Mounting evidence confirms that publication of airport hot spots raises runway-safety threat awareness, several U.S. specialists say. Noting successes at sites where runway incursions have dropped significantly, an ongoing standardization initiative by the U.S. Federal Aviation Administration (FAA) has created a single national process for generating hot-spot notifications to aircraft operators, pilots, airfield drivers and air traffic controllers. These official notifications coexist with informal educational media, which for the first time are available from a central repository on the agency's Web site.

The International Civil Aviation Organization (ICAO) defines *hot spot* as "a location on an aerodrome movement area with a history or potential risk of collision or runway incursion, and where heightened attention by pilots/drivers is necessary."[1] Its standards and recommended practices, amplified three years ago, have prompted similar steps by civil aviation authorities in a number of other countries, such as Canada and France.

ICAO emphasizes that flight crews should prepare well in advance for departure and arrival at any airport, including reviewing hot spots before taxiing from the gate and prior to beginning descent. "The 'before start' and 'descent' briefings also should contain a complete review of the expected taxi routes with special attention to the hot spots," its guidance says. "Special attention should be paid to temporary

HOT SPOT Intelligence

Standardization adds cautionary notes to more U.S. airport diagrams and airport/facility directories.

BY WAYNE ROSENKRANS

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situations such as work in progress, other unusual activity and recent changes in the aerodrome layout."

At a minimum, local runway safety teams should parlay lessons from accident/incident reports into identifying hot spots and producing "hot spot maps" using criteria such as those provided in the international guidance. "Hazards associated with hot spots should be mitigated as soon as possible and so far as is reasonably practicable," ICAO says. "Aerodrome charts showing hot spots should be produced locally, checked regularly for accuracy, revised as needed, distributed locally, and published in the [national] aeronautical information publication."[2]

Last year, the FAA introduced a 56-day cycle of delivery for its two hot spot resources in flight information publications. They comprise symbols and text on airport diagrams (Figure 1, p. 22) within the *Terminal Procedures Publication* and descriptions and airport diagrams in airport/facility directories.

"Hot spots are depicted on airport diagrams as open circles designated as 'HOT^1, HOT^2, etc.' and tabulated … with a brief description of each hot spot," the agency said. "Hot spots will remain charted on airport diagrams until such time as the increased risk has been reduced or eliminated."[3]

This year, a new policy on required content of airport diagrams — adding hot spots — has been introduced, and the *Runway Safety Hot Spots List* has enabled a selection of 84 hot spot charts, brochures, kneeboard pages and posters to be downloaded from <www.faa.gov/airports/runway_safety/hotspots/hotspots_list/>.

"Typically, [a hot spot] is a complex or confusing taxiway-taxiway or taxiway-runway intersection," the FAA says. "The area of increased risk has either a history of or a potential for runway incursions or surface incidents due to a variety of causes such as, but not limited to, airport layout; traffic flow; airport marking, signage and lighting; situational awareness; and training." Potential confusion typically is identified by interviewing groups of local users.

The FAA Air Traffic Organization's *Annual Runway Safety Report 2009* last October said,

"The use of labels for hot spots on all [airport] diagrams will make it easier for users of an airport to plan the safest possible path of movement in and around that airport. … Proper planning helps avoid confusion by eliminating last-minute questions and building familiarity with known problem areas. While some airports voluntarily labeled hot spots on proprietary versions of their airport diagrams in the past, officially accepted standards for such labeling did not exist."

Historical Context

The U.S. drive to introduce this safety tactic began during 2001 and 2002 as a runway-incursion countermeasure at North Las Vegas Airport, Las Vegas McCarran International Airport and Phoenix Sky Harbor International Airport, recalls Chris Diggons, assistant manager, runway safety, FAA Western-Pacific Region. "The first Jeppesen airport diagram with hot spot information was for Chicago O'Hare International Airport in April 2001," Diggons said, and the list of U.S. airports with at least one hot spot depicted by Jeppesen has grown to 154.

Airport operators were the first interest group to request that Jeppesen add hot spots to its U.S. airport diagrams. Managers from FAA regional runway safety program offices later requested them and, on rare occasions, an air carrier or pilot group also requested them, said Michael Pound, a corporate communications representative at Jeppesen. "We encouraged the airlines and pilots to contact the airport and/or a regional runway safety program office to ensure that [everyone] who had knowledge of all issues related to potential problems with ground movement maintained a manageable paper trail," Pound said. In 2009, FAA National Aeronautical Navigation Services, formerly the National Aeronautical Charting Office, developed and implemented a hot spot charting specification, he said.

Jeppesen also submitted its list to the FAA and asked the agency to synchronize all the U.S. hot spot information, Pound said. "Sourcing all hot spot descriptions now through the National Flight Data Center provides a method to harmonize any discrepancies that might arise," he said.

Example of Hot Spot Depiction on Airport Diagrams
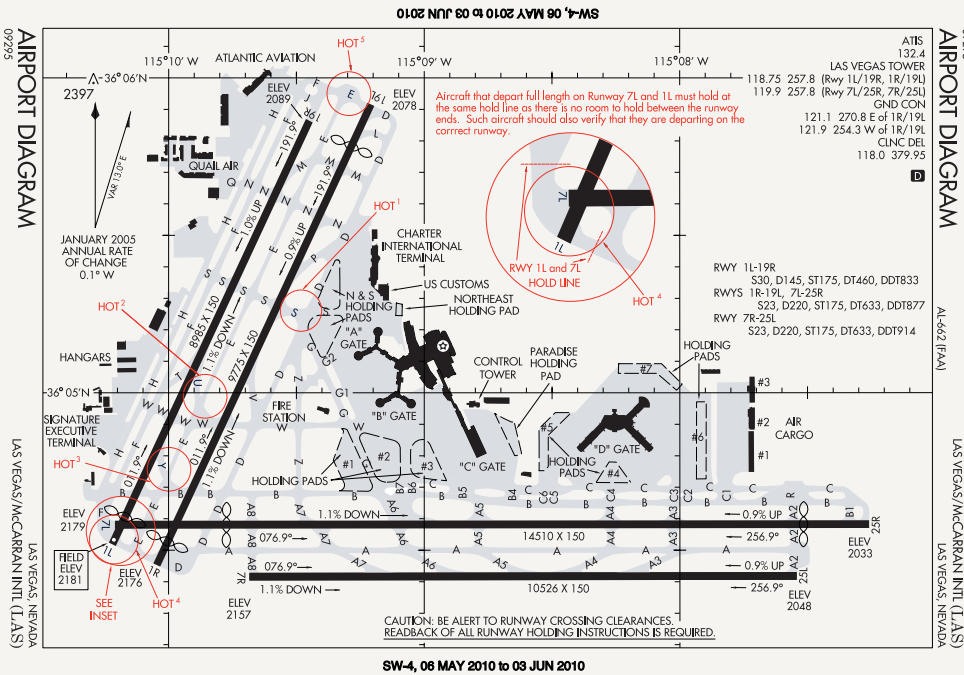
Note: Text and symbols shown in red are black on actual airport diagrams.

Source: U.S. Federal Aviation Administration

Figure 1

The FAA's policy on airport diagram content — Air Traffic Organization Order JO 7910.4D, "Airport Diagrams," effective May 3, 2010 — makes the depiction of hot spot symbols mandatory if available. The policy says airport diagrams will have the "location of hot spot(s) on movement areas with a description of the potential safety problem(s) that exist."

"The policy itself does not have a detailed process within it for hot spots," Diggons said. "We have a standalone document in which the FAA's Office of Runway Safety and National Aeronautical Navigation Services have determined how to submit hot spots for publication."

Under the FAA Air Traffic Organization's safety management system, adding a new hot spot to any airport diagram typically triggers a runway-safety action team visit by regional specialists and creates a high-priority entry in the national Runway Safety Action Plan database, except when these actions already have been taken. "The Airports Division considers a hot spot a safety issue, and provides it a high priority among upcoming improvement projects for the airport," he said.

Various factors have influenced successful introductions of hot spots in the FAA's Western-Pacific Region. North Las Vegas was "no. 1 on the hit parade" of runway incursions until the runway safety team developed a series of hot spot brochures, Diggons recalled. "With hot spots now on their airport diagram, they are off the high-risk horizon — back down to a more average runway-incursion rate."

In 2003, the FAA Office of Runway Safety began formalizing its hot spot process. "We have been working on that process ever since," Diggons said. Before official hot spots were introduced, sources for airport users were the Jeppesen airport diagrams or informal educational products of the FAA Office of Runway Safety. Because the unofficial products have no update cycle, however, they are marked "not for navigation," meaning that pilots also must review current airport diagrams.

Another distinction is that official descriptions focus concisely only on the type of risk and general action to take, Diggons said. This practice conforms to specifications designed to reduce the chance of a pilot or airfield driver deviating from air traffic control instructions, which take precedence. For hot spot charts and brochures, regional managers are not bound by those specifications, allowing more latitude to describe lessons learned at the location with photographs and explanatory details.

At McCarran, a hot spot was added to counteract a wrong-runway departure risk in which the geometry of Runways 1L and 7L was prone to pilot confusion, he added. "Report-wise, we have not had any more confusion," Diggons said.

"San Francisco has a confusing intersection at a 90-degree angle where aircraft pilots failed to make the appropriate turn and proceeded up the reverse high-speed taxiway where they came nose-to-nose with oncoming departing and arriving traffic at Runway 28L. That hot spot went into both Jeppesen and FAA products, and we haven't had any repeats of that so arguably we can say that the hot spot publication did the job … for so long that they are considering removing the hot spot."

By identifying hot spots and making two changes to signage, both to prevent pilot deviations, Tucson (Arizona) International Airport also became a model of success. "About 20 percent of pilot deviations were happening at a specific set of intersections for which we now have published hot spots; they no longer have those," Diggons said.

Serious runway incursions recently identified in the FAA's Northwest Mountain Region led to airport construction and publication of hot spots at Pueblo (Colorado) Memorial Airport and Billings (Montana) Logan International Airport, he noted. "The hot spots will be removed in early 2011 when their construction projects are finished," he said. Normally, the FAA is reluctant to remove hot spots, but Pueblo and Billings involved an exceptional temporary pattern linked directly to changes to its airport geometry and signs, so the decision is straightforward compared with San Francisco where "nothing appreciable" has been done to the layout, he said.

In some cases, a change of runway-taxiway-intersection geometry

eliminates a hazard or significantly reduces a risk, said Chris Pokorski, a safety engineer in the Office of Runway Safety. "We had one at Milwaukee [Wisconsin] General Mitchell International Airport where Taxiway Mike led right to the approach end of Runway 25L at an acute angle. That was a hot spot for a long time. They ended up changing the geometry so Taxiway Mike ends in a more normal, right-hand turn onto Taxiway November before pilots get to the approach end of Runway 25L. That eliminated the runway incursions at that intersection, so they have taken the hot spot off the airport diagram."

Unforeseen Consequences

Updated dimensions of precision obstacle-free zones of some runways with precision instrument approaches last year unintentionally became a factor causing low-severity runway incursions, Pokorski said. "Numerous airports had to move their runway holding position markings quite a way farther back from the approach end of the runway — to an unusual hold position, one unexpected by air crews," he said. "They would routinely cross the new 'hold-short line' because they expected it in a more normal position."

Airport diagrams normally do not depict these markings, but the runway safety team for Manchester (New Hampshire) Boston Regional Airport requested that an exception be granted after 12 runway incursions occurred at the new "hold-short line" for Runway 17, he said. Other pilots were confused when the same marking was added to Taxiway Papa about 800 ft (244 m) from the approach end of Runway 35, compared with its previous location about 250 ft (76 m) away on Taxiway Uniform. The FAA added a "RWY HOLD LINE" label and dashed line to the airport diagram

for Runway 17. With this change, and air traffic controllers instructing pilots to hold short at Taxiway Lima for Runway 17 departures, the runway incursions have been reduced to about one per year. Adding one or more hot spots in similar situations has been the best solution for other U.S. airports, however, Pokorski added. Diggons said, "Hot spots are in more common use, and airports are getting in line in recognizing the importance of hot spots to aviation safety."

Jeppesen's electronic airport diagrams support pilot briefings by incorporating hot spots derived from the same National Flight Data Center source as its paper chart service and the FAA's online versions. Plans call for hot spots to become a real-time resource to further increase situational awareness, Pound says.

"It is entirely possible, if not likely, that hot spots will be depicted in the Jeppesen Airport Moving Map application in the near future," he said. "However, there are issues to resolve first, including the use of color. Airframe manufacturers use certain colors to classify information presented on flight deck [displays], which has an impact on the use of color in this application. These are human factors concerns, and Jeppesen is experimenting with options that would meet the requirements of the original equipment manufacturers." Other companies also obtain hot spots from the National Flight Data Center or National Aeronautical Navigation Services. ◗

Notes

1. ICAO. Annex 4, *Aeronautical Charts*. 11th edition, July 2009.

2. ICAO. *Manual on the Prevention of Runway Incursions*. Doc 9870 AN/463. First Edition, 2007.

3. FAA. *Airport/Facility Directory, Southwest Region*. Effective April 8, 2010, to June 3, 2010.