SUMMARY

At 1539 hrs on 21 July 2017, a Boeing 737-800 took off from Belfast International Airport (BFS) with insufficient power to meet regulated performance requirements. The aircraft struck a supplementary runway approach light, which was 36 cm tall and 29 m beyond the end of the takeoff runway.

An outside air temperature (OAT) of -52°C had been entered into the Flight Management Computer (FMC) instead of the actual OAT of 16°C. This, together with the correctly calculated assumed temperature thrust reduction of 48°C[1], meant the aircraft engines were delivering only 60% of their maximum rated thrust. The low acceleration of the aircraft was not recognised by the crew until the aircraft was rapidly approaching the end of the runway. The aircraft rotated at the extreme end of the runway and climbed away at a very low rate. The crew did not apply full thrust until the aircraft was approximately 4 km from the end of the runway, at around 800 ft aal.

There was no damage to the aircraft, which continued its flight to Corfu, Greece without further incident. However, it was only the benign nature of the runway clearway and terrain elevation beyond, and the lack of obstacles in the climb-out path which allowed the aircraft to climb away without further collision after it struck the runway light. Had an engine failed at a critical moment during the takeoff, the consequences could have been catastrophic.

The investigation found the following causal factors for this serious incident:

1. An incorrect OAT was entered into the FMC, which caused the FMC to calculate an N_1[2] setting for takeoff which was significantly below that required for the aircraft weight and environmental conditions.

2. The incorrect OAT was not identified subsequently by the operating crew.

3. The abnormal acceleration during the takeoff run was not identified until the aircraft was rapidly approaching the end of the runway, and no action was taken to either reject the takeoff or increase engine thrust.

The investigation found the following contributory factors for this serious incident:

1. The aircraft's FMC did not have the capability to alert the flight crew to the fact that they had entered the incorrect OAT into the FMC, although this capability existed in a later FMC software standard available at the time.

2. The Electronic Flight Bags (EFB) did not display N_1 on their performance application (some applications do), which meant that the crew could not verify the FMC-calculated N_1 against an independently-calculated value.

[1] See 1.1.3 for further information

[2] N_1: engine fan or low pressure compressor speed.

3. The crew were unlikely to detect the abnormally low acceleration because of normal limitations in human performance.

The investigation identified other examples of accidents or serious incidents where there was a gross failure of an aircraft to achieve its expected takeoff performance, and found that technical solutions to address this serious safety issue are now feasible.

AAIB Special Bulletin S2/2017[3], published on 20 September 2017, provided initial information on the circumstances of this serious incident, clarification about the reporting of accidents and serious incidents, and made two safety recommendations related to FMC software updates. In this report, the AAIB makes four safety recommendations:

one supersedes a recommendation made in Special Bulletin S2/2017;
one concerns procedures to verify engine takeoff power settings; and
two concern the development of Takeoff Acceleration Monitoring Systems.

[3] https://assets.publishing.service.gov.uk/media/59c2302140f0b60d848fd9ad/AAIB_S2-2017_C-FWGH.pdf [accessed September 2018].