

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA24FA001

AIRCRAFT PERFORMANCE

Specialist's Study

February 27, 2025

TABLE OF CONTENTS

A	ACCIDENT.....	3
B	AIRCRAFT PERFORMANCE SPECIALIST	3
C	SUMMARY	3
D	DETAILS OF THE INVESTIGATION	3
1.0	AIRPLANE.....	3
2.0	AIRPORT	4
3.0	WEATHER	5
4.0	DATA.....	5
5.0	CALCULATIONS	5
6.0	FLIGHT PATH.....	5
E	DISCUSSION	14
F	REFERENCES	14

A ACCIDENT

Location: Lake Placid, New York
Date: October 1, 2023
Time: 16:08 Eastern Daylight Time
 20:08 UTC
Airplane: Cessna 177RG, N545PZ

B AIRCRAFT PERFORMANCE SPECIALIST

Specialist Carl Schultheisz
 National Transportation Safety Board
 Washington, DC

C SUMMARY

On October 1, 2023, at 16:08 Eastern Daylight Time (EDT), a Cessna 177RG, N545PZ, owned and operated by Lake Placid Air Service, was substantially damaged when it was involved in an accident near Lake Placid, New York. The pilot and pilot-rated passenger sustained fatal injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 aerial photography flight.

The airplane impacted an embankment about 15 feet below the level of the runway on airport property in a right-wing, nose-low attitude. The wreckage examination found the flaps were extended approximately 10°, and the stabilator trim was neutral.

D DETAILS OF THE INVESTIGATION

1.0 Airplane

The airplane was a Cessna 177RG, a high-wing, single-engine airplane with retractable gear that seats four. As indicated in the Federal Aviation Administration (FAA) registry, N545PZ was serial number 177RG1023, manufactured in 1976, equipped with a Lycoming IO-360-A1B6D engine, and registered to Lake Placid Flying Service, Inc¹.

Detailed weight and balance information for the flight was not found. Weight and balance are estimated using information from the Pilot's Operating Handbook (POH) [1]. A 2009 form recorded the empty weight as 1828 lbs at a moment arm of

¹ [Aircraft Inquiry](#)

103.2 in. Using that empty weight and moment arm and assuming a fuel load of 40 gallons (out of a 60-gallon usable fuel capacity) plus the reported weight of the occupants gives a weight of 2508 lbs at a moment arm of 102.5 in, which is about 1 in forward of the center of gravity (cg) limit indicated in the POH. (Assuming a fuel load of 60 gallons, the weight would have been 2628 lbs at a moment arm of 102.9 in, about 1.2 in forward of the cg limit.) Maximum takeoff weight is 2800 lbs.

The normal takeoff procedure in the POH indicates that 10° of flaps is preferred, and examination of the crash site found the flaps at 10°; it will be assumed that the flaps were at 10° throughout the flight. Rotation is expected at 55 knots indicated airspeed (KIAS), with subsequent climb at 65-75 KIAS.

The POH lists the power-off, flaps-up, wings-level stall speed at a weight of 2800 lbs as 57 kts calibrated airspeed (KCAS) at the most rearward cg and 61 KCAS at the most forward cg. At a weight of 2800 lbs, a stall speed of 57 KCAS corresponds to a maximum lift coefficient $C_{L_{max}}$ of 1.46, and a stall speed of 61 KCAS corresponds to a maximum lift coefficient $C_{L_{max}}$ of 1.28.

The POH lists the power-off, flaps 10°, wings-level stall speed at a weight of 2800 lbs as 53 KCAS at the most rearward cg and 57 KCAS at the most forward cg. At a weight of 2800 lbs, a stall speed of 53 KCAS corresponds to a maximum lift coefficient $C_{L_{max}}$ of 1.69, and a stall speed of 57 KCAS corresponds to a maximum lift coefficient $C_{L_{max}}$ of 1.46.

A note in the POH indicates that the stall speeds are independent of whether the landing gear are up or down. Another note indicates that the maximum altitude loss during a stall recovery is approximately 190 ft.

The POH includes a table showing that for flaps up or flaps 10°, indicated airspeeds are 1-2 kt less than calibrated airspeeds for airspeeds below 100 kt.

2.0 Airport

The flight departed from runway 32 at Lake Placid Airport (LKP). The FAA airport database reports that runway 14/32 is 4196 ft long by 60 ft wide, and that runway 32 has a displaced threshold of 1140.2 ft². The airport elevation is listed as 1747 ft, while the elevation of the threshold of runway 14 is listed as 1743.3 ft and the elevation of the displaced threshold of runway 32 is 1746.1 ft. The magnetic variation at LKP is 15° west; the true alignment of runway 32 is 306°. The terrain slopes down by about 25 ft off the departure end of runway 32.

² [Airport Data](#)

3.0 Weather

Weather was recorded at 15:51 EDT at Adirondack Regional Airport (SLK), which is about 13 NM northwest of Lake Placid. Visual meteorological conditions prevailed, with clear skies, visibility of 10 statute miles, winds of 7 kts from 10°, temperature 23 °C (73 °F), dewpoint 12 °C (54 °F), and a barometric setting of 30.23 inHg.

4.0 Data

Date, time, latitude, longitude, altitude, groundspeed, and track angle were recorded by a Garmin GPSMAP 396 onboard the airplane. Details of the device and the download of the data can be found in the Global Positioning System Device - Specialist's Factual Report [2] in the docket for this accident. Tabulated data for the accident flight and an earlier flight can be found in Attachments to that report [3,4], also in the docket for this accident. The data during the flight were at irregular intervals between 2 and 9 s long.

Winds aloft, temperature, and pressure as functions of altitude were taken from a High-Resolution Rapid Refresh (HRRR) model sounding from the National Oceanic and Atmospheric Administration³. The data were downloaded for coordinates 44.27° North, 73.97° West, at 16:00 EDT.

5.0 Calculations

A simplified mathematical model of the airplane was used to calculate parameters that were not recorded by the GPSMAP 396. True airspeed is the vector difference between the groundspeed vector and the local wind vector; the local temperature and pressure are used to convert true airspeed to calibrated airspeed. The simplified mathematical model employs an assumption that there is zero sideslip, so that changes in heading are a result of rolling the airplane to redirect the airplane's lift vector.

6.0 Flight Path

An overhead view of the flight path on a Google Earth background is shown in Figure 1. The airplane lifted off the runway shortly after 16:08:07 and began a slight left turn about 16:08:24. At 16:08:34, the airplane began turning right. At 16:08:41, the airplane reached its maximum recorded altitude of 1929 ft, and the right turn tightened. The airplane then descended toward the crash site located at 44.269042° North, 73.968803° West, at an elevation of about 1729 ft. Figure 2 shows an oblique view of the flight path looking southwest.

³ [READY Archived Meteorology](#)



Figure 1. Overhead view of the flight path on a Google Earth background. Annotations indicate the time EDT (hh:mm:ss) and recorded altitude (ft). The crash site is indicated by the red circle.

While the airplane was taxiing on the airport grounds, the recorded altitudes were 20-30 ft above the elevations indicated in Google Earth. Such a variation would be within the expected uncertainty for Global Positioning System positions of 20 m (65 ft), and the recorded altitudes were taken as altitudes above mean sea level (MSL) without alteration.

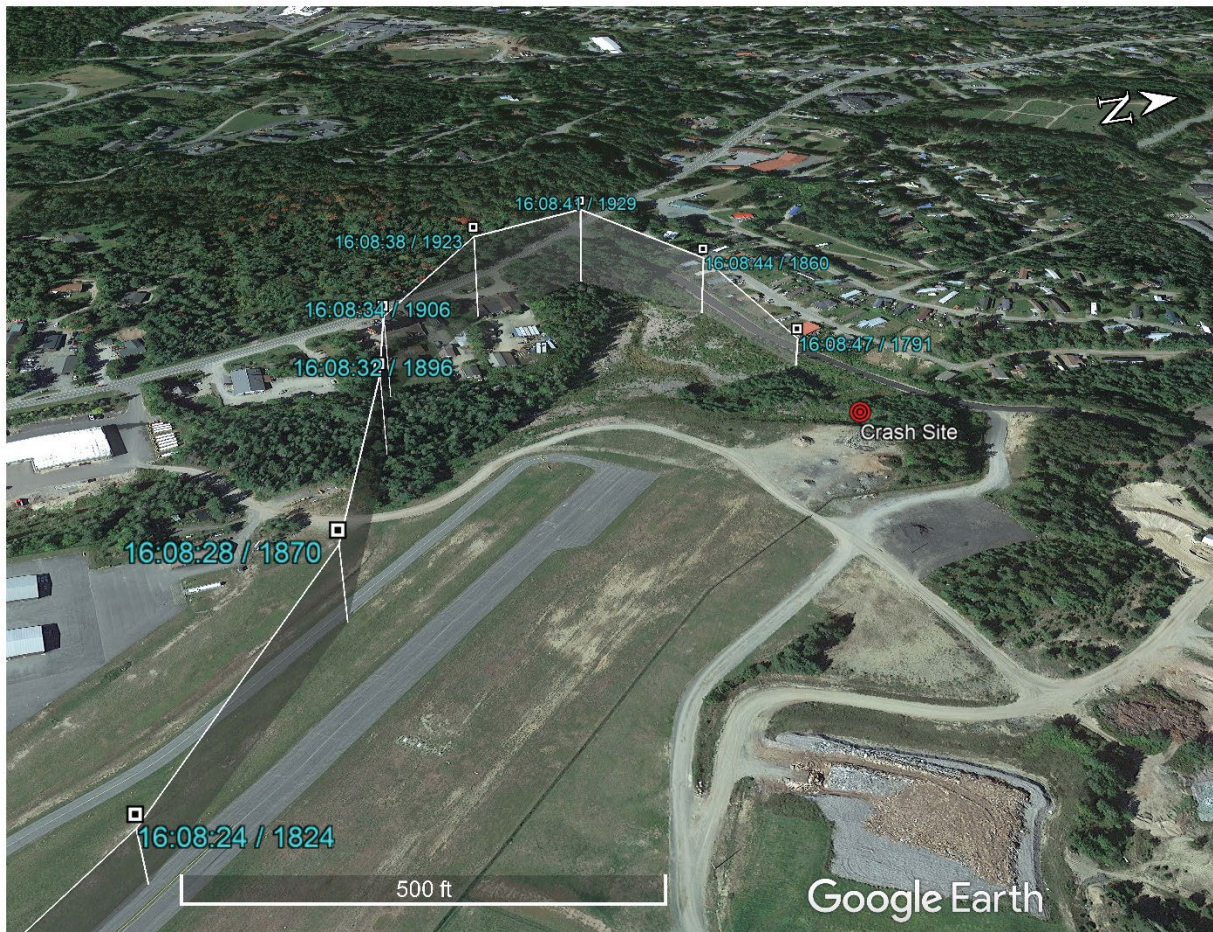


Figure 2. Oblique view of the flight path, looking southwest. Annotations indicate the time EDT (hh:mm:ss) and recorded altitude (ft). The crash site is indicated by the red circle.

Figure 3 plots the groundspeed, calibrated airspeed, recorded MSL altitude and pressure altitude for the flight as functions of time. Figure 4 plots the same parameters as functions of the distance from the threshold of runway 32. The ground run began near the threshold of runway 32 about 16:07:35, and the airplane reached 57 KCAS (equivalent to the rotation speed of 55 KIAS) about 16:08:05.3 and 984 ft from the threshold of runway 32. Takeoff occurred shortly after 16:08:07, just after the airplane crossed the 1140.2 ft displaced threshold of runway 32.

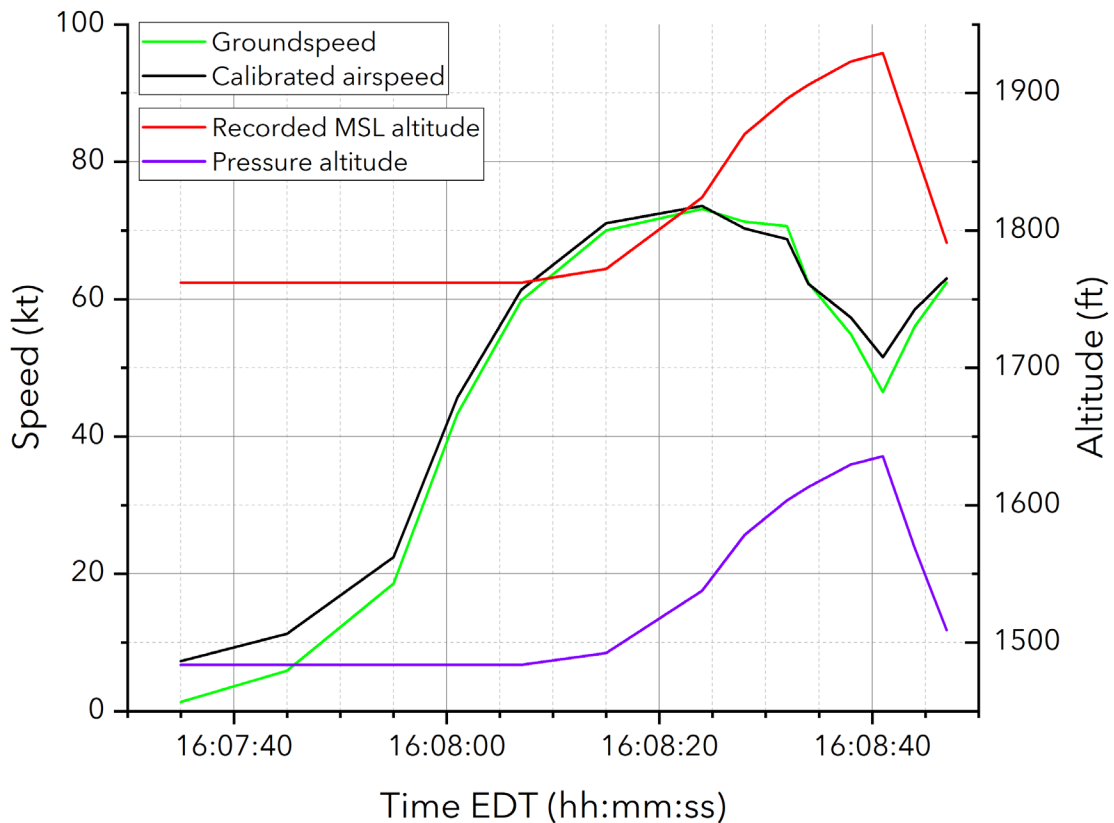


Figure 3. Groundspeed, calibrated airspeed, recorded MSL altitude and pressure altitude as functions of time.

The airplane reached a maximum speed of 74 KCAS at 16:08:24, consistent with the POH guidance that the initial climb should occur at 65-75 KIAS. However, the airspeed continued to decrease, reaching a minimum of 46.5 KCAS at 16:08:41.

Rate of climb reached a maximum of 517 ft/min at 16:08:28, and the altitude continued to increase until it reached a maximum of 1929 ft at 16:08:41. The maximum altitude corresponded to the minimum airspeed.

After 16:08:41, the altitude dropped sharply by about -1300 ft/min, while the airspeed increased back to a maximum of 63 KCAS.

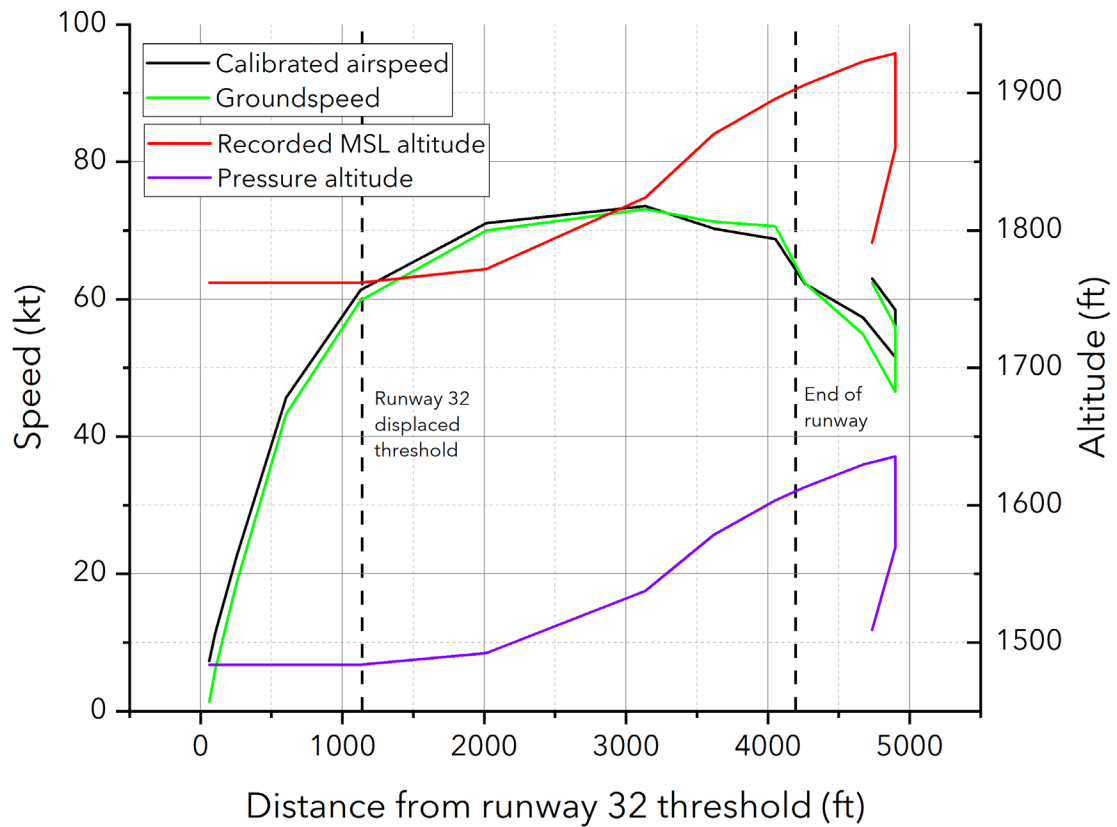


Figure 4. Groundspeed, calibrated airspeed, recorded MSL altitude and pressure altitude as functions of the distance from the runway 32 threshold.

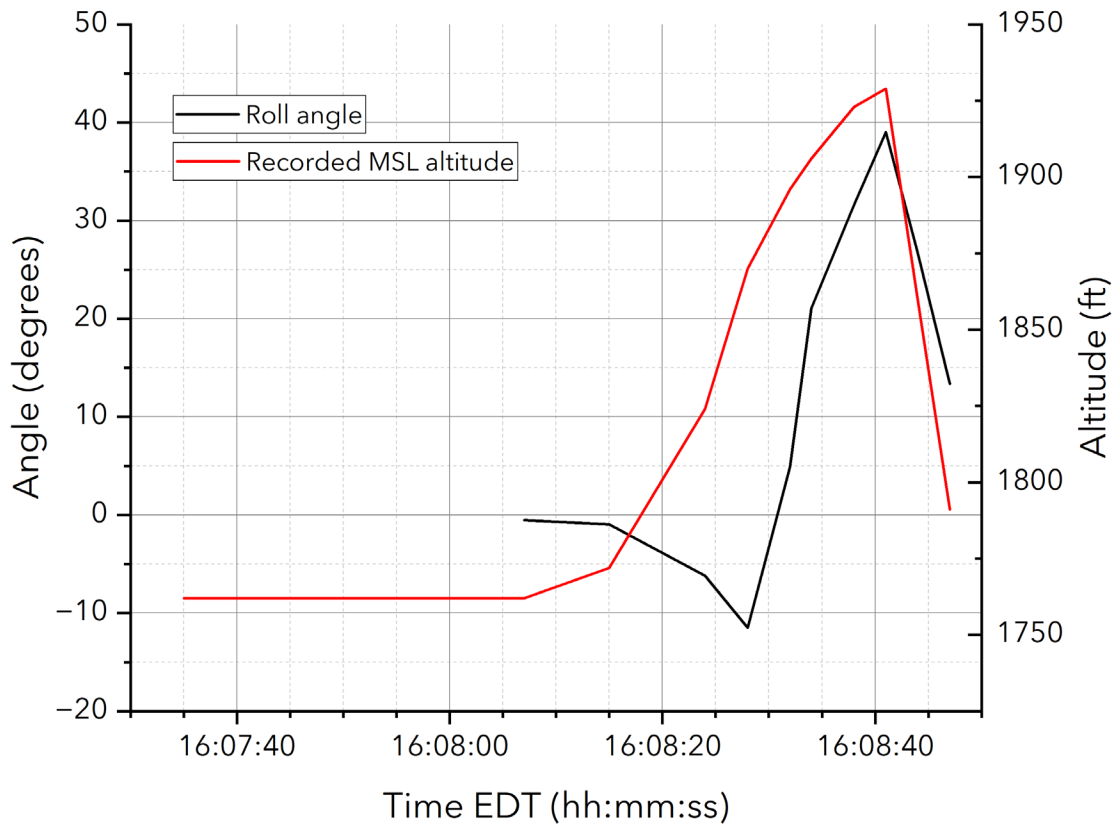


Figure 5. Roll angle and recorded MSL altitude as functions of time.

Figure 5 shows the calculated roll angle as a function of time, along with the recorded MSL altitude. The airplane initially began to turn to the left, and the roll angle reached -11.5° at 16:08:28. The airplane then began to roll back to the right, reaching a maximum roll angle of 39° at 16:08:41, the same time that the altitude reached a maximum and the airspeed reached a minimum.

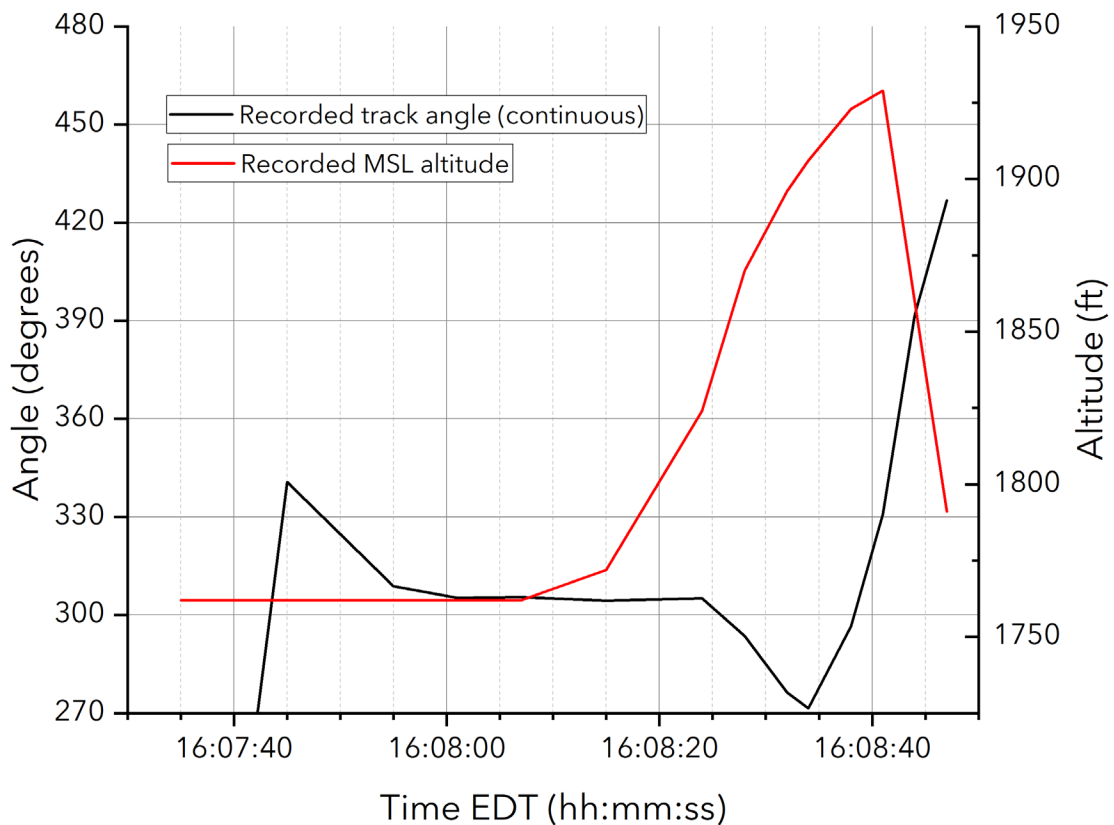


Figure 6. Recorded track angle and recorded MSL altitude as functions of time. The recorded track angle after 16:08:43 has been shifted by 360° to create a continuous curve.

Figure 6 shows the recorded track angle as a function of time, along with the recorded MSL altitude. The recorded track angle after 16:08:43 has had 360° added to it to create a continuous curve. At 16:08:41, when the altitude reaches its maximum, the track angle is 330.8°, which is about 25° relative to the true alignment of runway 32 at 306°. At that time, the airplane was still moving away from the runway and had not made the turn back toward the runway.

Between 16:08:34 and 16:08:41, the track angle changed by about 8.5°/s, as compared with a standard rate turn of 3°/s.

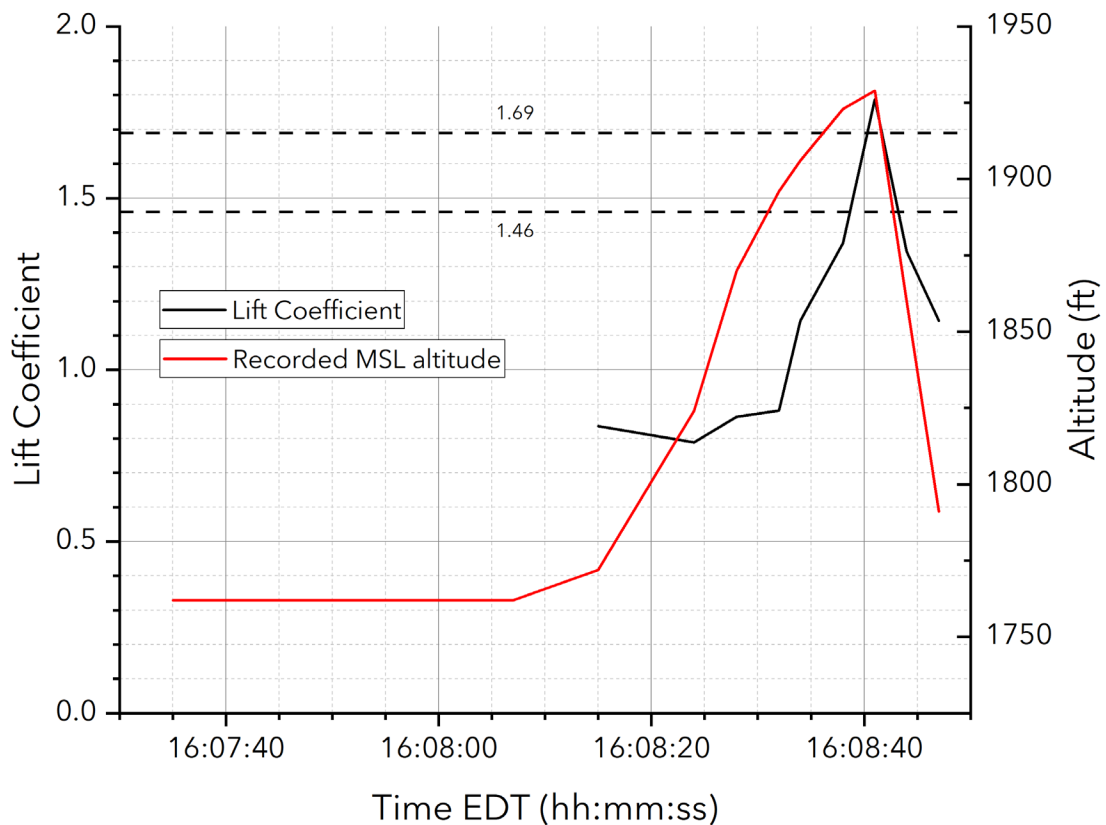


Figure 7. Lift coefficient and recorded MSL altitude as functions of time.

Figure 7 plots the lift coefficient and recorded MSL altitude as functions of time. The lift coefficient shows a sharp increase beginning at 16:08:32, and peaks at 1.79 at 16:08:41, the same time that the altitude and roll angle reach a maximum and the airspeed reaches a minimum. The calculated lift coefficient greatly exceeds the maximum lift coefficient $C_{L_{max}}$ of 1.46 calculated from data in the POH for flaps 10° at a forward cg, and even exceeds the $C_{L_{max}}$ of 1.69 for flaps 10° at an aft cg. Exceedance of the $C_{L_{max}}$ indicates the airplane has stalled, and an aerodynamic stall is consistent with the data from the flight, including the decreasing airspeed, large roll angle and sharp drop in altitude. The mismatch between the calculated lift coefficient and the expected value of $C_{L_{max}}$ calculated from the POH could be a result of an error in the assumed weight of the airplane, an error in the assumed winds aloft, noise in the recorded data, and/or the relatively low data rate. The calculations require numerical differentiation of the data, which amplifies noise in the data; longer times between data points also increases the uncertainty of the calculated derivative.

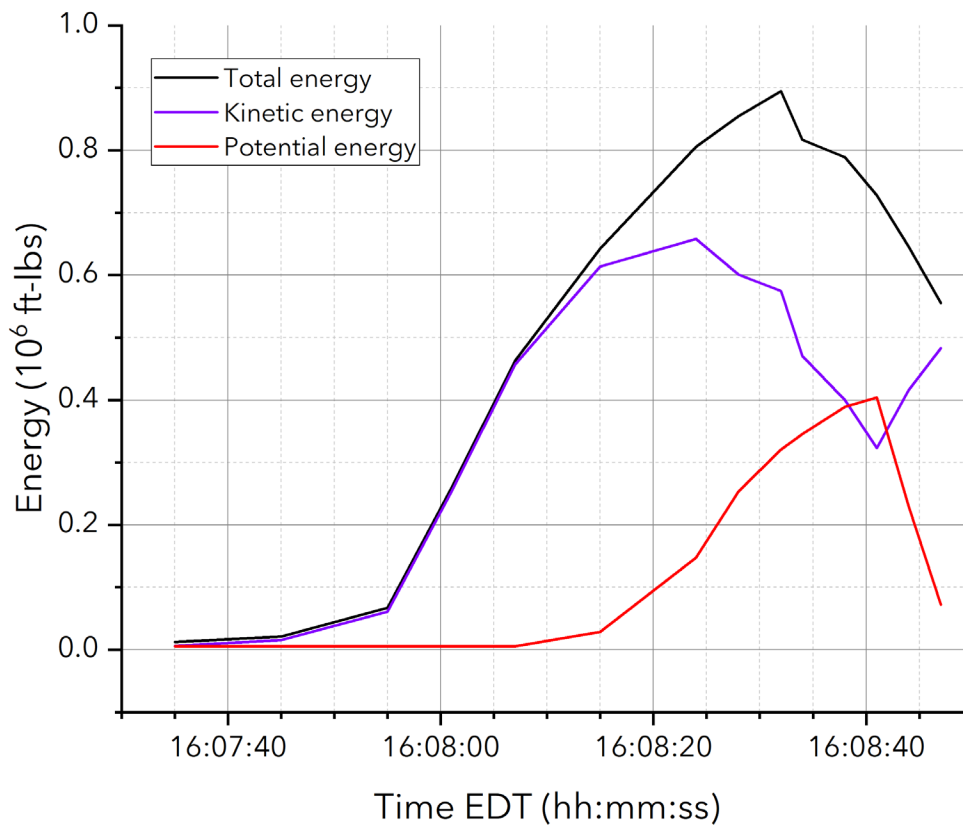


Figure 8. Potential energy, kinetic energy and total energy as functions of time.

Figure 8 shows the calculated potential energy, kinetic energy and total energy (the sum of potential and kinetic energy) as functions of time. Although the kinetic energy begins to decrease at 16:08:24 as the airplane begins to slow, that decrease is more than compensated by the increasing potential energy as the airplane climbs, until 16:08:32 when the total energy begins to decrease. The decrease in total energy after 16:08:32 would be consistent with a decrease in engine power. The peak in the total energy at 16:08:32 also coincides with the roll angle reversing from a left roll to a right roll and with the onset of the sharp increase in calculated lift coefficient.

E DISCUSSION

The airplane took off shortly after 16:08:07, a little more than 1140 ft from the threshold of runway 32. The total energy (potential plus kinetic) reached a peak at 16:08:32 and then began to decrease, which would be consistent with a decrease in engine power. Also at 16:08:32, the airplane began to transition from rolling left to rolling right, and the lift coefficient began to increase sharply.

The lift coefficient exceeded the expected value of $C_{L_{max}}$ calculated from the POH at 16:08:41, indicating an aerodynamic stall. Also at 16:08:41, the roll angle reached a maximum of 39°, the airspeed reached a minimum of 52 KCAS, and the altitude reached a maximum of 1929 ft, followed by a sharp drop at -1300 ft/min; all of these parameters show behavior consistent with aerodynamic stall. At 16:08:41, the airplane was turning right, but the recorded ground track angle at that time was 330.8°, an angle of about 25° relative to the true alignment of runway 32 at 306°, which means that the airplane was still traveling away from the airport at that time.

Submitted by:

Carl Schultheisz
Chief, Vehicle Performance Division

F REFERENCES

1. Pilot's Operating Handbook, Cessna Cardinal RG, 1976 Model 177RG, Cessna Aircraft Company, Wichita, Kansas, USA.
2. Global Positioning System Device – Specialist's Factual Report, National Transportation Safety Board, Washington, DC, 2024.
3. Attachment 1 to Global Positioning System Device – Specialist's Factual Report, National Transportation Safety Board, Washington, DC, 2024.
4. Attachment 2 to Global Positioning System Device – Specialist's Factual Report, National Transportation Safety Board, Washington, DC, 2024.