Log 2471

# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

Date: February 7, 1995

In reply refer to: A-95-13

Honorable David R. Hinson
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On September 2, 1993, a Piper Aircraft Corporation PA-18 Supercub airplane, N4713A, equipped with Schneider model 11000-C, 32-inch-diameter automobile tires—one version of oversized tires commonly referred to as "tundra" tires—crashed during a visual approach to a hunting strip near Eureka, Alaska.[1] Witnesses reported that the airplane flew over the runway at low altitude and then began a turn to final approach. The flight path steepened to almost vertical, and the airplane impacted nose down. The private pilot/hunting guide and his client were fatally injured; the airplane was destroyed. The airplane was operating about 10 percent over the maximum certificated gross weight at the time of the accident. No pre-existing mechanical anomalies were found. The National Transportation Safety Board determined that the pilot failed to maintain flying speed and entered an inadvertent stall.

On July 31, 1993, an Interstate Aircraft Company S-1B2 Arctic Tern airplane, N59AT, equipped with Airstreak 30-inch balloon tires—another version of tundra tires—crashed and burned at the 6,000-foot elevation level in the Johnson River Glacier area of Alaska.[2] The two Alaska-registered pilot/guides, who were on a big-game spotting flight at the time, sustained fatal injuries, and the airplane was destroyed. There were no known witnesses to the accident; however, the wreckage indicated that impact had occurred at a steep, nose-down angle. The airspeed indicator was found ejected from the wreckage with the needle fixed at 45 mph. The wreckage revealed no pre-existing mechanical anomalies, and the airplane's weight

[1] NTSB accident ANC-93-F-A167 (Somona Creek, Alaska).

[2] NTSB accident ANC-93-F-A143 (Johnson Glacier, Alaska).

at the time of the accident was more than 20 percent greater than the maximum allowable weight. The Safety Board determined that the pilot's attempted flight in an airplane that exceeded maximum weight resulted in an inadvertent stall/spin and collision with terrain.

On July 18, 1993, a Piper PA-18 Supercub airplane equipped with Airstreak 30-inch tundra tires, N1009A, was maneuvering at low altitude near Anchorage, Alaska when it crashed and burned.[3] The pilot and passenger were critically injured by the postcrash fire; the airplane was destroyed. The passenger told family members that as the airplane was making a low, slow turn, it suddenly "went over and straight down." Due to extensive injuries and slow recovery, the pilot was unable to provide information during the accident investigation. The wreckage revealed no mechanical anomalies, and the airplane's weight was within allowable limits. The Safety Board determined that the pilot-in-command caused the airplane to enter a stall/spin during maneuvering flight.

On April 23, 1993, a Piper PA-18 Supercub airplane equipped with Airstreak 30-inch tundra tires, N3741, crashed into a nearly level snow field at the 5,000-foot level in the Kashwitna River drainage near Palmer, Alaska.[4] The flight had departed Anchorage an hour before the crash for the purpose of spotting big game in preparation for the opening of hunting season. The two Alaska-registered guides were fatally injured, and the airplane was destroyed. Although there were no known witnesses to the crash, the wreckage indicated that at impact the flight path was nearly vertical and the airspeed was low. Examination of the wreckage revealed no pre-existing mechanical anomalies, and the airplane's weight and balance were within allowable limits. The Safety Board determined that the probable cause of the accident was the pilot-in-command not maintaining control of the airplane and his inadequate preflight preparation for high mountain terrain big game operations.

On November 12, 1992, a Piper PA-18 Supercub airplane, N9124D, equipped with Multipurpose Tire Company 24-inch tundra tires, collided with snow-covered terrain while on a low altitude, moose survey flight.[5] The commercially certificated pilot and the onboard observer, a U.S. Fish and Wildlife Service employee, sustained fatal injuries, and the airplane was destroyed. Examination of the wreckage indicated that impact occurred at a 40° nose-down attitude. Investigators estimated the weight of the Supercub to be 2,051 pounds at the time of the accident, which was 301 pounds over its certificated weight. No pre-existing mechanical anomalies were revealed. According to Fish and Wildlife Service personnel, the pilot and the observer were flying an "intensive" search pattern attempting to locate all moose within a 2-square-mile area. The pattern required overlapping circles or ovals at a 200- to 300-foot altitude, an airspeed of 60 to 70 mph, and banking at angles to 45°. The Safety

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[3] NTSB accident ANC-93-L-A120 (Chickaloon Creek, Alaska).

[4] NTSB accident ANC-93-F-A054 (Kashwitna River, Alaska).

[5] NTSB accident ANC-93-G-A020 (Beaver, Alaska).

Board determined that the probable cause of the accident was the pilot-in-command's failure to maintain airspeed, which resulted in an inadvertent stall at an altitude inadequate to effect a recovery.

The game-spotting flights and short-field landings that were being conducted immediately prior to these accidents involved operations at low airspeed and high bank angle, which result in the airplane flying close to the critical angle of attack and aerodynamic stall speed. The reduced stall margin associated with such operations has been a consistent factor in accidents involving inflight loss of control due to inadvertent aerodynamic stall.

Like the five airplanes involved in these accidents, many PA-18s and similar, high-wing, conventional-geared (tailwheel) airplanes in Alaska are equipped with tundra tires. Because the bush operations normally conducted by tundra tire-equipped airplanes involve greater exposure to flight near the aerodynamic stall condition, the Safety Board cannot conclude that there is a causal association in these five accidents between the pilot's loss of control and the presence of tundra tires. However, these accidents do raise the question of how tundra tire installations may affect the aerodynamic performance of the airplanes.

The use of tundra tires began in the late 1950s, to facilitate landings on rough terrain (tundra) in bush regions of the United States and Canada. Popularity of the tundra tires, which were originally developed during World War II for use on blimps,[6] spread quickly throughout Canada and Alaska. In 1957, the Canadian Ministry of Transport granted its first field approval to a bush lodge operator for use of balloon tires on a Piper PA-18.[7] The Ministry subsequently granted field approvals for balloon tires installed on other airplanes.

In 1960, the FAA Aircraft Certification Office (ACO) in Anchorage, Alaska, approved the first Supplemental Type Certificate (STC)[8] for normal/utility category PA-18 airplanes equipped with balloon tires. Federal aviation regulation 14 CFR 21.115(a) requires that "each applicant for a supplemental type certificate must show that the altered product meets applicable airworthiness requirements or provides a level of safety equal to that established by the regulations." The applicant for an STC is responsible for identifying the affected portions of the certification rules and for

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[6] Goodyear "Airwheels" (the manufacturer's model name for oversized wheels) and 25- by 11- by 4-inch tires were used extensively on Goodyear non-rigid airships (blimps) during the war.

[7] A field approval by the Canadian Ministry or the FAA authorizes the use of a specific tundra tire on one airplane. The field approval record identifies the model and size of tire, and the serial number of the airplane.

[8] According to 14 CFR 21.113, "Any person who alters a product by introducing a major change in type design, not great enough to require a new application for a type certificate, shall apply for a supplemental type certificate."

proposing an appropriate testing program to the ACO. The ACO, in turn, has the final responsibility for determining the scope of the testing program.

Since the early 1960s, the FAA has granted more than 20 STCs and many field approvals[9] for tundra tires and oversized wheels of various sizes on conventional geared airplanes, such as the Piper PA-18 Supercub, Interstate Arctic Tern, Bellanca Citabria "7 series" Champions, and Helio Courier 295; and on tricycle-geared airplanes such as the Cessna 206. However, the FAA did not require applicants to file design or manufacturing standards and did not require prior flight testing to demonstrate potential changes to performance, stall speed, stall warning, or longitudinal and lateral stability of these airplanes. In June 1986, some stall measurements were recorded as part of the STC record for Schneider 11000-C 32-inch tires on the Bellanca "7 series" Champions. The data resulted from a straight and level, power-off stall test conducted by the FAA on a Bellanca Citabria 7ECA airplane (S/N 1210-77, N109OE) equipped with the tundra tires; no power-on or turning maneuver stall test was conducted.[10] This limited flight test of the Bellanca 7ECA is the only FAA flight test conducted for STC approval of any tundra tire that is known by the Safety Board to have included stall measurements.

In response to inquiries by Safety Board investigators regarding what effect tundra tires may have on stalling speed, the FAA's Anchorage Aircraft Certification Office stated, "We have no data on the effect of large tires upon the stalling speed of the Piper PA-18 150[-hp] airplane....In general, large and heavy tires and wheels are expected to increase stall speed, reduce rate of climb, reduce cruising speed and range, limit maximum safe dive speed, and adversely affect airframe vibration characteristics."

The Safety Board is concerned that large tundra tires, in the range of 28 to 35 inches and more, may induce turbulent flow that passes across the horizontal and vertical stabilizers during operations at high angles of attack. The turbulent flow may degrade the longitudinal and directional stability, thus impairing the pilot's ability to avoid or arrest loss of control. Also, in the case of the Piper Supercub, no artificial stall warning is furnished to the pilot; indication of an imminent stall is provided by the inherent aerodynamic characteristics of the airplane, such as the onset of airframe buffet prior to the stall. The Safety Board believes that, in approving the

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[9] An FAA field approval is a modification to an individual airplane that is approved by an FAA Flight Standards District Office inspector. Because the inspector may not have the engineering expertise of the ACO, a field approval relies on engineering data previously generated during the original certification of the airplane or during approval of a Supplemental Type Certificate. Further, an inspector can approve a modification, such as a tundra tire, that has not received an STC if, in the inspector's judgment, the tire and the airplane type on which it will be installed are similar to a tire/airplane combination that already has received an STC. Field approvals are documented on FAA Form 337.

[10] The FAA Certification Office in Seattle, Washington, granted STC SA4601NM on October 21, 1988, for use of the Schneider 11000-C tires on the Bellanca 7ECA, 7GCBC, and other models in the "7 series."

installation of tundra tires, the FAA has overlooked the potential effect of the oversized tires upon flight characteristics during stall onset and the stall itself. This oversight dates to the 1960s, when aerodynamic testing was omitted by the FAA. It has been perpetuated by subsequent STC and field approvals by the FAA that permitted various airplane types to be operated with a variety of tundra tire models, based on the history of the original tundra tire STCs.[11]

Since the early 1960s, hundreds of airplanes operating in Alaska have been equipped with tundra tires, and dozens of versions of tundra tires—some exceeding 35 inches in diameter—have been marketed. The Safety Board is concerned that field approvals and STCs have been granted for use of these tires without flight test or other data on the aerodynamic effects of the tires and wheels. The Piper PA-18 is the airplane most frequently equipped with tundra tires. The Safety Board believes that the FAA should conduct a demonstration flight test to determine the effects of tundra tires on the PA-18's flight characteristics, including cruise, climb, takeoff, and landing performance; and, in both straight and turning flight, stall warning and aircraft stability at or near the critical angle of attack. Further, if the tests of the PA-18 indicate the need, the FAA should take corrective action and expand testing to other airplane types equipped with oversized tires.

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

> Conduct, by April 30, 1995, flight tests to determine the effects of tundra (oversized) tires and wheels on the Piper Aircraft Corporation PA-18 airplane's flight characteristics--including cruise, climb, takeoff, and landing performance--and, in both straight and turning flight, stall warning and aircraft stability at or near the critical angle of attack. Take appropriate corrective action, expand testing to other airplane types equipped with oversized tires as necessary, and disseminate the test results to the aviation community. (Class II, Priority Action) (A-95-13)

Chairman HALL, Vice Chairman FRANCIS, and Member HAMMERSCHMIDT concurred in this recommendation.

By: Jim Hall
Chairman

[11] The Safety Board notes that only one of the five accidents referenced in this letter involved an STC-approved tundra tire installation (accident number ANC-93-F-A167).