

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 787-9, G-CKWC	
No & Type of Engines:	2 Rolls-Royce Trent 1000-J3 Ten turbofan engines	
Year of Manufacture:	2018 (Serial no: 38893)	
Date & Time (UTC):	28 March 2018 at 2201 hrs	
Location:	London Gatwick Airport	
Type of Flight:	Commercial Air Transport (Passenger)	
Persons on Board:	Crew - 10	Passengers - 260
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	63	
Commander's Flying Experience:	18,765 hours (of which 699 were on type) Last 90 days - 190 hours Last 28 days - 60 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The aircraft began its takeoff roll from the displaced landing threshold of Runway 26R at Gatwick Airport, rather than at the beginning of the runway. This decreased the distance available for the takeoff by 417 m.

The beginning of the runway is marked by a white line, but the part of the runway before the landing threshold does not include white edge lights or centreline lights. This configuration complies with relevant specifications. The taxi route to the runway brought the aircraft up to the beginning of the runway on a taxiway that was on the same heading as the runway and no turn was required. This is unusual, as most runway entries will require a turn onto the runway centreline, but compliant. These factors, combined with the perceived lack of lighting on the pre-threshold part of the runway, meant the crew did not identify the beginning of the runway and instead taxied up to the lights of the landing threshold to begin their takeoff roll. Consequently, the aircraft took off with insufficient thrust to meet regulatory takeoff performance criteria for the actual length of runway available.

Following previous takeoff performance-related events with other aircraft operators, the airport operator undertook a review of operations using Runway 26R and introduced measures to reduce the likelihood of aircraft beginning their takeoff from the wrong point on the runway. Further measures were taken after this event.

History of the flight

G-CKWC was scheduled to depart Gatwick Airport (LGW) for Buenos Aires, Argentina at 2130 hrs. During the pre-flight briefing the crew had noted the presence of a NOTAM, which referred to the closure of the main runway at LGW and the use of the standby runway for takeoff and landings from 2145 hrs. The NOTAM stated that the last departure from the main runway would be five minutes before the closure. The crew noted that their departure was very close to that time and began planning for a takeoff from the standby runway. This meant a change of loading plan, including a reduction in planned cargo. A revised flight plan and loading plan were issued which would allow the flight to depart from the standby runway using full engine thrust.

At 2137 hrs, the aircraft pushed back from its stand at LGW. The aircraft taxied out for Runway 26R via Taxiways KA, K to hold at Holding Point P1. At 2156 hrs, the aircraft was given a conditional clearance to line up on Runway 26R after a landing A320. At 2158 hrs the aircraft crossed the holding point at P1 and taxied via P and AN to the runway. Whilst on Taxiway AN, before entering the runway, the crew received their takeoff clearance. Figure 1 shows the taxi routing taken by G-CKWC.

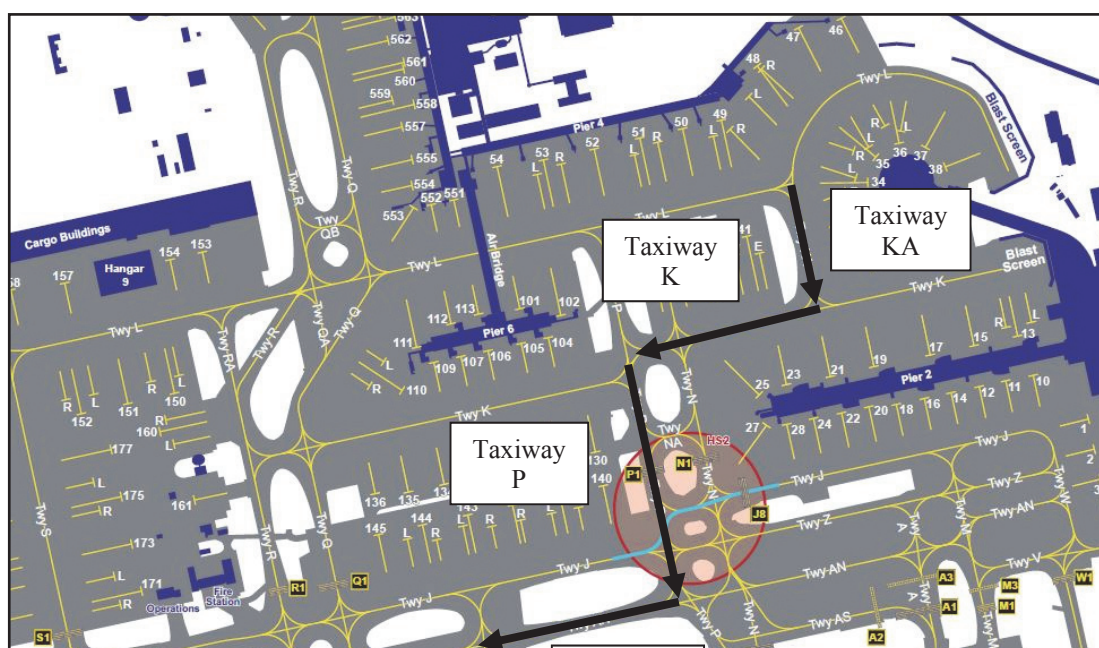


Figure 1

G-CKWC taxiway routing at LGW

The crew elected to perform a rolling takeoff. The tower controller noted that the aircraft did not appear to put on power or accelerate until at the Runway 26R landing threshold. The controller also saw that the aircraft did not appear to rotate until approximately abeam Taxiway FR as shown in Figure 2. The crew later recalled that there was not much runway remaining at lift-off.

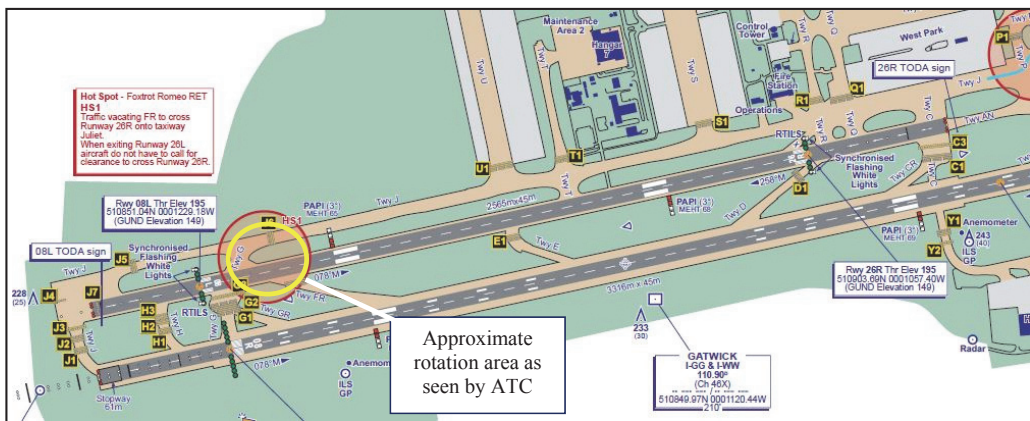


Figure 2

Full length of Runway 26R

Figure 3 shows where the aircraft takeoff performance was calculated from (TORA¹ 2,565 m) and where the takeoff actually commenced (TORA 2,140 m).

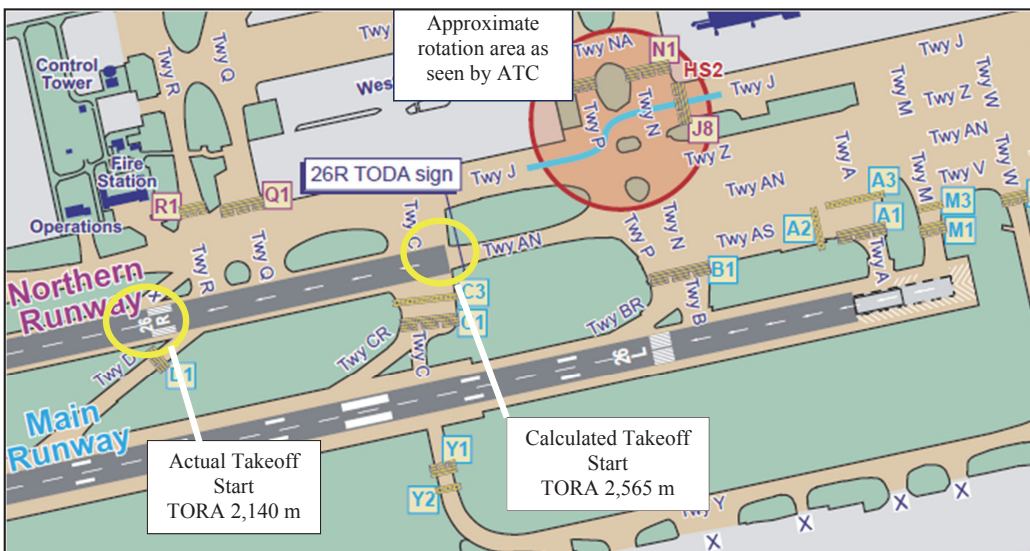


Figure 3

The calculated and actual takeoff start points

The tower controller filed a report, which was passed to the operator and subsequently upgraded to a Mandatory Occurrence Report (MOR)². After an evaluation of the flight data and the performance calculations, the operator submitted an MOR to the CAA. The AAIB was informed of the event by the CAA.

Footnote

¹ Takeoff run available (TORA) - the distance from the point on the surface of the aerodrome at which the aeroplane commences its takeoff run to the nearest point in the direction of takeoff at which the surface of the aerodrome is incapable of bearing the weight of the aeroplane under normal operating conditions.

² Mandatory occurrence report (MOR): an occurrence means any safety-related event which endangers or which, if not corrected or addressed, could endanger an aircraft, its occupants or any other person. See *Reporting of occurrences* later in this report.

Airfield information

LGW is a single runway airport although it does have a standby runway which can be used when the main runway is unavailable. The standby runway is used as a taxiway when not in use as a runway. The main and standby runways cannot be used at the same time as there is insufficient distance between them. There is a changeover period of approximately 15 minutes between using one of the runways and the other. During this period neither runway is available.

The use of the standby runway (08L/26R) at Gatwick is not common and occurs most frequently at night when the airport movements (takeoffs and landings) are reduced and work can be undertaken on the main runway. In 2017, movements on the standby runway accounted for only 1.3% of the total movements at the airport.

The Runway 26R landing threshold is displaced by 417 m from the start of the TORA due to obstacle clearance requirements for the approach. Takeoffs should be commenced from the beginning of the runway which is indicated by a white line. The start of the runway also has large centreline arrows showing the presence of a displaced landing threshold. The runway markings are shown at Figure 4.

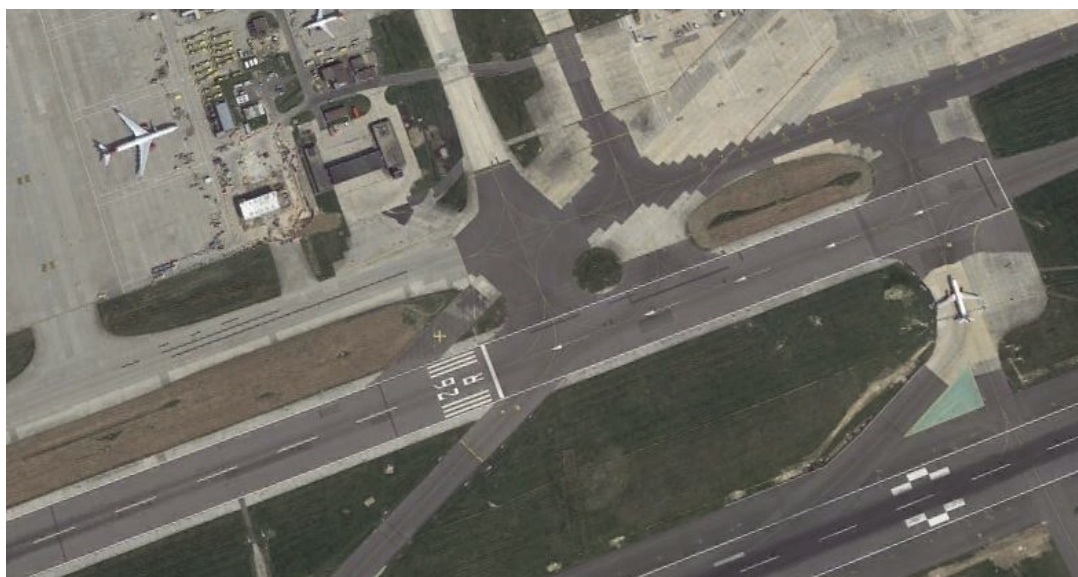


Figure 4

Image showing the runway markings © Google Earth

Runway 26R/08L has red edge lighting for the part of the runway before the displaced landing threshold and no centreline lights. This configuration is compliant with relevant regulations. The edge lights revert to white once past the displaced landing threshold. The area between the beginning of Runway 26R and the displaced threshold contains one bar and some centre lights of the approach lighting system. The displaced threshold has green threshold lights as well as a set of Runway Threshold Identification Lights (RTILS). RTILS consist of two synchronised white flashing lights, one at each end of the green threshold bar. The RTILS are angled for landing traffic and should not be visible to aircraft on the ground

at the beginning of the runway. Figure 5 shows the markings and lighting on Runway 26R shown from before the beginning of the runway.



Figure 5

View of the markings and lighting Runway 26R
(Photo courtesy of Gatwick Airport Limited)

Figure 6 shows the same view in darkness.



Figure 6

Start of Runway 26R at night
(Photo courtesy of Gatwick Airport Limited)

The entry to Runway 26R for departing traffic is along Taxiway AN from the Holding Points at P1 and N1 (as shown in Figure 3). This means that the aircraft must taxi in a straight line along AN which is on the same heading as the runway itself. This is an unusual arrangement for runway entry although it is compliant with relevant regulations. Pilots would be more used to entering the runway from a holding point adjacent to the runway, often with a 90° turn onto the runway centreline. The AN taxiway is approximately 250 m long before the aircraft reaches the white line indicating the start of the runway. In Figures 5 and 6 the green taxiway lights of AN are visible reaching and crossing the white line indicating the start of the runway.

After previous reported issues over many years with crews mis-identifying the start of the runway for takeoff, in the early 1990s³ LGW fitted a sign on the grass to the left of the beginning of the runway at the end of Taxiway AN to indicate the start of the TODA⁴ and the distance available from that point. The sign is covered when Runway 26R is not in use to avoid any confusion for pilots using Runway 26L. The sign is illuminated at night. None of the crew of G-CKWC recalled seeing the TODA sign even though it was illuminated.

The UK Aeronautical Information Publication (AIP) contains details on airports including Gatwick. Information in the AIP is used by commercial chart suppliers to produce the charts used by pilots in flight operation. The AIP includes a significant section of textual data which may be repeated by the chart suppliers in the data given to pilots in their commercial charts. In section 2.20, entitled '*Local Traffic Regulations*', subsection '*Runway and approach lights*' the AIP states:

*'Aircraft taking-off from Runway 26R **MUST NOT** commence their take-off run before reaching the **START OF TODA** information sign. This sign is located to the left of the runway, 417 m before the marked runway threshold.'*

There is no further information on the location from where aircraft should start their takeoff run.

Other reports

Information from Gatwick Airport indicated that there were at least four other incidents of aircraft not starting their takeoff roll at the beginning of the TORA on Runway 26R between September 2017 and the incident reported here. These incidents, which occurred to various operators other than the operator of G-CKWC, were recorded by the air traffic controllers at the airport.

Footnote

³ The investigation did not identify the exact date of installation.

⁴ Takeoff distance available (TODA) – the distance from the point on the surface of the aerodrome at which the aeroplane commences its takeoff run to the nearest obstacle in the direction of takeoff projecting above the surface of the aerodrome and capable of affecting the safety of the aeroplane, or TORA x 1.5, whichever is the less.

Crew report

The crew reported that the takeoff seemed normal although it did use the full runway distance. After departure both pilots commented that there was not much runway remaining at lift-off. Given the limiting length of the runway, the load had been reduced to allow takeoff, and therefore the crew were not surprised by the length of the runway used during the takeoff run and were unaware of any problem.

When asked specifically about what they saw at the beginning of Runway 26R the commander said that neither of the pilots could recall seeing anything that indicated they were in the wrong place nor did they see the TODA sign. The routing along Taxiway AN was dark and “the runway looked pitch black and the only thing we saw was the green lights”. He agreed that the crew were aware of the displaced threshold on Runway 26R but did not see the markings indicating the beginning of the runway.

The commander was familiar with Gatwick although he had rarely operated from Runway 26R.

Aircraft performance

The operator conducted an investigation which included analysis using recorded flight data and the B787 performance program used by the operator. Use of the performance program showed that, for the weather conditions on the night of the incident and the calculated aircraft weight of 223,813 kg, an accelerate stop distance of 2,564 m was required which is equal to the ASDA⁵ for the full length of Runway 26R.

From the position of the displaced landing threshold, the ASDA is 2,156 m. Had the aircraft suffered an engine failure just before V_1 and had the crew decided to stop, a runway overrun could have occurred. A calculation by the operator indicated that the aircraft was around 12,000 kg too heavy for the distance available. The airfield boundary fence is 2,250 m from the landing threshold of Runway 26R where the aircraft began its takeoff roll.

The operator also completed an analysis of the performance in the case of an engine failure at V_1 , followed by a continued takeoff. This showed that the accelerate-go⁶ distance was 2,354 m. From the displaced threshold of Runway 26R, the TODA is 2,295 m. The aircraft would have failed to meet the regulated takeoff performance criteria in both cases.

Assumptions are made in the calculation of regulated takeoff performance. Should actual circumstances be more favourable than the assumptions on any given takeoff, aircraft performance may be better than predicted. In this case, for example, allowance was made for a wet runway when it was damp, but no allowance was made for the fact that the runway

Footnote

⁵ Accelerate Stop Distance Available (ASDA) – the distance from the point on the surface of the aerodrome at which the aeroplane commences its takeoff run to the nearest point in the direction of takeoff at which the aeroplane cannot roll over the surface of the aerodrome and be brought to rest in an emergency without risk of accident.

⁶ Accelerate-go distance - the runway required to accelerate to V_1 with all engines operating at takeoff power, experience an engine failure at V_1 , and continue the takeoff on the remaining engine. The runway required includes the distance required to climb to 35 ft by which time V_2 speed must be attained.

is grooved or that the aircraft used a rolling takeoff technique. Each of these factors was likely to have had a beneficial effect, compared to the regulatory calculation, had the engine suffered an engine failure near V_1 .

Reporting of occurrences, accidents and serious incidents

Reporting of occurrences

Regulation (EU) 376/2014 is concerned with *'the reporting, analysis and follow-up of occurrences in civil aviation'*. Article 4, *'Mandatory Reporting'*, details requirements for the mandatory reporting of occurrences.

This event was reported internally by air traffic control personnel at Gatwick and later to the CAA. The internal report was passed by the Air Navigation Service Provider (ANSP) at Gatwick to the airport and the aircraft operators. The aircraft operator began an investigation into the event. The investigation showed that the aircraft had triggered a 'long lift-off' event in the company flight data monitoring program. Upon evaluation of flight data and the performance calculations, the operator upgraded the event to an MOR and submitted it to the CAA on 30 April 2018. The AAIB learned of the event on 14 May 2018 from the CAA.

Reporting of accidents and serious incidents

The reporting requirements for accidents and serious incidents flow from provisions within Annex 13 to The Convention on International Civil Aviation (Chicago Convention) and are brought into UK law through Regulation (EU) 996/2010 and The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 2018.

Annex 13, Attachment C defines a serious incident as:

'involving circumstances indicating that there was a high probability of an accident.'

It gives a list of examples of serious incidents which includes:

'Gross failure to achieve predicted performance during take-off or initial climb.'

These definitions are mirrored in EU 996/2010 and the UK Regulations 2018.

The relationship between EU 376/2014 and EU 996/2010 is shown by Recital (3) to EU 376/2014, which states:

'This regulation should not interfere with ... accident and incident investigations managed by national safety investigation authorities.'

And:

'In the event of an accident or a serious incident, notification of the occurrence is also subject to EU 996/2010.'

EU 996/2010, Article 9, *Obligation to notify accidents and serious incidents* states:

'Any person involved who has knowledge of the occurrence of an accident or serious incident shall notify without delay the competent safety investigation authority of the State of Occurrence thereof.'

This event involved a gross failure of the aircraft to achieve its predicted takeoff performance and would therefore have been reportable under the provisions of EU 996/2010 had it been recognised as a serious incident at the time.

Civil Aviation Publication (CAP) 493, *The Manual of Air Traffic Services (MATS) Part 1*, contains in Section 6, Chapter 3 information on how ANSPs should meet their obligations to report accidents and serious incidents. At the time of this incident to G-CKWC, following an accident or serious incident at an aerodrome, the senior controller was required to telephone the Area Control Centre (ACC) Watch Manager and, subsequently, submit an MOR. On receiving a report of an accident or serious incident, the Operational Supervisor at an ACC was required to telephone the AAIB. As a result of an AAIB Special Bulletin into another serious incident⁷ in 2017, a Supplementary Instruction to MATS Part 1 was issued by the CAA on 15 June 2018, which implemented changes to the initial reporting action procedures for air traffic control units. With effect from 14 August 2018, the senior controller at an aerodrome is also required to telephone the AAIB to report a serious incident. In circumstances where there is doubt about whether or not an occurrence should be classified as a serious incident, and therefore reported under the provisions of EU 996/2010, the AAIB recommends that it is reported. Further information is available at: <https://www.gov.uk/guidance/report-an-aircraft-accident-or-serious-incident>.

Following this serious incident, the ANSP at Gatwick committed to raising awareness with their staff about their obligations to report serious incidents to the AAIB. The ANSP commented that these measures, along with the fact that the amended MATS Part 1 includes examples of serious incidents, would help ATCOs observing occurrences to assess whether they should be reported under the provisions of EU 996/2010.

Other information

The airport operator set up a working group to look at issues associated with Runway 26R after a number of incidents in 2017. The working group involves airlines, ATC as well as airside management from the airport. The remit covers lighting, markings, procedures and publications.

Following this serious incident, the airport operator and ANSP introduced further measures to reduce the likelihood that aircraft would begin their takeoff from the incorrect point on Runway 26R. These measures, which are described in detail later in the report, included a Safety Notice (Figure 7) and revised runway markings between the beginning of the TORA and the displaced threshold (Figure 8).

Footnote

⁷ AAIB Special Bulletin S2/2017 C-FWGH.



Figure 7

Safety Notice issued by Gatwick and the ANSP

At the end of July 2018, Gatwick Airport also published the Gatwick Operators Briefing Pack, designed to provide a briefing to operators on air traffic control operations at Gatwick. The pack includes information on operations on the secondary runway. It was distributed to operators at Gatwick and would be sent to any new operators at the airport.

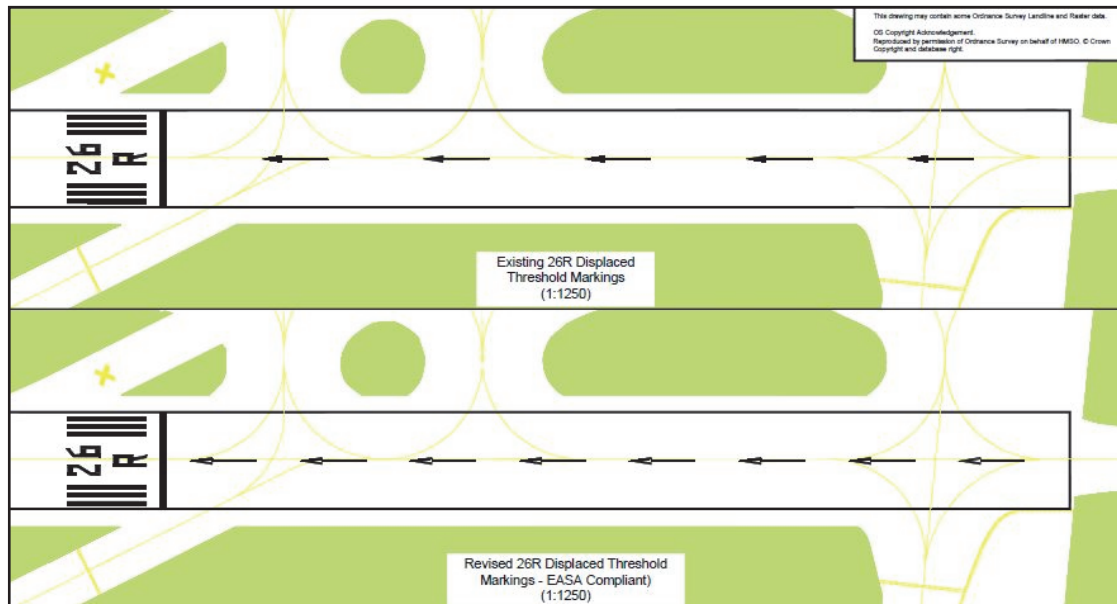


Figure 8

Revised markings Runway 26R

Analysis

The crew operating G-CKWC were familiar with Gatwick Airport but had operated from Runway 26R infrequently. They did not identify the beginning of the runway and taxied forward to the landing threshold before beginning their takeoff roll. This decreased the takeoff distance available and meant that the aircraft did not meet regulated takeoff performance requirements for its actual takeoff weight.

The distance available for the takeoff would have been insufficient (based on regulations) had an aircraft engine failed before V_1 and had the crew decided to stop. The actual accelerate stop distance required was 2,564 m, whereas the airfield boundary is approximately 2,250 m from the point at which G-CWKC began its takeoff roll. Runway overrun is a type of runway excursion, which is one of the CAA's 'Significant Seven' risks to commercial air transport.

The distance available for takeoff was also insufficient to meet regulatory requirements for obstacle clearance should the aircraft have continued the takeoff after an engine failure at V_1 .

This was not the first time that an aircraft had begun its takeoff roll from the landing threshold. Gatwick reports indicated there had been at least four incidents, involving multiple operators, between September 2017 and this incident involving G-CKWC. Failure of crews to identify the start of Runway 26R, especially at night, presents Gatwick with a potentially significant hazard to operations. The airport, aware of the risk, put in place several actions to improve the awareness of crews about the location of the beginning of the runway. They also committed to repainting the markings before the landing threshold.

Conclusion

The aircraft began its takeoff roll from the displaced threshold of Runway 26R rather than the beginning of the runway. The crew did not identify the beginning of the runway and instead taxied the aircraft forward to the landing threshold. A combination of an unusual straight-line runway entry, a perceived lack of lighting in the pre-threshold area and the bright threshold lights ahead contributed to the crew not identifying the beginning of the runway.

From the point at which the aircraft began its takeoff roll, its performance did not meet regulatory requirements for both stopping and continuing should an engine have failed close to V_1 . The risks in both cases were significant to the aircraft and its occupants.

Safety Action

Following this serious incident, the following safety action was taken by the airport operator and/or ANSP:

- An amendment was made to the NOTAM used to promulgate the closure of the main runway and the use of Runway 08L/26R. The amended NOTAM included wording describing the position from where the takeoff roll should commence.
- A Safety Notice was published on 13 April 2018 to provide further information for pilots on the location on Runway 26R from where they can commence their takeoff. This Safety Notice was subsequently amended and reissued to include a photograph with the airfield lighting illuminated. This amended notice is shown at Figure 7.
- A review was undertaken of the markings on the standby runway before the displaced landing threshold on both 08L and 26R which revealed that they were not EASA compliant. The airport planned remedial work for September 2018 which would increase the number of arrows painted on the centreline before the displaced threshold as shown at Figure 8.
- The airport operator agreed to investigate other paint schemes that may increase awareness of the location of the beginning of the runway. These might include an increase in the thickness of the white line which indicates the start of the runway so that it is easier to see at night, and some yellow taxiway edge markings to make the junction between AN and the start of the runway more obvious.
- The airport operator would investigate whether it would be possible to use an alternative holding point when Runway 26R is in use to allow for a more familiar 90° turn to line up onto the runway. This option would present significant challenges for the airport in terms of taxiway lighting and taxi routings which may need significant work in the longer term.

- The airport operator would review the wording of the AIP to see if more information could be included on the location of the beginning of the runway, how pilots might identify where they should begin their takeoff roll, and whether information from the Safety Notice could be included.
- The ANSP decided to raise awareness with staff about their obligation to report serious incidents to the AAIB.