

**AVIONICS UPDATE**

## Anti-runway incursion software aids pilot situational awareness

### How Honeywell's Runway Awareness and Advisory System EGPWS add-on could help prevent accidents.

By Jim Veihdeffer  
Contributing Writer



**In Aug 2006, a Bombardier CRJ100 operating Comair flight 5191 crashed during takeoff from LEX (Lexington KY). After having been cleared for Rwy 22, the crew mistakenly taxied onto and took off from Rwy 26. Of the 50 people on board, 49 were killed.**

It's widely known in the aviation community that the number one cause of fatal aircraft accidents is pilots taking perfectly sound airplanes and flying them into immovable obstacles such as mountains.

But controlled flight into terrain (CFIT) isn't limited to crashing into static topographical features due to disorientation caused by dark nights, fog or navigation errors.

In fact, the accident which caused the greatest loss of life in all of aviation history was the Mar 1977 runway collision between 2 Boeing 747s—operated by KLM and Pan Am—which killed 583 people at TFN (Los Rodeos, Tenerife, Canary Islands, Spain).

Pilots who like the idea of knowing with absolute certainty that they're headed for the correct runway on either takeoff or landing—or headed for a runway at all, versus,

say, a service road—will like the brief aural announcements from Honeywell's Runway Awareness and Advisory System (RAAS).

Of course, if you're fed up with cockpit advisories piping up in the middle of your business, you can save \$10,000. But, as the safety folks say, all it takes is one runway mix-up to ruin everyone's day. And all it takes is one collision averted to pay for the system many times over.

In Oct 2001, an SAS McDonnell Douglas MD87 airliner taking off from LIN (Linate, Milan, Italy) for Denmark hit a Cessna Citation 500 which had wandered across the runway. The accident killed all 114 people aboard both planes.

The deadliest US runway incursion accident was a collision between a USAir Boeing 737 and a SkyWest Fairchild Metro at LAX (Intl, Los Angeles CA) in Feb 1991, which killed 34. A controller had cleared the twin-turboprop onto Runway 24L's "takeoff position hold" to await clearance. It was night. The controller forgot the plane was there and cleared the 737 to land on the same runway.



**Honeywell Dir of Aerospace Flight Ops Tommy Littlejohn takes the left seat of the company's Sabre 65 to put RAAS through its paces over DVT (Deer Valley, Phoenix AZ).**

As recently as this January, a Key Lime Air Metro inadvertently entered a runway as a Frontier Airbus A319 was on short final to the same runway at DEN (Intl, Denver CO). As the A319 descended out of cloud cover, its crew saw the Metroliner on the runway and executed a missed approach, coming within about 50 ft of utilizing the charter craft as its runway threshold.

With this kind of track record, it's no surprise that the runway incursion issue has been on NTSB's "most wanted" list since the list's inception in 1990.

According to FAA, a runway incursion is "any occurrence in the airport runway environment involving an aircraft, vehicle, person or object on the ground that creates a collision hazard or results in a loss of required separation with an aircraft taking off, intending to take off, landing or intending to land."

Note that the FAA definition (and a similar ICAO one) does not specifically include taxiways. Yet in 2002 a China Air A340 erroneously used Taxiway K at ANC (Intl, Anchorage AK) for its takeoff, rather than Rwy 32. And just this February, an air traffic controller at LIS (Lisbon, Portugal) ordered an Air France A320 to abort its takeoff roll on a taxiway.

Nevertheless, FAA is well aware of this problem, as evidenced by an agency engineering brief dated Jan 17, 2007, which states, "Some airports are experiencing problems with pilots mistakenly identifying parallel taxiways for adjacent runways."

The agency has taken action on a number of fronts, including improving airport markings and installing the Airport Movement Area Safety System (AMASS) and Airport Surface Detection Equipment (ASDE).

Essentially a software package, AMASS warns tower controllers of likely incursions on runways. However, at the board's Mar 2007 Runway Incursion Forum, NTSB Chairman Mark Rosenker conceded that AMASS is not adequate to prevent serious runway collisions, because too much time is lost routing valuable information through air traffic control. Moreover, according to Darren Gaines of the National Air Traffic Controllers Association, speaking at the same forum, AMASS does not work reliably in the rain.

ASDE, currently being implemented at some congested airports, uses a short-range radar to detect ground movements and display them to the ground controller on a map representing the airport's surface. And some airports are using a Surface Movement Guidance and Control System (SMGCS), which allows pilots and drivers of ground vehicles to find their way on the airport during low-visibility conditions.

In Apr 2007, FAA released its Airport Moving Map Display (AMMD) standards for Class 2 electronic flight bag systems. Using global positioning system (GPS) technology, AMMD provides a constantly changing view of an airport's runways, taxiways and structures to help pilots identify and anticipate the aircraft's "own ship position."

"When the equipment will actually find its way into cockpit is driven by the market for the product," says FAA Spokesman Les Dorr, "but we've encouraged early adoption by getting the standards and guidance out quickly."

Dorr says FAA is currently working with manufacturers Jeppesen and ACSS in support of that goal. The former demonstrated its airport moving map technology at an FAA press conference in March, while ACSS says it expects to certify its moving map system this summer.

Thanks in part to these measures, as well as to improvements in airport signs, lightings and markings—or perhaps just the amount of attention being paid to the situation—the number of runway incursions designated as “serious” by FAA has dropped by more than 40% since 2001. In 2006 there was only one serious incursion for every 2 million takeoffs and landings.

However, with more than 600,000 pilots making about 62 million takeoffs and landings last year—and hundreds of thousands of individuals driving vehicles on airport grounds—we have a complex mixture of activities with potentially disastrous consequences.

Which is why many industry observers like the idea of a simple, inexpensive, in-cockpit, weather-independent system that doesn’t rely on time-sensitive complex communications—preferably one that’s ready now.

### **RAAS to the rescue**

RAAS is a software add-on application to Honeywell’s existing Enhanced Ground Proximity Warning System (EGPWS). For the most part, it’s already “in the box” for the Mark V and Mark VII models.

The “magic” derives from 2 key technologies that Honeywell already possesses—GPS and terrain database. Adding this new capability is really a repurposing of existing functionality.

“It’s not a complicated problem, technologically,” says Honeywell Dir Aerospace Flight Ops Tommy Littlejohn. “It’s mostly about what it should say and shouldn’t say.”

The GPS tells the aircraft exactly where it is and the EGPWS worldwide database maps the aircraft to the airport overlay. The terrain database is usually updated about 3 times a year, when Honeywell determines that updating is needed.

Note that this is different from the monthly FMS database updates. As Honeywell points out, aside from occasional runway extensions and tower relocations, terrain doesn’t change that much.



Jim Veihdeffer photo

To get an idea how RAAS works, imagine a virtual box outlining the runway. As the aircraft enters the imaginary box, a voice—available as male or female with varying volume levels, like TCAS—announces, “Approaching two-four left.”

Once you actually make the turn onto the active runway, you’ll hear, “On Runway two-four left.”

**Cockpit display in EGPWS mode with traffic overlay, shows the aircraft on base leg heading north preparing for final approach. Moments later, RAAS annunciated the correct runway.**

In the unusual situation that you wait too long before starting your rollout, the system can be set to repeat the advisory twice after a minute. This is an optional advisory that can be turned on or off according to operator preference. Littlejohn explains, “In effect, it’s saying, ‘Are you sure you want to be sitting out here on a live runway?’”

In all, there are 2 standard routine advisories, 3 optional routine advisories and 5 additional optional non-routine advisories.

One function that falls in the second category gives an in-air runway alert, such as “Approaching two-four left.” This is based on time of arrival and typically gives about a half-mile advance warning, or about 30 seconds. The voice annunciation can be disabled for crews who don’t like the distraction of a voice competing with radio traffic.

Another option provided courtesy of Honeywell’s worldwide database is a “distance remaining” callout for rollout and landing. This can be useful in determining whether an aborted takeoff or fly-over is needed. “Runway remaining” alerts—“four thousand remaining ... three thousand remaining ... one hundred remaining”—are based on user-defined aircraft performance characteristics. Thankfully, the passionless automated voice does not add to panic levels as pavement turns to meadow, or worse.

Littlejohn and Flight Test Pilot Rob Odger put the system through its paces for Pro Pilot recently at DVT (Deer Valley, Phoenix AZ).

With the tower’s cooperation, we delayed rollout in the company’s Sabre 65 by 60 seconds and, sure enough, the system repeated, “On runway seven right! On runway seven right!” Since the runway distance remaining was greater than the parameter set for the Sabre, no further alert was heard.

Now, if the pilot arrives at the runway, but for some reason turns the wrong way, the system would announce the runway and give the remaining distance—say, 2300 ft—in the direction the aircraft is actually pointed. In the case of the Sabre 65 with the runway distance set for 5000 ft, hearing “2300 remaining” would certainly tell the crew they’re headed the wrong way.

The system provides another safeguard in the case of an aborted takeoff. If the aircraft accelerates above 40 kts and then decelerates, the system will begin calling out runway remaining, per the operator-selectable parameter for that aircraft. “Once you get used to this thing, it becomes part of your day,” Littlejohn says.

In fact, the absence of an advisory on landing would suggest to the pilot that he may be about to touch down on a taxiway instead of the runway.

The landing alert is not a one-shot deal. If the aircraft veers outside the virtual box on parallel runways and enters the adjacent runway’s box, the system alerts the pilot each time the envelope boundary is crossed.

Meanwhile, to reduce the possibility of taking off from a taxiway, the system can be enabled to announce “On taxiway! On taxiway!” as one of the optional non-routine advisories.

Of course, RAAS does not cover all incursion situations, such as an aircraft about to land on top of another airplane on the runway. It only tells you where you are, not who else is around—but this unquestionably adds an important and reliable element to the pilot’s situational awareness.

### **Turning on**

RAAS functionality can be activated in either of 2 ways. For older EGPWS-equipped aircraft, the line replaceable unit (LRU) is retrofitted by bringing the old software up to the current standard via PCMCIA card (PC card) load. For newer models, it’s a simple turn-on activation. Either way, there’s virtually no aircraft downtime.

In 2003, Honeywell received supplemental type certification for RAAS. Since then it has put approximately 750 units in service, with another 650 waiting to be delivered out of an installed base of 35,000 EGPWS units. Sales are split about equally between business aircraft and the air transport market.

### **Down the road**

Honeywell is currently working on a concept to increase the usefulness of RAAS by linking EGPWS to the aircraft's flight controls. Provisionally dubbed "assisted recovery," the system would provide brief flight control inputs to an aircraft heading for disaster if the pilots were not responding to alerts. Currently being flight tested, the system commands the flight control system to avoid the imminent danger and returns control to the pilots when clear.

---



*Jim Veihdeffer is a Phoenix-based freelance writer, marketing consultant and editor with more than 15 years' experience in the aviation industry. He is an adjunct faculty member at Arizona State University, where he teaches writing.*

[http://www.propilotmag.com/July/article4\\_july.html](http://www.propilotmag.com/July/article4_july.html)

Professional Pilot is a monthly journal serving the corporate and regional aviation industry, including pilots, managers and dispatchers. Editorial content includes pilot technique, airmanship, operations, weather, reader surveys, helicopters, airplanes and avionics.