Airport World
Runway Status Lights – The Next Level of Runway Incursion Prevention
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The desire to bring incursion prevention information and increased situation awareness directly to the flight deck has been on industry's collective agenda for several years. Since 1990, the U.S. National Transportation Safety Board (NTSB) has included the "immediate warnings of probable collisions/incursions directly to flight crews in the cockpit" on its "Most Wanted List for Transportation Safety Improvements." Further, Eurocontrol's concern regarding the frequency – and forecasted increase – of incursions led to the 2003 release of "The European Action Plan for the Prevention of Runway Incursions," identifying 56 recommendations for enhancing runway safety by delivering, among other key areas still a focus today, an increase in situational awareness.

To address clear, direct alerting to the crew, and increase situational awareness, industry has been exploring the use of an airport's Advanced – Surface Movement Guidance and Control System (A-SMGCS) to inform the flight deck with an automatic warning of a potential incursion using field lighting – known as runway status lights. Test systems have proved that runway status lights do help reduce incursions by saving critical seconds in providing direct information to the flight deck and vehicle operators.

According to the FAA Runway Safety Plan 2009-2011, "We have been evaluating Take-off Hold Lights (THLs) on the same runway at Dallas-Fort Worth International Airport's (DFW) west airfield since 2006. Runway incursions on the test runway at DFW have decreased by 70 percent – during the 29 months before testing began, 10 runway incursions occurred at DFW. During the 29 months after testing began, only three occurred." Further, Deborah Hersman, Chairwoman of the NTSB, noted at the 2009 FAA International Runway Safety Summit that "testing of ground safety systems such as runway status lights has shown them to be both effective and well-accepted as a means of providing crews with additional reaction time to deal with potential hazards affecting their aircraft."

In October 2008, the Federal Aviation Administration (FAA) announced that it was deploying runway status lights as part of the Runway Status Lights Program (RWSL) to 22 major U.S. airports, with an additional airport added in 2010. While over the years there have been several tests and evaluations of different runway status lights concepts, the FAA program is the most prominent action to date in support of this new runway safety solution. By bringing runway incursion prevention information directly to the cockpit, the FAA is making a significant investment in the next level of runway incursion prevention.

Operational Concepts for Runway Status Lights

Runway status lights are a means of conveying a visual message to flight crews and vehicle operators when a specific action is demanded, leveraging existing airfield lighting or dedicated in-pavement lights installed in the surface of the airport. The FAA's RWSL program – which uses dedicated in-pavement lights – includes two categories of lights: Take-off Hold Lights (THLs), a series of parallel red lights on both sides of the runway centerline at the take-off hold

point of a runway that warn a pilot that a vehicle or another aircraft is on the runway or is predicted to enter it along an intersecting runway; and Runway Entrance Lights (RELs), an array of consecutive red lights on the taxiway centerline leading to the runway-taxiway intersection, with an additional light in the center of the runway, that warn a pilot approaching a runway holding point that another aircraft is on or approaching the runway. The lights are automatically illuminated when the A-SMGCS identifies traffic on or approaching the same runway.

For the FAA's RWSL program, when the RELs are illuminated, there is traffic on the runway, and the flight crew's action is to stop at the hold line and not enter or cross the runway. When THLs are illuminated, there is traffic on the runway, and the required action from the flight crew is to refrain from initiating a departure – to "hold."

It is important to note that runway status lights do not replace current airfield taxiway clearance practices. As such, although lights might not be illuminated, the pilots must still wait for controller instruction for clearance to cross a runway or to take off.

Components Required for Runway Status Lights

A runway status lights system requires three components: surface surveillance (A-SMGCS), field lighting and computer processing executing runway status light algorithms to automatically illuminate and extinguish the proper lights at the proper time.

Precise surface surveillance with a high update rate is critical for a runway status lights system to operate with a low number of false activations. The surveillance must accurately represent the traffic on the airport surface as well as on approach to the airport. It must be updated frequently enough so that accurate velocity and acceleration information can be derived. Ultimately, the surveillance and kinematic information is used to drive the system's algorithms that determine when to illuminate and extinguish the lights.

As noted previously, a system can leverage either existing lights or dedicated runway status lights. Recently, industry has begun deploying Light Emitting Diode (LED) lights over incandescent lights for many airfield applications, including runway status lights. The LED lights being deployed in the FAA's RWSL program will provide longer life at a lower overall lifecycle cost, in addition to being more energy efficient.

The computer processing/algorithms – highly complicated, specialized software – must be vigorously tested and proven to ensure that lights are illuminated and extinguished at the appropriate times to provide the desired safety and to prevent interference with normal operations. The algorithms predict when aircraft will occupy a runway, clear the runway or are airborne, as well as other kinematic data; based on this information, the algorithms determine when it is safe or unsafe for another aircraft to occupy the runway. As a result of these predictions, lighting commands are issued to the field lighting system to illuminate or extinguish lights. The timing of both the illumination and extinguishing of lights is of critical importance to the safe and normal operation of the airport.

With a runway status lights system, no controller console or interface is needed since the technology is designed to provide information directly to the cockpit without an impact on the controller's current operating procedures.

The Next Level of Runway Incursion Prevention

This spring, the FAA will begin the operational test and evaluation period of its first RWSL site at Orlando International Airport, with 22 other airports scheduled to follow suit over the next several years. With this next level of incursion prevention, flight crews will now have direct, immediate warning of potential incursions, helping to reduce the probability of runway incursions.