

CIVIL AERONAUTICS BOARD

AIRCRAFT ACCIDENT REPORT

ADOPTED: November 5, 1963

RELEASED: November 8, 1963

ZANTOP AIR TRANSPORT, INC
 CURTISS C-46F, N 616Z
 PUYALLUP, WASHINGTON
 FEBRUARY 16, 1963

SYNOPSIS

Zantop Air Transport, Inc., LOGAIR Flight 60-16, a Curtiss C-46F, N 616Z, crashed following an attempt to land on runway 17 at Thun Field, near Puyallup, Washington, at 1826 P.s.t., February 16, 1963. Both crew members survived the crash but were severely injured. There were no other occupants. The aircraft was destroyed by the impact and post-impact fire.

An engine malfunction seven minutes after takeoff from McChord AFB, Washington, was followed by an unsuccessful attempt to feather the propeller and by intermittent overspeeding. During an attempted go-around from the landing approach the pilot lost control of the aircraft and crashed in a pasture approximately one-half mile northeast of Thun Field.

The Board determines that the probable cause of this accident was the improper handling of an emergency situation, precipitated by a mechanical malfunction, which resulted in an unsuccessful single engine go-around.

A contributing factor was the failure of Radar Approach Control to provide complete, accurate airfield data to the pilot.

Investigation

Logair^{1/} Flight 60-16 originated at Hill AFB, Utah, February 16, 1963, and was scheduled to return to Hill AFB via Portland International Airport, Portland, Oregon; McChord AFB, Washington; and Malmstrom AFB, Montana.

Captain Keith R. Stone and First Officer D. Henschel of Zantop Air Transport, Inc., operated Flight 60-16 in a Curtiss C-46F aircraft N 616Z, from Hill AFB, and arrived at McChord AFB at 1619^{2/} February 16, 1963.

Captain Stone stated that the flight was routine and no mechanical discrepancies were noted or recorded in the flight log. No maintenance was performed at McChord AFB. The aircraft flew 9:50 hours on February 16, 1963, prior to its arrival at McChord AFB. The last recorded discrepancies concerning the copilot's sliding window, and the main hydraulic system accumulator pressure, were corrected before the aircraft left Hill AFB.

^{1/} Logistic Air Support.

^{2/} All times herein are Pacific Standard based on the 24-hour clock.

Captain Laurence W. Wenzel and First Officer Clarence B. Miller were originally assigned to fly C-46F, N 618Z. They departed McChord AFB in this aircraft but, 10 minutes after takeoff, they returned to McChord AFB because of a hydraulic malfunction. They were then rescheduled to fly N 616Z to Hill AFB via Malmstrom AFB. This aircraft had already been loaded with 9,471 pounds of cargo and 1,200 gallons of fuel. The weight and balance form signed by Captain Wenzel indicated that the takeoff gross weight was 46,751 pounds and the center of gravity (c.g.) was 29.3 percent Mean Aerodynamic Chord (MAC). Both the weight and c.g. were within limits.

The flight departed McChord AFB at 1813 on an Instrument Flight Plan to Malmstrom AFB via V-2, and V-120 airways, then direct to Malmstrom AFB. The crew requested and received radar vectors from McChord Departure Control to intercept V-2 airway. The departure was normal until 1820, at which time the aircraft was 13 miles east-northeast of McChord at approximately 4,600 feet m.s.l. climbing to 9,000 feet. At this point the crew requested a clearance to return to McChord AFB. The radar controller provided the flight with a vector to intercept the precision approach course for runway 16 at McChord. The flight was instructed to maintain 3,000 feet. The crew acknowledged the transmission and said they would descend to and maintain 3,000 feet. When the controller asked the crew the nature of their difficulty they advised that they had "feathered the left engine." The controller gave the flight the McChord weather as 2,600 scattered; estimated ceiling 7,000 broken; cirriform; visibility 15, temperature 48, dewpoint 43; wind calm; altimeter 30.07. At 1821:38 the crew reported a runaway propeller; at 1822:05 they reported it was under control; and at 1822:20 the crew radioed that the propeller had gone back to "flat pitch" again. The controller asked whether the flight was VFR and upon receiving an affirmative reply, advised the crew that the aircraft was "exactly five miles north of the runway at Thun Field." At 1822:59 the crew asked the controller to have "Thun Field flash their landing lights." At 1823:13 the crew requested "a Vector." The controller responded with "Roger, turn left heading 150 for Thun Field," which was acknowledged by the crew. At 1823:35 the flight was advised that they were 4 miles north of Thun Field. The runway length was given to the crew by the controller as "five thousand three hundred," which was correctly read back. At 1824:05 the controller instructed the flight to "turn right heading one five five," and stated that they were 3 miles north of the airport. At 1824:33 N 616Z was advised that it was one mile north of the field and possibly a little left of the runway. The field elevation was given to the flight as 520 feet which was acknowledged. At 1825:00 the crew made a transmission that was garbled in the beginning but ended "high we'll have to go around." This was the last radio contact between the aircraft and the controller. At 1825:40 and 1826:10 the controller made transmissions to the aircraft that were not answered.

An aeronautically qualified witness observed the aircraft an estimated three miles east of Puyallup, Washington. His attention was drawn to the aircraft when he " . . . heard the sound of one engine rev up at a high RPM just as though it had been changed to full low pitch." The witness noted that the aircraft appeared to maintain its altitude which he estimated to be 4,000 or 5,000 feet. A short time later, approximately two or three minutes, he heard the engine run up to high RPM, the sound level was quickly reduced and a flash of fire was seen coming from the aircraft. A "medium banked" turn to a southerly heading was noted, followed by a definite descent. The aircraft lights disappeared from sight. No crash or fire was seen or heard by the witness. He later learned of a crash near Thun Field and volunteered this information.

Another aeronautically qualified witness was standing midway down the west side of runway 17/35 at Thun Field. He observed a large aircraft on a long final approach. The aircraft appeared to be lined up with the runway and flying at an airspeed of approximately 110-120 knots. It passed over the north end of the asphalt portion of

runway about 20-25 feet high, went a few hundred feet down the runway and made a steep climbing turn over the trees to the east of the runway. He estimated the aircraft climbed to an altitude of 75 or 100 feet over the tree tops. These trees are reported to be 100 feet high. The witness further stated that the flight ". . . was holding its own until the propeller oversped again and the aircraft made a descending turn toward the west." He heard the sound of the crash, did not see the impact, but did see the resulting fire. The witness did not know whether the landing gear or landing flaps were extended during the approach to Thun Field or during the go-around. However, he stated that the landing lights were on during the landing approach. A number of other witnesses heard the sounds of the aircraft from various ground positions and one of them saw a flame shoot out of one engine. None of these witnesses saw anything else significant other than an airplane descending toward Thun Field.

The aircraft struck the ground left wing tip first and nose low. The left wing struck two trees 36 feet beyond the point of initial impact, tearing off the wing and causing the aircraft to rotate in a counterclockwise direction until it skidded, tail first, on its belly to a position 219 feet from the point of initial impact. Both engines were torn from the aircraft, the cockpit area was severely damaged, and the fuselage was broken just aft of the main cargo door. The left wing fuel tanks separated from the wing and burned after impact. The captain was thrown from the aircraft still strapped in his seat. He received multiple fractures and burns. The first officer did not recall how he got out of the wreckage, but was found some distance from the aircraft suffering from a broken leg, concussion, and burns.

Examination of the aircraft wreckage showed that all the major aircraft components were in the wreckage area. The landing gear and flaps were found in the "Up" position. The rudder trim tab was found set 2-3/4 inches to the right (nose left) and the right aileron tab was 1-3/4 inches up (right wing up). Both settings are approximately 50 percent of the respective trim tab's travel. The elevator trim tab settings could not be determined. No evidence was found of any pre-accident damage or malfunction of the flight control systems or the aircraft structure.

Examination of the engines showed both to be relatively intact with the propellers attached. The propeller dome of the left propeller was removed and the piston was found positioned at the low pitch (10°) stop. Examination of the carburetor from the left engine showed the mixture in the "full rich" position with the control arm bent away from the carburetor. The throttle was in the full open position, and the throttle control rod that connects the throttle arm to the jack shaft was separated from the rod end at the carburetor control arm. The internal threads of the rod end were worn. The throttle control rod was recovered with the lock nut in place on the carburetor end of the rod. The threads were worn away and the rod could be inserted into the mating rod end fitting without the threads engaging. A metal washer, found between the carburetor adapter and the blower case, had cut a hole in the gasket during installation. The carburetor passed a bench check satisfactorily. All other engine components were found in a normal condition except the propeller governor and the feather pump and motor assembly.

The pressure cutout switch in the propeller governor was found to have five pressure adjusting shims installed. A bench check revealed that the switch operated at 700-745 p.s.i. Three shims were removed and the switch opened at 590 p.s.i. which is a normal setting. The switch, as installed, was opening approximately 100 p.s.i. higher than specified by the overhaul manual. When retested by the overhaul facility with the five shims reinstalled the switch opened at 665-670 p.s.i. The published limits are 575-625 p.s.i. The records of the overhaul facility indicated that

scheduled calibration of their test gauges had been accomplished. The switch was installed in another aircraft, and during ground tests the pressure switch opened when the propeller was fully feathered. However, on two tests, the holding coil held the cockpit feathering switch "in" during the unfeathering cycle. A flight test revealed no discrepancies.

The feather pump and motor assembly could not be operated as a unit due to impact damage. The commutator was discolored by heat and had burned spots on it. One brush was stuck in a holder that had overheated; the holder was partially melted, and the brush spring had collapsed and lost tension. There was no external heat damage nor evidence of ground fire in the pump area. The pump was bench checked satisfactorily.

The right engine showed no signs of pre-accident damage or operational distress.

Both engines had been installed in N 616Z by the Zantop maintenance facilities at Ontario, California, and were released for flight on January 17, 1963. A test flight was performed on January 17, 1963, which included full feathering in flight, with no reported discrepancies. Both engines operated 227:51 hours time since overhaul (TSO) before the last flight. The mixture control arm on the left engine was replaced after 110:56 TSO, the right magneto of the left engine was replaced at 144:48 TSO, and a No. 2 check was performed in the aircraft at 147:38 during which time a No. 1 inspection was performed on the left engine. The left throttle linkage was adjusted by an unlicensed mechanic at this time. A ground check showed no discrepancies and the aircraft flew 65:53 without any reported engine problems after this maintenance. The aircraft records indicated that all maintenance was performed and signed off in accordance with company and FAA requirements. However, the investigators were not able to ascertain what person inspected the adjustment on the throttle linkage. The testimony of the maintenance personnel who performed the work during the engine runup and post runup adjustments indicated that there were no discrepancies on the engine when they completed their work. The engine runup after maintenance was documented and the form was signed off by the shift foreman.

The landing area at Thun Field was approximately 5,200 feet long and 3,420 feet of this area is a macadam surfaced runway 40 feet wide. The remainder of the landing area, approximately 800 feet on the north end of the runway and 1,000 feet on the south end, was rough graded soil containing gravel, rocks, stones, and sod. The runway lights consisted of two green lights on the runway edges, 660 feet down the runway from the approach end of runway 17 and 10 sets of white lights spaced 240 feet apart, along the runway. The parallel rows of lights were 49 feet apart. A number of these runway lights were missing or inoperative at the time of the accident. There was a rotating white beacon installed and operating at Thun Field. The remaining portion of the landing area was not lighted. According to a Federal Aviation Agency survey performed October 3, 1962, there are tall trees in the approach zone which reduce the useable length of the hard surfaced runway to 2,667 feet.

Approximately 1,000 feet east of and nearly parallel to the runway is a brightly lighted "drag strip" which is estimated to be 5,000 feet long and 90 feet wide. The drag strip looks very much like a lighted runway.

The FAA Radar Approach Control (RAPCON) chief testified that information taken from the State of Washington Directory of Airports was used to compile the data regarding Thun Field. This directory showed Thun Field's runway to be 5,300 feet long (3,500 feet asphalt) and 150 feet wide, elevation 520 feet, and a rotating beacon lighted all night. The Directory noted that 40-foot trees created an obstruction c

north approach. A card regarding Thun Field was placed in a cardex file for use by controllers in the RAPCON in assisting aircrews during in-flight emergencies. The RAPCON chief further testified that he was not aware of the FAA Form 29A Airport Facilities Record, which was prepared in October 1962 by the Seattle FAA Airport Engine

A Jeppesen Chart aboard the aircraft depicts Thun Field as having a 3,200-foot long hard-surfaced runway with 1,000-foot sod extensions on either end. However, this chart was not referred to by the crew.

The copilot testified that he recalled few details about the crash or the events immediately preceding it. He stated that the flight was normal until the captain initiated the feathering action for the left engine. The copilot does not know what action the captain took to feather the propeller or to control the overspeeding that followed the feathering attempt. The only engine instrument he recalled seeing was the manifold pressure gauge which showed 26 inches of mercury. At the captain's direction the first officer flew the aircraft while the captain attempted to feather the propeller and control the overspeed. The copilot stated that the captain was flying the aircraft during the approach to Thun Field. He remembers nothing about his escape from the aircraft.

The captain testified that he was unable to recall many details regarding this flight. He did, however, recall seeing some items, including a tachometer drop to 1700 r.p.m. and then increase to 3300 r.p.m.; the horizon go by the copilot's window; and a short intense flame coming from the exhaust pipe. He was also able to recall pressing the feathering button with both thumbs and the short flight he made immediately preceding this one. He was not able to recall his preparation for flight 60-16 and, except for the items listed above, has no recollection of any phase of the flight.

The feathering check list used in case of engine failure as prescribed by the Zantop Operations Manual is:

1. Meto Power or Power ----- (100 oct) as necessary
2. Propeller ----- Feather
3. Mixture ----- Idle cut off
4. Gear and Flaps ----- Up
5. Firewall Shut off ----- Full out
6. Throttle ----- Closed
7. Feathered Propeller ----- Full low RPM
8. Boost Pump ----- Off
9. Blower ----- Low
10. Fuel Selector ----- Off
11. Ignition ----- Off
12. Generator ----- Off

Analysis

The weather had no bearing on this accident.

The aircraft was loaded properly and its gross weight and center of gravity were within limits.

No evidence was found of any pre-impact malfunction of the flight control system or aircraft structure.

The only powerplant malfunctions that occurred before the accident were the separation of the throttle linkage, and a malfunction in the propeller feathering system.

The last recorded maintenance performed on the throttle linkage was at the Zantop facility in Ontario, California, during a No. 1 engine check. At that time the throttle linkage was adjusted to correct a lack of cushion on the left throttle which was discovered during the runup after inspection. This discrepancy was corrected by an unlicensed mechanic and as far as can be determined his work was not inspected. The jam nut which locks the throttle rod to the rod end at the throttle arm clevis was not properly secured. This is substantiated by the lack of burnishing of the face of the nut where it normally bears on the clevis shoulder. The control rod thread engagement inside the rod end was marginal, at best, barely reaching the witness hole. The extreme amount of wear that occurred to this rod end can be accounted for, in a large part, by the improper installation of the jam nut and by marginal mating between the threads of the rod and the rod end. This in turn allowed the throttle rod to become worn to such a degree that the threads could no longer hold in the rod end and the throttle linkage separated due to normal engine vibrations and throttle movements.

Ground tests showed that a throttle linkage disconnect, with the throttle near or forward of a climb power position, resulted in the throttle valve going to the full open position. The same tests made with the throttle aft of a climb power setting resulted in the throttle valve going to approximately 26 inches of mercury ("Hg). In either event there would be no immediate urgency to shut the engine down and feather the propeller. However, in view of the relatively short distance to McChord AFB and the single engine capabilities of the aircraft, the pilot's decision to shut down the engine and feather the propeller was in accordance with acceptable pilot procedure.

The copilot stated that, when his attention was drawn to the manifold pressure gauge by the pilot, he observed a reading of approximately 26 "Hg. No unusual noise or instrument readings were noted which would indicate an internal engine failure, nor were there any indications of engine fire. Therefore, the left engine was capable of delivering power without internal damage, prior to the initial attempt to feather and the power output of the left engine should have been controllable, in part, by proper use of the propeller control.

Examination of the feathering system indicates that it was capable of feathering the propeller. However, the high pressure setting of the propeller governor pressure cutout switch could have adversely affected the proper sequence of events during the feathering cycle. If this switch fails to open upon completion of a feathering cycle the feathering pump motor will continue to operate and the propeller will go into a unfeathering cycle. The function of the cutout switch is to release the holding coil in the cockpit feathering switch. If this coil does not release, the feathering button will stay depressed and keep the feathering motor operating continuously throughout the feathering and unfeathering cycle. When the propeller reaches the low pitch stop the pressure cutout switch will open, the feather-unfeather cycle will terminate and the propeller will resume a constant speed operation at the r.p.m. selected by the propeller control in the cockpit. As the propeller is forced through the unfeathering cycle and reaches the low pitch stop, the propeller will overspeed until it seeks out and stabilizes at the r.p.m. selected by the propeller control. The propeller will stay at this r.p.m. until some action is taken through either the feathering switch or the propeller control to change the selected pitch angle. The number of times the cycle was repeated is not known, however, the feather pump motor^{3/} was damaged by

^{3/} An intermittent duty rated electric motor.

temperature at the brush and commutator assembly. The operating capability of the feather pump motor was exceeded by repeated feather and unfeather cycles. This conclusion is further substantiated by the overspeeds observed by witnesses and the crew.

The feathering procedure for the C-46 published in the Zantop Operations Manual was not followed. The feathering switch was depressed, however, the mixture was found in the full rich position rather than idle cut off. The propeller control piston was found against the low pitch (high r.p.m.) stop indicating either that the propeller control in the cockpit was not selected to the high pitch (low r.p.m.) position as prescribed in the manual, or the feathering switch was still depressed and the feathering pump had driven the propeller to the low pitch stop. The observations of fire by the witnesses indicate that the firewall shutoff valve was not operated. From the above cited evidence it is apparent that the feathering procedure was not properly executed and this led to an intermittent overspeed condition as the propeller went through the feather-unfeather cycle. The feather-unfeather cycle could have been terminated at any time had the pilot manually released the feathering switch from its depressed position as he did when he performed the ground check of the feathering pump motor during his engine runup before takeoff.

The pilot's decision to land at Thun Field must be considered in the light of the circumstances and the information given to him by the RAPCON controller. Believing that he had a runway in excess of 5,000 feet available and closer to him than McChord AFB, he attempted to land under emergency conditions. RAPCON did not inform the pilot of physical facts essential to a proper evaluation of the airport's suitability. The omitted information included: partial runway lighting; tall trees in the approach zone; amount of useable hard-surfaced runway, and the fact that the runway was unusually narrow. His attempt to go around when he saw the actual condition of the field is understandable. In addition, there may have existed, in the pilot's mind, some doubt as to whether he was actually lined up with Thun Field. The brightly lighted drag strip to his left while on the final approach may have contributed to this doubt.

The estimated 120-knot airspeed on final approach is verified, in part, by the significant gain in altitude during the go-around in a relatively steep turn. At the gross weight of this airplane with a windmilling propeller on the left side, maximum power on the right engine and operating in ground effect, the aircraft would have little, if any, climb capability at a normal single engine approach speed. It is therefore obvious that either the left engine was developing some power or the aircraft had a relatively high airspeed on the final approach. The copilot stated that he did not know whether he put the landing gear down; however, the sound of the gear warning horn can be heard in the background of the recorded radio transmissions during the final phase of the flight indicating that the landing gear was not down and locked. It is not possible to determine whether the left turn during the go-around was caused by excessive drag from a windmilling left propeller or was induced by the pilot. From all evidence available it appears that the turn was intentional and that some power was available from the left engine. This probability is substantiated by a witness statement that the pilot apparently "had it made" after levelling off over the trees 175 to 200 feet above the ground. Then the propeller oversped and apparently created an asymmetrical drag condition which pulled the airplane down and to the left. The pilot saw the open field in front of him and attempted a wheels-up forced landing.

In summation, the pilot's interpretation of an engine malfunction led to a decision to feather the engine. The improperly rigged pressure cutout switch caused the feathering button to stay depressed, held by the holding coil. This, in turn, allowed the feathering pump motor to run until the propeller was driven to the low pitch stop, causing the propeller to overspeed. This malfunction, combined with the pilot's actions, caused the propeller to go through a series of feather-unfeather cycles with

their attendant overspeeds. The pilot's failure to correctly analyze the engine malfunction; to perform the feathering procedure in the prescribed manner; and to analyze the feathering system malfunction, all contributed to this condition. Furthermore, the inadequate information given to the pilot by RAPCON regarding the runway at The Field led the pilot to make a decision to land at that field. The go-around was a result of the physical appearance of the landing area, and was successful until the left propeller oversped causing the pilot to lose control of the aircraft, resulting in a crash landing.

Probable Cause

The Board determines that the probable cause of this accident was the improper handling of an emergency situation, precipitated by a mechanical malfunction, which resulted in an unsuccessful single engine go-around.

A contributing factor was the failure of Radar Approach Control to provide complete, accurate airfield data to the pilot.

BY THE CIVIL AERONAUTICS BOARD:

/s/ ALAN S. BOYD
Chairman

/s/ ROBERT T. MURPHY
Vice Chairman

/s/ G. JOSEPH MINETTI
Member

/s/ WHITNEY GILLILLAND
Member

CHAN GURNEY, Member, did not take part in the adoption of this report.

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

Investigation

The Civil Aeronautics Board was notified of the accident immediately after occurrence. An investigation was started at once in accordance with the provisions of Title VII of the Federal Aviation Act of 1958, as amended.

Air Carrier

Zantop Air Transport, Inc., is a Supplemental Air Carrier incorporated in the State of Michigan. It holds a currently effective interim certificate for supplemental air transportation and a temporary certificate of convenience and necessity for supplemental air transportation issued by the Civil Aeronautics Board. It also holds an air carrier operating certificate issued by the Federal Aviation Agency. LOGAIR flights are performed by this corporation under a contract with the United States Air Force.

Flight Personnel

Captain Laurence W. Wenzel, age 42, was employed by Zantop Air Transport, Inc., in April 1962. He held a valid air transport pilot certificate with ratings in C-46 aircraft. Captain Wenzel had a total of 7,003 hours, 1,133 hours of which were in C-46 type aircraft, and had flown 204 hours in the last 90 days. His last proficiency check in a C-46 was August 20, 1962. He held a first-class medical certificate, without waivers, dated January 30, 1963.

First Officer Clarence B. Miller, age 28, was employed by Zantop Air Transport, Inc., in 1962. He held a valid commercial pilot certificate with no type rating. His commercial license was for single engine land with instrument rating. First Officer Miller had 2,133 hours total time, 300 hours of which were in the C-46 and had flown 229 hours in the preceding 90 days. His last proficiency check was dated August 12, 1962, and was given in a C-46. He held a first-class medical certificate, without waivers, dated May 30, 1962.

Aircraft

N 616Z a Curtiss-Wright C-46F, serial No. 22590 was owned and operated by Zantop Air Transport, Inc. It had flown a total of 17,683 hours and was manufactured in 1942. The last major overhaul inspection was performed at 5,076 hours. Zantop maintenance records indicate that the last preflight check was performed on February 16, 1963. The aircraft had flown a total of 80 hours since the last numbered check, (#2), completed on February 6, 1963. The aircraft was equipped with two Pratt and Whitney R-2800-75 engines which had flown 228 hours since overhaul. Two Hamilton Standard model 23E5-50 propellers with blade type 649B1B-6 were installed. The No. 1 propeller had flown 228 hours since overhaul and the No. 2 propeller 80 hours.