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AAIB Safety Recommendations

Marcus Costa
Chief Accident Investigation Section
Interational Civil Aviation Organization
Canada

File Ref: EW/C2015/10/01

Date: 6 October 2016

Dear Mr Costa,

SAFETY RECOMMENDATION NUMBER 2016-055

In accordance with ICAO Annex 13, Chapter 6 para 6.9, please find attached the AAIB report on the accident to Beech B200 Super King Air, G-BYCP near Chigwell, Essex on 3 October 2015

The report will be published in AAIB Bulletin 10/2016 on Thursday 13 October 2016 and it contains three new Safety Recommendations, two of which are addressed to ICAO.

Your attention is also drawn to Regulation 14 of The UK Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996, and EU Regulation 996/2010 Article 18. We will be pleased to receive your acknowledgement of receipt and subsequently your response to the recommendations within 90 days, in accordance with Article 18 of EU Regulation 996/2010. Shortly after the Investigator-in-Charge has assessed the response, the response text will be included on the European Safety Recommendation Information System (SRIS) and on the AAIB's website. Please respond in electronic format if possible to investigations@aaib.gov.uk and quote the recommendation numbers in all correspondence.

Yours sincerely,

Philip Sleight
Acting Deputy Chief Inspector of Air Accidents
for Chief Inspector of Air Accidents

ACCIDENT

Aircraft Type and Registration:	Beech B200 Super King Air, G-BYCP
No & Type of Engines:	2 Pratt & Whitney Canada PT6A-42 turboprop engines
Year of Manufacture:	1981 (Serial no: BB-966)
Date & Time (UTC):	3 October 2015 at 0920 hrs
Location:	Near Chigwell, Essex
Type of Flight:	Non-commercial
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Fatal) Passengers - 1 (Fatal)
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	40 years
Commander's Flying Experience:	1,941 hours (of which 162 hours were on type) Last 90 days - 61 hours Last 28 days - 50 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft was climbing through approximately 750 ft amsl after takeoff when it began to turn right. It continued to climb in the turn until it reached approximately 875 ft amsl when it began to descend. The descent continued until the aircraft struck some trees at the edge of a field, approximately 1.8 nm southwest of the aerodrome. The evidence available was consistent with a loss of aircraft control in Instrument Meteorological Conditions (IMC), but this could not be concluded unequivocally because of a lack of evidence from within the cockpit. However, it is possible the pilot became incapacitated and the additional crew member was unable to recover the aircraft in the height available.

Three Safety Recommendations are made regarding the fitment of Terrain Awareness and Warning Systems (TAWS).

History of the flight

G-BYCP was planned to operate a non-commercial flight from Stapleford Aerodrome to RAF Brize Norton with two company employees on board (including the pilot) to pick up two passengers for onward travel. The pilot (the aircraft commander) held a Commercial Pilot's Licence (CPL) and occupied the left seat and another pilot, who held an Airline Transport Pilot's Licence (ATPL), occupied the right. The second occupant worked for the operator of G-BYCP but his licence was valid on Bombardier Challenger 300 and Embraer ERJ 135/145 aircraft and not on the King Air.

TAWS

The simulator trial and TAWS modelling suggested that, had the aircraft been fitted with a Class B TAWS, the circumstances would have satisfied system criteria to generate alerts indicating that the aircraft was descending after takeoff and, separately, had an excessive rate of descent. In a class A TAWS installation, alert criteria would most likely have been satisfied in relation to the bank angle and also for an excessive closure rate with the terrain. System logic would probably have prioritised particular alerts and supressed others, and the radar data available was not of sufficient fidelity to establish the order of alerts that would actually have been triggered. However, it was concluded that, had either class of TAWS been fitted, the crew would probably have been alerted to the fact that the flight path was deviating from the norm at an altitude high enough to allow the aircraft to be recovered to safe flight. This conclusion was supported by the simulator trial in which terrain contact was avoided by appropriate recovery action up to and including the point where the "PULL UP" alert was triggered.

Currently, within the EU, certified TAWS are not required for this category of aeroplane used commercially, unlike the current rules for regulators such as the FAA and Transport Canada which also address privately operated aeroplanes. Further, the draft opinion within the EASA's NPA on this subject, although affecting new build aeroplanes (those issued with individual certificate of airworthiness after 1 January 2019) would exclude aeroplanes currently in service.

The AAIB survey of six commercial UK King Air operators showed that the majority of such aeroplanes were not fitted with certified TAWS, nor were any operators planning on retrofitting their fleets. Non-certified terrain awareness solutions do not offer the same level of protection or mechanisms for alerting pilots, such as aural alerts, that are required on certified units. In this accident, it is likely that a certified TAWS system would have alerted the crew to the situation in time to change the outcome. Therefore, to provide protection against inadvertent flight into terrain for this class of aeroplane, whether operated privately or commercially, the following three Safety Recommendations are made:

Safety Recommendation 2016-055

It is recommended that the European Aviation Safety Agency require all in-service and future turbine aircraft with a Maximum Certificated Takeoff Mass of 5,700 kg or less and with a maximum operational passenger seating configuration of between six and nine passengers to be fitted with, as a minimum standard, a Class B Terrain Awareness and Warning System certified to ETSO-C151b.

Safety Recommendation 2016-056

It is recommended that the International Civil Aviation Organisation revise Annex 6 to the Convention on International Civil Aviation, Part 1 (International Commercial Air Transport – Aeroplanes) to upgrade recommendation 6.15.5 [carriage of TAWS on turbine aeroplanes with a Maximum Certificated Takeoff Mass of 5,700 kg or less and authorised to carry more than five but not more than nine passengers] to a standard.

Safety Recommendation 2016-057

It is recommended that the International Civil Aviation Organisation revise Annex 6 to the Convention on International Civil Aviation, Part 2 (International General Aviation – Aeroplanes) to upgrade recommendation 2.4.11.2 [carriage of TAWS on turbine aeroplanes with a Maximum Certificated Takeoff Mass of 5,700 kg or less and authorised to carry more than five but not more than nine passengers] to a standard.

Risk control 'barriers' to prevent loss of aircraft control and terrain impact

Risk control barriers in place to try and prevent an unintentional deviation from normal in-flight parameters include:

a. Six-monthly medical examinations for pilots over 40 years old carrying out single-pilot commercial operations carrying passengers.
b. Proficiency in manual handling skills
c. Adherence to automation policy.
d. Flight crew detect and recognise the mishandling via monitoring.
e. Flight crew detect and recognise the mishandling via automated alerts.
f. Flight crew correct the mishandling.
g. Automated features limit the deviation from normal parameters.

Barrier a aimed to reduce the likelihood that a pilot operating in a single-pilot environment will become medically incapacitated at the controls by requiring that pilot to undergo more frequent medical examinations than a pilot operating in a multi-pilot environment. This barrier cannot prevent incapacitation, however, especially when some medical conditions are difficult to predict or occur spontaneously.

Barrier c required the autopilot to be engaged above 1,000 ft agl after takeoff and, because it is likely that the departure was flown manually, the automation policy did not operate as an effective barrier to loss of control during this flight.

Barriers e and g were ineffective because the aircraft was not fitted – and was not required to be fitted – with TAWS, or automated features to limit the deviation of in-flight parameters. Recommendations 2016-055 to 2016-057 are intended to make barrier e

more effective because it is likely in this case that TAWS would have alerted the pilot and/or additional crew member to the initial deviation from the expected flightpath. If the pilot was incapacitated, this might have triggered an earlier response from the additional crew member.

Barriers b, d and f relate to pilot manual handling skills and the ability to detect, recognise and correct any mishandling. These barriers were compromised either because the pilot had insufficient skill to maintain control of his aircraft or because he became incapacitated.

Risk control barriers intended to try and prevent an unintended deviation from normal in-flight parameters leading to loss of control and impact with terrain include:

h. ATCO identifies the issue and alerts the flight crew.

i. Automated systems assist aircraft recovery.

j. Flight crew perform upset recovery procedure in response to monitoring and/or automated warnings.

k. TAWS alerts flight crew to inadequate terrain separation.

l. Flight crew carry out terrain avoidance manoeuvre in response to visual, ATCO or TAWS warning.

m. Flight crew detect and recognise the potential conflict visually.

Barriers h, i and k were ineffective during this flight because no ATC service was provided at the aerodrome, and the aircraft was not fitted with relevant automated systems or TAWS. Barriers j and l relied upon monitoring and visual assessment because of the lack of automated warnings, ATC or TAWS. Safety Recommendations 2016-055 to 2016-057 are intended to strengthen barriers j, k and l because it was likely that TAWS alerts would have been triggered in time for the aircraft to be recovered to safe flight. It was likely that the late change in aircraft attitude was in response to the monitoring of flight instruments or a visual assessment of ground features appearing as the aircraft descended. If so, the recovery manoeuvre could not be completed in the height available and barrier m was also ineffective.

Conclusion

Examination of the powerplants showed that they were probably producing medium to high power at impact. There was contradictory evidence as to whether or not the left inboard flap was fully extended at impact but it was concluded that the aircraft would have been controllable even if there had been a flap asymmetry. The possibility of a pre-accident control restriction could not be discounted, although the late change of aircraft attitude showed that, had there been a restriction, it cleared itself.

The evidence available suggested a loss of aircraft control while in IMC followed by an unsuccessful attempt to recover the aircraft to safe flight. It is possible that the pilot lost control through a lack of skill but this seemed highly unlikely given that he was properly

licensed and had just completed an extensive period of supervised training. Incapacitation of the pilot, followed by an attempted recovery by the additional crew member, was a possibility consistent with the evidence and supported by the post-mortem report. Without direct evidence from within the cockpit, it could not be stated unequivocally that the pilot became incapacitated. Likewise, loss of control due to a lack of skill, control restriction or distraction due to flap asymmetry could not be excluded entirely. On the balance of probabilities, however, it was likely that the pilot lost control of the aircraft due to medical incapacitation and the additional crew member was unable to recover the aircraft in the height available.