SERIOUS INCIDENT

Aircraft Type and Registration:	Airbus A320-232, G-EUUU
No & Type of Engines:	2 International Aero Engine V2527-A5 turbofan engines
Year of Manufacture:	2008
Date & Time (UTC):	27 March 2009 at 1520 hrs
Location:	Oslo, Norway
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 6 Passengers - 147
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	42 years
Commander's Flying Experience:	9,000 hours (of which 600 were on type) Last 90 days - 175 hours Last 28 days - 27 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further investigation by the AAIB

Synopsis

The aircraft was on final approach to land and was experiencing airframe icing. At about 1,700 ft, airframe buffet was felt which the crew thought was pre-stall buffet. The crew increased the aircraft's approach speed and the buffet reduced. It disappeared completely at 500 ft and the aircraft landed without further incident. It was probable that the buffet was due to ice accretion on the top surface of the wings and was not pre-stall buffet.

History of the flight

The aircraft was on approach to Runway 01 at Oslo but there were delays due to snow clearance operations on the runway. The crew had planned and briefed for an autoland and were using full flap (know as configuration full) and autothrust with an approach speed of 138 kt. The aircraft was vectored extensively during which ice was noticed on the icing probe. Both wing and engine anti-icing systems were selected to ON in response.

While descending through about 1,700 ft on the final approach, airframe buffet was felt which the crew assessed to be the "early stages of stall buffet". They considered going around but thought that might make the situation worse in the prevailing weather conditions. The approach speed was increased in stages to 145 kt and, although the buffet continued, it

became "lighter in intensity". The buffet disappeared completely at 500 ft and the aircraft landed without further incident.

After the flight, the captain inspected the wings and saw "evidence of snow and ice in patches on the top surface and leading edges". However, in his opinion, the contamination would not have caused the aircraft to stall even though the buffet had felt like the early stages of stall buffet.

Weather conditions

The weather at Oslo was a surface wind of 050°/11 kt, visibility of 2,000 m, broken cloud at 800 ft and a temperature of -3° C. The runway headwind component was about 8 kt.

Recorded data

Data was available from the aircraft flight data recorder. During the incident, the aircraft was in configuration full and the landing gear was down. V_{LS}[1] was 128 kt and $V_{\alpha Prot}$[2] varied between 117 and 119 kt. The approach speed selected by the crew was 138 kt but this was increased progressively to 145 kt as the buffet was detected.

Analysis of the data by the manufacturer

The manufacturer analysed the flight data recorder information and stated that it:

> *'seemed to reflect the buffet, probably due to the presence of ice on the top of the wings. There was buffet but the alpha reached (up to +7°) was too far from the alpha stall to lead to stall buffet.'*

Footnote

[1] V_{LS} is the lowest selectable speed and is computed by the Flight Augmentation Computers (FACs) based on aerodynamic data.

[2] $V_{\alpha Prot}$ is a speed corresponding to an angle of attack at which the flight control system switches to a low speed protection mode.

Wing anti-icing

In flight, selecting the wing anti-ice system to ON opens a valve in each wing so that hot air from the pneumatic system heats the three outboard slats of each wing. There is no direct heating of the rest of the wing surfaces.

Guidance from the manufacturer on flying in icing conditions

The Flight Crew Operating Manual (FCOM) Part 3 has a section on ice protection. It states:

> *'If there is evidence of significant ice accretion, and to take account of ice formation on non-heated structure, the minimum speed should be, in configuration full, V_{LS} + 5 kt.'*

Calculation of approach speed (V_{APP})

For an approach using autothrust, the Flight Management and Guidance Computer (FMGC) computes V_{APP} as V_{LS} plus the higher of 5 kt or one third of the headwind component on landing. The crew can modify the figure in the FMGS (Flight Management Guidance System) to take account of conditions on the day. In addition, the crew may manually select the speed to be flown by the autothrust system.

The wind conditions reported at Oslo meant that the FMGS would have calculated the approach speed as V_{LS} (128 kt) plus 5 kt giving a V_{APP} of 133 kt.

Analysis

$V_{APP,}$ at 133 kt, effectively included the 5 kt increment recommended in the FCOM for flight with ice formation on non-heated parts of the aircraft. The crew's manual selection of an approach speed of 138 kt, prior to the onset of buffet, gave an additional margin above $V_{APP.}$ During the buffet, the aircraft speed was further increased from

138 to 145 kt during which time $V_{\alpha Prot}$ remained below 120 kt and the angle of attack remained below 7°. At no time did the low speed protection features of the aircraft become active.

It is probable that the buffet experienced was due to ice accretion on the top surface of the wings, as suggested by the manufacturer, and was not pre-stall buffet.