LOG 1327

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 7, 1981

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-49 through -53

For the past several years, the Beech Baron/Travel Air series of airplanes have demonstrated a propensity for entering flat spins under conditions of high asymmetric power and low speed. Between March 1978 and March 1980, there were eight fatal accidents of this type. The accident at Cumming, Georgia, on February 19, 1980, involving a Beech 95-B55 typifies the operational circumstances of most of these accidents. The instructional flight was the second in a multiengine course involving single-engine operation and the demonstration of minimum control speed. The pilot trainee, the only survivor, recalls attempting to move his body as far forward as possible during the spin in order to bring the nose of the airplane down. Witnesses saw the aircraft spinning with the tail lower than the nose.

The involvement of Beech Baron/Travel Air airplanes in flat spin accidents is not a new problem nor one that has just recently emerged. The Safety Board has previously sent five safety recommendations (A-75-64 and A-76-97 through -100) to the Federal Aviation Administration (FAA) regarding this subject. The Safety Board believes that had the FAA complied with these recommendations some of these accidents may have been prevented.

Based on the circumstances of these accidents, the Safety Board concludes that training for a potential emergency in Beech Baron/Travel Air airplanes, such as an engine-out condition, may be more hazardous than the emergency itself. For some conditions of airplane gross weight and altitude, the single-engine stall speeds of the aircraft are greater than the single-engine minimum control speeds (Vmc). Consequently, when pilots, including instructor pilots, attempt to demonstrate Vmc or loss of directional control, they may unexpectedly encounter a single-engine stall. At high asymmetric power, the stall in these airplanes is abrupt and is accompanied by rapid rolling to an inverted or near inverted position, followed by entry into a flat spin.

While one could take the position that pilots should be more careful and recover the airplane before this loss-of-control situation develops, the Safety Board believes that such a position is tenuous. The Beech Baron flat-spin accident record, coupled with the fact that some of the instructor pilots involved were highly experienced in Beech aircraft, tends to confirm that the situation demands above-average pilot skill and alertness.

The single-engine stall characteristics of these aircraft, under the above circumstances, create an undue tendency to spin that is not measured or tested under 14 CFR 23.205, "Critical Engine Inoperative Stalls." Tests under this part, for example, involve: (1) only 75 percent maximum continuous power, or less, rather than takeoff or maximum available power used in Vmc demonstrations; (2) a feathered propeller rather than a windmilling propeller; and (3) minimal sideslip. This regulation, when scrutinized, is relatively weak insofar as detection of undue spinning tendencies is concerned.

In any event, the airplane is not safely controllable or maneuverable under the high asymmetric power conditions and other adverse factors that are routinely related to the demonstration of Vmc. With high asymmetric power, rolloff at the stall constitutes an unsafe feature that is not compatible with intended usage in a multiengine training environment.

The U.S. Army in a 1974 report, "T-42A Single-Engine Performance and Stall Investigation," described the single-engine (asymmetric) power on stalls of the Beech Model B55B as violent and potentially catastrophic. The following excerpts from that report detail these characteristics:

> The stall characteristics with single-engine power on are considerably more severe than those for symmetrical power conditions. Single-engine power-on stall is characterized by a rapid roll toward the inoperative (dead) engine. If not immediately arrested, this roll progresses rapidly into a wing-over or split-S entry into an upright spin. Vigorous and immediate recovery action is required.
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> Instantaneous Recovery Action. When recovery was initiated immediately at stall, a rapid forward movement of the elevator control normally arrested the roll rate and regained control of the aircraft. Full rudder control opposite to the direction of roll was normally already applied since stall occurs below Vmc. If full rudder had not been previously initiated, it was applied concurrently with the forward elevator control. If these combined actions did not arrest the roll rate, power was reduced on the operative (good) engine. Recovery was normally from a large bank angle (approaching 90 degrees), nose-down attitude which results in a steep, diving pullout. Rapidly increasing airspeed during the pullout exceeded the airframe limits for the landing gear and flaps requiring these items to be retracted. Extreme care was necessary during the pullout to avoid a high-speed, accelerated stall.
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> Delay Recovery Action (1 second delay). When any delay in recovery action was allowed at full stall, the roll rate increased rapidly. Virtually full forward movement of the elevator control and complete power reduction on the operative engine was required for recovery. Recovery following a slight delay (1/4 to 1/2 second) was from a split-S or complete wing-over maneuver. With slightly longer delays (approaching 1 second) the wing-over progresses immediately into an upright spin. The considerations discussed above concerning rapidly building airspeed and avoidance of a high-speed, accelerated stall likewise apply for the delayed recovery.

In 1976, the operational concept of a safe single-engine speed (Vsse) was introduced to alleviate the adverse dynamic effects of an intentional engine-out at or close to either Vmc or the single-engine stall speed. Subsequently, the FAA disseminated information regarding Vsse and proper engine inoperative procedures through flight training clinics, pilot safety seminars, and flight instructor refresher courses. Any beneficial effects, however, were short-lived as evidenced by the increasing number of Beech Baron flat-spin accidents. The Safety Board believes that, in addition to pilot education, positive effort is needed to resolve any existing undue spinning tendencies during critical engine-inoperative stalls of this as well as similar aircraft which may be certificated in the future.

In October 1980, the Beech Aircraft Corporation initiated a stall research program to study the potential for moderating the inherent roll rates of conventional light twin-engine aircraft in single-engine, fully stalled conditions. Beech anticipates that this two-phase wind tunnel/flight test program will take at least 18 months to complete. While Beech's stall research program is commendable, the Safety Board does not believe that it is adequately expedient in resolving the involvement of Beech airplanes in flat-spin accidents.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Require that a placard be installed in all Beech Baron/Travel Air aircraft warning of the dangers of and prohibiting intentional single-engine stalls. (Class II, Priority Action) (A-81-49)
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> Amend 14 CFR 23.205, "Critical Engine Inoperative Stalls," to make the test requirements more rigorous with regard to the potential detection of an airplane's propensity to display any undue spinning tendency. (Class II, Priority Action) (A-81-50)
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> Require Beech Aircraft Corporation to disseminate information relating to Beech Baron/Travel Air single-engine stall speeds, including graphical or other information showing the operational conditions and limits wherein flight at the published value of Vmc is not possible. (Class II, Priority Action) (A-81-51)
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> Convene a special certification review team to explore and evaluate the relative margins of safety of the Beech Baron in low-speed, high-power, single-engine operations for all conditions which may be realistically anticipated in a multiengine, pilot-training environment. (Class II, Priority Action) (A-81-52)
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> Require that all Beech Baron/Travel Air aircraft be retrofitted with aerodynamic air flow kits or components designed to alleviate their hazardous single-engine stall characteristics. Relative to the retrofit, Beech Aircraft's stall research program should provide for prompt development of appropriate hardware, rigging of controls, and/or other necessary modifications. (Class II, Priority Action) (A-81-53)

In addition, the National Transportation Safety Board reiterates our previous recommendation that the Federal Aviation Administration:

Issue an Advisory Circular dealing solely with simulated and actual engine-out emergencies in typical high performance, multiengine general aviation airplanes. (Class II - Priority Action) (A-75-64)

This Circular, aside from providing general operational guidelines and technical information, should supplement present FAA Advisory Circular 61-67, "Hazards Associated With Spins in Airplanes Prohibited From Intentional Spinning," by placing special emphasis on the potentially catastrophic and often irreversible situations which may develop, such as the flat spin, if a loss of control is allowed to occur. This information should be mailed directly to all pilots holding multiengine class ratings, distributed to fixed base operators and flight schools, and disseminated among the various flight instructor clinics and safety seminars held throughout the year. In addition, the FAA's Accident Prevention Staff should, where feasible, discuss operational details with recipients to assure that the objectives of the Circular are thoroughly understood.

KING, Chairman, DRIVER, Vice Chairman, McADAMS and GOLDMAN, Members, concurred in these recommendations. BURSLEY, Member, did not participate.

By: James B. King
Chairman