National Transportation Safety Board
Aviation Accident Final Report

Location:	Chesterfield, MO	**Accident Number:**	CHI07LA154
Date & Time:	05/23/2007, 1540 CDT	**Registration:**	N4082L
Aircraft:	Cessna 421	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Serious
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

Shortly after takeoff the pilot experienced a loss of power on the right engine. He attempted to return to the airport to land, but determined that he was not going to reach the runway so he elected to land on a dirt field. He flew under power lines that were in his flight path and attempted to flare the airplane prior to it impacting the terrain. The airplane was equipped with Teledyne Continental GTSIO-520 engines. Post accident examination of the right engine revealed that all of the teeth on the starter adapter gear and several of the teeth on the crankshaft gear were missing. Several gear teeth and metal filings were located in the oil sump. The torsional damper to shaft gear woodruff key was sheared. The torsional damper was placed on a test bench to determine the damping time. The consecutive tests averaged a damping time of 6.9 seconds. The damping time of a new damper is min/max 1.5 to 3.125 seconds. Metallurgical examination revealed 15 starter gear teeth and 11 crankshaft gear teeth were fractured near their root. No indications of preexisting cracking were noted. At least two of the starter gear teeth and several of the crankshaft gear teeth displayed spalling and wear at the pitch line of the teeth. On June 13, 1994, Teledyne Continental issued a Mandatory Service Bulletin, MSB94-4, addressing the possible failure of the starter adapter gear and/or crankshaft gear on GTSIO-520 and GIO-550 engines. On October 31, 2005, Teledyne Continental issued revision, MSB94-4G. The service bulletin called for an inspection of the starter adapter viscous damper and shaft gear backlash every 100 hours of engine operation, and a visual inspection of the starter adapter shaft and crankshaft gear teeth for spalling, pitting, and wear, every 400 hours of engine operation. The Federal Aviation Administration (FAA) issued Airworthiness Directive (AD) 2005-20-04, effective November 1, 2005, requiring compliance with the Teledyne Continental Mandatory Service Bulletin. Maintenance records showed the mandatory service bulletin had been complied with when the right engine was overhauled and installed in March 2001. There was no indication in the maintenance records that either the mandatory service bulletin or the AD had been complied with since the engine was installed. The engine had a total time of 541.9 hours at the time of the accident. The pilot did not follow the published emergency procedures.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Maintenance personnel failed to comply with an Airworthiness Directive which resulted in the total failure of the starter adapter gear teeth and the crankshaft gear teeth and the pilot failed to follow the published emergency procedures. Contributing to the accident were the low altitude at which the loss of power occurred, the power lines, and the unsuitable terrain which prevented the pilot from adequately flaring the airplane and resulted in the subsequent hard landing.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
1. 1 ENGINE
2. (C) ENGINE ASSEMBLY,GEAR - WORN
3. (C) ENGINE ASSEMBLY,GEAR - FAILURE,TOTAL
4. (C) MAINTENANCE,COMPLIANCE WITH AD - NOT PERFORMED - OTHER MAINTENANCE PERSONNEL
5. (C) EMERGENCY PROCEDURE - NOT FOLLOWED - PILOT IN COMMAND

Occurrence #2: FORCED LANDING
Phase of Operation: DESCENT - EMERGENCY

Findings
6. (F) ALTITUDE - LOW

Occurrence #3: HARD LANDING
Phase of Operation: LANDING - FLARE/TOUCHDOWN

Findings
7. (F) TERRAIN CONDITION - NONE SUITABLE
8. (F) OBJECT - WIRE,TRANSMISSION
9. (F) FLARE - INADEQUATE - PILOT IN COMMAND
10. TERRAIN CONDITION - GROUND

Factual Information

On May 23, 2007, at 1540 central daylight time, a Cessna 421, N4082L, collided with the terrain following a loss of engine power shortly after takeoff from the Spirit of St. Louis Airport (SUS), Chesterfield, Missouri. The pilot received serious injuries. The airplane sustained substantial damage. The 14 Code of Federal Regulations Part 91 flight was operating in visual meteorological conditions and a visual flight rules flight plan was filed. The intended destination was the St. Louis Downtown Airport (CPS), Cahokia, Illinois.

The pilot reported that the right engine suddenly lost power shortly after takeoff at an altitude of about 800 feet above mean sea level (msl) when he was at an indicated airspeed of 135 miles per hour. He stated the needle on the tachometer went to zero. The airplane turned 30 to 40 degrees to the right and banked 50 degrees to the right. He stated he leveled the airplane and added power at which time the airplane again banked to the right.

The pilot stated he informed the air traffic control tower of the problem and he was cleared to land on any runway. He stated he verified that the fuel pumps were on high and he pulled the right engine propeller control back to the stop. He stated that one or both engines then surged so he pushed the propeller control full forward thinking he may be able to regain power, which did not happen.

The pilot reported that runway 8L was in front of him so he concentrated on landing. He determined that he was not going to reach the runway so he elected to land in a dirt field. He stated he lowered the landing gear and aimed to land under power lines that were in his flight path. He stated he attempted to flare the airplane and it impacted the terrain. The left wing tip tank and all three landing gear separated from the airplane during the impact sequence. The pilot stated he turned off the fuel pumps and the battery prior to exiting the airplane.

The airplane was equipped with Teledyne Continental GTSIO-520 engines. Following the accident, the left engine, serial number 219314, was examined and placed on a test bench where it was operated to full power without any deficiencies noted.

Examination of the right engine, serial number, 219318, revealed that all of the teeth on the starter adapter gear and several of the teeth on the crankshaft gear were missing. Several gear teeth and metal filings were located in the oil sump. The torsional damper to shaft gear woodruff key was sheared. The torsional damper was placed on a test bench to determine the damping time. The consecutive tests averaged a damping time of 6.9 seconds. The damping time of a new damper is min/max 1.5 to 3.125 seconds.

The starter gear, crankshaft gear, and separated gear teeth were examined at the Safety Board's Material Laboratory. This examination revealed 15 starter gear teeth and 11 crankshaft gear teeth were fractured near their root. No indications of preexisting cracking were noted. At least two of the starter gear teeth and several of the crankshaft gear teeth displayed spalling and wear at the pitch line of the teeth.

On June 13, 1994, Teledyne Continental issued a Mandatory Service Bulletin, MSB94-4, addressing the possible failure of the starter adapter gear and/or crankshaft gear on GTSIO-520 and GIO-550 engines. On October 31, 2005, Teledyne Continental issued revision, MSB94-4G. The service bulletin called for an inspection of the starter adapter viscous damper

and shaft gear backlash every 100 hours of engine operation, and a visual inspection of the starter adapter shaft and crankshaft gear teeth for spalling, pitting, and wear, every 400 hours of engine operation.

The Federal Aviation Administration (FAA) issued Airworthiness Directive (AD) 2005-20-04, effective November 1, 2005, requiring compliance with the Teledyne Continental Mandatory Service Bulletin. The FAA then issued AD 2007-05-15, effective April 16, 2007, which corrected an error in AD 2005-20-04.

The overhauled right engine was installed on the airplane on March 20, 2001. Maintenance records showed the mandatory service bulletin had been complied with when the engine was installed. There was no indication in the maintenance records that either the mandatory service bulletin or the AD had been complied with since the engine was installed. The engine had a total time of 541.9 hours at the time of the accident.

The Cessna 421 Owner's Manual states the following procedures for an engine failure after takeoff at an aispeed above 120 miles per hour:

(1) Mixtures - FULL RICH

(2) Propellers - FULL FORWARD

(3) Throttles - FULL FORWARD (39.5 in. Hg)

(4) Landing Gear - UP

(5) Inoperative Engine - DETERMINE (idle engine same side as idle foot.)

(6) Inoperative Propeller - FEATHER

(7) Establish Bank - 5 degrees Toward good engine.

(8) Climb to Clear Obstacle - 120 MPH IAS

(9) Climb at Best Single-Engine Climb Speed - 120 MPH IAS

(10) Trim Tabs - ADJUST (5 degree bank toward good engine).

(11) Inoperative Engine - SECURE as follows:

(a) Mixture - IDLE CUT-OFF

(b) Fuel Selector - OFF.

(c) Auxiliary Fule Pump - OFF

(d) Magneto Switches - OFF

(e) Alternator Switch - OFF

(f) Cowl Flap - CLOSED

(12) As Soon as Practical - LAND

Pilot Information

Certificate:	Airline Transport	**Age:**	63, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 With Waivers/Limitations	**Last FAA Medical Exam:**	06/01/2006
Occupational Pilot:		**Last Flight Review or Equivalent:**	08/01/2006
Flight Time:	15450 hours (Total, all aircraft), 1200 hours (Total, this make and model), 95 hours (Last 90 days, all aircraft), 33 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N4082L
Model/Series:	421	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	421-0082
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	09/01/2006, Annual	**Certified Max Gross Wt.:**	6840 lbs
Time Since Last Inspection:	35 Hours	**Engines:**	2 Reciprocating
Airframe Total Time:	2835 Hours at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed	**Engine Model/Series:**	GTSIO-520-D
Registered Owner:	William C. Patrick, Jr.	**Rated Power:**	375 hp
Operator:	William C. Patrick, Jr.	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	SUS, 463 ft msl	**Distance from Accident Site:**	
Observation Time:	1545 CDT	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 6500 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	Broken / 8500 ft agl	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	180°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.09 inches Hg	**Temperature/Dew Point:**	29°C / 14°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Chesterfield, MO (SUS)	**Type of Flight Plan Filed:**	VFR/IFR
Destination:	Cahokia, IL (CPS)	**Type of Clearance:**	VFR
Departure Time:	1540 CDT	**Type of Airspace:**	

Airport Information

Airport:	Spirit of St. Louis (SUS)	**Runway Surface Type:**	Dirt
Airport Elevation:	463 ft	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	Forced Landing

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious	**Latitude, Longitude:**	38.662222, -90.651944

Administrative Information

Investigator In Charge (IIC):	Pamela S Sullivan	**Report Date:**	05/28/2008
Additional Participating Persons:	Tom Russell; FAA; St. Louis, MO Peter Basile; Cessna Aircraft; Wichita, KS Jennifer Kaiser; NTSB; Denver, CO Rodney Martinez; Continental Motors; Mobile, AL Andrew Swick; Continental Motors; Mobile, AL Grant Gillian; FAA; St. Louis, MO		
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.ntsb.gov/pubdms/.		