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Flight Operations Standards

Cancels AIC 61/1994(Pink 105)

TURBO-PROP AND OTHER PROPELLER DRIVEN AEROPLANES: ICING-INDUCED STALLS

1 Introduction

1.1 AIC 104/1998 (Pink 176) published on 8 September 1998 drew attention to the general hazards of frost, ice and snow as they apply to the operation of all classes of aeroplanes and helicopters.

1.2 A CAA Safety Regulation Group research project has re-assessed data from a serious event involving a turbo-prop aeroplane. This event involved loss of control in icing conditions due to undetected stalling at speeds significantly above the normal stalling speed, accompanied by violent roll oscillations. There have been other similar occurrences.

1.3 Although these events are rare and unusual, this Circular has been written to alert pilots to the possibility that control of an aeroplane can be lost as a result of an icing-induced wing stall, the onset of which can be so insidious as to be difficult to detect. It contains advice on how these effects can be recognised and on what recovery action should be appropriate. It is considered that turbo-prop and other propeller driven aeroplanes are more prone to this type of event than turbo-jet driven aeroplanes because of the altitudes and speeds at which they operate. The Authority believes that awareness on this topic is vital.

2 Icing-Induced Wing Stalls and Consequent Effects

2.1 Flight data recorder studies have revealed a disturbing feature common to each of these events. Not only did the wing stall at a speed of approximately 30% above the normal stall speed, but the stall's longitudinal characteristics were abnormally benign. There was little that was immediately obvious to alert the pilot to the approaching stall, as the loss of lift associated with this type of stall can be limited, with little or no nose-down pitch. This situation, combined with the continued effectiveness of the elevator control, has probably led to the pilots failing to recognise the stalled condition, and holding the aeroplane either manually or through the autopilot pitch modes, in a stalled condition for extended periods.

2.2 In the serious event studied, the crew concentrated on the severe lateral control problems produced by the stall, which caused the aeroplane to develop a large rolling oscillation. In another case this oscillation built up so gently that the crew did not disengage the autopilot until 30 seconds after stall entry and the oscillation continued to increase until after a further 30 seconds it reached ± 60 degrees of roll. In another case the aircraft developed ± 80 degrees of roll as soon as it entered the stall.

2.3 A combination of the rolling oscillation and onset of high drag caused the aeroplane to enter a high rate of descent. In only one case did the crew eventually appear to recognise the source of the problem: after 25 seconds in the stall they pushed the stick forward to unstall the wing and regain roll control.

2.4 The problem appears to be one of pilot recognition due to the lack of awareness of the possibility of these rare and unusual events. It is probable that in all cases a recovery could have been achieved at any time by conventional stall recovery action.

3 Advice to Pilots on Stall Recognition and Recovery

3.1 In the light of these events, the following advice is given on the recognition of, and recovery from, insidious icing-induced wing-stalls:

(a) Loss of performance in icing conditions may indicate a serious build-up of airframe icing (even if this cannot be seen) which causes a gradual loss of lift and a significant increase in drag;

(b) this build up of ice can cause the aeroplane to stall at approximately 30% above its normal stalling speed;

(c) it is vital to remember that the longitudinal characteristics of an icing-induced wing-stall can be so gentle that the pilot may not be aware that it has occurred;

(d) the stall warning system installed on the aeroplane may not alert the pilot to the insidious icing-induced wing-stall, so should not be relied upon to give a warning of this condition. Airframe buffet, however, may assist in identifying the onset of wing-stall;

(e) the first clue may be a roll control problem. This can appear as a gradually increasing roll oscillation or a violent wing drop;

(f) a combination of rolling oscillation and onset of high drag can cause the aeroplane to enter a high rate of descent unless prompt recovery action is taken;

(g) if a roll control problem develops in icing conditions, the pilot should suspect that the aeroplane has entered an icing-induced wing-stall and should take immediate stall recovery action. The de-icing system should also be activated. If the aeroplane is fitted with an anti-icing system this should have been activated prior to entry into icing conditions in accordance with the Flight Manual/Operations Manual procedures and recommendations. If the anti-icing system has not been in use then it should be immediately activated. Consideration should also be given to leaving icing conditions by adjusting track and/or altitude, if possible.

4 Training on Stall Recognition

4.1 Periodic visits to operators by Flight Operations (Training) Inspectors includes, where appropriate, discussion on icing-induced stalls, with particular emphasis on turbo-prop and propeller driven aeroplanes.

This Circular is issued for information, guidance and necessary action.

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