AC NO: 20-93

DATE: 1/29/76

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: FLUTTER DUE TO ICE OR FOREIGN SUBSTANCE ON OR IN AIRCRAFT CONTROL SURFACES

1. PURPOSE. This advisory circular provides information concerning the potential hazard associated with aircraft control surface flutter caused by imbalance.

2. REFERENCE. The following advisory circulars also contain information that applies to the operation of aircraft in cold weather.

   a. AC 20-73, Aircraft Ice Protection

   b. AC 91-6, Water, Slush, and Snow on the Runway

   c. AC 91-13A, Cold Weather Operation of Aircraft

   d. AC 150/5380-4, Ramp Operations During Periods of Snow and Ice Accumulation

3. BACKGROUND. There have been several accidents/incidents in which loss of control or extensive structural damage resulted from severe vibration caused by control surface flutter. Investigation in each case revealed the aircraft had departed with as little as 1/8 inch of ice adhering to ailerons, elevators, or rudder(s), or that water from melting ice had flowed back with subsequent refreezing inside of the control surfaces. While this condition has not been positively identified as a probable cause in fatal accidents, there is evidence to indicate that it may have been a contributing factor.

4. DISCUSSION. Pilots should be aware of conditions which contribute to control surface flutter. Control surface tail-heaviness is a major factor. To counteract this tail-heaviness, manufacturers add weight ahead of the control surface hinge line. The amount of weight is critical, and only a small accumulation of ice, slush, and/or other foreign matter on or within this surface aft of the hinge line may offset an otherwise delicate balance condition. If an unbalanced condition develops during flight at any airspeed, some greater or lesser speed may become flutter critical, and violent instability may occur suddenly as

speed is INCREASED OR DECREASED. In such a case, the margin of safety against flutter is in the amount of balance, and there is no reliable speed margin.

5. RECOMMENDATION. Pilots are cautioned to ensure that any accumulation of ice, snow, mud, etc., is removed from all exterior surfaces of the aircraft prior to flight. In addition, pilots should ascertain that no foreign substances, including water or ice, have accumulated inside of these surfaces. In the event control flutter occurs and does not cause immediate failure or loss of control, the pilot should attempt to reduce power and airspeed to restore control surface balance. An airspeed low enough to stop flutter may be at or near the stall speed, and control vibration may be of such severity as to preclude the pilot's recognition of an imminent stall. Continued flight is not recommended, and the aircraft should be landed as soon as possible.

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