

CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: January 9, 1958

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THE C. R. VOSE COMPANY, A LOCKHEED LODESTAR, MODEL 18-56,
N 45378, KING SALMON, ALASKA, JULY 10, 1957

The Accident

At 0642, ^{1/} July 10, 1957, a Lockheed Lodestar, model 18-56, owned by the C. R. Vose Company, crashed, exploded, and burned during takeoff at the King Salmon, Alaska, Airport. All occupants, two crew members and four passengers, were killed. The aircraft was destroyed.

History of the Flight

At King Salmon on the morning of July 10, 1957, about 0615, following two weeks in Alaska on a combined business and pleasure trip, Mr. C. R. Vose and party boarded N 45378 as its passengers. The flight crew of the executive Lodestar was Pilot Edward Coligny and Mechanic-Flight Engineer Ralph L. Hughes. The Vose party contemplated a flight to Anchorage, Alaska, the first segment of its return trip to Seattle, Washington.

Earlier that morning Mr. Hughes had filed a VFR flight plan to Anchorage which proposed a departure time of 0630 and a routing to Anchorage over Airway Green 8 at an altitude of 6,000 feet. The flight plan also showed that the flight duration would be 1 hour and 40 minutes at a cruising speed of 170 knots and that there was sufficient fuel on board for 6 hours and 30 minutes.

At 0638, following a period of engine rump on the parking ramp, the flight called the King Salmon tower for taxi and takeoff information. The duty controller cleared it to runway 11 and furnished the latest wind and altimeter conditions: "Wind east-northeast 8; altimeter 29.90." There being no other traffic, N 45378 was cleared directly onto runway 11 where several persons saw it pause one to two minutes and heard its propellers run through one or two times.

The takeoff was started at 0642 and it seemed entirely normal as the aircraft left the runway surface and climbed to between 75 and 100 feet. The landing gear, however, remained extended. The climb continued normally although somewhat steeper to between 150 and 200 feet, at which time the climb of the aircraft steepened rapidly but smoothly until it was nearly vertical. At the peak of the climb the aircraft pivoted counterclockwise, plunged to the ground, and exploded. An intense fuel-fed fire followed.

^{1/} Times herein are Alaska standard based on the 24-hour clock.

The airport traffic controller alerted the U. S. A. F. emergency equipment located on the base and the fire was quickly extinguished; however, not before the aircraft was nearly destroyed.

Weather conditions at King Salmon at the time of the accident were clear, visibility 60 miles.

Investigation

Investigation by the Board revealed that the Vose party arrived in Alaska on June 27 and had visited numerous locations prior to July 7 when they landed at King Salmon after a flight from Nome. Until July 10, the morning of the accident, the group visited friends and relatives near King Salmon. N 45378 remained parked on the airport ramp at King Salmon.

On July 9, Alaska Aeromarine Company, acting according to instructions from the Lodestar crew, added 220 gallons of fuel to that already aboard the aircraft. The refueling attendant stated that because 91/98 octane fuel was the highest grade available at King Salmon, a situation which was known to the crew having landed there earlier during the Alaskan trip, he was instructed to add fuel to the rear and auxiliary tanks only. The 220 gallons filled these tanks. The crew told him that there was 100 octane in the front tanks and they did not want it mixed with the lower octane. The front tanks therefore were not opened and the amount of fuel in them at King Salmon is unknown. A refueling slip indicated complete fuel service was performed at Nome.

Flight reports and maintenance log sheets recovered from the wreckage showed that no maintenance discrepancies of significance had been experienced during the Alaskan trip. Witnesses said there was no work accomplished while the aircraft was parked at King Salmon and one recalled a crew member's remark when the flight arrived on July 7 that N 45378 was "fine."

On July 10 the Vose party of six was returned to King Salmon by commercial pilots in three light aircraft. The pilot and flight engineer arrived first about 0600 and thereafter were noticed moving about the aircraft in preparation for departure. Pilots of the light planes noted that baggage, estimated to weigh about 550 pounds, was distributed and placed in approximately equal amounts in the front and rear baggage compartments. Persons who were in contact with the crew and passengers said they all appeared well rested and were jovial in anticipation of their return home.

As soon as the party boarded the aircraft its engines were started and an estimated 10 minutes elapsed during which the engines were warmed and power checked. One witness observed Mr. Coligny and Mr. Hughes seated in the left and right cockpit seats, respectively. At 0638 the flight requested and received taxi clearance and thereafter proceeded to runway 11 by a taxi course which required several turns. While approaching the takeoff runway the flight was informed that there was no other traffic and it was cleared directly onto the runway for takeoff. The aircraft taxied into position where it stopped for one to two minutes during which time several persons heard the propellers run through.

The takeoff was observed by four witnesses located at three different places on the airport. These locations afforded three views of the takeoff--a rear view, a side view, and a quartering rear view. The witnesses included two

experienced pilots and the tower controller. All were in substantial agreement as to the events which occurred.

The eyewitnesses said the takeoff roll was begun with a smooth unfaltering application of power. The ground roll was straight and the plane became airborne after about 2,000 feet. The transition from ground to air seemed entirely normal and there was no noticeable yaw, pitch, or roll. The aircraft assumed a normal climb to between 75 and 100 feet; however, the landing gear remained extended. The climb was somewhat steeper until the aircraft reached 150-200 feet. Witnesses said that at this point as airspeed increased the climb steepened rapidly but smoothly until the aircraft was in a near vertical nose-up attitude. Still there was no noticeable roll or yaw and the path of the aircraft remained approximately over the runway. The witness located directly behind the aircraft stated that at the peak of the climb, variously estimated as between 500 and 700 feet, he could read the identification of the plane painted on the upper surface of the right wing. The Lodestar then nosed forward slightly and hung momentarily in a steep nose-up attitude with its wing rocking. One witness, the most experienced pilot, said that the aircraft at this position was clearly stalled. Immediately thereafter the aircraft pivoted counterclockwise reversing its heading, assumed a vertical nose-down attitude, and plunged to the ground.

Several additional witnesses saw the descent, their attention called to it by witnesses who saw the entire flight. Still others heard the engines' sound but did not see the plane. Almost all of these persons, including the most qualified pilots, stated that the engine sound indicated continuous development of high power throughout the flight. A few, however, described a reduction of power at the peak of the climb and one or two others stated that they thought one or both engines were malfunctioning. Nearly all witnesses agreed that during the descent there was an engine sound indicating high power.

The crash site was located about 300 feet to the right of the centerline of runway 11 and approximately 3,850 feet from the runway threshold. The latter distance is about one-half of the runway length. At impact the aircraft was on a heading of about 290 degrees, or approximately the reciprocal of the takeoff direction. The high concentration of wreckage, the near horizontal contact of the propeller blades with the ground, and the compression nature of the structural damage showed the aircraft struck the ground in a near vertical nose-down descent. The impact and subsequent fire destroyed much of the aircraft structure. Examination confirmed that the landing gear was extended at impact.

Because of the unusual ascent after takeoff great attention was devoted to the examination of the control system and in particular the elevator and the elevator trim tab controls. Investigation in this regard disclosed that the empennage was about 80 percent destroyed, having fallen directly into the concentration of fire as the fuselage accordioned during the impact. These forces, however, acted to relieve tensions on the control cables and upon examination it was found that all control cables to the empennage were properly attached at both the cockpit and empennage ends. Except where the cables were cut to remove the occupants from the aircraft the cables were intact. As near as could be determined there was no evidence to indicate jamming or interference of the elevator, rudder, or trim control systems. Similarly, the aileron control cables were found unbroken and properly attached.

The cockpit control settings were also carefully examined. Although all other trim tab controls were positioned normally for takeoff the elevator trim tab indicator was found indicating a setting of 17-1/2 units nose-down. This setting, according to several competent Lodestar pilots, including the chief pilot of the C. R. Vose Company, was abnormal for any flight configuration, especially for takeoff which was normally at or near zero, depending upon the gross load.

The elevator trim tab control setting of 17-1/2 units nose-down as shown by the indicator was pursued by examination of the trim tab control assemblies recovered from the wreckage of N 45378. It was learned that the windings of the control cable on the elevator trim tab control drums in each of the elevator trim tab assemblies corresponded with the control cable windings on the cockpit elevator trim tab control drum. Disassembly of the units and a study of their mechanical operation showed the elevator trim tab of N 45378 was positioned for an extreme nose-down condition when the units were recovered. Thus, this examination further revealed the cockpit indicator showed an indication which corresponded closely to the trim tab position.

The elevator trim tab is connected on the Lodestar aircraft directly to a shaft screw which extends or retracts as the control cable rotates the trim tab control drum. Because of this mechanical design the position of the shaft screw is not susceptible to displacement by impact. On N 45378 the position of this unit corresponded to the 17-1/2 units nose-down indication of the cockpit indicator.

Cockpit positioning of the elevator trim tab setting is accomplished by a crank-type control located on the pedestal just below the throttles when set in the idle position. An arrow moves with the cranking action pointing to the trim tab setting, which is displayed as units of nose-up or nose-down adjustment. The range of adjustment is from 25 units nose-up to 25 units nose-down. Clockwise turning of the crank produces nose-up trim and the reverse, nose-down. Examination of the indicator of N 45378 showed the numerical graduations were clear and easily readable even after the accident.

All other cockpit control positions of the subject aircraft were found normal for the takeoff configuration except for the landing gear handle. This was found in the down and locked position, thus corresponding to the actual position of the landing gear. This was not considered normal because it showed no attempt had been made to retract the gear after the aircraft became airborne.

Evidence showed that all major components of the aircraft and all flight control surfaces were within the immediate wreckage area. It was also determined that all doors and access panels were closed on impact. No evidence was found to indicate structural failure or fire in flight.

The powerplants of N 45378 were torn from their mounts and buried approximately four feet in the sandy soil by vertical impact. These units were removed from the wreckage site to a sheltered location suitable for examination.

Nearly all cylinders were removed from the engines for inspection and to permit examination of the interiors of the engines. This revealed normal operation of the cylinders prior to impact and clear evidence of adequate lubrication of all components. Examination of the screen and magnetic plug revealed no

foreign material. The inspection also showed that damage was the result of impact and there was no evidence of malfunction or failure.

The blades of both propellers showed deep scratches and bending in evidence of high rotational forces at impact. Also, deflection of one or more spider arms of each propeller was indicative of appreciable power. Markings on the propeller shim plates made by impact showed the propeller blade angles were those commensurate with equal and appreciable development of power from the engines.

Testimony of the Vose chief pilot indicated that the allowable gross takeoff weight for N 45378 was 19,500 pounds. This, however, was not substantiated by the records on the aircraft kept by the Civil Aeronautics Administration. The latest CAA Form ACA-337, dated February 25, 1957, listed the allowable gross takeoff weight as 18,500 pounds. Further review of this form with regard to work performed on the aircraft at the time, and in light of Aircraft Specification No. A-723, showed that N 45378 substantially qualified for the 19,500-pound weight, including being equipped with 1820-72 engines. Nevertheless, application, inspection of the aircraft, and certain requirements concerning aircraft manuals for the increased gross weight as required by CAR No. SR-407 had not been complied with.

Investigation of the loading condition of N 45378 at the time of the accident of necessity required an approximation of the amount of fuel in the front tanks and the weight of baggage. Assuming a minimum weight of 550 pounds of baggage and that the front tanks were at least one-fourth full, together with other accepted weights from the latest weight and balance data, it was evident that N 45378 was loaded to at least an approximate gross takeoff weight of 19,500 pounds, or about 1,000 pounds overloaded. This load was, however, properly distributed with respect to the center of gravity limitations of the aircraft.

Because of the abnormal ascent of the aircraft the possibility of a sudden weight shift was actively considered. Witness testimony and locations of baggage in the wreckage disclosed the load had been correctly distributed and the baggage had been properly placed in the baggage compartments. There were no large single items aboard to cause a shift of weight which could account for the flight path of the airplane. Rescue personnel found that although passenger seats were torn free, all occupants were in seats with safety belts fastened at the time of impact. They also confirmed that Mr. Coligny and Mr. Hughes occupied the left and right cockpit positions, respectively.

A triangular wedge-type external elevator-rudder control lock was found at the perimeter of the fire area. This item was undamaged except that the side facing the fire was scorched and its paint was blistered. Suspecting this lock may have been on the empennage during flight the investigators pursued this as a possibility. From the chief pilot of the Vose organization it was learned the lock was merely surplus equipment and no longer used as a gust lock on N 45378. He stated that the Lear rudder system was on the aircraft and when this modification was accomplished in early 1957 a new locking system was also installed. He said the design of the system which held the yoke rearward would make it virtually impossible for Mr. Coligny to take his seat with the locking system engaged. Further, turns during taxiing as were made by the aircraft would be very difficult with the lock engaged. Investigation showed that this locking device was not in place in the cockpit after the crash and there was no indication it was in place prior to impact.

Records indicated that the Lodestar, at the time of the last ACA-337, had received a 1,500-hour inspection. This, among other things, included an inspection of the airframe, control system, the installation of the Lear-type rudder, and the installation of two new engines. On February 25, 1957, following completion of the work, the aircraft was test flown and returned to service. From then until the accident the aircraft had been flown about 215 hours.

Statements were obtained from experienced Lodestar pilots concerning the yoke forces which could be produced by various settings of the elevator trim tab controls. These were to the effect that the trim tab forces are very powerful and that certain improper trim tab positions would produce forces which the crew may not have been able to overcome if they were surprised and did not take prompt corrective action. In two instances pilots reflecting personal experiences stated they had taken off with the elevator trim tab inadvertently positioned for a full-flap landing. They stated that shortly after becoming airborne they experienced a very powerful rearward pressure on the yoke. This occurred rapidly enough that an element of surprise was introduced. The pilots said that except for an immediate change of trim they believed the force would have been too powerful to overcome. One pilot said his plane reached a steep nose-up attitude and although his corrective action was prompt the aircraft nearly stalled.

In its accident investigation work the Board has found that at least two Lodestar accidents resulted from improperly positioned elevator trim tabs during takeoff. In both instances witness' descriptions of the flight paths of the aircraft were nearly identical to the descriptions given of the flight path of N 45378.

The Vose chief pilot testified that Pilot Coligny had been a personal acquaintance of his for many years and that Mr. Vose employed him on April 1, 1957. Records on Mr. Coligny indicated that at this time he had accumulated more than 10,000 flying hours, with about 1,000 in the PV-1 and Lodestar aircraft. Following employment, the chief pilot flew with Mr. Coligny for approximately 100 hours. He stated that during this time Mr. Coligny's operation of the aircraft was satisfactory and described him as an accomplished and conservative pilot. In response to questions he said the subject aircraft was equipped with a pre-takeoff checklist and that from his observations he noted it was Mr. Coligny's habit to use it.

Analysis

At takeoff N 45378 was loaded to an estimated weight of 19,500 pounds. CAA records indicate that the aircraft substantially qualified for this weight but no application had been made for it. Thus, the aircraft was certificated for only 18,500 pounds and was therefore overweight approximately 1,000 pounds at takeoff. Since the aircraft was qualified for the higher weight and the load was properly distributed it is obvious the additional weight would not adversely affect its operation and was not a factor in the accident.

During the Board's investigation every consideration was given to the various causes which could produce the steep ascent of the aircraft. In this regard, numerous possibilities such as load shifts, control malfunction, and locked controls were exhaustively pursued and virtually eliminated by clear and cumulative evidence. Further, the very nature of the flight path, which was

straight without roll or yaw, and which reached an approximate height of between 500 and 700 feet in less than 4,000 feet of forward movement, clearly eliminates the possibility of malfunction or failure of either or both powerplants. Furthermore, exhaustive examination of these units revealed they were capable of normal operation prior to impact. The Board determined by clear and cumulative evidence that any changes in power sound which may have been heard during the short flight of the aircraft must have been caused by throttle movement rather than powerplant malfunction.

An analysis of fuel consumption from Nome to King Salmon, based on the amount of fuel added to the rear and auxiliary fuel tanks at King Salmon, reveals considerable amounts were burned from each of these tanks en route. The considerable nose-up trim required during a normal landing would be increased by this apparent fuel scheduling. From an operational consideration it is therefore believed that the trim position during landing at King Salmon, if not changed for takeoff, and if coupled with surprise and delayed corrective action, would produce a nose-up force that could not be overcome manually.

The possibility of an improperly positioned nose-up trim condition is also suggested by the setting found after the crash, 17-1/2 units nose-down. According to reliable statements and testimony, the setting does not relate to any normal flight configuration for the aircraft. Operationally, the flight path as described could not have occurred had this nose-down setting existed during the takeoff. Believing the condition was not the result of impact, it is very probable that it resulted from a desperate attempt of the crew to relieve the yoke pressure without regard to obtaining a specific setting.

The improperly positioned nose-up trim setting is suggested by similarity between the flight path of N 45378 and the flight paths of other aircraft that crashed because of this condition. The condition is also suggested by the similarity of the early part of the flight to those in which accidents nearly resulted from the condition.

After careful consideration and analysis of the available evidence, it is the belief of the Board that this accident was the result of taking off with the elevator trim tab positioned for landing.

Findings

On the basis of all available evidence the Board finds that:

1. The aircraft and crew were properly certificated.
2. The flight, after being cleared, began a takeoff from runway 11 in clear weather conditions at the King Salmon Airport.
3. The aircraft was loaded about 1,000 pounds in excess of the allowable gross takeoff weight; however, the load was properly distributed and the excess weight was not a factor in the accident.
4. After becoming airborne the aircraft assumed a normal climb attitude to about 100 feet.

5. As airspeed increased the climb steepened smoothly but rapidly until the aircraft was climbing in a near vertical nose-up attitude.

6. The aircraft stalled at an altitude of between 500 and 700 feet, pivoted counterclockwise, and plunged to the ground in a vertical nose-down attitude.

7. Examination of the cockpit trim tab control indicator and actuating mechanism of the elevator trim tab revealed the tab was set to 17-1/2 units nose-down.

8. The above elevator trim tab position is abnormal for any usual flight condition, especially for takeoff, and resulted from a desperate attempt to relieve yoke pressure.

9. The rearward yoke pressure resulted from the elevator trim tab being positioned for landing during the takeoff.

Probable Cause

The Board determines that the probable cause of this accident was the pilot's action in taking off with the elevator trim tab positioned for landing.

BY THE CIVIL AERONAUTICS BOARD:

/s/ JAMES R. DURFEE

/s/ CHAN GURNEY

/s/ HAROLD D. DENNY

/s/ G. JOSEPH 'NETTI

/s/ LOUIS J. HECTOR

S U P P L E M E N T A L D A T A

Investigation and Taking of Depositions

The Civil Aeronautics Board was notified of this accident through CAA facilities about 0800 July 10, 1957. An investigation was immediately initiated in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. Depositions were taken at King Salmon, Alaska, on July 20, 1957, and in New York, New York, on August 16, 1957.

Operator

The C. R. Vose Company is an insurance brokerage organization domiciled in New York, New York. It owned N 45378 as its only aircraft which was used in furtherance of its business.

Flight Personnel

Edward Coligny, age 49, had been employed by the C. R. Vose Company as a pilot since April 1, 1957. He held a currently effective airman certificate with airline transport rating. Mr. Coligny had accumulated approximately 10,000 flying hours. He was first rated on Lockheed Lodestars in August 1953, had accumulated about 1,000 hours, of which 160 were in N 45378, between April 1 and the accident date. Mr. Coligny was rated in the DC-3 and A-26 aircraft and held numerous other airman ratings. His latest CAA first-class medical certificate was current and dated November 5, 1956. It carried the following limitation, "Holder shall possess adequate correcting lenses while exercising the privileges of airman certificate."

Ralph L. Hughes, age 45, had been in the employ of the company for several years as a flight engineer and mechanic on N 45378. He held a valid airman certificate and ratings as a flight engineer and as a mechanic on aircraft and aircraft engines. Mr. Hughes' principal responsibility was to maintain the Vose aircraft.

The Aircraft

N 45378, a Lockheed Lodestar, model 18-56, serial number 2506, was owned and operated by the C. R. Vose Company. It was purchased new November 23, 1945, by Mr. Vose and at the time of the accident had accumulated 4,181 flying hours. An airworthiness certificate issued July 17, 1956, stated, "Remain in effect as long as the aircraft is maintained in accordance with Civil Air Regulation Part 43." Records showed the aircraft was properly maintained. Last overhaul of the aircraft was completed February 25, 1957, during which two new Wright engines, model R-1820-72, and two overhauled Hamilton Standard propellers, models 33D50-111 with model 6511A-12 blades were installed. The last 100-hour check was completed May 5, 1957.