



Redefining V_A

BY MARK LACAGNINA

The FAA wants to clear up potentially dangerous misunderstandings about maneuvering speed.

Contrary to a common misconception among pilots, operating an airplane at or below its design maneuvering speed (V_A) provides only limited protection against structural damage, according to the U.S. Federal Aviation Administration (FAA), which has proposed that airplane flight manuals be revised to clarify that abrupt and/or full flight control inputs *can* cause something to break.

The rule-making action responds to a U.S. National Transportation Safety Board (NTSB) recommendation related to the crash of an Airbus A300 in New York on Nov. 12, 2001. NTSB found

that the probable cause of the accident was “the in-flight separation of the vertical stabilizer as a result of the loads beyond ultimate design loads that were created by the first officer’s unnecessary and excessive rudder pedal inputs.”¹

In a notice issued late last year, the FAA said the accident investigation revealed that “many pilots of transport category airplanes believe that as long as they are below the airplane’s V_A , they can make any control input they desire without risking structural damage to the airplane.”²

This is a false and potentially dangerous assumption, according to the FAA.

Excessive rudder pedal inputs caused the vertical stabilizer to separate from an A300 during departure from New York in 2001.

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Understanding what V_A is — and is not — requires a basic knowledge of how it is used during airplane design and certification. The design maneuvering speed established by the manufacturer is a benchmark to gauge structural loads resulting from specific movements of the flight control surfaces and to determine how strong the airplane must be to withstand the loads.

The most important consideration is that the structural design criteria of U.S. Federal Aviation Regulations Part 25 “only consider a single full control input in any single axis,” the FAA said. “The standards do not address full control inputs in more than one axis at the same time or multiple inputs in the same axis.”

Flight 587

The A300 accident demonstrated that catastrophic structural damage can result from such control inputs. The first officer, the pilot flying, was known to have an exaggerated concern about wake turbulence and to overreact to wake encounters with excessive control inputs.

According to the NTSB report, the airplane, operated as American Airlines Flight 587, encountered mild wake turbulence from a preceding Boeing 747 while climbing through 2,430 ft at about 240 kt, or 30 kt below V_A . The A300 was in a 23-degree left bank, and the wake began to roll the airplane further left. The first officer abruptly applied right aileron/spoiler and full right rudder. The airplane responded by rapidly rolling and yawing right. Perceiving that these movements were caused by the wake turbulence, not by his control inputs, the first officer applied full left rudder and left aileron/spoiler. This was followed in the next few seconds by three more cyclic control inputs.

The control inputs induced side-slip angles that imposed extremely

high aerodynamic loads on the vertical stabilizer, causing it to separate from the fuselage. The crippled airplane descended into a residential area, killing all 260 people aboard and five people on the ground.

Guidelines for Revision

Among the 15 NTSB recommendations generated by the accident investigation was that the FAA should “amend all relevant regulatory and advisory materials to clarify that operating at or below maneuvering speed does not provide structural protection against multiple full control inputs in one axis or full control inputs in more than one axis at the same time.”

In response, the FAA has proposed guidelines to revise Part 25.1583, which currently requires that airplane flight manuals (AFMs) include the following statement about V_A : “Full application of rudder and aileron controls, as well as maneuvers that involve angles-of-attack near the stall, should be confined to speeds below this value.”

Rather than specifying wording for a new statement, the agency said that it should be tailored to the particular airplane design while including explanations that “full application of pitch, roll or yaw controls should be confined to speeds below V_A ” and that “rapid and large alternating control inputs, especially in combination with large changes in pitch, roll or yaw, and full control inputs in more than one axis at the same time should be avoided, as they may result in structural failures at any speed, including below V_A .”

The FAA pointed out that inclusion of the terms “pitch, roll and yaw controls” accounts for other control surfaces that provide or augment control in any given axis.

The phrase “as well as maneuvers that involve angles-of-attack near the stall”

would be eliminated. “The existing text assumes that, for high angle-of-attack maneuvers below V_A , the airplane will always stall before structural failure can occur,” the FAA said. “However, this is not always the case.”

The proposal applies only to new airplanes. The FAA noted that, at its request, manufacturers of “major transport category airplane types currently in service” have voluntarily revised their AFMs to include statements that conform to the proposed guidelines.

The agency received four formal responses to the proposal. NTSB and the Air Line Pilots Association, International (ALPA) expressed support. ALPA also urged the FAA to include “all airspeed restrictions related to aircraft design limitations” in the proposal and in pilot training programs. “For example, include information to clarify the operational difference between V_A and the rough air penetration speed, V_B ,” ALPA said.

In a response comprising two sentences, Airbus stated its understanding that the manufacturer will be authorized to select the wording for the AFM statement.

Several comments were filed by Geoffrey Barrance, a retired avionics systems safety engineer, who characterized the proposal as “weak” and said that it “does not address the problem facing a pilot in knowing at what speed a certain input to the airframe is safe and what type of input is likely to cause structural failure.”

The FAA told ASW that these comments are being considered in the development of a “final rule package” that likely will be issued this year. 🌀

Notes

1. NTSB Aircraft Accident Report NTSB/AAR-04/04.
2. Docket no. FAA-2009-0810. *Federal Register* Volume 74 (Sept. 4, 2009).