

# SAFETY FOCUS

2013/02



## “TOES OFF BRAKES” INADVERTENT APPLICATION OF BRAKES DURING TAKE-OFF ROLL

### INTRODUCTION

The purpose of this BASP Safety Focus is to raise awareness of the potential hazard of mistakenly applying the brakes during the take-off roll. Over the past few years there has been a major fatal accident and a serious incident, where the reports concluded that this was one of the main factors.

### BACKGROUND

In the first event a Yakovlev 42 was destroyed in September 2011 when it crashed about 1 km from the end of the runway at Yaroslavl Airport in Russia, killing 44 of the 45 on board. Take-off was initiated at nominal engine thrust and at a speed of 185 km/h the nose wheel lifted off the runway but the pitch angle did not increase; shortly afterwards the Indicated Air Speed (IAS) momentarily decreased. The crew used additional elevator and trimmed the stabiliser nose up but the aircraft still did not become airborne. It travelled past the end of the runway onto the grass, finally lifting off about 400 m past the threshold. The aircraft struck a localiser antenna and rapidly attained a 20 degrees nose-up attitude reaching a height of 5-6 metres. The aircraft then rolled left, struck the ground and broke up.

The report concluded that the Captain had over 1,300 hours on the Yakovlev 42 aircraft. However, he flew the smaller Yakovlev 40 aircraft on which he had more experience; the same applied to the Co-pilot. Both aircraft have a different method of braking and the investigation concluded that the Captain or Co-pilot probably held his feet on the brake pedals during take-off roll in a similar manner that he had used on the Yakovlev 40. Thus, in the accident, he inadvertently activated the brakes while pulling the controls to lift the nose for take-off.

According to the Chief of the Investigative Commission: "the immediate cause of the Yak-42 plane crash was the flight crew's erroneous actions, namely the pilot stepping on the brake pedals before raising the nose wheel because of the wrong position of the feet on the brake platforms during take-off".



The second event happened in February 2011 at RAF Northolt, London, and involved a German registered Gulfstream G150. A take-off was attempted from Runway 25. When the Commander pulled the control column back to rotate at  $V_R$ , and subsequently fully back, the aircraft only pitched up to  $1^\circ$ . The take-off was rejected just before  $V_2$ , full braking was applied and the aircraft came to a stop at the end of the paved surface. A fire broke out around the left main wheels which was suppressed quickly by the Rescue and Fire Fighting Service. The flight data showed that the aircraft's acceleration during the take-off roll was below normal but the investigation did not reveal any technical fault with the aircraft. The most likely explanation for the lack of acceleration and rotation was that the brakes were being applied during the take-off, probably as a result of inadvertent braking application by the Commander, which caused a reduction in acceleration and a nose-down pitching moment sufficient to prevent the aircraft from rotating. However, it could not be ruled out that another factor had caused partial brake operation. As a result the aircraft suffered fire damage to the left brakes and tyres, and the left and right brakes seized.

Tests showed that a pedal angle of only  $2^\circ$  was required to produce a brake pressure of 2,620 kPa (380 psi), which resulted in a 6.3 mm deflection of the upper part of the pedal. Thus, the pedals need only a relatively small deflection to produce the amount of brake pressure required to cause the reduced acceleration and prevent rotation. The manufacturer's test pilots noted that, during taxi, by resting the feet on the pedals some brake pressure could be applied, which was almost imperceptible but could be recognised by the reduction in expected taxi speed.

It is interesting to note that neither pilot noticed the lack of normal acceleration of the aircraft, even though the acceleration had reduced to nearly zero at one point. A particular aircraft's performance will be different for every take-off and this demonstrates that pilots are not always able to judge how the take-off is progressing.

As the most likely remaining explanation for the lack of acceleration and rotation in both of the events was that pressure was inadvertently applied to the brakes pedals by one of the pilots, it is felt that operators and pilots should be made aware of these incidents. They should make careful note of where they rest their feet during the take-off roll, especially if the aircraft uses differential braking for ground manoeuvring.



## **ACTION TO BE TAKEN**

Flight crew should be aware that:

- Holding the toes clear of the upper part of the pedals while placing the heels on the rudder bar allows the possibility that some pressure could be applied to the brake pedal without the pilot being conscious of it;
- Brake pedals need only a relatively small deflection to produce the amount of brake pressure required to cause a reduced acceleration and prevent rotation;
- The correct steering and braking techniques for each different aircraft type for ground manoeuvring and the take-off roll must be studied and practised by pilots;
- Pilots' toes should not be able to touch the brake pedals during the take-off roll; and
- A particular aircraft's performance will be different for every take-off and this demonstrates that pilots are not always able to judge how the take-off is progressing – so crew should attempt to gain some appreciation of their aircraft's acceleration at differing weights.

## **FURTHER INFORMATION**

AAIB:

[Bulletin 12/2011](#)

FSF Aviation Safety Network:

[Yakovlev 42 Accident Report](#)

Transportation Safety Board Canada:

[Boeing 747 Investigation Report](#)

## **QUERIES**

Any queries or further guidance required as a result of this communication should be addressed to CAA Flight Operations Policy at the following e-mail address: [FOP.Admin@caa.co.uk](mailto:FOP.Admin@caa.co.uk).

## **CANCELLATION**

This Safety Focus shall remain in force until 31 October 2013.