



# Federal Aviation Administration

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## Memorandum

Date: November 8, 2009

To: See Distribution

From: Manager, Transport Airplane Directorate, Aircraft Certification Service, ANM-100

Prepared by: Carl J. Niedermeyer, ANM-115

Subject: Notice to Rescind Policy Statement PS-ANM100-2002-00102, "Requirement for Flight Flutter Tests to Determine Freedom from Shock Induced Flutter Phenomena", originally issued March 5, 1981

Memo No.: ANM-115-09-014

Regulatory Reference: 14 CFR 25.629, AC 25.629-1A

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This memo is notice that the FAA is rescinding the subject policy statement. We have attached the policy statement for reference.

The North American Rockwell B-1 bomber exhibited a phenomenon during flight testing which was then thought to be a single degree of freedom, shock-induced flutter instability. This phenomenon was not well understood at the time but occurred at higher angles of attack and was attributed to the new supercritical airfoil technology that was incorporated on the B-1 bomber. At the same time Boeing was developing the Models 767 and 757 airplanes which also used supercritical airfoil technology. There was a concern that they could exhibit the same phenomenon, which could not be reliably predicted by analysis. Therefore, the FAA issued the policy statement to ensure that flight flutter testing conducted to substantiate Title 14, Code of Federal Regulations (14 CFR) 25.629 would be done at all conditions where the instability might occur. Later flight flutter testing of the Models 767 and 757 airplanes showed no evidence of the phenomenon. Thus, the policy statement was not applied to any airplane programs after the Models 767 and 757 programs.

We now believe the B-1 phenomenon was a configuration issue specific to the B-1 bomber because of a combination of factors. These factors include a leading edge vortex and flow separation over the outboard portion of the wing at higher angles of attack. This was a legitimate concern when supercritical airfoil technology was new and not well understood. It was appropriate at the time to issue a policy statement. The policy statement notes, "The

requirements for these tests may be amended, revised in scope, or deleted as additional information is developed from research programs currently in progress, and from the accumulation of test results from certification programs.” Since then many airplane designs have incorporated more advanced supercritical airfoil technology. The transonic flutter model tests and the multitude of flight flutter tests conducted on these airplanes and their derivatives have shown no evidence of the shock induced flutter instability phenomenon that was thought to have occurred on the B-1 bomber. Therefore, we rescind the policy statement.

*signed by Stephen P. Boyd (for)*

Ali Bahrami

Attachment:

Policy Statement PS-ANM100-2002-00102, “Requirement for Flight Flutter Tests to Determine Freedom from Shock Induced Flutter Phenomena, FAR 25.629,” issued 3/5/1981.

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**PS-ANM100-2002-00102, Issued 3/5/1981**

INFORMATION: Requirement for Flight Flutter Tests to Determine Freedom from Shock Induced Flutter Phenomena, FAR 25.629

Chief, Lead Region Staff, ANW-110

AWS-100, ANW-100S, ANW-100L, AWE-210, ASW-210, ACE-211, ACE-215, AGL-210  
AEA-210, ASO-210, ANE-210

A relatively new type of aeroelastic instability identified as a shock induced flutter phenomena has been encountered on testing of aircraft such as the B-1. This aeroelastic self-excited single degree flutter instability, which is not classical flutter, involves the chordwise motion of a shock wave resulting from the swept wing oscillating in the first bending mode. The phenomena generally occurs at transonic speeds when the aircraft is flying at angles-of-attack greater than required for steady level flight.

Although there still exists considerable controversy over the mechanisms that drive this instability, there is little doubt as to its hazardous nature. It has been suggested that a strong shock forms on the upper surface of the air-foil at some angles-of-attack dependent on the mach number, and moves aft with increasing angle-of-attack. This movement can be quite large for modified conventional airfoils with relatively flat upper surfaces or with supercritical type airfoils. Since the angle-of-attack can vary with wing bending for a swept wing, the shock can oscillate fore and aft on the upper surface of the wing in relationship to the wing first bending vibration mode. When aerodynamic phase lag is considered, the aerodynamic forces modified by the shock can reinforce and drive the wing in the bending mode.

Since this shock behavior cannot be reliably predicted by analytical techniques, flight testing per 25.629 must be performed at sufficient conditions to assure the applicability of the test results to all conditions where the instability might take place. This requirement can be currently limited to swept wing aircraft which operate in the transonic speed range and incorporate airfoil types that may be subject to aft movements of shock waves over the chord.

The test envelope conditions of mach number, angle-of-attack (load factor), and altitude can be limited to those conditions most likely to promote the induced flutter instability.

Instrumented flight tests should be required to ensure freedom from this phenomena. FAR 25.629(a) can be interpreted to require these tests as "other tests found necessary by the Administrator."

The requirements for these tests may be amended, revised in scope, or deleted as additional information is developed from research programs currently in progress, and from the accumulation of test results from certification programs.

This information was formulated under the cognizance of AWS-120 and the members of the Special Certification Review Team than was established to evaluate this requirement for the Boeing 757 and 767 airplanes.

Signed by  
D. L. Riggin