



National Transportation Safety Board Aviation Accident Final Report

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|--------------------------------|--------------------------------------|-------------------------|------------|
| Location: | Wheeling, IL | Accident Number: | CHI05FA212 |
| Date & Time: | 08/05/2005, 1225 CDT | Registration: | N421KC |
| Aircraft: | Cessna 421C | Aircraft Damage: | Destroyed |
| Defining Event: | | Injuries: | 2 Minor |
| Flight Conducted Under: | Part 91: General Aviation - Personal | | |

Analysis

The twin-engine airplane sustained substantial damage when it impacted the top of a single-story industrial building and then impacted a landscape embankment and trees during an attempted single-engine go-around. The pilot reported that the left engine failed during initial climb. He feathered the left propeller and returned to the airport to execute an emergency landing. The pilot reported that he had "excessive speed" on final approach and "overshot the runway." When the airplane was at mid-field, the pilot elected to do a go-around. He did not raise the landing gear and the flaps remained about 15-degrees down. The airplane lost altitude and impacted the terrain about .5 miles from the airport. A witness reported seeing the airplane attempt to land on the runway twice during the same approach, but ballooned both times before executing the go-around. The Pilot's Operating Handbook (POH) "Rate-of-Climb One Engine Inoperative" chart indicated that about a 450-foot rate-of-climb was possible during the single-engine go-around if the airplane was in a clean configuration. The chart also indicated that a 350-foot penalty would be subtracted from the rate-of-climb if the landing gear were in the DOWN position, and additionally, a 200-foot penalty would be subtracted from the rate-of-climb if the flaps were in the 15-degree DOWN position. Inspection of the left engine revealed that the starter adapter shaft gear had failed. Inspection of the engine maintenance logbooks revealed that the Teledyne Continental Motors Service Bulletin CSB94-4, and subsequent revisions including the Mandatory Service Bulletin MSB94-4F, issued on July 5, 2005, had not been complied with since the last engine overhaul on July 17, 1998. The service bulletin required a visual inspection of the starter adapter every 400 hours. The engine logbook indicated that the engine had accumulated about 1,270 hours since the last overhaul. The service bulletin contained a WARNING that stated, "Compliance with this bulletin is required to prevent possible failure of the starter adapter shaft gear and/or crankshaft gear which can result in metal contamination and/or engine failure."

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's improper in-flight decision to execute a go-around without raising the landing gear and raising the flaps to the full UP position, resulting in low airspeed and the airplane stalling.

Contributing factors to the accident included the pilot's failure to comply with the manufacturer's mandatory service bulletin and the failure of the starter adapter shaft gear which resulted in the loss of power to the left engine, and the collision with the building.

Findings

Occurrence #1: LOSS OF ENGINE POWER
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings

1. (F) MAINTENANCE,SERVICE BULLETIN/LETTER - NOT COMPLIED WITH - PILOT IN COMMAND
2. (F) ENGINE ASSEMBLY,OTHER - FAILURE

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: GO-AROUND (VFR)

Findings

3. (C) GO-AROUND - ATTEMPTED - PILOT IN COMMAND
4. (C) IN-FLIGHT PLANNING/DECISION - IMPROPER - PILOT IN COMMAND
5. (C) AIRSPEED - LOW - PILOT IN COMMAND
6. STALL - ENCOUNTERED - PILOT IN COMMAND
7. (C) FLIGHT CONTROL,FLAP - EXTENDED
8. (C) LANDING GEAR - EXTENDED

Occurrence #3: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: DESCENT - UNCONTROLLED

Findings

9. (F) OBJECT - BUILDING(NONRESIDENTIAL)

Occurrence #4: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings

10. TERRAIN CONDITION - DIRT BANK/RISING EMBANKMENT

Factual Information

HISTORY OF FLIGHT

On August 5, 2005, at 1225 central daylight time, a Cessna 421C, N421KC, was destroyed when it impacted a commercial building and terrain while attempting a go-around about 0.5 miles northwest of the Palwaukee Municipal Airport (PWK), Wheeling, Illinois. The pilot and passenger received minor injuries. The Title 14 Code of Federal Regulations Part 91 personal flight departed from PWK at 1220 and was en route to Mackinac Island, Michigan. Shortly after takeoff, the pilot reported a loss of power to the left engine and circled southeast of the airport to land on runway 34. The pilot attempted to land on runway 34, but executed a go-around. Visual meteorological conditions prevailed at the time of the accident. No flight plan was filed.

The pilot reported that he performed a preflight and departed to the northeast. At 600 feet above ground level (agl) he reduced power to 32.5 inches of manifold pressure (MAP) and 1,900 RPM. The pilot reported that an engine failed. He reported that he identified that the left engine failed and confirmed that the airplane was in a "clean" configuration. He contacted PWK tower and reported that he was returning to PWK for landing.

The pilot reported that he was northeast of PWK when the engine lost power, and that the tower cleared him to land on runway 34. The pilot reported that while he was on the base leg for runway 34, he lowered the flaps to 30 degrees. He reported that he turned on to the final approach course, the airspeed was 115 knots and he planned to "cross the fence" at 100 knots. He lowered the landing gear and lowered the flaps to 45 degrees.

The pilot reported, "Although the descent on final was not too steep, Gear Down, Flaps 45 degrees, and the throttle was in Idle position; I was unable to slow down the aircraft at all. I crossed the fence at 118 KIAS. Because of the excessive airspeed, I overshot the runway. At mid-field, when I realized that a safe landing can not be made, I push the Right throttle full forward and retracted the flaps to 15 degree and then to zero degree. I applied right rudder to maintain directional control and bank 5 degree to the Right. Right after retracting the flaps, I remember moving the landing gear to the UP position. (Although I realized later that the aircraft crashed with the gear in the down position.)"

The pilot reported the when the airplane crossed the fence at the northwest side of the airport, he verified that the mixture, propeller, and throttle were fully forward, and the airplane was in the clean configuration. The pilot reported, "It felt like the RIGHT engine does not produce full power."

The pilot reported that the airspeed continued to decrease and he was not able to gain any altitude. The airplane collided with the roof of a one story industrial building at 15-20 feet, and then impacted a landscape embankment and pine trees. The airplane came to rest on its belly. The pilot reported that he and the passenger evacuated the airplane immediately with only minor injuries.

A witness reported that he observed the airplane attempt to land on runway 34 two times during the same approach. He observed the airplane first attempt to land near the intersection of runway 34 and runway 30, but the airplane ballooned up. The airplane attempted to land again but it ballooned up a second time. The witness heard the pilot add power and attempt a go-around. He reported that the airplane cleared the airport fence, but he lost sight of the

airplane behind a tree line. He reported that the landing gear was down during the go-around.

PERSONNEL INFORMATION

The pilot held a private pilot's certificate with single-engine land, multiengine land, and airplane instrument ratings. The pilot reported that he had a total of 728 flight hours with 28 hours in make and model. He held a second-class medical certificate that was issued on September 22, 2004.

The pilot purchased N421KC in May 2005.

AIRCRAFT INFORMATION

The airplane was a twin-engine Cessna 421C, serial number 421C-0028. The airplane seated 8 and had a maximum gross weight of 7,450 pounds. The engines were 375 horsepower Continental GTSIO-520-L engines. The last annual inspection was conducted on March 24, 2005. The airplane had flown about 35 hours since the last inspection and had a total time of about 6,870 hours.

The engine maintenance logbooks indicated that the left and right engines were replaced with overhauled engines on July 17, 1998. As part of the engine overhauls, both engines had the starter adapter shaft gear and crankshaft gear inspection complied with per the Teledyne Continental Motors (TCM) Service Bulletin CSB94-4 along with the installation of the Service Kit EQ6642.

The TCM Service Bulletin CSB94-4 was first issued on June 13, 1994, and the CSB94-4D was reissued as a Mandatory Service Bulletin, MSB94-4E. The latest revision of the Service Bulletin was Mandatory Service Bulletin MSB94-4F, issued on July 5, 2005.

CSB94-4D states the following in GENERAL INFORMATION: "Continued operation of the GTSIO-520 and GIO-550 series engines with starter adapter viscous dampers that have been overheated can lead to distress and possible failure of the starter adapter shaft gear and crankshaft teeth."

A "WARNING" in the Service Bulletin states:

"Compliance with this bulletin is required to prevent possible failure of the starter adapter shaft gear and/or crankshaft gear which can result in metal contamination and/or engine failure."

To comply with the Service Bulletin, the following procedures were required to be followed:

1. Unscheduled maintenance inspection due to rough engine operation (Part 1).
2. At every 100 hour or annual inspection (which ever occurs first) perform the inspections detailed in Part 2, "STARTER ADAPTER VISCOUS DAMPER and SHAFTGEAR BACKLASH INSPECTION".
3. Starter adapters with less than 400 hours total time in service must be inspected in accordance with the "VISUAL INSPECTION PROCEDURE" set forth in Part 3 of this bulletin upon the accumulation of 400 hours total time in service and every 400 hours time in service thereafter.
4. Starter adapters with more than 400 hours total time in service must be inspected in accordance with the "VISUAL INSPECTION PROCEDURES" set forth in Part 3 of this bulletin

within the next 25 hours of operation and every 400 hours thereafter.

5. If needle bearing P/N 537721 is installed in the crankcase, it must be removed and replaced with the bushing P/N 654472. Refer to Part 3, paragraph 9 and also Part 4 on page 10 for installation instruction. Order bushing P/N 654472 separately, if required.

6. If service kit P/N EQ 6642R has not been installed prior to engine overhaul it must be installed at the next engine overhaul or at the time of starter adapter replacement, whichever occurs first. Refer to the latest revision of TCM SB97-6 or mandatory replacement parts. Refer to Part 5 for instructions for installing service kit EQ 6642R.

NOTE: Both the crankshaft gear and the starter adapter assembly, included in EQ 6642R, must be replaced at the same time if the tooth wear of either the crankshaft gear or the starter adapter shaft gear is unacceptable in accordance with this bulletin.

The left and right engine logbooks indicated that neither the TCM Service Bulletin CSB94-4 nor Mandatory Service Bulletin CSB94-4E had been complied with since the engines had been overhauled on July 17, 1998. The engines had accumulated about 1,272 hours since the last overhaul.

The Federal Aviation Administration (FAA) issued Airworthiness Directive (AD) 2005-20-04 on November 1, 2005. The AD stated, "We are issuing this AD to prevent failure of the starter adapter assembly and or crankshaft gear, resulting in failure of the engine and possible forced landing." The AD further stated, "You must use TCM Mandatory Service Bulletin No. MSB94-4F, dated July 5, 2005, to perform the actions required by this AD."

METEOROLOGICAL CONDITIONS

The observed weather at PWK at 1253 was: Winds 070 degrees at 9 knots, sky clear, visibility 10 statute miles, temperature 26 degrees Celsius, dew point 16 degrees Celsius, altimeter 30.24 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The airplane impacted a one-story industrial building, and then impacted a landscape embankment and pine trees. The wreckage path was about 114 feet in length on a westerly heading. The location of the main wreckage was coordinates 42 degrees 7 minutes 42 seconds north latitude, 087 degrees 54 minutes 52 seconds west longitude. The airplane remained upright and there was no ground fire. The main landing gear and nose landing gear were found separated from the fuselage. The left wing was partially separated from the fuselage near the wing root. The left and right wing fuel tanks were full of fuel. The landing gear handle was in the down position. The flap lever and indicator were about 1/4 down. The split flaps were found extended about 15 degrees. The left propeller was found in the feathered position. The right propeller blades exhibited leading edge gouges and chordwise scratching.

The on-site inspection of the right engine revealed that the crankshaft rotated and drive train continuity was confirmed. All cylinders exhibited thumb compression.

The on-site inspection of the left engine revealed that the idler gear support pin had separated from the engine and was found lying in the engine accessory section. The two studs that held the idler gear support pin to the crankcase were sheared off.

The left and right engines were shipped to the engine manufacturer for teardown inspections.

TESTS AND RESEARCH INFORMATION

The left and right engines were sent to Teledyne Continental Motors (TCM) for engine teardowns on October 4, 2005, with the National Transportation Safety Board investigator-in-charge (IIC) providing oversight.

The inspection of the left engine revealed that the idler gear pin was not in place and the support studs were fractured through at the aft crankcase threaded bores. The fractured studs, retaining nuts, and washers were not found on site and were not returned with the engine.

The left engine starter adapter shaftgear teeth were all missing and exhibited mechanical damage. The shaftgear teeth were recovered from the oil sump and were examined by the TCM metallurgical laboratory. The TCM metallurgical report indicated that the intact fracture surfaces exhibited overload texture. The fracture surfaces of the other shaftgear teeth appeared crushed and smeared.

The inspection revealed that six teeth were missing from the left engine crankshaft gear. The fractures exhibited overload texture at the bottom edge and were smeared at the top edges. The camshaft gear had numerous teeth missing whose fractures exhibited overload texture. The inboard bearing support for the idler gear was cracked.

The TCM metallurgical report stated: "The inboard bearing support for the idler gear was found cracked. The idler gear meshes with the crankshaft gear and is located directly above the crank gear." It further stated, "This type of crankcase damage can occur if a broken tooth interferes with the mesh between the crankshaft and idler gear."

The left engine viscous damper was mounted on the TCM production test fixture to measure the damping time. The unit was tested six times and the damping time averaged 8.934 seconds. Damping time intervals for new units are 1.5 - 3.125 seconds. The damper was opened to examine the condition of the internal components. The viscous medium present was dried-out, cracked, and non-uniform in thickness. An exemplar viscous damper unit was opened and the silicone medium was clear in color and had a consistency like molasses.

The inspection of the right engine revealed that the starter adapter shaftgear teeth were worn and exhibited unacceptable wear in accordance with the latest revision of the TCM Service Bulletin 94-4. The right engine viscous damper was mounted on the TCM production test fixture to measure the damping time. The unit was tested six times and the damping time averaged 8.419 seconds. The damper was opened to examine the condition of the internal components. The viscous medium present was dried-out, cracked, and non-uniform in thickness. The inspection of the right engine did not reveal any anomalies that would have prevented normal operation and production of rated horsepower.

ADDITIONAL INFORMATION

The Cessna 421C Pilot's Operating Handbook (POH) "Rate-of-Climb One Engine Inoperative" chart provides a means of determining what rate-of-climb can be expected under various conditions. Using the current weather conditions and approximate weight of the airplane on the accident flight, the chart indicated that about a 450 foot rate-of-climb could be expected if the landing gear were in the UP position, the wing flaps in the UP position, and the propeller feathered. The chart also indicated that a 350-foot penalty would be subtracted from the rate-of-climb if the landing gear were in the DOWN position, and additionally, a 200-foot penalty would be subtracted from the rate-of-climb if the flaps were in the 15-degree DOWN position.

On December 2, 2004, a Cessna 421B, N421SD, was involved in a fatal accident near Apison, Tennessee. The NTSB investigation number was ATLO5FA032. A factor in that accident was a partial failure of the left engine starter adapter due to overload.

The FAA, Cessna Aircraft Company, and Teledyne Continental Motors were parties to the investigation.

The aircraft wreckage was released to Fries Automotive Services, Wheeling, Illinois.

Pilot Information

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| Certificate: | Private | Age: | 51, Male |
| Airplane Rating(s): | Multi-engine Land; Single-engine Land | Seat Occupied: | Left |
| Other Aircraft Rating(s): | None | Restraint Used: | Seatbelt, Shoulder harness |
| Instrument Rating(s): | Airplane | Second Pilot Present: | No |
| Instructor Rating(s): | None | Toxicology Performed: | No |
| Medical Certification: | Class 2 None | Last FAA Medical Exam: | 04/01/2004 |
| Occupational Pilot: | | Last Flight Review or Equivalent: | |
| Flight Time: | 728 hours (Total, all aircraft), 28 hours (Total, this make and model), 15 hours (Pilot In Command, all aircraft) | | |

Aircraft and Owner/Operator Information

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|--------------------------------------|--|---------------------------------------|-----------------|
| Aircraft Make: | Cessna | Registration: | N421KC |
| Model/Series: | 421C | Aircraft Category: | Airplane |
| Year of Manufacture: | | Amateur Built: | No |
| Airworthiness Certificate: | Normal | Serial Number: | 421C-0028 |
| Landing Gear Type: | Retractable - Tricycle | Seats: | 8 |
| Date/Type of Last Inspection: | 03/01/2005, Annual | Certified Max Gross Wt.: | 7450 lbs |
| Time Since Last Inspection: | 15 Hours | Engines: | 2 Reciprocating |
| Airframe Total Time: | 6835 Hours as of last inspection | Engine Manufacturer: | Continental |
| ELT: | Installed, activated, did not aid in locating accident | Engine Model/Series: | GTSIO-520-L |
| Registered Owner: | Goldeneagleco Ltd. | Rated Power: | 375 hp |
| Operator: | Goldeneagleco Ltd. | Operating Certificate(s) Held: | None |

Meteorological Information and Flight Plan

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|----------------------------------|----------------------------------|---|------------------|
| Conditions at Accident Site: | Visual Conditions | Condition of Light: | Day |
| Observation Facility, Elevation: | PWK, 647 ft msl | Distance from Accident Site: | 0 Nautical Miles |
| Observation Time: | 1253 CDT | Direction from Accident Site: | 160° |
| Lowest Cloud Condition: | Clear | Visibility | 10 Miles |
| Lowest Ceiling: | Overcast / 5000 ft agl | Visibility (RVR): | |
| Wind Speed/Gusts: | 9 knots / | Turbulence Type Forecast/Actual: | / |
| Wind Direction: | 70° | Turbulence Severity Forecast/Actual: | / |
| Altimeter Setting: | 30.24 inches Hg | Temperature/Dew Point: | 26 °C / 16 °C |
| Precipitation and Obscuration: | No Obscuration; No Precipitation | | |
| Departure Point: | Wheeling, IL (PWK) | Type of Flight Plan Filed: | Unknown |
| Destination: | Mackinac Island, MI (MCD) | Type of Clearance: | None |
| Departure Time: | 1220 CDT | Type of Airspace: | |

Airport Information

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|----------------------|-----------------------------------|---------------------------|---------|
| Airport: | Palwaukee Municipal Airport (PWK) | Runway Surface Type: | Asphalt |
| Airport Elevation: | 647 ft | Runway Surface Condition: | Dry |
| Runway Used: | 34 | IFR Approach: | None |
| Runway Length/Width: | 5000 ft / 150 ft | VFR Approach/Landing: | None |

Wreckage and Impact Information

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|---------------------|---------|----------------------|-----------------------|
| Crew Injuries: | 1 Minor | Aircraft Damage: | Destroyed |
| Passenger Injuries: | 1 Minor | Aircraft Fire: | None |
| Ground Injuries: | N/A | Aircraft Explosion: | None |
| Total Injuries: | 2 Minor | Latitude, Longitude: | 42.130000, -87.914444 |

Administrative Information

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|-----------------------------------|--|--------------|------------|
| Investigator In Charge (IIC): | Jim Silliman | Report Date: | 02/26/2007 |
| Additional Participating Persons: | Jim Kennedy; FAA-DuPage FSDO; West Chicago, IL Emile Lohman; Cessna Aircraft Company; Wichita, KS Eric Thomas; Teledyne Continental Motors; Mobile, AL | | |
| Publish Date: | | | |
| Investigation Docket: | NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.nts.gov/pubdms/ . | | |

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).