NATIONAL TRANSPORTATION SAFETY BOARD

AIRCRAFT ACCIDENT REPORT

NORTH AMERICAN ROCKWELL, INC.

TURBO COMMANDER 690, N1NR

WELLSBURG, WEST VIRGINIA

AUGUST 14, 1972

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591
REPORT NUMBER: NTSB-AAR-73-5

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ADOPTED: MARCH 21, 1973

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16. Abstract

At approximately 1110 eastern daylight time on August 14, 1972, a Turbo Commander 690, N1NR, owned and operated by North American Rockwell, Inc., crashed in the vicinity of Wellsburg, West Virginia. The two crewmembers and the sole passenger were fatally injured.

N1NR departed the Greater Pittsburgh International Airport, Pittsburgh, Pennsylvania, at 1101 eastern daylight time, on a company-scheduled training flight. The flight requested and reported reaching 12,500 feet. At approximately 1110 eastern daylight time, Greater Pittsburgh Departure Control requested loss of radar and radio contact with the aircraft.

The National Transportation Safety Board determines that the probable cause of this accident was the loss of aircraft control in a stall maneuver, for reasons unknown, from which recovery was not accomplished.

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TURBO COMMANDER 690, N1NR
WELLSBURG, WEST VIRGINIA
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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20591
AIRCRAFT ACCIDENT REPORT

Adopted: March 21, 1973

NORTH AMERICAN ROCKWELL, INC.
TURBO COMMANDER 690, N1NR
WELLSBURG, WEST VIRGINIA
AUGUST 14, 1972

SYNOPSIS

At approximately 1110 eastern daylight time on August 14, 1972, a Turbo Commander 690, N1NR, owned and operated by North American Rockwell, Inc., crashed in the vicinity of Wellsburg, West Virginia. The two crewmembers and the sole passenger were fatally injured.

The aircraft departed the Greater Pittsburgh International Airport, Pittsburgh, Pennsylvania, at 1101 eastern daylight time, on a company-scheduled training flight. The flight was cleared for, and reported reaching 12,500 feet altitude. At approximately 1110 eastern daylight time, Greater Pittsburgh Departure Control lost radar and radio contact with the aircraft.

The National Transportation Safety Board determines that the probable cause of this accident was the loss of aircraft control in a stall maneuver, for reasons unknown, from which recovery was not accomplished.

As a result of this investigation, the Safety Board is submitting three recommendations to the Federal Aviation Administration.

INVFSTIGATION

Aircraft N1NR, a Turbo Commander 690, a corporate aircraft owned by North American Rockwell, Inc., departed from the Greater Pittsburgh International Airport, Pittsburgh, Pennsylvania, on August 14, 1972, at 1101 1/ on a company-scheduled pilot training flight. There were two crewmembers and one passenger on board the aircraft.

Immediately after takeoff the flight contacted the Greater Pittsburgh Departure Control (Departure Control), and radar contact with the aircraft was established. The pilot advised Departure Control that he wished to conduct "air work" southwest of Pittsburgh at a VFR altitude of 12,500 feet. The flight was subsequently cleared to 12,500 feet, and it reported level at that altitude at 1107. Departure Control continued to observe the aircraft's radar target until it was approximately 20 miles southwest of the Imperial (IRL) VORTAC. Shortly thereafter, at approximately 1110, the aircraft's beacon and primary radar return disappeared from the radarscope. Departure Control attempted to advise N1NR that radar contact was lost, but no acknowledgment was received nor were there any further radio communications from the flight.

At approximately 1120, controllers in the Wheeling Airport Tower, Wheeling, West Virginia, received a telephone call advising them that an airplane had crashed along a highway approximately 5 miles east of Wellsburg, West Virginia. The caller estimated the time of the crash as 1105.

Sixteen persons who witnessed the crash were interviewed regarding their observations of the aircraft. Most of these witnesses stated that their attention was initially attracted by engine sounds that varied in pitch and intensity. The consensus was that the aircraft went through a sequential series of spins and apparent recoveries and that the final events were a stall followed by a near vertical dive to impact. Four witnesses reported white smoke trailing from the wings; however, no in-flight fire was observed.

The aircraft wreckage was found between two dwellings in a rural area, approximately 20 miles southwest of the IRL VORTAC (Pittsburgh). All of the aircraft structure, including all control surfaces, was contained within the impact crater, which measured approximately 25 feet in diameter. Intensive ground fire damage was noted throughout the wreckage.

Mamination of the recovered airframe, powerplants, and components disclosed no preimpact failures or malfunctions. There was no evidence of in-flight fire, explosion, or aircraft structural breakup. Inspection of the propeller pitch control cams showed that at impact the left engine was

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1/ All times herein are eastern daylight, based on the 24-hour clock.

in the normal cruise pitch range and that the right engine was in the flight-idle position. Measurement of the thrust-lever-arm positions in their respective power covers showed a position corresponding to the normal cruise range for the left engine and a position corresponding to flight idle for the right engine. Propeller blade angles at impact could not be established.

All three occupants of the aircraft received fatal injuries in the crash. There were no injuries to any persons on the ground.

The pilot-in-command (instructor-pilot) had received a 50-minute flight checkout in the Turbo Commander 690 at the manufacturer's facility which included full stall and unusual attitude recoveries. Both pilots held airline transport certificates and current Class I medical certificates. (For detailed information, see Appendix A.)

It was learned from the Director of Flight Operations for North American Rockwell, Inc., that this flight had been dispatched for the purpose of transition training for the copilot in this model aircraft. The exact nature and sequence of the maneuvers to be performed on the flight could not be determined; however, it was established that this was the initial transition training flight for the copilot. A company transition training guide for the Turbo Commander 690, which lists a sequence of procedures and maneuvers to be performed during this type of training, was available in the Flight Operations Department. It was noted that the first five items listed in this training guide were:

"1. Ground check out.
"2. Maximum rate of takeoff.
"3. Climb to altitude at various speeds.
"4. Stalls: single- and multiengine (approach to stalls).
"5. Slow flight with turns."

Although this training guide was the accepted format for company pilot training, it could not be ascertained that the crew had the guide on board the aircraft for this flight.

The aircraft was equipped with a stall warning horn which is designed to provide warning of a stall at 5 to 10 m.p.h. above the stall speed. A review of the stall characteristics of the Turbo Commander as detailed in the initial type inspection report for this model aircraft showed that in all of the tested stall conditions (takeoff, clean cruise, and landing), a stall warning was provided by the artificial stall warning horn and that "some" airframe buffeting was experienced at the stall.

The aircraft was certificated by the manufacturer under the delegated option authority granted by the Federal Aviation Administration (FAA). The certification of this aircraft did not require testing for spin characteristics or recovery. The aircraft was placarded against intentional spins. (For detailed aircraft information see Appendix B.)

The aircraft flight manual, provided by the manufacturer to operators of the airplane, makes reference to the avoidance of spin maneuvers as follows:

> "This airplane must be operated as a normal category airplane. Acrobatic maneuvers, including spins, are unauthorized.
>
> "Up to 560 feet altitude loss may occur during recovery from full stall."

With regard to stalls, the flight manual states, in part:

> "Stall speeds are given for three airplane conditions: Takeoff, Clean Cruise, and Landing. Figure 4-1 /stall speed v. bank angle graph/ shows that the effect of bank angle is to produce an increase in stall speeds.
>
> "Other primary variables controlling stall speeds are power, gross weight, and rate of entry into the stall. Decreasing gross weight will result in lower stall speeds, while reducing power or entry rate will increase stall speeds. C.G. position and trim speed are secondary variables affecting stall speeds."

In this same section, the manual also lists the "Scheduled Variables" with regard to stall entry as follows:

> "Trim speed = 140% of STALL SPEED
> "Entry Rate = -1 MPH CAS/SEC (Uniformly Decreasing Airspeed)."

ANALYSIS

There was no preimpact failure or malfunction of any system or component, nor was there evidence of in-flight fire or structural breakup. The white smoke trailing from the wings, reported by some witnesses, is believed to have been fuel vapor.

With the exception of operational factors, all other phases of the investigation relative to causal determination were negative. Since this was the initial training flight for the copilot, it is reasonable to expect that the instructor-pilot followed the company's transition training syllabus for the Turbo Commander 690 which was available to him. The correlation of the training guide with the duration of flight would have placed the flight in the practice stall portion of the syllabus. Although the syllabus prescribed "approach to stalls," the instructor-pilot might have patterned this training flight to provide such instruction in full stalls as he was required to perform in his pilot qualification flight.

Witnesses who observed the aircraft during the crash sequence reported that it went through a series of spins and apparent recoveries before it finally stalled and dived into the ground. Based on this evidence, the Board believes that control of the aircraft was lost during a practice stall maneuver shortly after the flight reported at 12,500 feet. The reason for the loss of control and the failure to recover has not been determined.

The stall warning horn installed in the aircraft should have alerted the pilots when they were approaching the stall condition. However, if the stall entry is continued until airframe buffeting occurs, the aircraft is at, or very close to, the full-stall condition. If stall recovery is not initiated at this point, then, inadvertent entry into a spin is quite possible.

No engineering test data are available on spin characteristics or recovery for the Turbo Commander, as the FAA aircraft certification process did not require that this type of aircraft be tested in that flight regime. Accordingly, the aircraft was placarded against intentional spins.

A stall maneuver is the most critical maneuver listed on the flight training syllabus. The criticality of this operation demands that an instructor-pilot exercise a high degree of alertness to prevent the aircraft from entering an unusual attitude or uncontrollable flight condition, from which it would require extraordinary effort and skill to recover. The company's transition training guide prescribed that a stall maneuver should proceed only to the "approach to stall" condition.

The FAA, in recognizing the possible hazards involved in this type of maneuver, has published guidelines for instructor-pilots and trainees which describe the acceptable performance of various flight maneuvers for multi-engine airplane ratings for private and commerical pilot certificates. 2/ With regard to stalls and partial stalls it states, in part:

> ". . . stalls should be entered by increasing the angle of attack smoothly, so that the airspeed decreases at a uniform rate. Sufficient power may be used throughout all stalls to keep the engines running smoothly.
>
> "No stall will be required with any engine throttled or cut off and the other engine(s) developing effective power. . . .
>
> "Recoveries should be initiated at the first physical indication of a stall, such as uncontrollable pitching, buffeting, rapid decay of control effectiveness, or the application of full back elevator without producing further stall development. . . .

2/ Flight Test Guide - Multiengine Airplane Class or Type Rating, AC-61-4B, Federal Aviation Administration, Revised 1968.

"Failure to initiate corrective action on partial stalls before the nose pitches uncontrollably, indications of a secondary stall during recoveries, or diving to higher than cruising airspeed during recovery will be disqualifying."

Although the spin characteristics of this aircraft were not established for certification, it can reasonably be assumed that entry into this flight regime, either intentionally or unintentionally, would require immediate and correct recovery techniques to regain control of the aircraft. Under a prolonged spin condition, as described by witnesses in this case, it is problematical as to whether effective control of the aircraft could be regained.

Examination of the propeller-positioning cams and related components showed that the left and right engines were in the normal cruise and flight-idle ranges, respectively, at impact. These positions could indicate that either a single-engine training maneuver was being conducted at the time of the loss of control or that asymmetrical thrust was being employed to assist in the recovery from a spin.

It would seem that the presence of two highly experienced pilots aboard the training flight would preclude the possibility of either the inadvertent loss of control or the failure to effect a recovery from such a condition. However, experience has shown that this type of situation can induce certain hazards; for example: (1) Because the pilot receiving instructions was well qualified, the instructor-pilot might have permitted him, during stall demonstrations, to proceed beyond the "approach to stall" into a full stall, thereby entering a flight attitude from which recovery could not be effected. (2) There might have been a tendency on the part of the instructor-pilot to be complacent or let his "guard down" for the unexpected because he was instructing an experienced pilot. (3) A lack of communication between the crew as to who was in control of the aircraft at a critical moment could have precipitated an adverse flight condition.

Although the circumstances of the accident preclude the precise determination of cause, the Safety Board believes that any of the aforementioned possibilities could have been a significant causal factor, considering the unexplained circumstances which surrounded the loss of control of this aircraft.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was the loss of aircraft control in a stall maneuver, for reasons unknown, from which recovery was not accomplished.

RECOMMENDATIONS

The National Transportation Safety Board believes that Advisory Circular 61-40, Certification - Pilots and Flight Instructors, superseded by Advisory Circular 61-4B, Flight Test Guide - Multiengine Airplane, has great accident prevention merit with regard to this type of accident. The requirement in both publications to conduct "approach to stalls" and not to conduct "full stalls" should be reemphasized to all pilots.

The Board is in agreement with the FAA's basic concept of type certification to assure that during normal operation, the operational pilot will not encounter any airplane characteristic that has not been explored by an experienced test pilot.

We believe that the one-turn spin recovery capability in single-engine aircraft, coupled with the placarding of the aircraft against intentional spins, meets the intent of the philosophy for providing an adequate level of safety. However, we do not believe that multiengine aircraft have been provided with a similar level of safety.

Since the certification rules do not require spin testing of multiengine aircraft, the full-stall regime of flight may not have been fully explored by experienced test pilots. Therefore, the operational pilot may attempt full stalls in aircraft in which there is not adequate data on the handling characteristics in the full-stalled condition. In order to preclude the conducting of full stalls by the average pilot in this type aircraft, the Board believes that the aircraft should be placarded against full-stall maneuvers and that this prohibition should be included in the airplane flight manual.

The Board also believes that it would be beneficial to safety to inform pilots of the differences between the airplane type certification stall requirements and pilots certification demonstrations of "approach to stall" maneuvers and to emphasize the inherent dangers which might exist at or close to speeds at which full stalls occur, particularly with one engine inoperative.

In our continued effort to prevent stall and spin accidents during pilot training, the Safety Board recommends that the Federal Aviation Administration:

1. Reissue Advisory Circular 61-40 to all pilots and flight instructors, reemphasizing the requirement to conduct or demonstrate only "approach to stalls," not full stalls. (A-73-8)

2. Require that flightcrews be provided with information in the airplane flight manual and by means of a suitable placard placed in the cockpit to indicate a prohibition against intentional full stalls on all twin-engine airplanes which have not been spin tested. (A-73-9)

3. Describe in each aircraft flight manual the aircraft characteristics which result from "approach to stalls" to assure that pilots will be able to perceive the end point of this maneuver. (A-73-10)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JOHN H. REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

March 21, 1973.

CREW INFORMATION

The pilot-in-command, Mr. Roger Bahling, aged 30, held FAA Airline Transport Pilot Certificate No. 1518528, as well as a current first-class medical certificate, without restrictions, dated June 12, 1972. Mr Bahling held a type rating in the North American Sabreliner aircraft. He was employed by North American Rockwell on July 15, 1964. He completed a 50-minute factory flight checkout in the Turbo Commander 690 aircraft on July 26, 1972. His last proficiency check was on January 7, 1972, in a Turbo Commander 681 aircraft. Company records showed his total flying time to have been 5,507:15 hours, of which approximately 1,500:00 hours were accumulated in the turboprop-type aircraft. His flight time in the last 90 days was 74:25 hours, and he had no flight time in the 24 hours prior to the accident. Company records reflected no history of aircraft accidents. Mr. Bahling did not hold an FAA-certified flight instructor rating.

The copilot, Mr. James Kinchloe, aged 35, held FAA Airline Transport Pilot Certificate No. 1721736, as well as a current first-class medical certificate, without restrictions, dated June 6, 1972. Mr Kinchloe did not hold any type ratings in large aircraft. He was employed by North American Rockwell on August 28, 1968. His last proficiency check was on March 7, 1972, in a Turbo Commander 681 aircraft. Company records showed his total flying time to have been 2,749:35 hours. No breakdown is available as to time accumulated in turboprop-type aircraft. He had no flight time in the last 24 hours, and his flight time in the 90 days prior to the accident was 134:40 hours. Company records reflected no history of aircraft accidents.

AIRCRAFT INFORMATION

Turbo Commander 690, N1NR, S/N 11024 was issued an Airworthiness Certificate on July 15, 1972. It was powered by two Garrett-AiRESEARCH fixed-shaft turboprop engines, model TPE 331-5-251.

The total time on the aircraft, engines, and propellers was 64:45 hours. No major inspection was performed on the aircraft after the certification date, July 15, 1972.

Hartzell propellers, model HCB37V-5FL, were installed on the aircraft.