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

Performance Study

Specialist Report
Marie Moler

A. ACCIDENT

Location:	Santa Monica, California
Date:	September 29, 2013
Time:	1820 PDT
Airplane:	Cessna 525A Citation, N194SJ
NTSB Number:	WPR13FA430

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On September 29, 2013, at 1820 Pacific daylight time (PDT), a Cessna 525A Citation, N194SJ, veered off the right side of runway 21 and collided with a hangar at the Santa Monica Municipal Airport (SMO), Santa Monica, California. The private pilot and three passengers were fatally injured and the airplane was destroyed by a post-crash fire. The airplane was registered to CREX-MML LLC and operated by the pilot as a 14 Code of Federal Regulations, Part 91 flight. Visual meteorological conditions prevailed for the flight, which operated on an instrument flight rules flight plan. The flight originated at Hailey, Idaho, about 1614 PDT.

The aircraft was not equipped with a flight data recorder or a cockpit voice recorder. Available information for the accident flight included the radar track, ground marks from the aircraft's tires, and security camera footage from Santa Monica Municipal Airport.

RADAR STUDY

This portion of the report describes the accident airplane's ground track, altitude, speed, and estimated attitude on approach to SMO. Radar data used in this study are from the Los Angeles, California LAXA ASR-9 (airport surveillance radar) sampled at a frequency of once every 4.5 seconds. The radar is approximately 5.5 nautical miles (NM) from the aircraft's final location. These radar have approximately a 60 NM range and an inherent 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.

Times in the study are reported in PDT.

Weather Observation

The weather conditions reported at SMO at 18:24 (four minutes after landing) were winds from 240° at 4 kts, 10 miles prevailing visibility with no clouds below 12,000 ft. The temperature was 21°C (70°F), the dewpoint 12°C (53°F), and the altimeter pressure was 29.97 inHg.

Radar Track

The aircraft's flight on approach into SMO is shown in Figure 1. The last radar return was recorded at 18:20:26 PDT, about 1500 ft before the airport threshold.

Figure 1. Aircraft approach flight path from LAXA radar.

The aircraft's groundspeed was calculated from radar and is shown versus time in Figure 2. Its final groundspeed was about 115 kts. Wind was, as stated above, 4 kts from 240°, which would have added a slight headwind when landing on runway 21. The approach speed (V_{APP}) for the 525A for 15° of flaps is between 98 kts indicated airspeed (for 8000 lbs landing weight) and 122 kts (for 12375 lbs landing weight) [1].

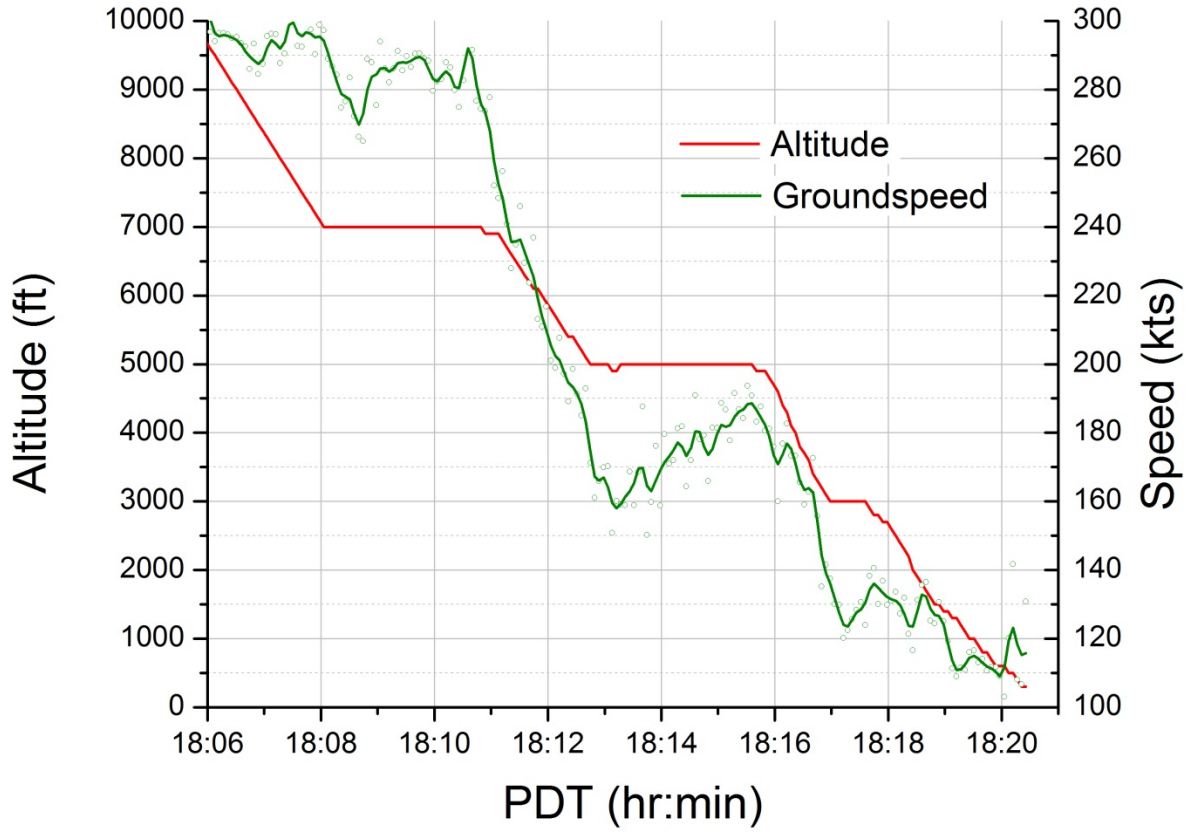

Figure 2. Aircraft altitude and groundspeed for final 14 minutes of flight.

Figure 3 shows the altitude and groundspeed versus ground distance for the final 3.5 NM of the flight. The aircraft's glide slope was 3.9°. Runway 21 at SMO has a four light precision approach path indicator (PAPI) for a 4.00° glide slope. The tower controller reported that the airplane landed normally in the designated touchdown zone, abeam the tower and 1000 ft from the threshold [2]. The path from the last radar return to the 1000 ft mark is shown in orange on Figure 3. The glide slope of this last 2500 ft of flight was about 3°.

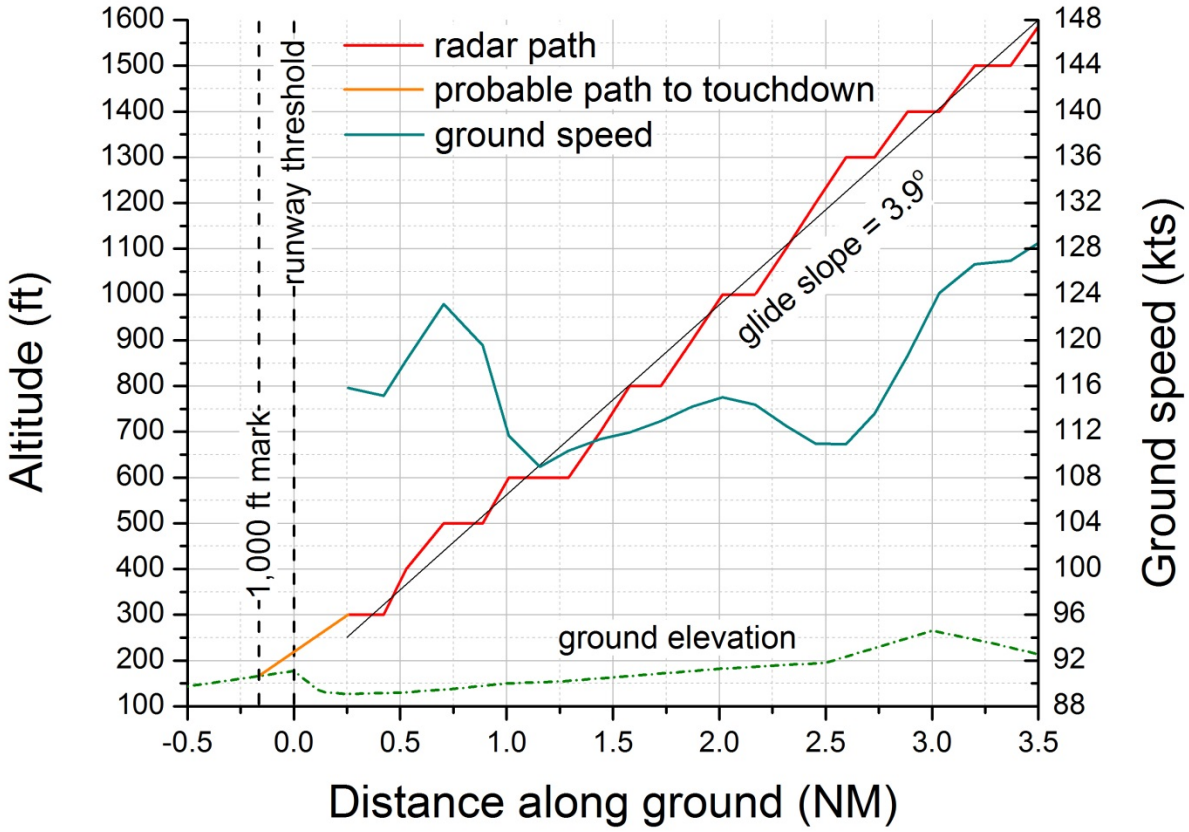

Figure 3. Aircraft altitude and groundspeed for final 3.5 NM of approach.

GROUND ROLL STUDY

The rubber tire marks left by the aircraft on the runway and other paved surfaces were photographed and their locations recorded. The first tire mark was found about 2800 ft from the threshold of runway 21 and 35 ft right of the centerline. Figure 4 shows a photograph of one set of tire marks left by the accident aircraft. The aircraft's path was determined by connecting the recorded tire marks and is shown in Figure 5. Aircraft braking causes rubber from the tires to be deposited onto the runway.

Figure 4. Tire marks from the left and right main gears. The nose gear mark is lighter and closer to the right main tire mark. The hanger the aircraft impacted is in the top right of the picture.

Six security cameras at the Santa Monica Municipal Airport recorded the accident aircraft. The aircraft was first recorded on video approximately 2000 ft from the runway threshold. The average speed of the aircraft was estimated for each camera recording and once for between camera views. The estimated speeds in knots are shown in Figure 5, below. The details of the speed calculations can be found in the NTSB Video Study [3]. The calculated speeds in Figure 5 do not uniformly decrease due to the uncertainty of estimating the speed from video. Additional configuration information, such as flap or spoiler settings or thrust reverser deployment could not be determined from the video due to low resolution.

Figure 5. Recorded tire marks shown (not to scale) in black. Speed estimates from the Video Study are shown in knots next to green arrows. The projected ground roll path is shown as a white line. The arc of the camera views are shown as colored lines.

Cessna Aircraft Company provided data from two exemplar landings and ground rolls for a Citation 525A. The data included distance along the runway, calibrated airspeed, GPS speed, left and right brake pressures, brake pedal inputs, and flaps. To compare the exemplar and the accident aircraft landings and ground rolls, it was assumed that all aircraft touched down at the 1000 ft mark, as reported by the tower controller. Figure 6, below, shows the ground speed versus runway location for all three ground rolls.

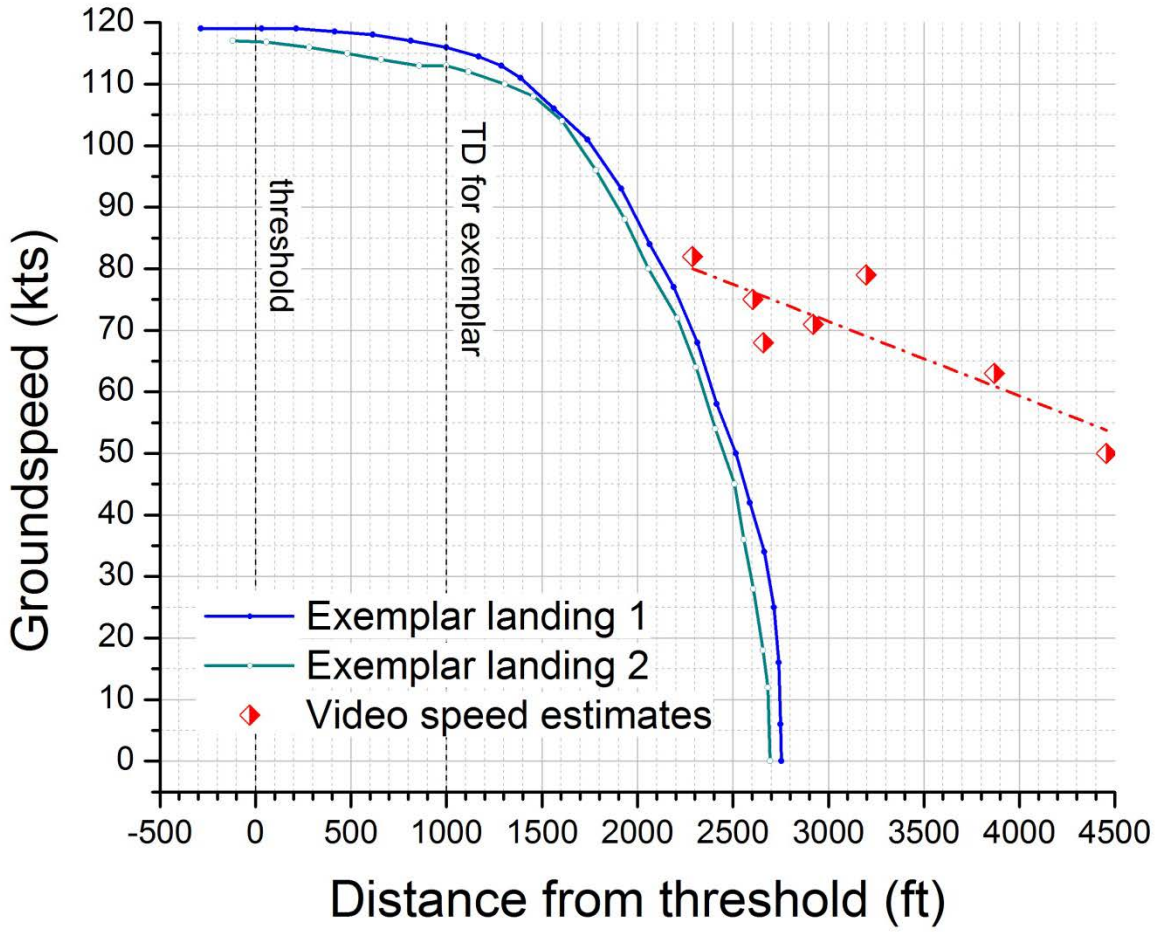

Figure 6. Groundspeed versus distance from threshold for two exemplar landings and ground roll (blue and green lines) and the accident aircraft speed estimates (red points). Also included are the tire marks along the accident aircraft ground roll.

The first speed estimate is about 10 kts faster than the exemplar ground rolls at the same location. This may indicate that during the first 1000 ft of the ground roll, the accident aircraft was decelerating near as expected. The exemplar aircraft slowed to a stop more than 1700 ft before the accident aircraft impacted the hanger.

D. CONCLUSIONS

The aircraft's flight path, altitude, and calculated speeds during the approach were consistent with the standard approach for a Citation 525A into SMO. The aircraft's ground roll was longer and faster than exemplar landings. Tire marks indicate braking occurred late in the ground roll. The aircraft's flap and spoiler settings and thrust reverser deployment are unknown. A reason for the lack of normal deceleration could not be determined using the available data.

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E. REFERENCES

1. Pilots' Abbreviated Checklist, Model 525A Citation CJ2, Revision 6. Cessna Aircraft Company, Wichita, Kansas, 21 June 2000.

2. Tower Controller Interview, WPR13FA430, National Transportation Safety Board.

3. Video Study, WPR13FA430, National Transportation Safety Board.