

National Transportation Safety Board

Office of Research and Engineering

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CEN24LA085

AIRPLANE PERFORMANCE STUDY

May 15, 2024
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A. ACCIDENT

Location: San Marcos, Texas
Date: January 2, 2024
Time: 1710 CST
2310 GMT
Airplane: LearJet 35A, N46MF

B. AIRPLANE PERFORMANCE GROUP

No airplane performance group was formed.

C. SUMMARY

On January 2, 2024, about 1710 central standard time (CST), a Learjet 35A, N45MF, was substantially damaged when it was involved in an accident near San Marcos, Texas. The 2 pilots and 3 passengers were not injured. The airplane was operated under the provisions of Title 14 *Code of Federal Regulations* Part 135 as an air medical transport flight.

The airplane departed Albuquerque International Sunport Airport (ABQ), Albuquerque, New Mexico, about 1448 mountain standard time and flew to San Marcos Regional Airport (HYI), Austin, Texas. See Figure 1. The crew flew the instrument landing system ILS 13 approach to the ungrooved asphalt runway 13 which is 5,601 ft long.

The pilot reported that, during the landing, he touched down within the touchdown zone, applied the brakes, and deployed the spoilers. He further reported that the airplane did not respond to braking and did not slow down enough to remain on the runway.

The airplane departed the end of runway and came to rest in the grass. The lower fuselage sustained substantial damage.

Times in the study are quoted in CST unless otherwise noted. Greenwich Mean Time (GMT) = CST + 6 hr.

D. THE AIRPLANE

A picture of the accident airplane, a LearJet 35A, is shown in Figure 2. It was manufactured in 1981 and is registered to Med Flight Air Ambulance, Inc. The airplane is equipped with two Honeywell (previously Garrett) TFE731 turbofan engines.

E. WEATHER SUMMARY

A routine weather observation for HYI about one hour and ten minutes before the accident was reported as¹:

KHYI 022200Z 07008KT 10SM VCTS -RA OVC013 10/09 A3003 RMK AO2 LTG DSNT N AND W TSB00

The automated surface weather observation for San Marcos Regional Airport on January 2nd at 1600 CST is wind from 070° at 8 knots (kt); 10 statute miles visibility; thunderstorms in the vicinity with light rain; overcast ceiling at 1,300 ft above ground level (agl); temperature 10° Celsius (C), dew point 9°C; altimeter 30.03" of mercury. The observation site is automated and has a precipitation sensor. Lightning to the north and west beginning at 1600 CST.

The weather observation four minutes before the accident was reported as²:

KHYI 022306Z 31012G24KT 9SM OVC009 10/09 A3007 RMK AO2 LTG DSNT N RAE2257 CIG 006V011=

The automated surface weather observation for San Marcos Regional Airport on January 2nd at 1706 CST is wind from 310° at 12 kt, gusts to 24 kt; 9 statute miles visibility; overcast ceiling at 900 ft agl; temperature 10° Celsius (C), dew point 9°C; altimeter 30.07" of mercury. The observation site is automated and has a precipitation sensor. Lightning to the north. Rain ended at 1657 CST. Variable ceiling between 600 ft agl and 1100 ft agl.

F. AIRPLANE PERFORMANCE STUDY

The airplane performance study is based largely on ADS-B data provided by the FAA. ADS-B broadcasts an airplane's Global Positioning System (GPS) position to the ground where it is displayed to Air Traffic Control (ATC). The GPS position is also transmitted to other airplanes with ADS-B receivers, either directly or relayed through ground stations, to allow self-separation and to increase situational awareness.

GPS has an accuracy of approximately 20 meters in both the horizontal and vertical dimensions. GPS augmented with the Wide Area Augmentation System (WAAS) is accurate to approximately 1.5 - 2 meters.

¹ This weather observation is similar to the Automatic Terminal Information Service (ATIS) "Information Delta" which the flight crew received before landing.

² This weather observation is similar to ATIS "Information Echo" that the flight crew never received.

Bombardier computed an unfactored dry landing distance of 3,250 ft for the following conditions using the FAA Approved Flight Manual (AFM) for the LearJet 35A. Figure 3 shows the calculation using the AFM "Actual Landing Distance" chart.

1. HYI Runway 13 (126° magnetic and 5,601 ft long)
2. Elevation of 593 ft
3. Temperature of 10°C
4. Landing weight of 12,862 lb
5. Winds 310° at 12 kt with gust 24 kt
6. 10 knot tailwind (This is the greatest tailwind listed in the AFM landing chart.)
7. Runway gradient of -0.36%
8. Anti-skid on
9. Flaps 40°

However, the AFM Supplement for a wet/contaminated runway (as was the case in the accident) specifies a factor of 1.4 to be applied to the unfactored dry landing distance. This results in a factored landing distance of 4,550 ft.

In addition to landing distance, the AFM lists the reference landing speed or the airspeed used for final approach, V_{ref} , as 119 kt indicated (KIAS) at the conditions above, not including the wind gust. V_{ref} increases to 125 kt when the recommended "half the gust factor" or 6 kt is added.

Figure 4 shows an over-head view of the recorded ADS-B ground track from Albuquerque to the wreckage location off the end of runway 13. Figure 5 is the same ground track but focuses on the last 3 NM of the approach and landing and includes altitude and estimated calibrated airspeed (KCAS). N46MF crossed the runway 13 threshold at approximately 144 KCAS and 300 ft agl. The optimal threshold crossing height (TCH) is between 40 and 60 feet³.

Figure 6 includes time histories for altitude, ground speed (V_g) and estimated calibrated airspeed (V_c) for the entire flight. Figure 6 highlights the last 3 NM of the approach and landing. The airplane touched down at approximately 1710:10 and 124 KCAS, about half-way down the runway (around the runway 8/26 intersection) with approximately 2,700 ft of runway remaining. The airplane came to rest in the grass about 300 ft off the end of the runway, 3,000 ft beyond the touchdown point.

Recorded data in Figure 7 indicate that N46MF had about a 15 kt tailwind and a descent rate that exceeded 2,000 ft/min approximately 10 sec before touchdown⁴. This was reduced to 1,000 ft/min about 3 sec before touchdown and 25 ft above the runway.

³ FAA Order 8260.3, United States Standard for Terminal Instrument Procedures (TERPS).

⁴ The Med Flight Air Ambulance General Operations Manual notes that a stabilized approach is one of the key features of safe approaches and landings. The GOM lists one of the criteria for a stabilized approach as a rate of descent no greater than 1,000 fpm below 1,000 ft above the terrain.

G. SUMMARY AND CONCLUSIONS

Recorded ADS-B data indicate that N46MF crossed the runway threshold about 250 ft high and landed about half-way down runway 13 at San Marcos Regional Airport. The airplane came to rest in the grass approximately 300 ft off the end of the runway as shown in Figure 8. In addition to the runway being wet, a 15 kt tailwind existed around the time of the landing. ATC did not advise the flight crew of the tailwind⁵.

The ILS approach to runway 13 was not stable as per the operator's stabilized approach criteria.

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National Transportation Safety Board

⁵ FAA Order JO 7110.65 for ATC states: "When authorizing use of runways and a tailwind component exists, always state both wind direction and velocity."

H. FIGURES

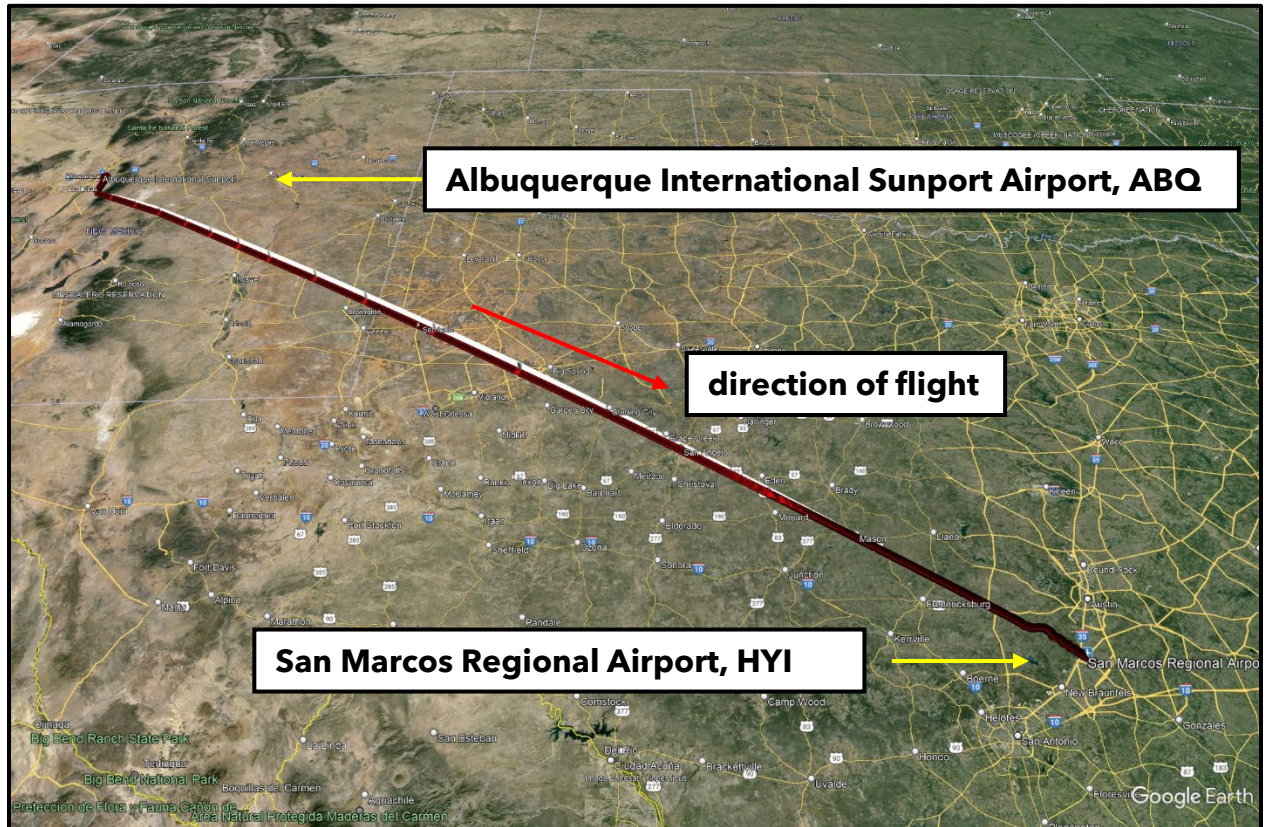


Figure 1: The One Hour, Twenty-Two Minute Flight departed Albuquerque International Sunport Airport at 1548 CST



Figure 2: Accident Airplane, N46MF, a 1981 LearJet 35A

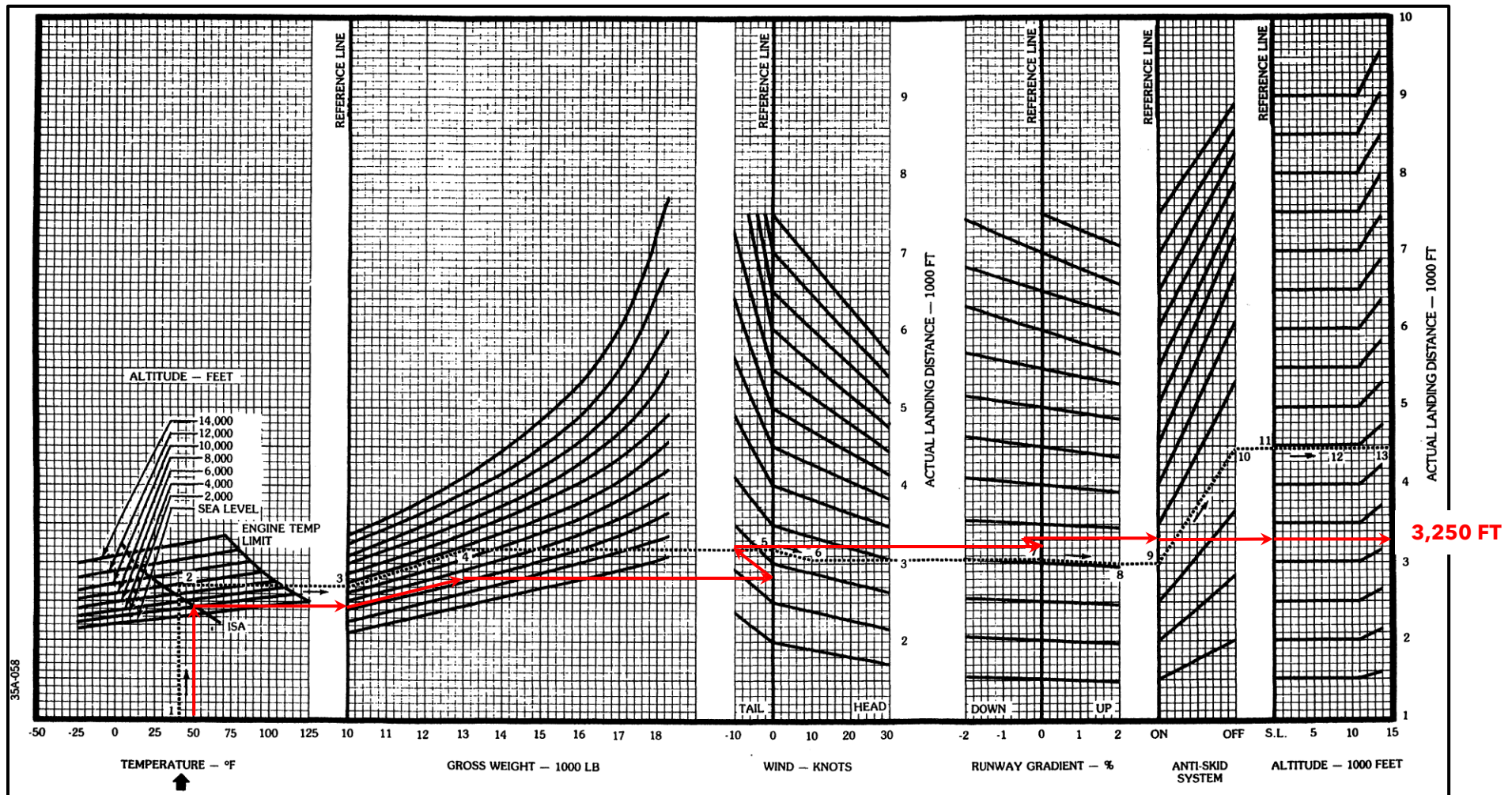


Figure 3: AFM Actual Landing Distance Calculation

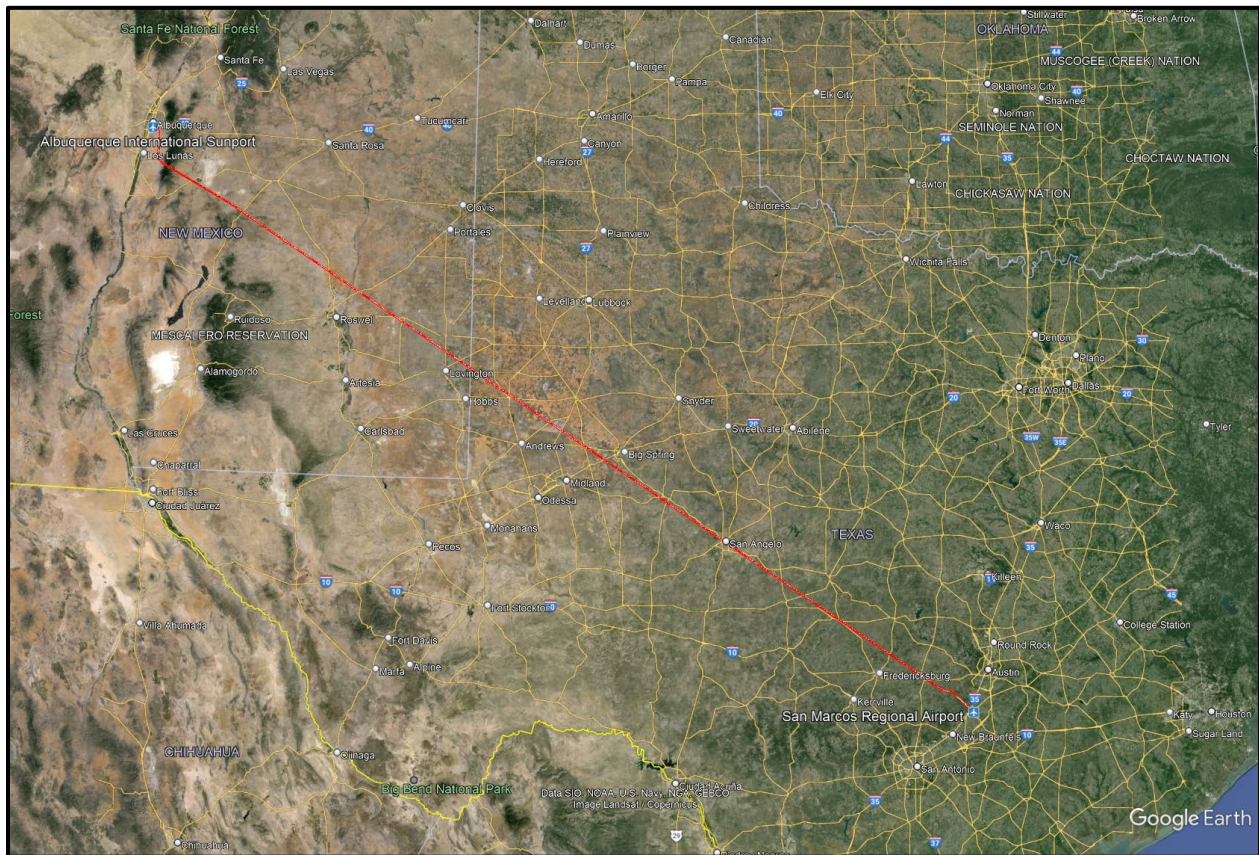


Figure 4: Recorded ADS-B Ground Track for 550 NM Accident Flight

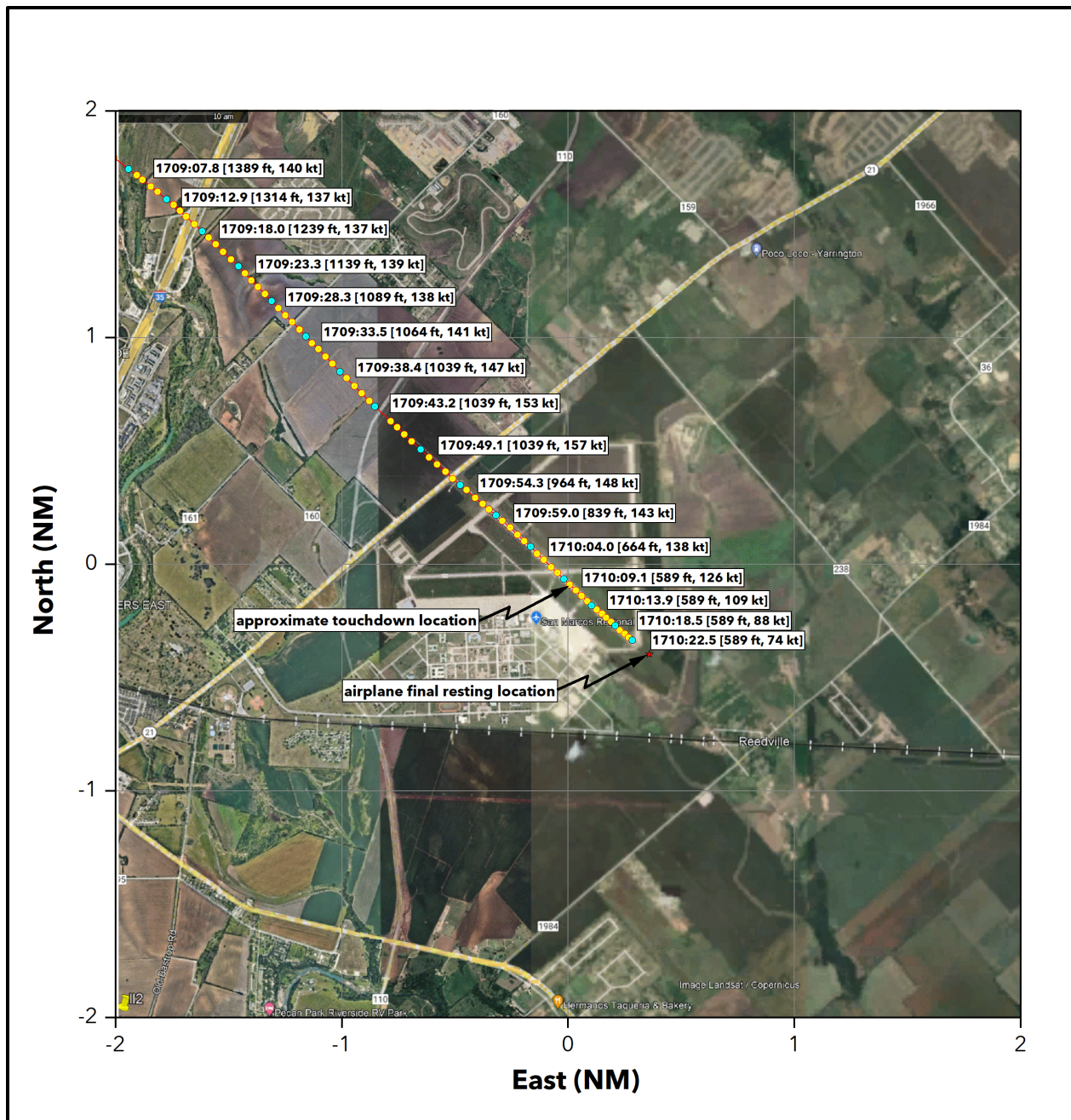


Figure 5: Recorded ADS-B Ground Track with Altitude and Estimated Calibrated Airspeed for the Final Approach into HYI

CEN24LA085: Learjet 35, N46MF
San Marcos, TX
1/2/2024

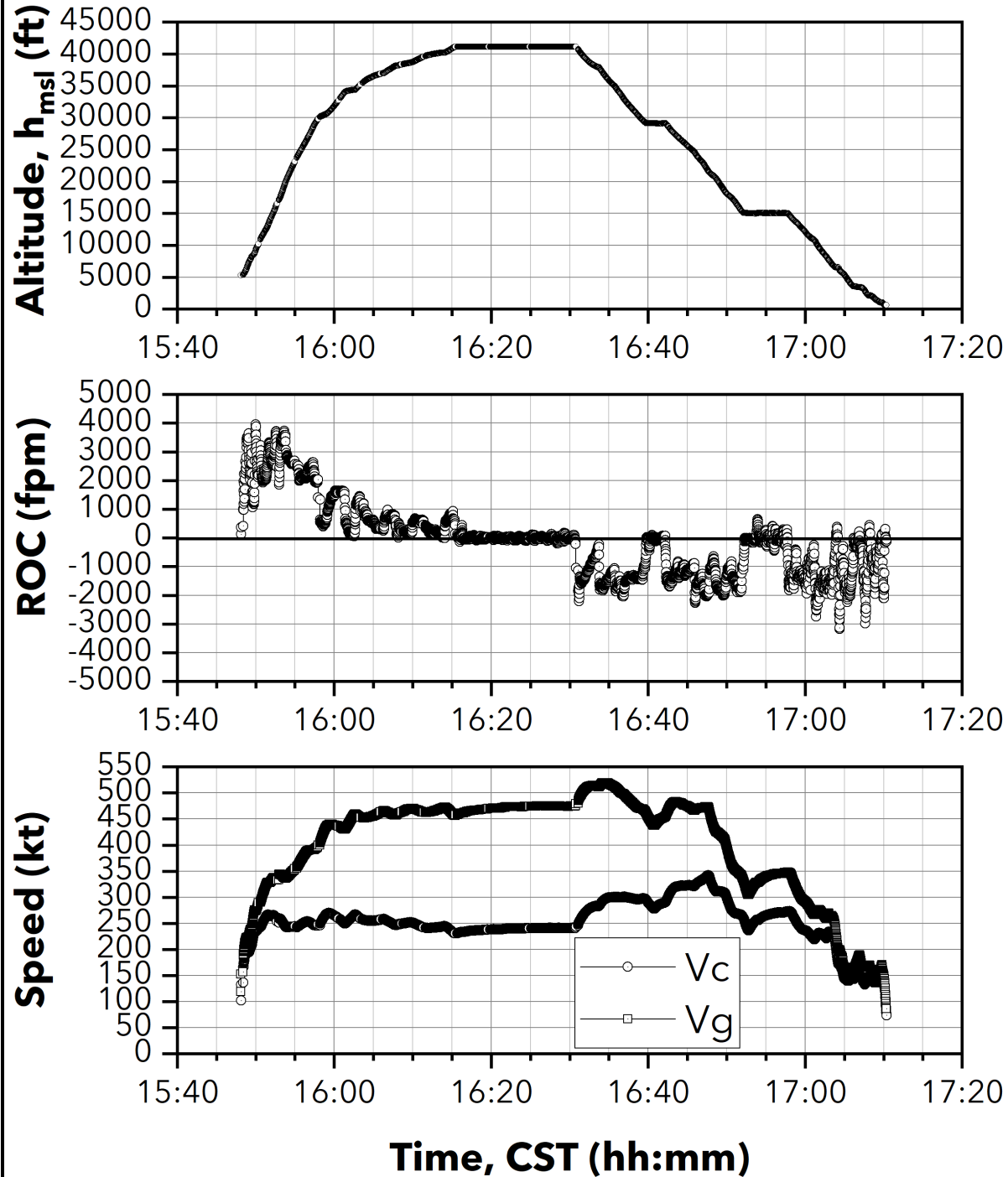


Figure 6: ADS-B Altitude, Rate of Climb (ROC), and Ground Speed with Estimated Airspeed for Accident Flight

CEN24LA085: Learjet 35, N46MF
San Marcos, TX
1/2/2024

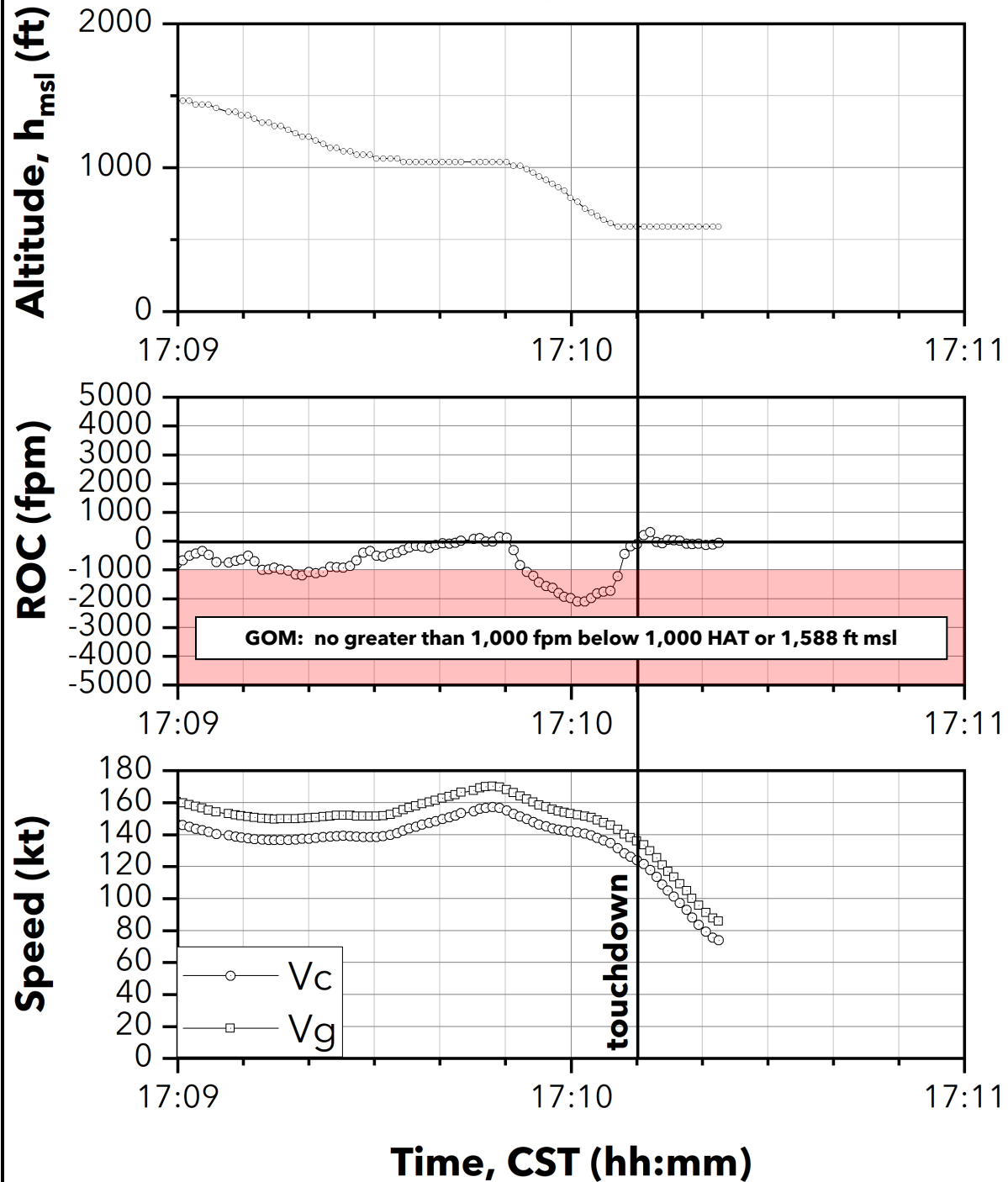


Figure 7: ADS-B Altitude, Rate of Climb (ROC), and Ground Speed with Estimated Airspeed for Accident Flight during Final Approach



Figure 8: N46MF Came to Rest about 300 ft off of Runway 13