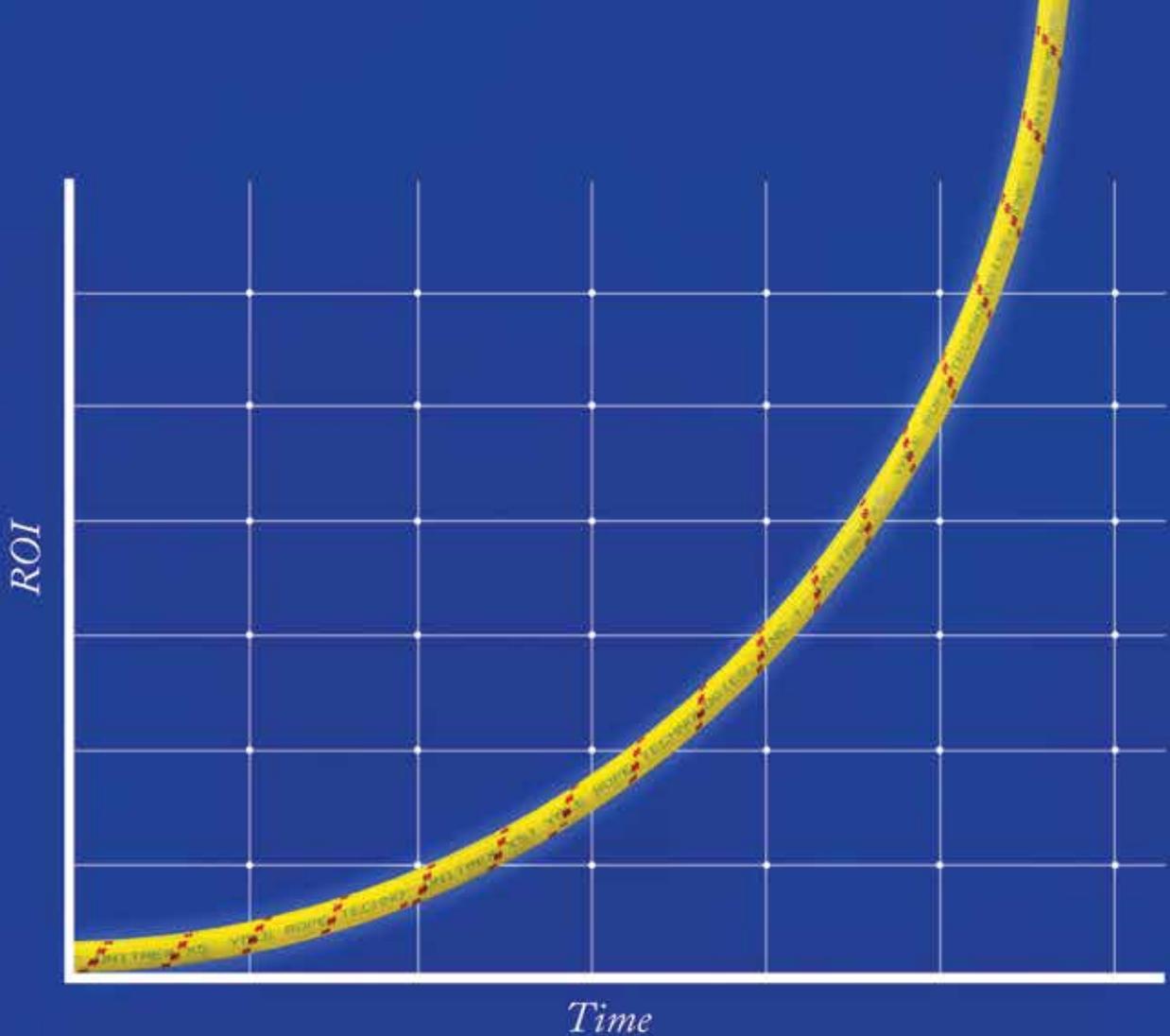
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ating and responding to the report. The person who does an incident investigation should not necessarily be the same person who is charged with holding people accountable and following through on report recommendations. Keeping these assignments separate will help assure you get an impartial investigation. The resulting report can then be handed off to someone in the chain of command who can serve as a strong, unbiased advocate for implementing any recommendations.

Sample Incident Investigation and Reporting Policy

Once you've established your incident reporting protocol, be sure to add it to your drone operations software platform so you have quick access when you need it.

If your UAS operation is small and you need to do it yourself, here's a sample policy as a template.

The UAS manager is responsible for ensuring that an internal accident safety report is completed within 21 calendar days of notification of any accident involving the company's aircraft when:

- The aircraft is destroyed, lost, or substantially damaged (ie, damage or failure which negatively affects the structural strength, performance, or flight characteristics of the aircraft. This type of damage would normally require major repair or replacement.)
- There is any injury to a third party
- There is any injury to a [Company Name] staff member which requires more than first aid or results in a loss of consciousness
- There is claimed damage to the property of a customer caused by the operation
- There is claimed damage to the property of a third-party caused by the operation

Accident/Incident Reporting

National reporting requirements

1. The manager responsible for UAS operations will ensure that national accident or incident reporting requirements are met. Details may be found in the national requirements section of this policy.

Internal Reporting

1. Regardless of national requirements, the UAS must be notified whenever there is any accident or incident involving a Company owned or operated UAS which:

- 1.1. Injuries to Company Employees: Causes an injury requiring treatment beyond first aid or loss of consciousness to a Company employee or contractor;
- 1.2. Injuries to Non-Company people: Causes an injury to someone who is not a Company employee or contractor;
- 1.3. Aircraft Damage: Substantially damages or destroys a UAS owned or operated by Company; or
- 1.4. Damage to Non-Company Owned Property: Causes noticeable damage to non-Company owned Property.

Safe commercial drone programs are built on aviation best practices. These practices are geared toward rigorous, standardized and repeated processes and a spirit of inquiry. Keep this in mind as you set up your organization's standards for notifying company management of drone incidents. Don't think of it as a punitive system, but as an integral part of your successful UAS program.

Diego Barrera is an FAA Part 107-certified drone pilot and director of professional services at Skyward, a Verizon company. He works with companies to set up safe, efficient drone programs and train drone pilots. Reach him by contacting Skyward's professional services team at contact@skyward.io.





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PVD Coatings Extend the Life of High-Value IGT and Steam Turbine Components

Newly developed PVD coatings provide superior erosion and corrosion protection for high-value turbine components, improving efficiency and reducing MRO costs

Industrial Gas Turbine (IGT) manufacturers and MROs are continually seeking new ways to improve the performance and longevity of critical components. To achieve this, high-value components must be designed and manufactured to withstand increasingly extreme temperatures, particle erosion and hot gas corrosion stress.

Given the critical role of IGTs to utilities and bulk users of power, improving efficiency and extending operating life of critical components is the key to managing costs while maximizing efficiency and uptime. Even seemingly minor factors such as the surface finish of compressor blades, for example, play a key role in increasing fuel efficiency.

As a result, OEMs and MROs are turning to advanced coatings that modify the surface of turbine components to improve wear and corrosion resistance, while also providing a lower coefficient of friction required for metal-on-metal contact of rotating parts such as shafts. One solution in this category that is garnering attention are physical vapor deposition (PVD) coatings for both IGT and steam turbine components.

"There is a high demand from OEMs and MROs for proven and cost-effective solutions that can extend the life of key turbine components that are operating in hotter and more demanding environments in order to reduce MRO costs," says Paul Brooks, Lead Segment Manager of Power Generation at Oerlikon Balzers, a global OEM coatings provider to the industrial power generation industry.

Protecting Turbine Compressor Sections from Erosion

Even today, the overriding goal of IGT OEMs continue to seek new ways to incrementally increase turbine efficiency. As a result, higher firing temperatures are often utilized, further increasing the temperatures inside turbines and leading to additional wear of component parts.

Erosion / corrosion & fouling of compressor blades, vanes and inlet guide vanes (IGVs) is a concern, given that the surface finish has a direct impact on optimum airflow and, therefore, engine efficiency. This can occur as a result of many factors, including tiny particulate or moisture droplets that make it past air inlet filtration systems into the compressor section. An IGT located near a refinery, for example, can draw in polymers and sulfur from the air. Sand and salt are also common location-based issues.

Over time, the particulate sticks to the blades, creating a rougher surface that degrades turbine performance. As the blades foul, the efficiency of the entire compressor system eventually drops. This can drive up operating costs until the parts are serviced. Even then, parts that are re-polished to a mirror finish become quickly fouled again.

"Ensuring that surfaces of compressor blades are maintained smooth during service will maximize air flow through the compressor and sustain compressor efficiency," says Brooks. "This is an area where PVD coatings excel because of their



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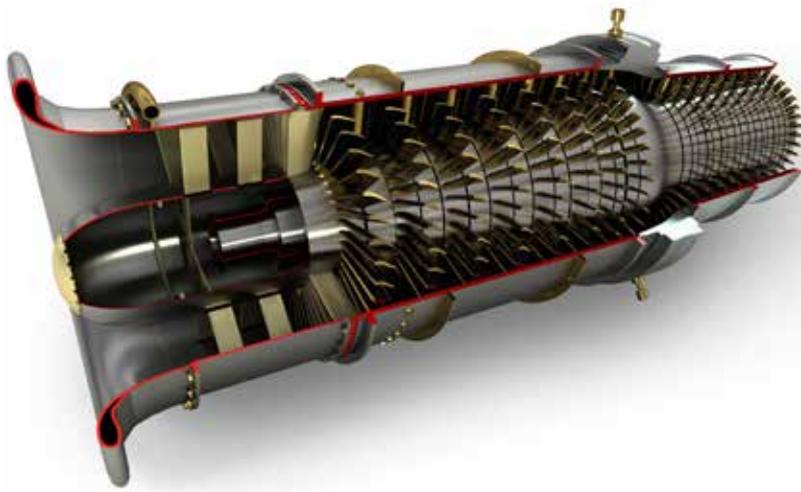
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unique combination of extreme surface hardness and a low friction coefficient. PVD coatings have only been used marginally in gas turbines to date, largely because of limited awareness in this sector.”

Although the base material used to manufacture compressor section blades and vanes varies, and continues to evolve, most OEMs today utilize stainless steel, or apply a galvanic coating over a base steel. Unfortunately, galvanic coatings are relatively soft and erode over time. Due to the high cost of these components, solutions such as PVD coatings that are much harder and last longer are now considered a more ideal solution.

PVD represents a variety of vacuum deposition methods that can be used to produce very thin coatings, typically 1-5 µm in thickness. The thin coatings, in conjunction with close tolerancing, means that the component retains its form, fit and dimensions after coating without the need for re-machining. Thicker coatings up to 25µm can also be applied, if needed, to increase erosion resistance.

PVD coatings also provide a viable alternative in replacing hard chrome plating. This comes at an opportune time, given the industry’s transition away from hard chromium plating to more environmentally friendly alternatives. For many years, hard chrome plating was the standard for achieving wear and corrosion protection, but due to European REACH regulations, the application of hard chrome plating is now highly regulated.

One REACH compliant PVD coating, BALINIT® Turbine Pro from Oerlikon Balzers, is specifically geared towards protecting engine compressor blades, vanes and integrated bladed rotors (blisks) from particle erosion by maintaining a highly polished surface finish to retain efficiency gains for the lifetime of the part.

The formulation delivers a metal aluminum nitride (MeAlN) structure that results in an optimal relation of high hardness to residual compressive stress even under high thermal conditions. The PVD coating can be applied to steels, super alloys and titanium components and has an extremely low surface roughness once applied.

The high hardness of BALINIT Turbine Pro has already

been proven in solid particle, liquid droplet, liquid cavitation, waterjet and other erosion tests with the coating on various substrates (steel, Inconel and titanium) in different coating thickness and high temperatures.

In the solid particle erosion test in which materials were evaluated based on mass loss, for example, BALINIT Turbine Pro demonstrated more than five times higher erosion protection than other PVD coatings, including titanium nitride (TiN). That value increased to more than 40X when compared to uncoated titanium and even more for steel.

The Hot Section of Turbines

PVD coatings also show promise for the hot turbine sections of IGTs. Thermal protection is a key MRO consideration for components in the hottest section of a gas turbine where temperatures can exceed 800 degrees centigrade. The intense heat, which can be increased based on the magnitude of the load, as well as the type of fuel used for combustion, can significantly reduce the life of combustion components.

Oerlikon Balzers is currently working with leading IGT OEMs on development of a PVD coatings that address both erosion and the corrosion that occurs in the hot sections of the turbine. Given the variety of metal substrates utilized for component parts and the variable demands in different sections of IGTs, the company regularly collaborates with OEMs to advance new coating formulations.

As a global coatings provider to the IGT industry, Oerlikon Balzers has facilities in 36 countries across 111 locations. “When there is a need to source or qualify a coating, it is an advantage to have a local supply chain & not have to send components to the other side of the world,” says Brooks.

Steam Turbine Components

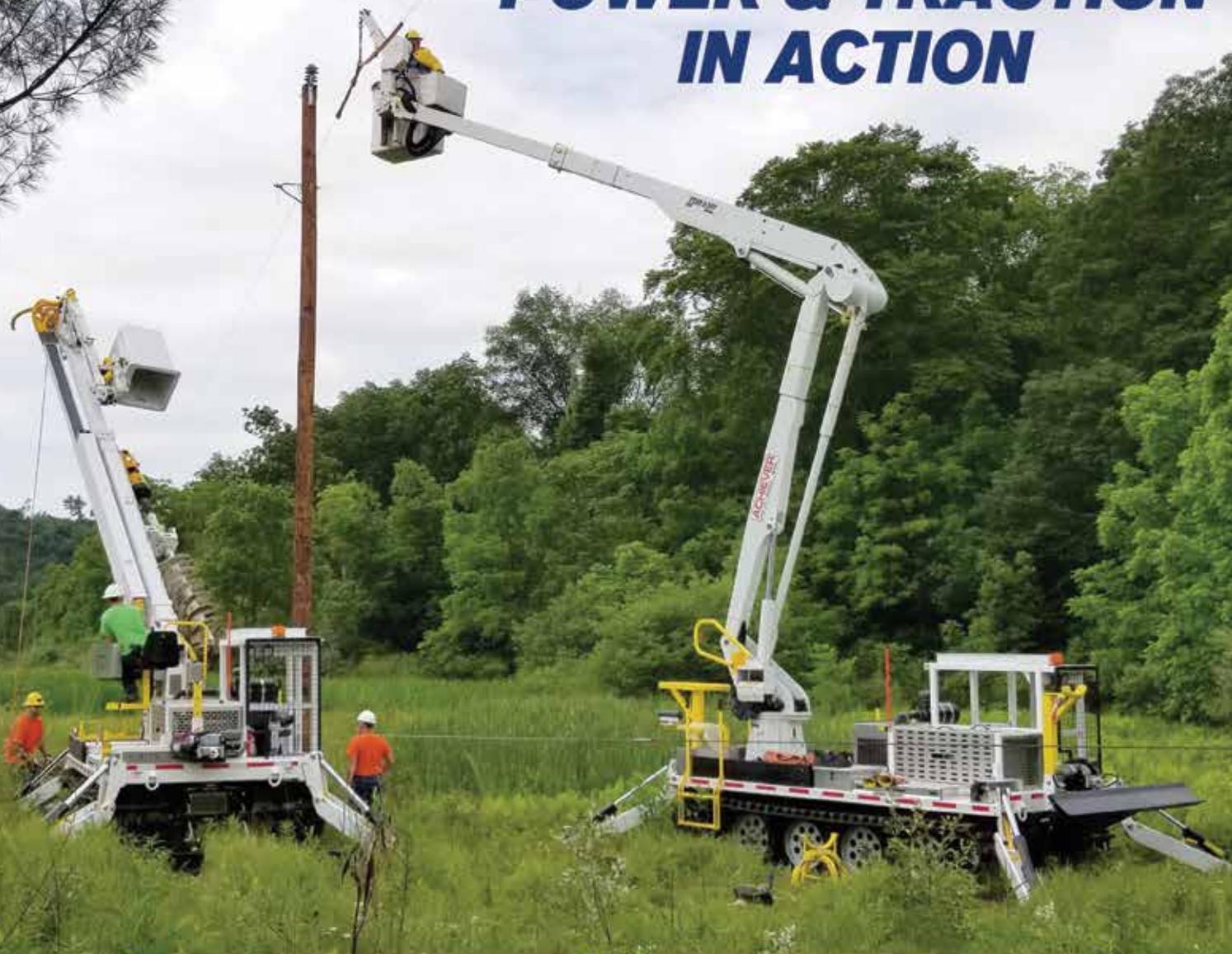
Components of steam turbines also face high temperatures, erosion and fretting with the additional concern of steam-based corrosion. Steam turbines can operate on a standalone basis or in conjunction with gas turbines, as in the case of combined cycle power plants.

The primary concern when coating steam turbine blades and vanes is shortened life due to solid particle or water droplet erosion. As hot steam comes through to the high-pressure stage of the steam turbine, blades & vanes are subject to solid particle erosion. As the steam cools and turns to liquid in the low-pressure stages, water droplet erosion becomes the subject issue.

A companion solution, BALINIT D, was developed specifically for applications with high temperature steam to improve erosion and oxidation resistance.

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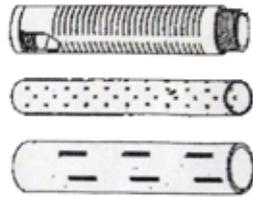
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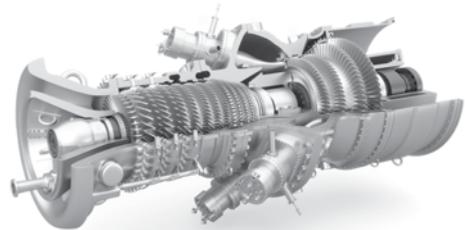
erties, the PVD coating allows OEMs to substitute expensive alloys with less expensive stainless-steel or chrome steel substrates.

Efficiency Goes a Long Way

Coatings play an important role in extending the life of critical gas and steam turbines while maintaining optimal operating efficiencies. Consider that just a single percent gain in efficiency for a 200-megawatt gas turbine could represent the equivalent power needed for 1500 homes.

"Given the ever-increasing performance requirements of IGTs and steam turbines, there are more demands on the components," says Brooks. "PVD coatings are an effective means to improve operational performance, reduce operational costs, extend operating hours and reduce maintenance intervals."

For more information about PVD coating solutions for gas and steam turbines from Oerlikon Balzers, call (408) 375-4408, email balzers.components@oerlikon.com; or visit www.oerlikon.com/balzers



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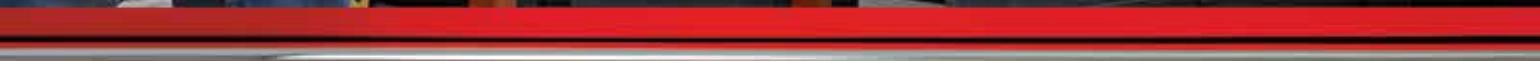
About 70% of drops happen during the exchange of the lanyard from one tool to another. The Snap-on Tools@Height system features independent tethering, which means each tool is attached to its own lanyard. Minimizing exchanges reduces the likelihood of drops and increases safety.

MINIMIZE RISK

Independent tethering also allows the tool to be removed from and returned to its holster or pouch using just one hand. Safety is improved by allowing the user to maintain the critical "three points of contact" when working at height.

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