Boeing 737-86J, C-FWGH	On takeoff from Belfast International Airport	21 July 2017	Serious Incident

Safety Recommendation 2017-016

It is recommended that the Federal Aviation Administration, mandate the use of Flight Management Computer software revision U12.0, or later revision incorporating the outside air temperature crosscheck, for operators of Boeing 737 Next Generation aircraft.

Date Safety Recommendation made: 20 September 2017

LATEST RESPONSE

Response received: 27 November 2018

In order to evaluate Safety Recommendation 17.100, we conducted research to ascertain the extent to which FMC software version U12 is already in use among 737 Next Generation (NG) operators, any reasons operators may have for continuing to use older software versions, and what actions may have already been taken to advise operators of the issue. In order to gather this information, we coordinated with the FAA Advanced Avionics & Airborne Software System Oversight Division and the individual Principal Avionics Inspectors (PAI) conducting oversight of various Boeing 737 NG operators.

Based on the research conducted, we do not concur with Safety Recommendation 17.100.

There are currently four FMC software versions in use among United States (US) Boeing 737 NG operators: U10.8A, U11, U12, and U13. U12 and U13 account for the vast majority (approximately 75%) of aircraft operating under part 121 in the US. Like any type of software, each FMC version may have specific hardware compatibilities, added functions and capabilities, fixes to bugs from previous versions, and bugs or deficiencies of its own. An operator's decision on which software version or versions to use is a programmatic one which typically includes these characteristics, as well as operational considerations such as fleet commonality, procedural changes, training, and resources. While some operators upgraded their entire NG fleets to U12 or U13, others are operating with mixed software versions, or made the conscious decision not to install U12 at all. The reasons vary from operator to operator.

For example, one part 121 major airline operates approximately 28 percent of its NG fleet with U11 software installed, due to compatibility issues with onboard equipment in use on those aircraft. In particular, the HGS5200 head-up displays in this fleet are not compatible with software later than U11; a mandate for the use of U12 would require retrofit of these and other onboard systems. While the remaining NG aircraft in this airline's fleet are compatible with U12, they chose not to install U12 in those aircraft, due to issues with the software "locking up." As a result, this operator continued to use older software until U13, which contained a fix for these issues, became available. The operator then installed U13 on all compatible aircraft in the fleet.

Another part 121 airline decided to operate U11 software across its fleet due to "service issues" with the U12 software. This operator plans to upgrade its fleet to a later version when these issues are addressed and the use of the updated version will be more beneficial for their operations.

As a result of this assessment, the FAA concludes that operators using older software are doing so based on a comparison of benefits and drawbacks. The FAA mandating use of U12 places a burden on the operator that outweighs any safety benefit gained.

Boeing took steps to address and publicize the erroneous OAT issue. At the time of the incident that precipitated Safety Recommendation 17.100, Boeing issued a Service Bulletin advising operators of the potential hazard, and recommending installation of U12 software by January 2019. In December 2017, as

a result of the AAIB recommendation, Boeing conducted a Safety Review Board which determined that the existing measures were adequate to address the hazard.

AAIB Assessment – Superceded - Closed

RESPONSE HISTORY

Response received: 11 December 2017

The FAA has assigned this recommendation to its Flight Technologies and Procedures Division/Flight Operations Branch. To that end, the point of contact has conducted preliminary coordination with the FAA's Aircraft Evaluation Group (AEG) team responsible for Boeing 737 Next Generation aircraft. This coordination has revealed that there may be hardware compatibility, fleet compatibility, and cost implications for some 737 operators that are currently using pre-U 12.0 software revisions. These implications must be understood and considered before we can make a determination about the recommended mandate. The Flight Technologies and Procedures Division/Flight Operations Branch will coordinate further with AEG as well as the individual Certificate Management Offices to determine if and to what extent the various 737 operators would be burdened if the U12.0 software revision were to be mandated as recommended. We will provide a more updated response by December 17, 2018.

AAIB Assessment – Partially Adequate - Open

(SRIS Reference: GB.SIA-2017-0016

Boeing 737-86J, C-FWGH	On takeoff from Belfast International Airport	21 July 2017	Serious Incident

Safety Recommendation 2017-017

It is recommended that The Boeing Company promulgates to all 737 operators the information contained within this Special Bulletin and reminds them of previous similar occurrences reported in the Boeing 737 Flight Crew Operations Manual Bulletin dated December 2014.

Date Safety Recommendation made: 20 September 2017

LATEST RESPONSE

Response received: 15 January 2018

The Boeing Company recently completed the FAA's internal Safety Process which culminated with this event being presented at the FAA's Safety Review Board (SRB). The SRB consists of 737 Program Executive and Senior managers who have voting power to determine if an issue is considered Safety or not. (A single vote for safety is all that is needed to classify an issue as Safety, a unanimous decision is not required). A similar event had previously been presented to the Board where a determination of 'Safety' had been made. Mitigating action consisted of the release of the Service Bulletin. As such, no further action is anticipated resulting from the latest event under investigation.

However, it was agreed that a Multi Operator Message should be sent to all 737 operators to remind operators of this issue, the associated Service Bulletin and the time remaining to install the U12 FMC update and BP15 Displays update.

In addition, the FAA plans to discuss this issue and remind operators of the existing Flight Operations Technical Bulletin at the January Fleet Team Call.

AAIB Assessment – Partially Adequate - Open

RESPONSE HISTORY

N/A

(SRIS Reference: GB.SIA-2017-0017)

Safety Recommendation 2018-012

It is recommended that the Federal Aviation Administration mandate the use of Flight Management Computer OPS software revision U12.0, or later, and the Common Display System Block Point 15 update where this is required, to enable the outside air temperature crosscheck on all applicable Boeing 737 aircraft.

Date Safety Recommendation made: 14 November 2018

LATEST RESPONSE

Response received: 23 April 2019

To evaluate Safety Recommendation 18.175, the FAA conducted research to ascertain the relationship between Common Display System Block Point 15 (BP15) and Flight Management Computer OPS software revision U12.0 (OPS U12). The work was coordinated with the Transport Aircraft Seattle Aircraft Evaluation Group. Based on the research conducted, and the previous assessment of Safety Recommendation 17.100, the FAA does not concur with Safety Recommendation 18.175.

OPS U12.0 was released in December 2015, and BP15 was subsequently released in October 2016. While OPS U12 and BP15 pertain to two different onboard systems and BP15 is not a prerequisite for OPS U12 installation, the two software versions are co-dependent in that BP15 solves some compatibility issues between OPS U12 and previous Block Point versions. For example, the automated outside air temperature crosscheck feature included in UPS U12 is not compatible with previous Block Point versions and is, therefore, only available on those aircraft that also have BP15 installed. This relationship is what precipitated safety recommendation 18.175 to supersede the very similar 17.100.

Safety Recommendation 18.175 helps to underscore the many interdependency and compatibility considerations that must be taken by operators when considering software and hardware upgrades. The FAA maintains that an operator's decisions on when and how to install software updates are programmatic in nature and must be based upon many interrelated factors. For these reasons, and those stated in the previous response to Safety Recommendation 17.100, the FAA reiterates its assessment that the burden placed on operators by the recommended mandates would likely outweigh any safety benefit gained. The FAA further assesses that a simple manual reasonability crosscheck of takeoff settings and speeds prior to departure is still an effective safeguard against incorrect takeoff data.

The FAA considers it has effectively addressed this safety recommendation and considers its actions complete.

AAIB Assessment – Not Adequate - Closed

RESPONSE HISTORY

N/A

(SRIS Reference: GB.SIA-2018-0012)

Boeing 737-86J, C-FWGH	On takeoff from Belfast International Airport	21 July 2017	Serious Incident

Safety Recommendation 2018-013

It is recommended that the Boeing Commercial Airplanes give guidance to operators of Boeing 737 aircraft on how they might verify the FMC-calculated value of N1 against an independently-calculated value.

Date Safety Recommendation made: 14 November 2018

LATEST RESPONSE

Response received: 13 February 2019

Boeing agrees with this recommendation and has recently published guidance in the enclosure B) FOTB. This guidance is intended to reduce takeoff performance errors that are introduced either by dispatch and load planning, automated ground-based systems (such as weather data), or pilot data entry errors.

This guidance is applicable for all Boeing airplane models including all models of the 737.

Specific guidance as applicable for the safety recommendation (verification of the FMC calculated N1 value) is outlined on page 5 of the FOTB.

AAIB Assessment – Adequate - Closed

RESPONSE HISTORY

N/A

(SRIS Reference: GB.SIA-2018-0013)

Boeing 737-86J, C-FWGH	On takeoff from Belfast International Airport	21 July 2017	Serious Incident

Safety Recommendation 2018-014

It is recommended that the European Aviation Safety Agency, in conjunction with the Federal Aviation Administration, sponsor the development of technical specifications and, subsequently, develop certification standards for a Takeoff Acceleration Monitoring System which will alert the crew of an aircraft to abnormally low acceleration during takeoff.

Date Safety Recommendation made: 14 November 2018

LATEST RESPONSE

Response received: 8 February 2019

The safety issue "Entry of aircraft performance data" was included in the Agency's safety risk portfolio commercial air transport fixed-wing in 2016 {link).

To reduce the risks, EASA issued a Safety Information Bulletin {SIB) "Use of Erroneous Parameters at Take-off' to alert operators and flight crew to the safety issue and to recommend the implementation of operational mitigation measures (published in February 2016: https://ad.easa.europa.eu/ad/2016-02).

The effectiveness of the SIB 2016-02 is being evaluated with the support of the EASA Advisory Bodies composed of competent authorities and industry (consultation February/March 2019).

The outcome will be used by EASA to decide whether additional means of mitigating the safety risk should be assessed; this may include the use of Takeoff Acceleration Monitoring System (TAMS).

EASA will liaise with FAA on this matter.

AAIB Assessment – Not Adequate - Open

RESPONSE HISTORY

N/A

(SRIS Reference: GB.SIA-2018-0014)

Boeing 737-86J, C-FWGH	On takeoff from Belfast International Airport	21 July 2017	Serious Incident

Safety Recommendation 2018-015

It is recommended that the International Civil Aviation Organization note the conclusions of this report and introduce provisions addressing Takeoff Acceleration Monitoring Systems.

Date Safety Recommendation made: 14 November 2018

LATEST RESPONSE

Response received: 1 March 2019

With respect to the above-mentioned safety recommendation, this subject will be referred to the Flight Operations Panel Working Group for consideration during their next meeting scheduled for the end of April 2019.

I trust that the foregoing information meets the intent of the safety recommendation of the United Kingdom Air Accidents Branch.

AAIB Assessment – Partially Adequate - Open

RESPONSE HISTORY

N/A

(SRIS Reference: GB.SIA-2018-0015)