National Transportation Safety Board
Office of Research and Engineering
Washington, D.C. 20594

Performance Study

Specialist Report
Marie Moler

A. ACCIDENT

Location:	70 NM south of Monterrey, Mexico
Date:	December 9, 2012
Time:	0330 CST, 0930 UTC
Airplane:	Learjet 25 N345MC
Operator:	Starwood Management, LLC
NTSB Number:	DCA13RA025

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On December 9, 2012, at 0330 Central Standard Time, a Learjet 25, N345MC, crashed in mountainous terrain at an elevation of about 5,600 feet above mean sea level approximately 70 miles south of Monterrey, Mexico. The flight departed General Mariano Escobedo International Airport (MMMY), Monterrey, Nuevo Leon, Mexico at 0319 and was en route to Adolfo Lopez Mateo International Airport (MMTO), Toluca, Estado de Mexico, Mexico. The two crew members and five passengers were fatally injured and the aircraft was destroyed.

D. PERFORMANCE STUDY

This performance study describes the accident airplane ground track, altitude, speed, and flight path angle. Radar data used in this study was from the Air and Marine Operations Center (AMOC) based in Riverside, California. The radar stations that recorded the accident flight are located in the United States and were between 120 NM and 170 NM away from the wreckage site. The aircraft location and altitude were recorded every 12 seconds with an uncertainty of ±2 Azimuth Change Pulses (ACP) = ± (2 ACP) x (360º/4096 ACP) = ±0.176° in azimuth, ±50 ft in altitude, and ±1/16 NM in range. Due to the long distance between the radar stations and the accident aircraft the uncertainty in the data due to the azimuth tolerance is considerable – approximately ±1/3 NM at a range of 120 NM and ±1/2 NM at a range of 170 NM. The magnetic variance of each radar site was not known. Radar data from in-country Mexican radar sites was not provided to the NTSB.

Times within the study are reported in CST.

Weather Observation

Winds aloft were provided by a Monterrey, Mexico sounding. The recorded mean wind for 0-6 km of altitude was 245° at 16 kts and a maximum wind from 250° of 72 kts was recorded at 47,778 ft. The full winds aloft and temperature data for every 1,000 ft of altitude can be found in the NTSB Meteorology Factual Report. The full wind profile was used in this report for the calculation of aircraft airspeeds.

Airplane Ground Track, Altitude, and Airspeed

The flight originated from General Mariano Escobedo International Airport (MMMY), Monterrey, Nuevo Leon, Mexico at about 0319 CST with the destination of Adolfo Lopez Mateo International Airport (MMTO), Toluca, Estado de Mexico, Mexico. Figure 1 shows the secondary returns from two different US radar sources (shown as red and blue dots respectively). QZA is an Air Route Surveillance Radar (ARSR) -4 in Oilton, Texas. B45 is a Tethered Aerostat Radar System (TARS) in Rio Grande City, TX. Both radar sites were a considerable distance from the accident aircraft path and the respective tracks were offset from each other. Both radar sources were used since while the QZA data set has fewer dropouts, the B45 data records the last three returns of the accident flight and the aircraft's final descent. The two data sets were combined and an averaged ground track was plotted between them. Individual radar returns were taken at different times and cannot be directly compared to one another, but most returns are within the uncertainty bounds discussed earlier from the averaged path. Further deviations could be a result of the unknown magnetic variance of the radar sites. The averaged ground track and the secondary altitude returns were used to calculate the aircraft's speeds and flight path angle.

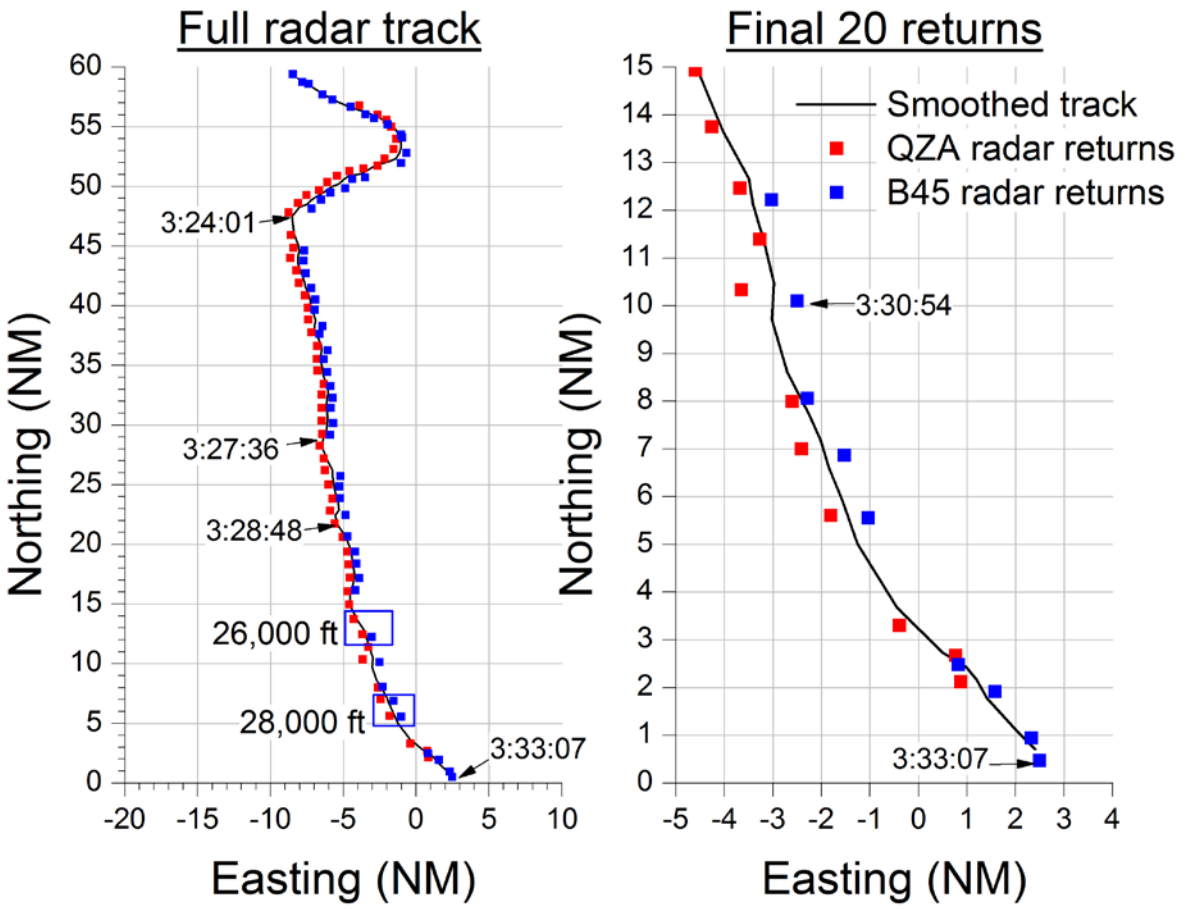

Figure 1. Aircraft radar path and smoothed track. The origin point (0,0) is where the aircraft wreckage was located.

Aircraft altitude is shown in Figure 2. The aircraft took off from Monterrey and began to climb with the intention of reaching 37,000 ft [NTSB Air Traffic Control Factual Report] with an average climb rate of about 1,800 ft/s. At about 0330:15, two and a half minutes before the final descent, the aircraft stopped climbing and held an altitude of approximately 26,000 ft for about 15 seconds. At 0331:30 the aircraft again held an altitude of 28,000 ft for a little over 15 seconds before climbing to 28,700 ft. Then at 0332:11 the aircraft descended 500 ft, returned to 28,800 ft, and then descended to the terrain. The holds in altitude at 26,000 and 28,000 ft and the last two gains in altitude are labeled in Figure 2.

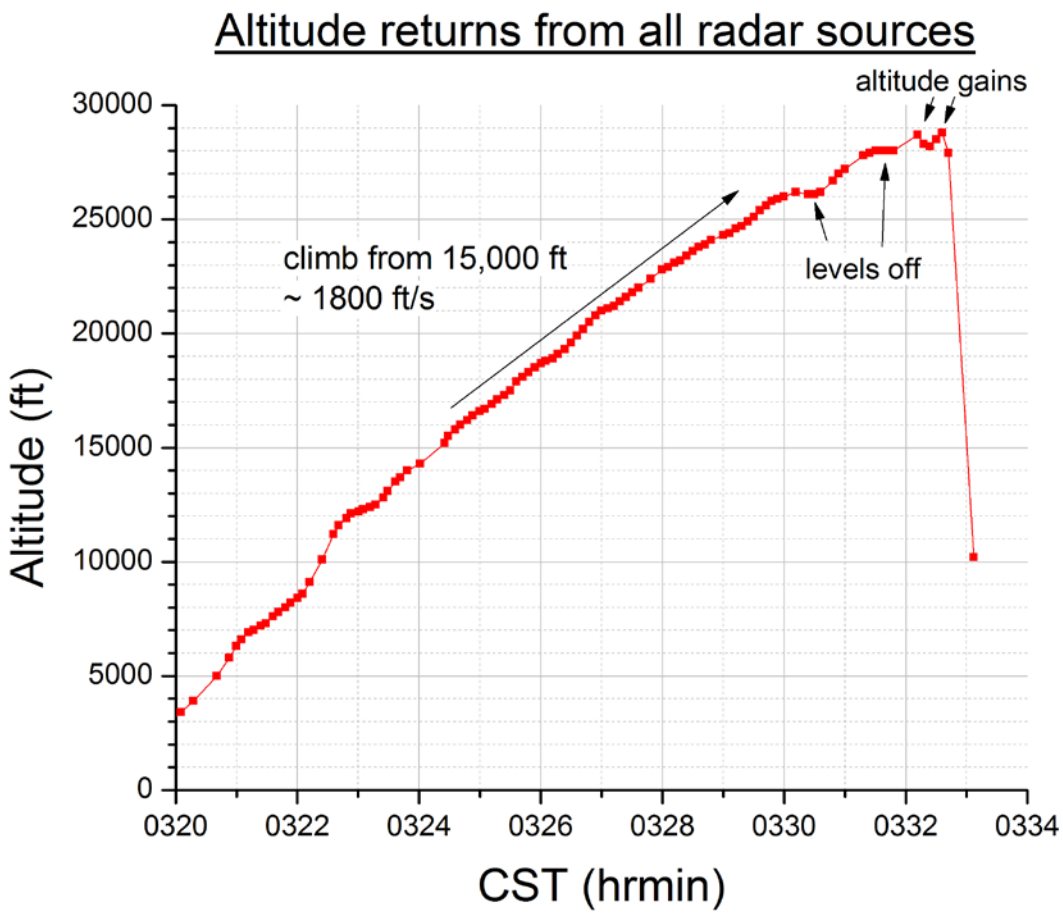

Figure 2. Aircraft altitude.

The averaged latitude and longitude data and the altitude data were entered into Google Earth and are shown below in Figure 3. Included are the portions of the flight where the altitude was briefly held before climb resumed.

Figure 3. Aircraft track. MMMY airport is shown to the far left. Orange circles display aircraft time and altitude.

Due to the uncertainty in the radar data and the smoothed ground track, the aircraft's position data cannot be reliably compared to the wreckage location. Figure 4 shows the final few radar returns and the wreckage location. The wreckage was approximately three miles to the west of the final radar return. Due to insufficient data to understand this discrepancy, the last portion of the aircraft's flight, from the final radar return to the ground, was not analyzed.

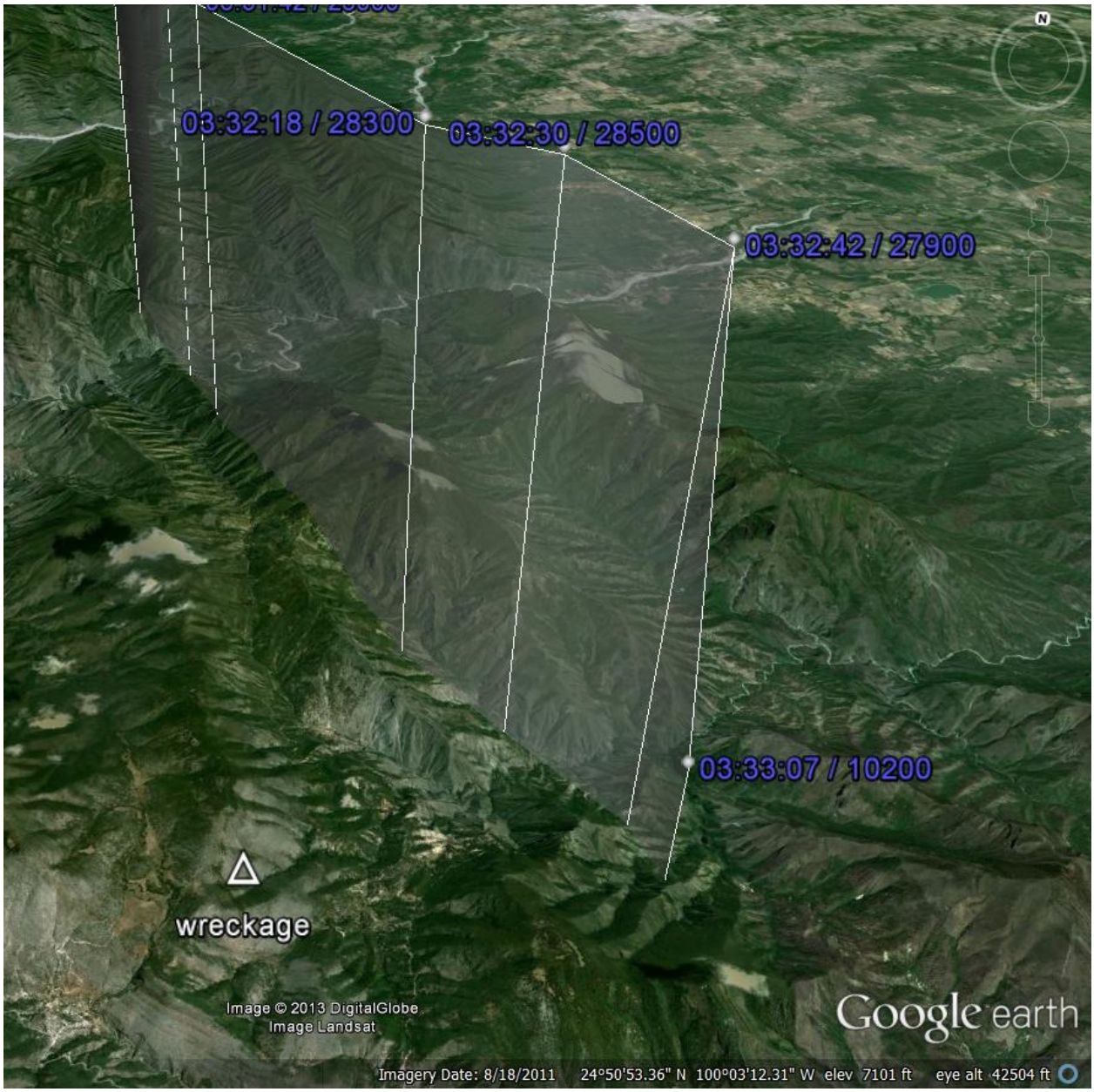

Figure 4. Aircraft track and wreckage location.

The aircraft began its final descent at 332:30 from 28,500 ft to 27,900 ft as shown in Figure 5. The descent rate increased to about 40,000 ft/min between 27,900 ft and the last return of 10,200 ft.

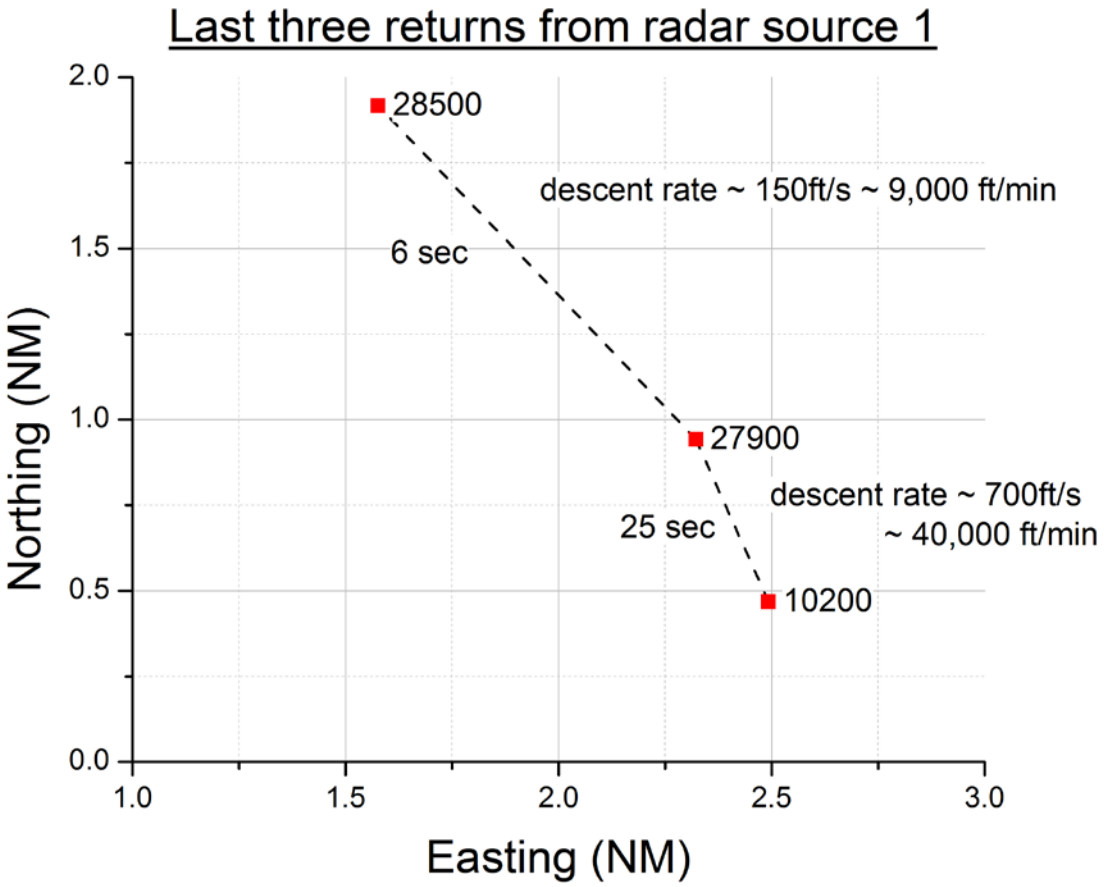

Figure 5. Last three radar returns as Easting versus Northing.

Figure 6, below, shows the aircraft's altitude and the calculated groundspeed, true airspeed, and Mach number. The speed values have been smoothed to reduce the noise arising from numerical differentiation and the uncertainty of the radar data. Even though it was smoothed, the fluctuation of the aircraft's calculated speed was considerable (±40 kts), and it is unlikely that the speed of the aircraft varied as much as the calculation indicates. The general trend showed that throughout the climb the aircraft was gaining speed to a final, pre-loss of control speed of about 400 kts and 0.65 M. The speed and altitude of the aircraft put it well within the performance envelope for the Lear 25.

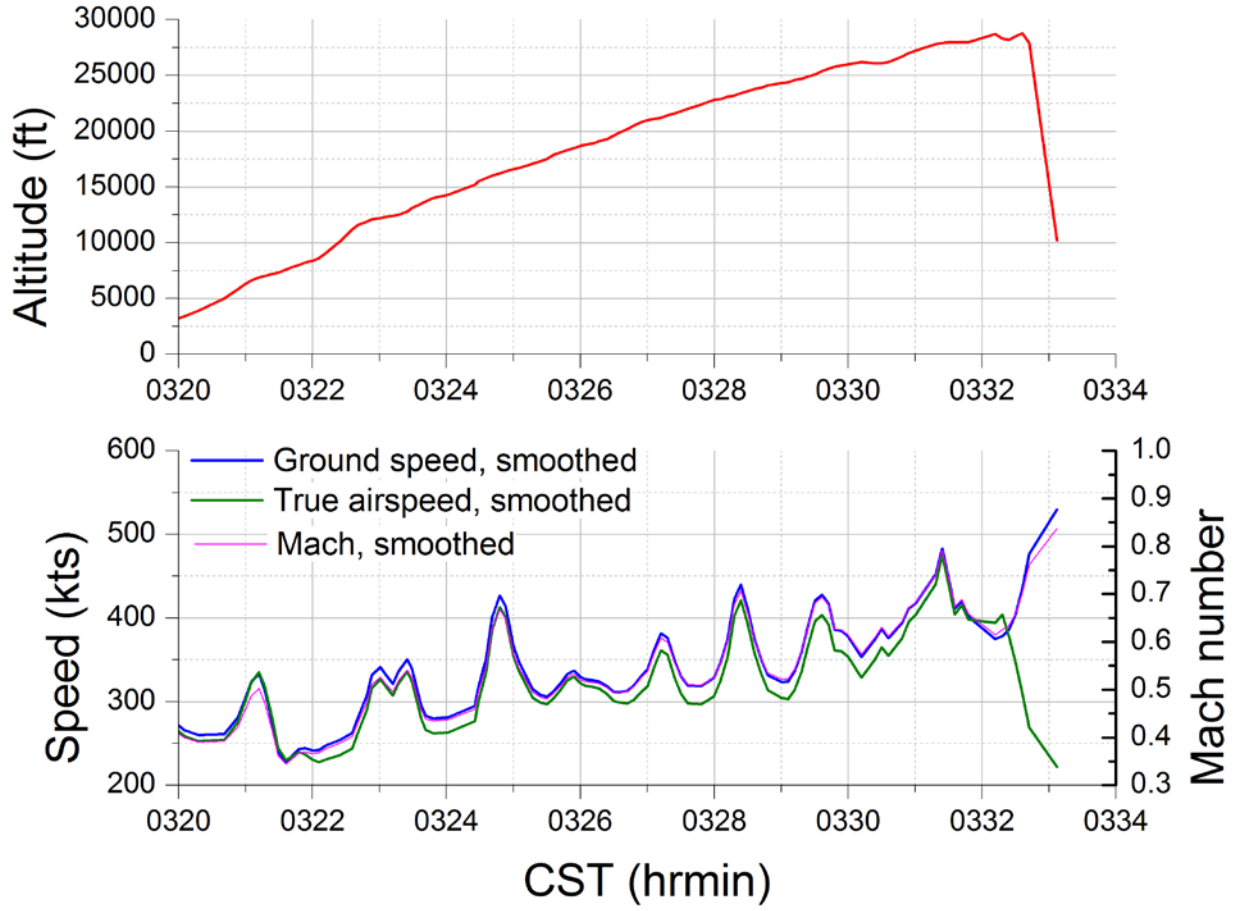

Figure 6. Radar altitude and calculated and smoothed speeds and Mach number.

Also calculated was the aircraft's flight path angle, shown in Figure 7. The last two increases in altitude did not demonstrate unusually high rates of climb (labelled on the altitude portion of Figure 7) or flight path angle (the flight path angle did not exceed 8° nose up). The results of the radar data did not show evidence that the aircraft suddenly pitched up beyond the stall angle, nor did the airspeed drop below the aircraft's normal flight envelope until after the aircraft began its final descent.

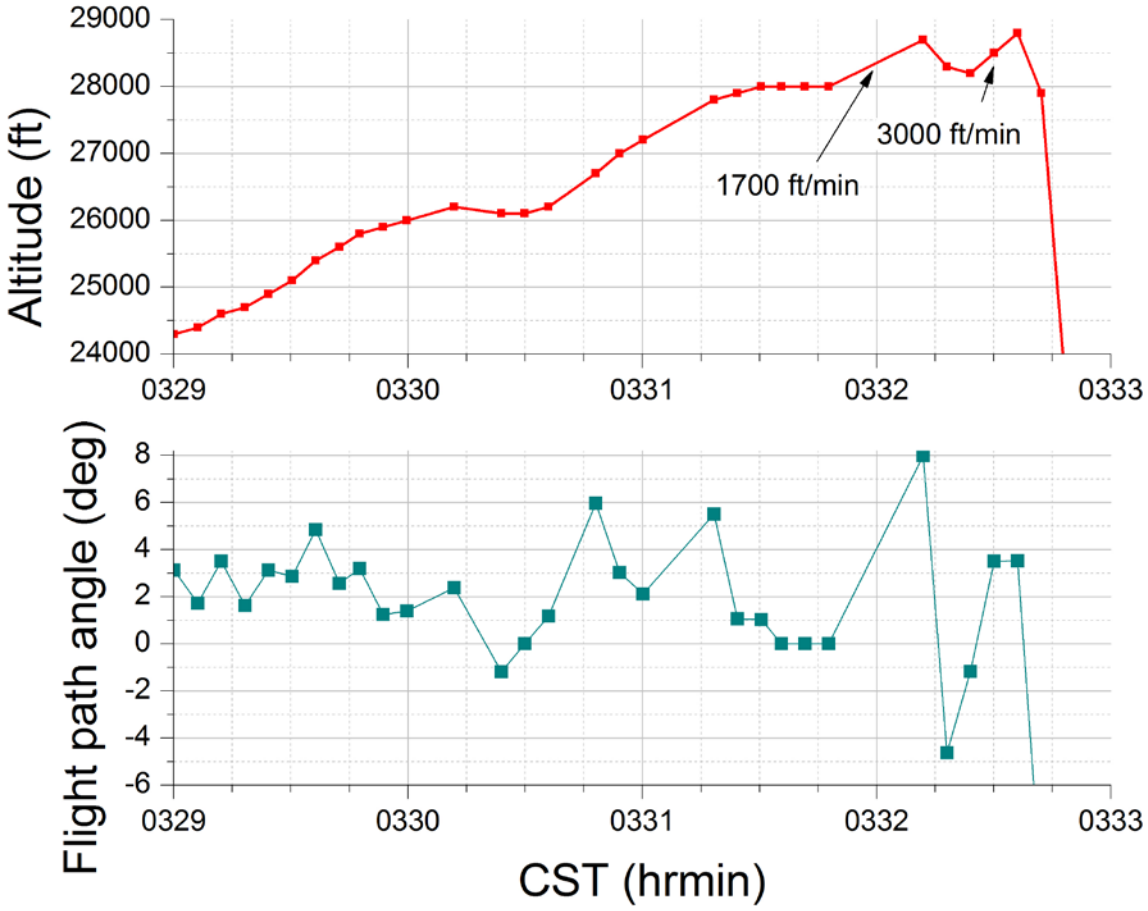

Figure 7. Radar altitude and calculated flight path angle.

E. CONCLUSIONS

Data from long-range radar installations based in the United States were used to determine the location of the aircraft and to calculate its speed and flight path angle. While there were some features of interest in the aircraft's climb, specifically its pauses at 26,000 and 28,000 ft and its last two gains in altitude after 0331:45, there did not appear to be any unusual maneuvers that were outside the normal performance envelope of the airplane or any indications that the airplane should have experienced an aerodynamic stall.

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F. References

Radar and ATC data were provided by the NTSB Office of Aviation Safety Air Traffic Control Specialist.

Meteorology data was provided by the NTSB Office of Aviation Safety Meteorology Specialist.