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SAFETYWIRE

AINsight: Beware of Erroneous Takeoff Parameters

(Source: Stuart “Kipp” LAU; AIN, May 23, 2024)

Several studies have identified the use of erroneous takeoff parameters as a safety issue. All pilots are vulnerable because the problem is not specific to any one aircraft type, region, or operator. Using erroneous takeoff parameters can result in early rotation causing a tail strike, collision with obstacles in the departure path, loss of control after takeoff, or a runway overrun.

Several recent incidents and accidents have involved intersection takeoffs, where pilots either take off from the wrong intersection or make errors while calculating takeoff performance parameters.

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Wrong Intersection

On February 22, a Marathon Airlines Embraer ERJ-195LR operating for Air Serbia was substantially damaged following a runway overrun at Belgrade Nikola Tesla Airport (LYBE) in Serbia. There were no injuries.

According to the preliminary report, the flight crew planned an intersection takeoff from Runway 30L at Taxiway D6. Takeoff runway available (TORA) from this intersection is 7,706 feet. The crew based the takeoff performance calculations on this distance.

ATC provided taxi instructions to Runway 30L at Taxiway D6. Nearing the runway, the crew informed ATC that “Air Serbia 86C, approaching D6, ready.” The controller responded, “Hold short,” followed by a clearance to “line up and wait via D6.”

The crew lined up on Runway 30L at Taxiway D5 instead of D6 as instructed. According to the transcript, ATC then urgently inquired if the crew realized that they were at intersection D5 instead of D6. ATC also informed the pilots that the TORA from the D5 intersection was only 4,135 feet, suggesting that it was insufficient for a safe takeoff.

At this point, the crew requested a “minute to perform checks.” According to the crew’s statements, they performed the flight parameter calculations on the first officer’s tablet, while ATC offered the option to backtrack to D6 if needed. Thirty seconds later, the pilots confirmed that they were “ready for takeoff” and ATC issued a takeoff clearance for Runway 30L at the D5 intersection.

During the takeoff roll at 100 knots, the crew noticed that there was insufficient runway remaining to take off. Rather than rejecting the takeoff, they felt it was safer to continue and added maximum thrust. As the aircraft departed the paved runway surface, the tower controller noted that there was a lot of dust and the aircraft climbed out very slowly. The pilots reported that the aircraft began to shake as they left the runway and subsequently hit an object.

Investigators found that the aircraft became airborne about 1,650 feet past the runway end and that the aircraft struck several objects, including the approach lights and an ILS antenna. The aircraft initially climbed at a very slow rate and attained a height of 50 feet nearly 6,700 feet beyond the runway end.

Once airborne, the crew received multiple alerts related to issues with onboard aircraft systems, including the flaps and bleed air system. After working through several abnormal checklists, the crew declared “Mayday” and returned to Belgrade for a landing using a higher approach speed due to flap issues.

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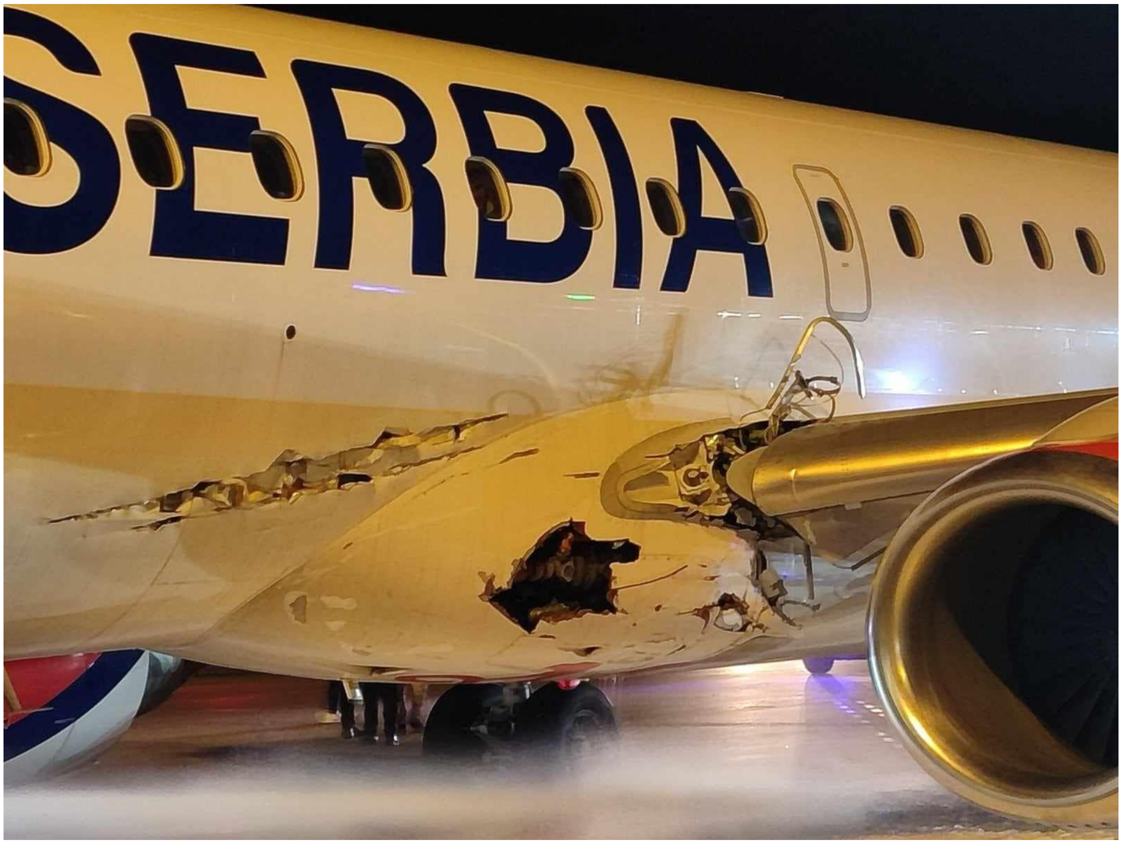

After landing, emergency crews informed the flight crew of a fuel leak from the left-hand wing. Later, investigators would find several objects embedded in the left wing, including parts of the airport boundary fence.

The preliminary report identified that "one of the likely causes of this accident is the inadequate assessment of parameters for takeoff during preflight preparation by the flight crew of the aircraft, following the decision to take off from a shorter length of the runway in relation to the initially planned one."

Wrong Data

On Sept. 12, 2021, a KLM Cityhopper Embraer 195E2 was involved in a serious incident and became airborne 1,450 feet before the end of Runway 25R in Berlin, Germany. The incident occurred due to the flight crew performing an intersection takeoff and both pilots inadvertently selecting the wrong intersection on the takeoff performance computer during preflight planning. Investigators determined that the takeoff and initial climb were unaffected, but a high-speed rejected takeoff or an engine failure immediately after takeoff would have caused an accident.

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Investigators found that Cityhopper pilots use an iPad as an EFB. Pilots of the Embraer fleet use the manufacturer's "ePerf" application for takeoff and landing calculations. The flight crew of the incident flight had planned a takeoff from Runway 25R at the L5 intersection.

However, each pilot independently calculated takeoff performance data from Runway 25R at K5, not L5. The K5 intersection is almost the full length of Runway 25R; L5 is 4,330 feet further down the runway.

This error was significant. Takeoff data for Runway 25R/K5 uses Flaps 1 and an assumed temperature (derated or "flex" takeoff) of 57 deg C. Takeoff data for Runway 25R/L5 requires Flaps 3 and an assumed temperature of 35 deg C.

A greater flap selection and higher thrust setting would shorten the takeoff roll. Although not mentioned in the report, the V-speeds would have been significantly different as well.

Investigators identified several shortcomings with the ePerf application. It was observed that pilots' data entry into the application was done very quickly since it is considered a "routine operation." Likewise, it was noted that access points for each available runway were listed via a drop-down menu in alphabetical order. As an example, Berlin's Runway 25R would present the K5 intersection before L5 (with no pictorial display for visual feedback). Investigators felt it was "relatively easy" for both pilots to make the same mistake.

Another issue identified relates to touchscreens, commonly recognized to be vulnerable to selection errors due to two factors—a lack of any system feedback and the "fat-finger" problem. A fat-finger problem relates to a large, relatively crude device pointing at small targets.

Of interest, during the flight crew interviews, the pilots pointed to some automation and performance differences between the Embraer fleet. The E2, as noted, is more automated than earlier variants and is heavier. Investigators felt that frequently switching between type variants may have been a contributing factor considering the incident pilots flew three different E-Jet variants—the E175, E190, and 195E2—during a four-day pairing.

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A Global Problem

In 2007, the French BEA and Civil Aviation Authority commissioned a study entitled, "Use of Erroneous Parameters at Takeoff." The study followed two serious tail-strike incidents at Paris Charles de Gaulle Airport and examined several other accidents and incidents around the world.

These events, as explained, "generally involved new-generation aircraft and had causal factors that included undetected crew errors, of varying degrees of significance, when they entered takeoff parameters."

The study does list many common errors such as weight and balance entry errors, incorrect V-speeds, incorrect flaps/slat and thrust settings, and a departure from a runway intersection, wrong intersection, or even a wrong runway.

These errors related to takeoff data were identified as "frequent" but are generally detected by the application of SOPs or by personal methods such as mental calculations. The study found that nearly half of the pilots surveyed had experienced errors in parameters or configuration at takeoff; those pilots had a global dispersion from many operators flying different types of aircraft.

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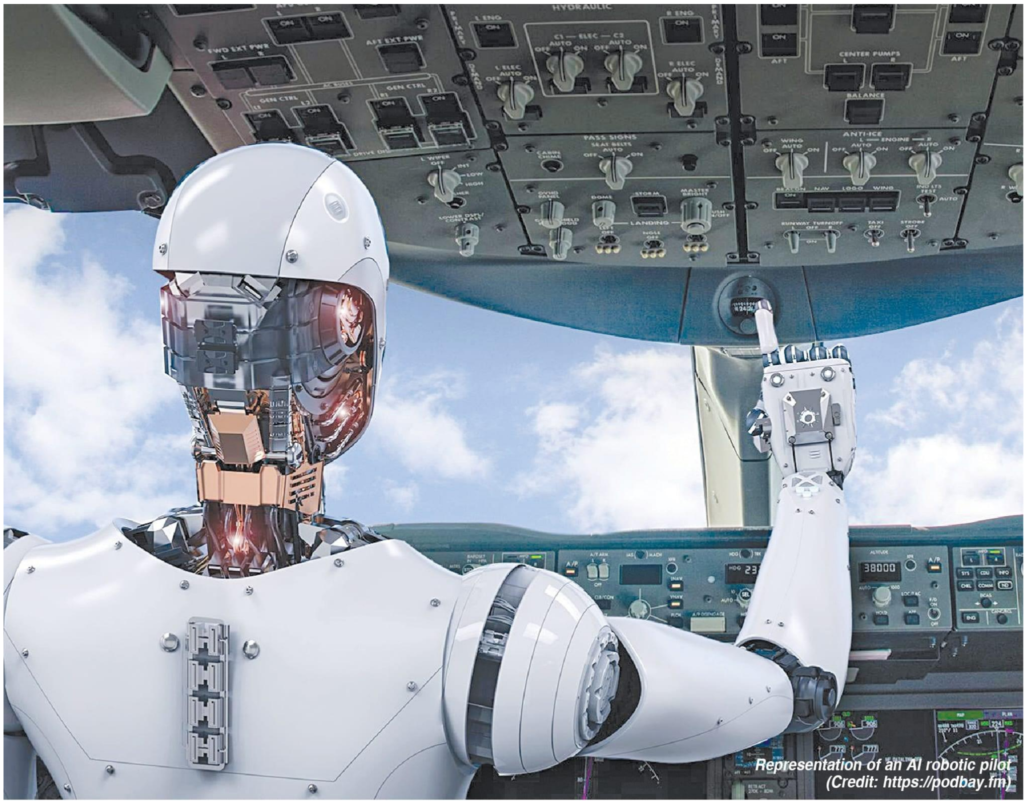
If You Believe the Hype, We Should All Be Looking for Work

(Source: Chris Lutat; Aviation International News, May 1, 2024)

Several times a year, I am asked to join with other speakers to address aviation professionals, normally in the setting of an annual safety standdown or safety day. Inevitably, during these engagements, I am asked to comment on how the rapid pace of developing technology, specifically in aircraft automation and autonomy, will impact the future of cockpit crews and flight departments. It's an interesting question and deserves a thoughtful answer since it gets to the very core of the flying profession: what's required of pilots when it comes to contemporary airmanship?

For well over a decade, the arrival of uncrewed air vehicles, remotely piloted vehicles, drones, or whatever you want to call them has piqued the imagination of everyone involved in the aviation profession. Add to that the hype of AI as a threat to virtually every human-occupied position in aviation and you have an environment of unease and insecurity that is hard to escape, especially if you read our industry's trade publications and listen to the news.

The idea of coming to work one day to find that your copilot has been replaced by a robotic system is not an uncommonly held fear these days. To those outside of aviation and some of us on the inside, it seems as if none of us will be working in cockpits or support roles by the end of the decade.



Representation of an AI robotic pilot (Credit: https://podbay.fm)

Unfortunately, all of this talk about the impending removal of humans has had the effect of distracting many of us from real safety focus areas that need our attention right now. These vulnerabilities in both the operator and the technology are as prevalent today as they were before the widespread adoption of advanced flight guidance systems, including flight management systems, precision satellite-based navigation, and dozens of other digital technologies that have proliferated on the flight deck over the past 30 years.

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Sometimes I ask skeptics of the role of the human operator how often aircraft systems fail while airborne with passengers and cargo, how frequently aircraft divert because a crewmember becomes incapacitated, or how many times in a day a well-trained and experienced flight crew acts with great skill and precision to safely land an aircraft that has experienced a unique or rare inflight emergency.

The answer to how frequently these situations occur is, simply, all the time.

Should we be engaged in the discussions that describe a more automated future? Absolutely: ignoring the debate is foolish. The resulting systems will be better if flight crews are involved on the front end.

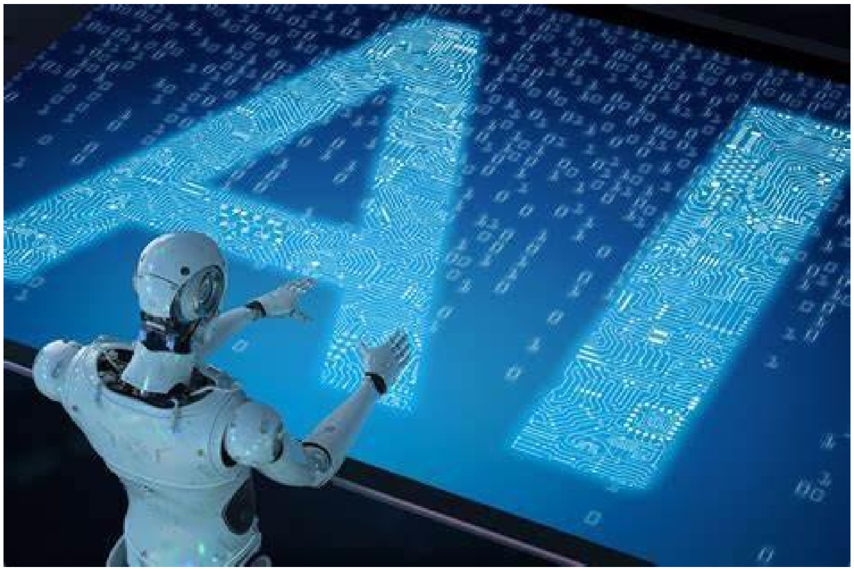
In my view, however, not just as a longtime industry observer but as a crew member of large, long-range aircraft, most of our focus should be on what will likely be many more decades of "humans in the loop"—and two humans at that—and how they are uniquely suited to use these highly complex systems to deliver increasingly higher levels of efficiency and widening safety margins.

I read several well-respected trade publications every month and browse the most reputable safety websites almost daily. Recently, I was persuaded even more in my opinion of the primacy of the human operator in the cockpit, the cabin, under the wing, and on the shop or hangar floor when I read Missy Cummings' article in IEEE Spectrum, titled "What Self-Driving Cars Tell Us About AI Risk."

Cummings is a roboticist who once flew fighter aircraft aboard U.S. Navy aircraft carriers. Her "5 Practical Insights" regarding AI and autonomous systems have applications well outside of surface transportation. Understanding these concepts provides great insight into the importance of our individual "human-in-the-loop" role.

Practical insights regarding AI and autonomous systems:

1. Human errors in operation get replaced by human errors in coding.
2. AI failure modes are hard to predict.
3. Probabilistic estimates do not approximate judgment under uncertainty.
4. Maintaining AI is just as important as creating AI.
5. AI has system-level implications that can't be ignored.



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If you re-read this list and replace “AI” with “flight deck automation,” you can see the close relationship and the influence of these concepts in aviation. For emphasis, consider this quote from Cummings in the journal article:

“Neither the AI in LLMs [large language models] nor the one in autonomous cars can ‘understand’ the situation, the context, or any unobserved factors that a person would consider in a similar situation. The difference is that while a language model may give you nonsense, a self-driving car can kill you.”

For years, as a proponent of wise and thoughtful integration of the human operator with complex technology, I have accumulated a few insights that are eerily similar to those of Cummings. They map over to the above list and come from decades of experience reading, writing, and experiencing firsthand the safety demands of modern aviation. Here are just five of them:

1. Complex systems fail in complex ways (from "Normal Accidents" by George Perrott).
2. The real world happens. Just ask the crews of the most notorious aviation accidents of the past 20 years—those with both “heroic” and “tragic” outcomes.
3. It’s impossible to “automate” all aircraft systems to handle every nuance of contemporary flight operations.
4. The more complex systems there are on the aircraft, the more maintenance and oversight are necessary to ensure smooth and reliable operations on the line.
5. We tend to overestimate technology in the short term and underestimate it in the long run (paraphrased from Kevin Kelly, former editor of *Wired* magazine).

So where does that leave us, and what practical knowledge can you take from this short discussion? I think it all matters and deserves contemplation—but if it can be boiled down to just one thing, I suggest that, wherever your occupation fits in the broad spectrum of aviation, there are interactions with technology and automation that are worthy of your study and mastery today. Less concern about an imagined, distant future and more focus on becoming the very best professional you can be will yield not only broader safety margins for your flight department but much better personal performance and satisfaction on the job. In my next blog in this series, I’ll address some of the pressing needs surrounding airmanship in contemporary flight operations. Until then, fly safely, and always, fly the airplane first.

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SAFETY MANAGER'S CORNER

Corrective Action Plan

Information is the lifeblood of a safety management system. Although information can arrive from several different sources, one of the most important is undoubtedly employee submitted reports. When a new safety hazard report arrives into your SMS, it's an extremely valuable input from that very place where hazards live and breathe. No one person is everywhere, but collectively the employee group covers all of the operation's ground and has the opportunity to provide incredible insight into the safety posture.

Given its informational value, every safety report requires a corresponding corrective action plan. Often this plan is straight-forward in development and execution, but there are also circumstances that demand detailed plans and thorough follow-up. It's critical not to sell this part short; identifying the hazard is only the first step. Determining what to do about it makes the difference. A corrective action can appear extremely easy or ridiculously obvious, but do not fall into that trap. Yes, hazards revealed in some reports are easily addressed, but that's not the norm.

Let's look at an example. Suppose during departure the pilot monitoring changed and set an incorrect altitude of 1000' above the cleared altitude and did not seek concurrence from the pilot flying. The error was detected by the pilot flying and level off was accomplished before an altitude deviation occurred. A very straightforward hazard, on the surface at least. A brief at the next pilot meeting for informational purposes might seem an appropriate way to close out this report. TRAP! Yes, that is perhaps an effective method of passing information, here and now. Does it do anything to pass the hazard and lessons learned info down the line? Do any underlying training issues exist? Did any checklist management problems contribute to the error? How many similar errors have occurred in the previous two years? Those are just a few questions worth exploring, for example.

A thorough corrective action plan would examine all related factors and either confirm or eliminate systemic connections. It would also ensure the information is available to flight crews beyond the next pilot meeting. Always remember, the real benefit of safety management lies in the results produced by corrective action plans. Make sure the ones effected in your operation produce results.

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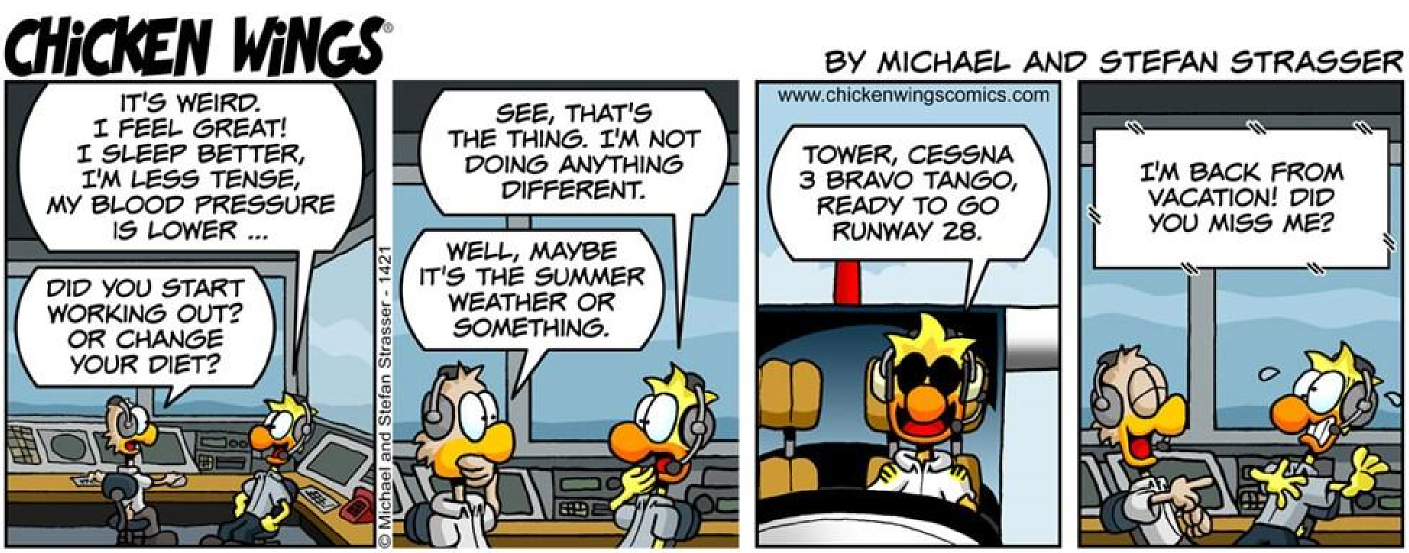
Quote of the Month

"The only place success comes before work is in the dictionary."

-Vince Lombardi

Actions speak louder than words. The proof is in the pudding. No shortage of clichés exist describing the powerful effect of positive personal actions. Knowing what to do and then doing it right should never be taken for granted; preparation and dedication are necessary ingredients in the recipe of success. These commitments must come from not only individuals alone but from the collective organization as well. You see, it's the organization that provides the context, the operating environment that so heavily influences individual behavior. We all know how difficult it is to swim against the tide of culture, for good or bad. That's why the organization's systems and culture are so important; they pull individuals along, hopefully in the right direction. Let your actions be a well done model, and contribute positively in those areas where the organization's systems require improvement or proactive participation. Following the advice of the first great American thinker is an excellent "well done."



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UPCOMING COURSES

July 11, 2024—PROS Course
Risk-Based IOSA Training
Virtual

August 26 to August 30, 2024—PROS Course
ALAT Training
Denver, CO

September 12, 2024—PROS Course
Risk-Based IOSA Training
Virtual

September 24 to September 26, 2024—PRISM Course
Safety Management System (SMS)
Denver, CO

November 7, 2024—PROS Course
Risk-Based IOSA Training
Virtual

November 11 to November 15, 2024—PROS Course
ALAT Training
Denver, CO

Go to [Upcoming Training Classes] to register.

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