

Runway Status Lights (RWSL)

INTRODUCTION

The aim of this Briefing Leaflet is to introduce the core elements of Runway Status Lights (RWSL) as they have been deployed and identify the operational considerations relevant to flight crews. This leaflet has been assembled with information from the FAA, EUROCONTROL and the JCAB.

RWSL is an automated system that provides advisory information for flight crews and airport vehicle drivers to indicate if it is unsafe to enter, cross or takeoff from a runway. The system has been implemented on certain runways at a number of busy airports in the United States and Japan and is being implemented at Paris Charles de Gaulle (CDG) airport in France. Designed to reduce the number of runway incursions, the system is comprised of Runway Entrance Lights (RELs) and Takeoff Hold Lights (THLs).

The RWSL increases pilot and vehicle operators' situational awareness by directly providing runway occupancy status through the autonomous illumination of in-pavement lights on runways and taxiways. The concept of operations relies on the ability to warn at least one of the aircraft or vehicles in a conflict scenario and in some cases, provide additional warnings to everyone involved for increased safety. RWSL is designed to be compatible with existing procedures at airports. States implementing RWSLs are working together to ensure harmonization of those procedures specifically relating to RWSL. In addition, provisions to be included in the ICAO PANS ATM document will provide international guidance on the harmonization of the RWSL procedures, referred to by ICAO as autonomous runway incursion warning systems (ARIWS), will become applicable in November 2016. This guidance will only apply to airports where such a system is installed and used.

RUNWAY ENTRANCE LIGHTS

The FAA Provides the following information about RELs, the system description and operation is consistent with REL deployments in Europe and Japan however some variation exists in the speeds used to activate the automated system.

The Runway Entrance Lights system is composed of flush mounted, in-pavement, unidirectional fixtures that are parallel to and focused along the taxiway centerline and directed toward the pilot at the holding point. A specific array of Runway Entrance Lights include the first light at the holding point followed by a series of evenly spaced lights to the runway edge; and one additional light at the runway centerline in line with the last two lights before the runway edge (see Figures 1, 2 and 3). When activated, these red lights indicate that there is high speed traffic on the runway or there is an aircraft on final approach within the activation area.

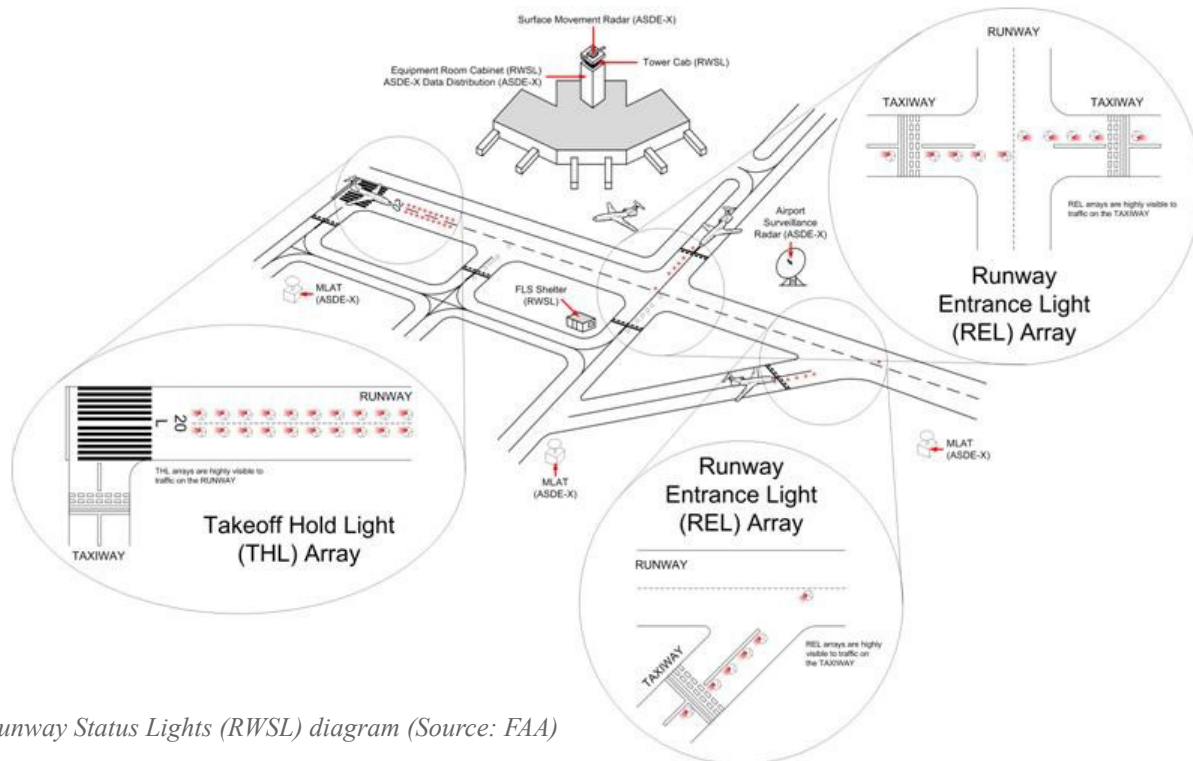


Figure 1 Runway Status Lights (RWSL) diagram (Source: FAA)

Operating Characteristics – Departing Aircraft:

When a departing aircraft reaches 30 knots, all taxiway intersections with Runway Entrance Lights arrays along the runway ahead of the aircraft will illuminate (see Figure 1). As the aircraft approaches a Runway Entrance Lights equipped taxiway intersection, the lights at that intersection extinguish approximately 2 to 3 seconds before the aircraft reaches it. This allows controllers to apply “anticipated separation” to permit Air Traffic Control to move traffic more expeditiously without compromising safety. After the aircraft is declared “airborne” by the system, all lights will extinguish.

Operating Characteristics – Arriving Aircraft:

When an aircraft on final approach is approximately 1 mile from the runway threshold all sets of Runway Entrance Light arrays along the runway will illuminate. The distance is adjustable and can be configured for specific operations at particular airports. Lights extinguish at each equipped taxiway intersection approximately 2 to 3 seconds before the aircraft reaches it to apply anticipated separation until the aircraft has slowed to approximately 80 knots (site adjustable parameter). Below 80 knots, all arrays that are not within 30 seconds of the aircraft’s forward path are extinguished. Once the arriving aircraft slows to approximately 34 knots (site adjustable parameter), it is declared to be in a taxi state, and all lights extinguish.

What a pilot would observe:

A pilot at or approaching the holding point to a runway will observe Runway Entrance Lights illuminating and extinguishing in reaction to an aircraft or vehicle operating on the runway, or an arriving aircraft operating less than 1 mile from the runway threshold.

EUROCONTROL provides the following note on RWSL in low visibility procedures.

Note: When LVP are in force at CDG airport, the REL behaviour is not changed. Note that RELs are not available between CAT 3 holding points (located at about 150m from RWY centreline) used in that case and CAT1 holding points.

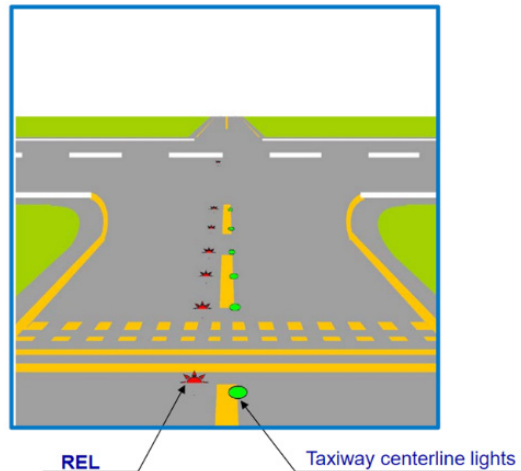


Figure 2 Example placement of Runway Entrance Lights (RELs)
(Source: JCAB)



Figure 3 Illuminated Runway Entrance Lights (RELs)
(Source: JCAB)

TAKEOFF HOLD LIGHTS

The FAA provides the following information on THLs, the system description and operation is consistent with REL deployments in Europe and Japan.

The Takeoff Hold Lights system is composed of in-pavement, unidirectional fixtures in a double longitudinal row aligned either side of the runway centerline lighting. Fixtures are focused toward the arrival end of the runway at the “line up and wait” point, and they extend for 1,500 feet (approx. 450m) in front of the holding aircraft (see Figures 1, 4 and 5). Illuminated red lights provide a signal, to an aircraft in position for takeoff or rolling, that it is unsafe to takeoff because the runway is occupied or about to be occupied by another aircraft or ground vehicle.

Two aircraft, or a surface vehicle and an aircraft, are required for the lights to illuminate. The departing aircraft must be in position for takeoff or beginning takeoff roll. Another aircraft or a surface vehicle must be on or about to cross the runway.

Operating Characteristics – Departing Aircraft:

Takeoff Hold Lights will illuminate for an aircraft in position for departure or departing when there is another aircraft or vehicle on the runway or about to enter the runway (see Figure 1). Once that aircraft or vehicle exits the runway, the Takeoff Hold Lights extinguish. A pilot may notice lights extinguish prior to the downfield aircraft or vehicle being completely clear of the runway but still moving. Like Runway Entrance Lights, Takeoff Hold Lights have an “anticipated separation” feature.

When the Takeoff Hold Lights extinguish, this is not clearance to begin a takeoff roll. All takeoff clearances will be issued by Air Traffic Control.

What a pilot would observe:

A pilot in position to depart from a runway, or has begun takeoff roll, will observe Takeoff Hold Lights illuminating in reaction to an aircraft or vehicle on the runway or about to enter or cross it. Lights will extinguish when the runway is clear. A pilot may observe several cycles of lights illuminating and extinguishing depending on the amount of crossing traffic.

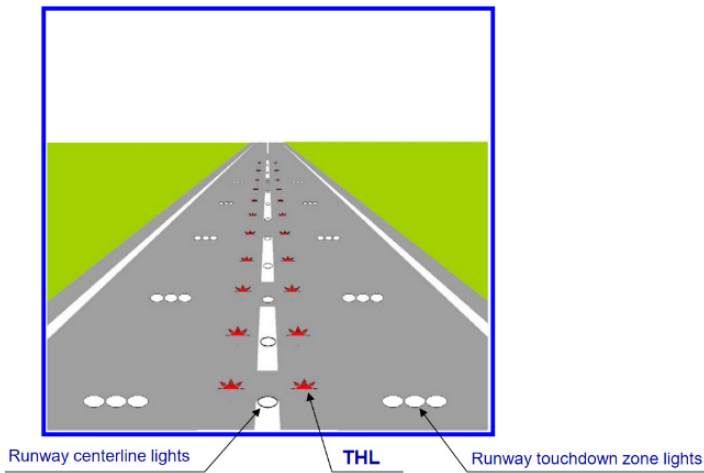


Figure 4 Example placement of Takeoff Hold Lights (THLs)
(Source: JCAB)

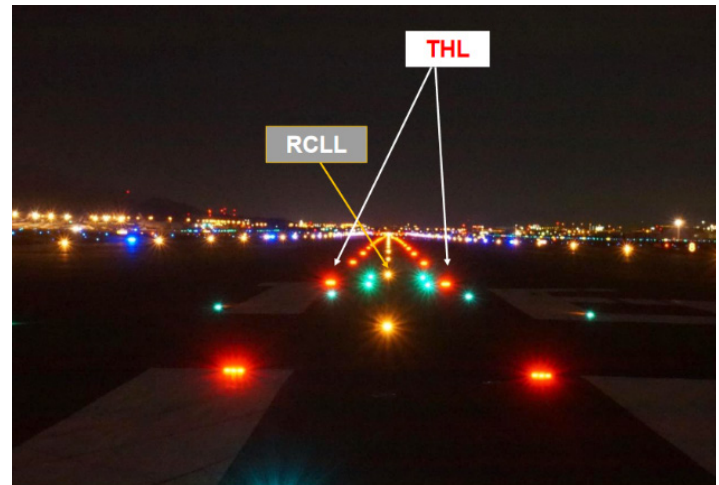


Figure 5 Illuminated Takeoff Hold Lights (THLs)
(Source: JCAB)

VARIABLE MESSAGE SIGNS

Provisionally installed at Tokyo Haneda (RJTT) in advance of installation of RELs. VMS is installed at taxiway in the vicinity of holding position of the connecting taxiway and is turned on when other aircraft occupies the runway. "STOP" is displayed in white characters on red background, otherwise turned off (see Figures 6 and 7).

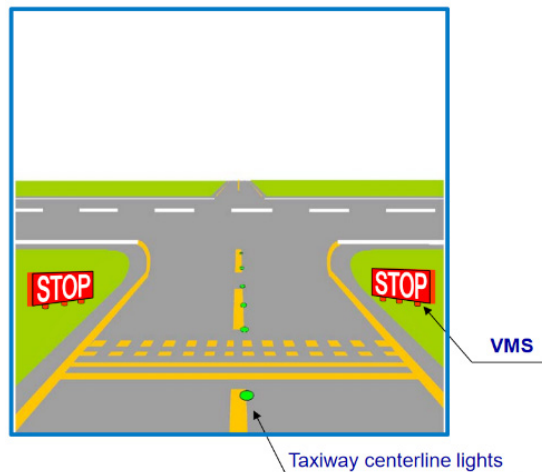


Figure 6 Example placement of Variable Message Signs
(Source: JCAB)



Extinguished



Illuminated

Figure 7 Variable Message Signs in Operation
(Source: JCAB)

OPERATIONAL CONSIDERATIONS

Air traffic control operations do not change when RWSL is introduced. Additional protocols are added to ensure effective use of the RWSL system. These protocols are similar in those areas where RWSL has been introduced and are summarized below.

Key Concepts

RED Lights always mean stop

An ATC clearance is always needed when lights are extinguished.

RWSL only has two states:

- **On** – lights are red;
- **Off** – lights are switched off.

***Note:** The **RWSL** never illuminates green lights to convey safety or clearance.*

Even if RWSL is off, the pilot shall not enter the runway or commence take-off unless an ATC clearance is received. When RWSL is on, even if a controller issues a clearance, the pilot is not to enter the runway or take off.

If the controller issues a clearance but the RWSL is on, the pilot should communicate with ATC to resolve any mismatch between the clearance and RWSL system. If the problem cannot be solved, RWSL should be turned off and the clearance to enter the runway or to take off should be re-issued. In all cases, if following the established protocol is not safe, pilots should proceed according to their best judgment of safety (understanding that illuminated **RWSL** indicates a potential conflict exists) and contact **ATC** at the earliest opportunity. When **RWSL** lights contradict air traffic clearances, pilots and vehicle operators are trained to respond first to the status lights since they are intended to serve as a backup safety net when the humans in the loop make errors. Conversely, pilots and vehicle operators are trained that RWSL is an advisory safety system only and that **RWSL** off **NEVER** should be perceived as an air traffic control clearance.

RUNWAY ENTRANCE LIGHTS

When **RELs** are red, the runway is unsafe to enter or cross and pilots /vehicle drivers should stop immediately. When the lights are off, pilots/vehicle operators shall not enter or cross the runway without ATC clearance.

***EUROCONTROL Note:** When LVP are in force at CDG airport, the REL (available from CAT 1 holding points up to the RWY) behaviour is not changed, and the above protocol for operators is the same (If RELs illuminate red, stop immediately and contact ATC). When LVP are in force the CAT 3 holding points are used and stop bars located at these holding points are active. These stop bars should not be mistaken for RELs; stop bars are operated by the tower controller and their switching off should always be associated with an ATC clearance, whereas RELs are fully automated, and are an additional safety measure.*

TAKEOFF HOLD LIGHTS

If lined-up and waiting on the runway and **THLs** are red, the runway is not safe for takeoff and pilots should remain in position for takeoff.

If the takeoff roll has begun and the **THLs** turn red, pilots should safely stop the aircraft and notify **ATC** that they have stopped because of red lights.

MORE INFORMATION

The following sources were used in the production of this Briefing Leaflet and provide more information on RWSL.

<http://www.developpement-durable.gouv.fr/IMG/pdf/Plaque-RWSL-telechargeable.pdf>

https://www.faa.gov/air_traffic/publications/media/aim_basic_4-03-14.pdf (Section 2-1-6, p. 85)

<http://www.icao.int/APAC/Meetings/2015%20VisualAids/RWSL%20JAPAN.pdf>

http://www.mlit.go.jp/en/koku/koku_fr13_000007.html