Aviation Investigation Final Report

Location:	Downers Grove, Illinois	**Accident Number:**	CHI01FA312
Date & Time:	September 7, 2001, 11:53 Local	**Registration:**	N81557
Aircraft:	Piper PA-32R-301T	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	3 Serious, 1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airplane impacted terrain after striking trees and a power line in a residential area during initial climb from runway 27. Recorded wind data from two weather observation stations reported winds from 170 degrees at 14 knots gusting 17 knots and 200 degrees at 16 knots gusting 22 knots. The pilot used a power setting of 35 inches of manifold pressure and a flap setting of 10 degrees for the takeoff configuration. The only takeoff configurations cited in the pilot's operating handbook and checklists are with the use of 36 inches of manifold pressure and a flap setting of either 0 or 25 degrees. There is no performance data within the pilot's operating handbook for flight configurations using 10 degrees of flaps. A review of the airplane's weight and balance forms found a discrepancy in the empty weight values. The airplane's weight and balance forms were reviewed and Safety Board calculations indicated that the airplane had an empty weight of 2,357.57 pounds and a center of gravity of 79.9 inches, compared to an empty weight of 2,261.67 pounds and a CG of 83.3 inches listed in the latest revision forms. The pilot reported using a basic empty weight of 2,304 pounds and a CG of 83.3 inches in his weight and balance calculations. The Safety Board calculated the weight and CG location for the accident flight as 3,490 pounds and 87 inches, respectively. The forward CG range for the accident airplane's weight was between 89 inches and 95 inches. Information about the effects of CG location and wind velocity on takeoff performance is available to pilots from the Federal Aviation Administration and commercial publications. Postaccident examination of the engine found evidence of some spark plug fouling, and camshaft and lifter body wear, although the negative effect of this wear on engine performance is not known because the proper short field takeoff procedures were not followed. The airplane's engine logs did not specify whether oil filters were inspected for metal debris during oil and filter changes.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the improper preflight planning/preparation and the short field take off/procedure not followed by the pilot. Contributing factors were the airplane's forward center of gravity, the variable gusting wind and improper weight and balance calculations by maintenance personnel.

Findings

Occurrence #1: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: CLIMB

Findings
1. (F) WEATHER CONDITION - VARIABLE WIND
2. (C) SHORT FIELD TAKEOFF/PROCEDURE - NOT FOLLOWED - PILOT IN COMMAND
3. (F) WEATHER CONDITION - GUSTS
4. (C) PREFLIGHT PLANNING/PREPARATION - IMPROPER - PILOT IN COMMAND
5. (F) MAINTENANCE - IMPROPER - OTHER MAINTENANCE PERSONNEL
6. (F) AIRCRAFT WEIGHT AND BALANCE - EXCEEDED

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Factual Information

On September 7, 2001, at 1153 central daylight time, a Piper PA-32R-301T, N81557, owned and piloted by a private pilot, was destroyed on impact with terrain during initial climb from runway 27 (2,800 feet by 40 feet, asphalt) at the Brookridge Air Park Airport (LL22), Downers Grove, Illinois. The airplane impacted terrain in a residential neighborhood following an in-flight collision with trees and a power line. Visual meteorological conditions prevailed at the time of the accident. The 14 CFR Part 91 personal flight was not operating on a flight plan but had filed an instrument flight rules flight plan. The pilot and two passengers received serious injuries, one passenger was uninjured, and there were no ground injuries. The flight originated from LL22 en route to Mackinac Island, Michigan.

The pilot reported the following in a written statement, "...I completed the balance of the Ground Check Check List and the Before Take Off Check List then set the Altimeter at 750 ft. MSL and set the flaps at 10 degrees. Prior to takeoff, the wind sock at the East end of the runaway was out of the varying out of the South at 10-15 knots. I looked at the windsock at the West end of the runway and could not tell if it was true out of the South, so I taxied to the West end to observe the windsock. A couple of houses to the East on the North side of the runway there was an American Flag above a garage and it looked like the wind was slightly out of the South Southwest. I taxied back to the East end of the field and prepared to use runway 27."

"At approximately 11:30 am, announced my departure on Runway 27 on 122.9. I then taxied on to the runway, held the brakes until the engine reached 35 inches of Manifold. I released the brakes, approximately half was down the runway, reached 70 KMH and rotated."

"I began to climb, a few seconds after lift off, the stall warning came on, I lowered the nose to gain more air speed and retracted the landing gear. I was able to climb above the trees. I turned to the Southwest thinking that above the trees I would get more lift from the wind and again lowered the nose trying to gain airspeed. After a few seconds the plane began to sink and I announced to the passengers that we were going down. I then concentrated on keeping the wings level as we descended."

"...Just after take off I flew over [a resident's] house to the South East and he observed the windsock, which is 100 yards from his kitchen, to be out of the Northeast. This was a 180 degree wind shift from what I had observed prior to takeoff."

According to a police report, "...[The witness] stated that he was in his back yard working in his garden when he heard a 'very very low plane'. [The witness] said that he heard the plane's engine and it appeared to be working normally. [The witness] viewed the plane overhead banking hard to the left. The plane then hit a large pine tree in his front yard, it continued into

the power lines. [The witness] heard a large boom when he plane crashed into the ground across the street..."

During a postaccident interview with the National Transportation Safety Board and the Federal Aviation Administration (FAA), the pilot stated that the maximum altitude he attained during climbout was approximately 80 feet agl and his use of 10 degrees of flaps was described as something that he began on his own. He did not weigh the baggage that was on the airplane and he did not perform performance calculations for the accident flight. He added that he used 35 inches of manifold pressure so as not to overboost the engine.

The pilot reported using the following weights in his weight and balance calculations:

Basic empty weight: 2,304 lbs
Center of gravity: 83 inches

Pilot and front passenger: 335 lbs
Rear passengers: 310 lbs

Front baggage: 50 lbs
Rear baggage: 75 lbs

Fuel: 61 gallons or 366 lbs

The recovered baggage was weighed by the local law enforcement's forensic unit who reported it to weigh 172 lbs. The pilot stated during an initial interview with the FAA that there was 100 lbs of baggage on board the airplane. The pilot attributed the difference in weight due to water that was used by the fire department. A portable oxygen tank, which had a weight of 13 lbs, was mounted between the aft facing seats of the airplane. The pilot stated that the oxygen tank came with the airplane, and he thought that its weight was included in the airplane's basic empty weight. The oxygen tank was not included as an item in any of the aircraft weight and balance forms.

The airplane's weight and balance forms found in the airplane's POH are included in this report. They begin with the airplane's licensure on January 22, 1980 and include 7 revisions with the latest revision being dated October 25, 1994. The latest revision lists a basic empty weight of 2,261.67 lbs and a center of gravity (CG) of 83.3 inches. The pilot determined, through the use of a graphical plotter and calculations, a weight of 3,455 lbs with an approximate CG location of 89.9 inches for the accident flight.

The CG limits, with a straight line variation between points, for the airplane are:

weight	forward limit	rearward limit
3,600 lbs	91.4	95.0

3,200 lbs	82.75	95.0
2,400 lbs	78.0	95.0

One of the effects of CG location is described in AC 61-21A as, "...The airplane will cruise faster with an aft CG location because of reduced drag. The drag is reduced because a smaller angle of attack and less downward deflection of the stabilizer are required to support the airplane and overcome the nose-down pitching moment."

The POH stipulates the use of 0 degrees of flaps, full power and a rotation speed of 70-80 KIAS for a "normal takeoff". The liftoff speeds for a maximum effort takeoff using 0 degrees of flaps are listed for the following weights in the performance charts included in the POH, which are:

3,600 lbs	66 KIAS
3,200 lbs	64 KIAS
2,800 lbs	62 KIAS

The rotation speed for a short or soft field takeoff, obstacle clearance takeoff is 59-62 KIAS which is then followed by accelerating to 65-68 KIAS after breaking ground. The lift off speeds for a 25 degree flap takeoff as:

3,600 lbs	62 KIAS
3,200 lbs	61 KIAS
2,800 lbs	59 KIAS

The POH does not include performance charts for a 10 degree flap takeoff. Federal Aviation Regulation (FAR) 91.03, Preflight action, states, "Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. This information must include...(b) For any flight, runway lengths at airports of intended use, and the following takeoff and landing distance information: (1) For civil aircraft for which an approved Airplane Flight Manual or Rotorcraft Flight Manual containing takeoff and landing distance data is required, the takeoff and landing distance data contained therein..."

The power setting for all takeoff configurations listed in the POH cite a propeller speed of 2,700 rpm and a manifold pressure of 36 inches before brake release on a paved, level, dry runway.

Factors that affect takeoff performance listed in Flight Theory for Pilots are: aircraft gross weight, thrust on the aircraft, temperature, pressure altitude, wind direction and velocity, runway slope, and runway surface. The effect of weight change has a threefold effect on takeoff performance: (1) takeoff velocity is increased, (2) there is more mass to accelerate and, (3) there is more rolling friction. The coefficient of rolling friction is about 0.03 (an increase in weight of 1,000 lbs. means a loss in accelerating force of 30 lbs). If rolling friction is ignored the effect of weight change to takeoff distance can be derived from the following

equation:

w1: original weight
w2: new weight
s1: original takeoff distance
exp: exponent
*: multiplication
/: division

s2=s1*[(w2/w1)exp2]

The effect of runway slope is such that the component of weight that is parallel to the runway surface with reduce the net accelerating force, in the case of an upslope, or an increase the accelerating force, in case of a downslope:

accelerating force=+/- w *sine(degrees of slope)

A rule of thumb cited is "Five percent increase in takeoff distance for each percent of uphill slope."

The Lewis University Airport automated weather observing system, located 9 nm southwest of L22, recorded at 1145, wind 170 degrees at 14 knots gusting 17 knots, 10 sm visibility, scattered clouds at 2,700 feet agl and 3,700 feet agl, broken clouds at 3,700 feet agl and 4,400 feet agl, temperature of 31 degrees C, dew point of 26 degrees C, and an altimeter of 29.78 inches of Hg.

The Chicago Midway Airport automated surface observing system, located 12 nm east of L22, recorded at 1153, wind 200 degrees at 16 knots gusting 22 knots, 10 sm visibility, scattered clouds at 3,100 feet agl, temperature of 29 degrees C, dew point of 22 degrees C, and an altimeter of 29.77 inches of Hg.

According to advisory circular 61-21A, Flight Training Handbook, "...The effect of wind on takeoff distance is large, and proper consideration also must be provided when predicting takeoff distance. The effect of a headwind is to allow the airplane to reach the lift-off speed at a lower groundspeed while the effect of a tailwind is to require the airplane to achieve a greater groundspeed to attain the lift-off speed. A headwind which is 10 percent of the takeoff airspeed will reduce the takeoff distance approximately 19 percent (Fig. 17-63). However, a tailwind which is 10 percent of the takeoff airspeed will increase the takeoff distance approximately 21 percent. In the case where the headwind speed is 50 percent of the takeoff speed, the takeoff distance would be approximately 25 percent of the zero wind takeoff distance (75 percent reduction)..."

Advisory circular 00-6A, Aviation Weather, states, "Obstructions such as buildings, trees, and rough terrain disrupt smooth wind flow into a complex snarl of eddies as diagramed in figure

78. An aircraft flying through these eddies experiences turbulence... The degree of mechanical turbulence depends on wind speed and roughness of the obstructions. The higher the speed and/or the rougher the surface, the greater the turbulence...The airport area is especially vulnerable to mechanical turbulence which invariably causes gusty surface winds. When an aircraft is in a low-level approach or a climb, airspeed fluctuates in the gusts, and the aircraft may even stall. During extremely gusty conditions, maintain a margin of airspeed above normal approach or climb speed to allow for changes in airspeed..."

FAA publication, FAA-P-8740-23, Planning Your Takeoff, states, "...a gusting wind situation will require you to keep the airplane on the ground for a slightly longer period of time, thereby increasing your takeoff roll. The publication further states, "When flying close to the ground, drag is reduced due to the restricted air flow patterns around the wing... the so called 'ground effect'. This makes it possible to lift off at too high a pitch angle, or too soon with a heavy load. However, taking off too soon, at possibly too steep an attitude, will cause the airplane's angle of attack to be at or near that of a stall, with drag and thrust nearly equal. If you leave ground effect under these conditions, the airplane may not be able to accelerate to its proper climb speed, without first lowering the nose momentarily. Don't force your airplane to become airborne too soon. Let it lift off when it's ready to fly. Then, hold it in ground effect momentarily before climbing out. This is especially important when departing from a short, soft field with obstacles. What can happen is that you get yourself "behind the power curve." In such cases, the only way to regain your normal climb attitude is to lower the nose, accelerate, and then climb ... the problem is will it be too late, or can you sacrifice altitude for speed or ... are obstacles a problem?"

Pilot logbook entries indicate the pilot's last biennial flight review was on April 11, 1999. FAR 61.56(c) states, "Except as provided in paragraphs (d), (e), and (g) of this section, no person may act as pilot in command of an aircraft unless, since the beginning of the 24th calendar month before the month in which that pilot acts as pilot in command, that person has - (1) Accomplished a flight review given in an aircraft for which that pilot is rated by an authorized instructor; and (2) A logbook endorsed from an authorized flight instructor who gave the review certifying that the person has satisfactorily completed the review.

The pilot received his last instrument proficiency check (IPC) was on May 8, 2000. FAR 61.57(c) states, "Instrument experience. Except as provided in paragraph (e) of this section, no person may act as pilot in command under IFR or in weather conditions less than the minimums prescribed for VFR, unless within the preceding 6 calendar months, that person has: (1) For the purpose of obtaining instrument experience in an aircraft (other than a glider), performed and logged under actual or simulated instrument conditions, either in flight in the appropriate category of aircraft for the instrument privileges sought or in a flight simulator or flight training device that is representative of the aircraft category for the instrument privileges sought - (i) At least six instrument approaches; (ii) Holding procedures; and (iii) Intercepting and tracking courses through the use of navigation systems." There were no logbook entries regarding instrument approaches, holding procedures or intercepting and tracking courses through the use of navigation systems.

Inspection of the engine revealed no anomalies.

The Federal Aviation Administration and Textron Lycoming were parties to the investigation.

The wreckage was released to the registered owner's insurance representative.

Pilot Information

Certificate:	Private	**Age:**	62,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	June 2, 2000
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	
Flight Time:	1693 hours (Total, all aircraft), 297 hours (Total, this make and model), 16 hours (Last 90 days, all aircraft), 14 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N81557
Model/Series:	PA-32R-301T	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	32R-8029055
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	January 5, 2001 Annual	**Certified Max Gross Wt.:**	3600 lbs
Time Since Last Inspection:	92.8 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2959 Hrs	**Engine Manufacturer:**	Lycoming
ELT:		**Engine Model/Series:**	TIO-540-S1AD
Registered Owner:	WFH, LP, William F. Helwig	**Rated Power:**	300 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	LOT,673 ft msl	**Distance from Accident Site:**	9 Nautical Miles
Observation Time:	11:45 Local	**Direction from Accident Site:**	245°
Lowest Cloud Condition:	Scattered / 2700 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 4400 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	14 knots / 17 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.78 inches Hg	**Temperature/Dew Point:**	31°C / 26°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Downers Grove, IL (LL22)	**Type of Flight Plan Filed:**	IFR
Destination:	Mackinac Island, MI (MCD)	**Type of Clearance:**	Unknown
Departure Time:	11:48 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	Brookeridge Air Park Airport LL22	**Runway Surface Type:**	Asphalt
Airport Elevation:	750 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	27	**IFR Approach:**	Unknown
Runway Length/Width:	2800 ft / 40 ft	**VFR Approach/Landing:**	Unknown

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Destroyed
Passenger Injuries:	3 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Serious, 1 None	**Latitude, Longitude:**	41.759895,-88.010673(est)

Administrative Information

Investigator In Charge (IIC):	Gallo, Mitchell
Additional Participating Persons:	Dennis L Cmunt; Federal Aviation Adminstration; West Chicago, IL Gregory Erickson; Textron Lycoming; Wayne, IL
Original Publish Date:	October 24, 2002
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=53462