HOLD SHORT FOR RUNWAY SAFETY

Runway RISKS

Reducing Incursions, Excursions, and Confusion

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Factors Contributing to Runway Excursions

The causal factors contributing to runway excursions and the dangers associated with them can be grouped into four basic categories:

- *destabilized approaches*
- *runway surface braking coefficient/contamination*
- *aircraft performance*
- *post-excursion survivability*

By examining these items in upcoming issues and presenting associated case studies from around the world, we hope to raise the collective runway safety awareness of all of ALPA's membership.

Landing Distance

By Captain Bob Perkins (ACJ)

When you arrive at an airport and are preparing for landing, you must ensure that the available landing distance is sufficient to safely stop the aircraft under the prevailing meteorological conditions and aircraft performance limitations. Unfortunately, the methodology for making that assessment is hardly simple. This article examines the different types of data available to pilots to make this determination, what they mean, and how they should be applied. We will also assess just how much accuracy using the correct data provides.

When a new aircraft type (or a derivative type) is first certified, the manufacturer must provide certain specific data on its performance characteristics as required by Federal Aviation Administration (FAA) and Transport Canada (TC) regulations. These agencies prescribe a myriad of rules specifying how flight tests are to be conducted in order to determine aircraft capabilities. These tests determine such things as takeoff and landing distance, crosswind limitations, and required runway width, just to name a few. To begin, let's take a look at the calculation of aircraft landing-distance data.

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Reducing the Risks of Runway Excursions

By Captain Bill DeGroh (EGL)

The subject of runway incursions continues to be a hot topic, and extensive efforts are being made to prevent them. However, it is interesting to note that a study of commercial transport aircraft accidents ("Reducing the Risk of Runway Excursions," Flight Safety Foundation, May 2009) demonstrates that of the 431 runway-related accidents reported between 1995 and 2008, 97% were runway excursions. Statistically, the number of runway excursion accidents is 40 times the number of runway incursion accidents.

This is not to suggest that the runway incursion problem has been solved, but it is clear that much more needs to be done to reduce the runway excursion accident rate. This was the task accepted by the Flight Safety Foundation Runway Safety Initiative (FSF RSI), established in late 2006. This effort resulted in the FSF publication "Reducing the Risk of Runway Excursions" (R3E) in May 2009.

The R3E document includes a background discussion, accident data factors, common risk factors, multiple risk factors, recommended mitigations,

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Landing Distance
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Landing-distance performance data is derived by the manufacturer using a flight test aircraft and a test pilot. Testing parameters specify the descent rate to be flown to touchdown, the point at which power is reduced to idle, the time from main wheel contact to nose-wheel down, and the maximum manual braking that is to be applied and sustained until the aircraft is stopped. The use of reverse thrust is not allowed during this certification testing. Following these defined protocols, the distance traveled from an altitude of 50 feet above the runway to the position of the stopped aircraft is measured and certified as the aircraft's required landing distance.

Unfortunately, this type of landing has very little relationship to the realities of actual line operations. Any pilot who has performed an acceptance flight on a new aircraft and applied maximum manual braking upon touchdown knows that the flying public would select ground transport in a heartbeat if pilots were required to fly this way all the time. Of course, during normal air carrier operations, we apply a factor intended to ensure that the landing distance we have calculated cannot be more than the available "landing field length." Let's examine how this calculation process translates into the real world, landing on a less-than-perfect runway surface that is contaminated with precipitation, such as compacted snow.

Generally, the coefficient of runway friction/slipperiness is measured by a term called Mu. Theoretically, a runway with 100% friction characteristics would be reported as a Mu of 1, and a runway with 0% friction characteristics would be reported as a Mu of 0. Everything else falls somewhere in between. Most new runways enter service with a friction coefficient around 0.6 Mu, but deteriorate over time due to rubber buildup, paint applications, chemicals, erosion, etc. With the presence of compacted snow, braking ability would be considered fair at best, and depending on the ambient temperature and depth of the contaminant, it easily could be poor. Any coefficient of friction measurement that is more than 0.4 is considered good. The Canadian Runway Friction Index (CRFI) is similar to the kind of friction-measuring guidance used in the United States and can be considered the same for the purposes of this article. Of course, the CRFI can be used only at Canadian airports, and then only with the appropriate CRFI tables.

Experience has shown all pilots that one thing that degrades a runway's friction characteristic is the presence of moisture.

Experience has shown all pilots that one thing that degrades a runway's friction characteristic is the presence of moisture. Whether it is rain, snow, slush, or ice, they all decrease the friction value of the runway surface, resulting in diminished braking action and a longer required landing distance. But how much longer? That's where the problem lies. The certification testing we spoke of earlier relies on predictable data. Test pilots take the airplane up, fly it to a landing, stop, and measure the distance traveled, resulting in a hard number that is based on known factors. In line operations, stopping-distance calculations are based on assumptions regarding the braking force achievable between aircraft and runway.

In order to calculate stopping distance in real-world conditions, it is necessary for a pilot to know what type of contaminant is present, how deep it is, the ambient temperature, the aircraft's ground speed, and its type of brake system. Of course, since a single pass of a tire over a contaminated runway will change its surface characteristics by displacing or compacting some of the contaminant, it is next to impossible to achieve a consistent, repeatable measurement of the friction value. So, based on our experience and using all available data, we give our best guess

Do you have a best-practices recommendation for safe airport operations?

Through personal experience, many pilots have learned or developed their own best practices for safe operations. If you have a suggestion regarding safe operating procedures in the airport environment, please share it with us by clicking on the button below. All suggestions will be reviewed and considered for publication in subsequent newsletters.

Thank you for your contribution. SUBMIT as to needed stopping distance, and we are usually pretty accurate.

But, with all of the variables involved, it doesn't take much for a small error in calculation or execution to magnify into a larger one. If you consider the possibility that you didn't touch down exactly where you should have, are dealing with an additional knot or two of tailwind component, or weren't quite as fast on the brakes as the test pilot was, you can see how the little errors can add up.

The controlled certification test flight planned a touchdown at the 1,000-foot mark. In line operations, pilots normally aim a bit beyond that. Descending via normal glide slopes routinely results in touchdown around the 1,200–1,400-foot mark, as does reliance on PAPI lights. Some aiming-point markings are painted well beyond the electronic touchdown point. If you are flying a large aircraft such as a B-747, the glide slope touchdown point is actually a bit farther down the runway, perhaps out to 1,600 feet, and if you are using autoland or HUD guidance, the touchdown point may be up to 2,000 feet down the runway.

So, it can easily happen that before you touch down, you are already up to twice as far down the runway as a test aircraft. Are our brakes and anti-skid systems as good as those on the new test aircraft? Are our touchdown and braking as firm and rapid as the test pilot's? Do we even try, initially, to use maximum braking? Normally, the answer to these questions is no. But we can use thrust reverse as an added benefit for increased stopping effort, right? Well, yes, but certified stopping-distance numbers are predicated solely on manual braking, not on using thrust reverse. If you are late getting the reverse on, or it doesn't activate properly, you may well have a problem.

Under normal landing conditions, whether on dry or wet runways, the 60% calculation factor generally provides pilots a margin for error that is sufficient to account for all of these little "add-ons," so we often don't have a problem, nor do we expect anything to be amiss. But, when we are faced with lower friction values, the landing distance can easily exceed the landing field length, and then a problem can arise.

As indicated in reports that reconstructed the causal factors leading to the Chicago Midway Airport overrun in December 2005, the braking calculation provided a margin of a mere 40 feet under poor braking conditions, and it assumed the use of thrust reverse, which was not in accordance with the certification data for the aircraft type involved. All of these factors can be considered as little "add-ons."

When faced with a slippery runway surface of any kind, you should fully understand the data you are using to compute required landing distance. As for the Canadian CRFI, the certified landing-distance data is based on test conditions using maximum braking and 1,000-foot touchdown criteria. The distances calculated assume that you will be on profile, on speed, touch down in the same manner as the test aircraft, and continue to use maximum stopping effort in order to meet the published numbers. Unfortunately, the majority of U.S. air operators do not possess this set of performance data.

Efforts are currently under way to ensure that manufacturers provide flight crews with appropriate performance numbers, in an easily applied format, that account for all reasonable runway surface conditions that pilots are likely to encounter. It is hoped that this information will be made available soon. In the meantime, let's all be careful out there.

Bob Perkins is the IFALPA Airport and Ground Environment Committee chairman.

Reducing the Risks

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conclusions, and recommendations. It also offers an appendix containing a Runway Risk Awareness Tool, Briefing Notes, selected FSF publications, and additional resources. R3E is available from the Flight Safety Foundation and is recommended reading for all pilots.

In a parallel effort directed at eliminating the problem of runway excursions, the Federal Aviation Administration (FAA) established an Aviation Rulemaking Committee (ARC), whose charter expired in October 2009. The objectives and scope of the committee's deliberations were to discuss the landing performance assessment methods provided in Safety Alert for Operators (SAFO) 06012 regarding takeoff performance on contaminated runways and issues relevant to Part 139, Certification of Airports. The ARC produced comprehensive, recommended rule changes for 14 CFR Parts 25, 26, 91.K, 121, 125, and 135. In May 2009, the landing recommendations were submitted to the FAA, and the takeoff recommendations were made. An associated Notice of Proposed Rulemaking (NPRM) is not expected before 2013, although recommended changes to the Aeronautical Information Manual (AIM) and the Airport Winter Operations Advisory Circular and improvements to the NOTAM system are anticipated to be in place much sooner.

In addition to FSF and FAA efforts in this regard, ICAO has established a Friction Task Force (FTF) to address issues regarding takeoff and landing operations on contaminated runways. As you can see, there is a great deal of activity occurring industry-wide in a concerted effort to effectively address runway excursions.

Bill DeGroh is the chairman of ALPA's Aircraft Design and Operations (ADO) Technical Group.

Taxiway Excursions

By First Officer Steve Jangelis (DAL)

Then it happened . . . a thumping sound accompanied by a slight shudder of the airplane to the right.

The flight was on final approach into Jackson, Mississippi. Winds were gusting, strong storms peppered the sky with turbulence, and torrential rain impeded their progress, but the flight crew skillfully handled the challenging meteorological conditions. The first officer, the pilot flying, smoothly brought the jet to touchdown on the runway. As the flight crew rolled out, a transfer of steering occurred from the first officer to the captain, and they let out a collective sigh of relief. On their fourth leg of a 15-hour duty day, a diversion to another airport would have tested the endurance of even Charles Lindbergh.

The businessman traveling in first class had spent the last hour riding through some of the worst summer weather the South could offer. After two hours staring out the window and enduring what the pilots called a "ground stop," he had begun to wonder if they would ever land in Jackson; but, he had arrived. He recalled that in a phone call just before departure, a colleague had said, "If it's sunny and no rain here in Jackson, your pilot must be lying!" Relieved to be on terra firma, the businessman retrieved his smart phone from the bag at his feet and prepared to review his e-mails.

The captain, a veteran with many years of flying experience, concluded that his jet could make the turn onto the reverse, high-speed turnoff. He grasped the tiller with a steady hand and started the turn. Then it happened . . . a thumping sound accompanied by a slight shudder of the airplane to the right. Not too concerned with the noise, the businessman in first class continued with his e-mails when a voice came over the airplane's PA system: "Ladies and gentlemen, this is the captain. . . . It appears we have a wheel stuck in some mud. I need all passengers to remain seated while we bring some buses and stairs to the airplane to get you to the terminal."

What that flight crew experienced was a taxiway excursion. Although we have seen an increase in such events, they do not receive the same sensational media coverage as other aviation incidents. They are significant events, however, and should not be overlooked.

In spite of the presence of experienced flight crews, why do taxiway excursions occur? Very often, a missed NOTAM or an overlooked note on an airport diagram might be the cause. Through crew debriefs and related research, we have compiled some recommended best practices that might save you from involvement in a potentially embarrassing event.

1) Always review NOTAMs. Although many airports have lengthy lists of NOTAMs, this is the best source of data regarding taxiway conditions and surface warnings. Company NOTAMs and flight plan remarks are also important to review prior to arrival. They can contain type-specific warnings to flight crews resulting from past incidents reported via ASAP or NASA ASRS.

2) Always have the airport diagram out and available. This practice will help maintain your situational awareness on the field. Even in the best of conditions, it is easy to lose track of your position on the taxiway complex. Should a nonstandard taxi clearance be issued, you will have the chart readily available in order to react with the minimum amount of confusion.

3) Review all notes and boxed items on the airport diagram. Many airport diagrams have notes and warnings about taxiways and intersections that are prohibited for use by larger aircraft. These advisories usually contain extremely important data intended to assist pilots in avoiding runway excursions.

4) Safe taxi speed. Keeping the aircraft slow and under control prior to entering turns will guarantee safe passage through the tighter angles associated with some airport taxiways. Your FOM will offer guidance on maximum speeds for entering turns.

5) Ask questions. Despite the fact that pilots fly into certain airports infrequently or for the first time with passengers on board, we are expected to handle taxiing proficiently. To do so, a team approach can be applied by using the ground or local controller for guidance in un-

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Displaced Hold-Short Markings and Precision Obstacle Free Zones (POFZs)

Several years ago, many airports began moving the hold-short lines farther back from the runway in order to expand the Precision Obstacle Free Zone (POFZ). As a result, many hold-short lines are no longer near the edge of the runway where they traditionally have been located. Because the new, nonstandard hold-short locations are frequently not depicted on NACO or Jeppesen airport diagrams, the potential for a runway incursion is magnified.

Taxiway E at KPIT provides a good example of this problem, as depicted through the diagram and photos below. You will see that, as you taxi for takeoff on Runway 28C, the hold-short line is crossed well before you reach the end of the runway.

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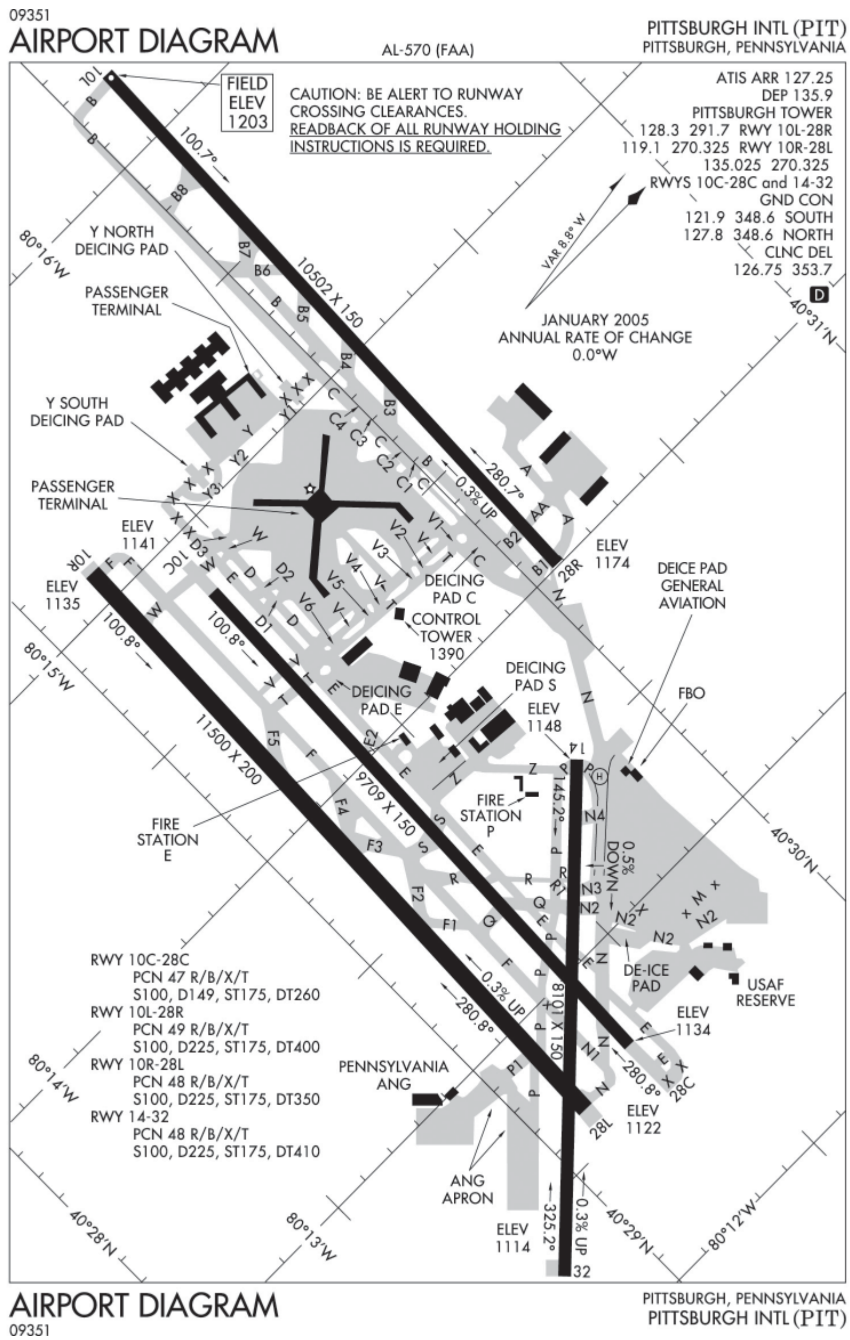
KPIT's Taxiway E hold-short line for Runway 28C.

KPIT Taxiway E enhanced hold-short line and wigwag warning lights



Displaced Hold-Short Markings
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KPIT's runway holding position sign for Runway 28C, located next to Taxiway E.

Because displaced hold-short lines present a potential problem for pilots industry-wide, ALPA is working with the FAA's national Runway Safety Office, NACO, and Jeppesen to educate airmen on changes to hold-short locations. If you identify a nonstandard hold-short location that is not depicted on charts, please report it through a NASA ASRS report and through your carrier's voluntary reporting program.

Taxiway Excursions
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certain circumstances. Because they know the airport taxiway system, controllers can often be the best resource on how to safely maneuver your aircraft while guiding you to the ramp or the runway. If a turn looks unsafe, ask. Controllers will assist when requested. It is up to you to seek that help.

6) Speak up. All flight crewmembers are responsible for safely taxiing their aircraft. If something unusual is heard or looks unsafe, perhaps a quick time-out to discuss the situation may be in order. This practice guarantees that two sets of eyes are on the task at hand; it will keep situational awareness up and potential for errors down.

Thousands of flights are completed safely every day because of flight crews' attention to duty and dedication to safe operations and good practices. While these recommendations for avoiding runway excursions during taxi reflect an elementary approach, nonetheless they are offered to you as a reminder of ways to avoid simple mistakes that may result in costly and unnecessary damage to aircraft and airman safety records.

Steve Jangelis is the chairman of ALPA's AGE Group.

Thank you for your continued interest in maintaining runway safety. In our next issue of Runway Risks, *we will focus on the impact of runway contamination on surface braking coefficient. Please contact us at runway-safety@alpa.org with your concerns.*

FLY SAFELY!

ALPA has developed a special website dedicated solely to runway safety. There you will find links to runway safety educational material and video re-creations of several high-profile incidents. Material on this website is being added on a regular basis, so stop by for the latest information on runway safety. Previous issues of this newsletter can also be found there. The website address is **holdshort.alpa.org.**

Our Goals

While our main goal of distributing this newsletter is to increase your education and awareness of runway safety hazards, ALPA is also committed to providing access to educational resources on our website. In addition, we strive to:

1. provide you with awareness tools,
2. conduct this educational campaign to provide information to line pilots,
3. continue the pursuit of long-term system mitigations of runway safety hazards.