

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR21FA203

VEHICLE PERFORMANCE

Airplane Performance Study

A. ACCIDENT

Location: Las Vegas, Nevada
Date: May 24, 2021
Time: 1417 Pacific daylight time (PDT)
2117 Universal coordinated time (UTC)
Aircraft: Dassault Aviation Mirage F-1, N567EM

B. SUMMARY

On May 24, 2021, about 14:17 Pacific daylight time, an experimental Dassault Aviation Mirage F-1 Turbo-jet, N567EM, was destroyed when it was involved in an accident near Nellis Air Force Base, (LSV), Las Vegas, Nevada. The pilot was fatally injured. The airplane was operated as a public-use aircraft in support of the United States Air Force's simulated combat training.

C. PERFORMANCE STUDY

1.0 Aircraft

The airplane involved was a Mirage F-1, a French fighter and attack aircraft. It is a single-engine, swept wing, super-sonic airplane capable of Mach 2.2. Its maximum takeoff weight is over 35,000 lbs.

2.0 Available Data

This performance study is based on radar from LSV, approximately two miles north of the wreckage location. The LSV ASR-9 (airport surveillance radar) was sampled at a frequency of every 4.5 seconds. These data have approximately a 60 nautical mile (NM) range and an inherent uncertainty of ± 2 Azimuth Change Pulses (ACP) = $\pm (2 \text{ ACP}) \times (360^\circ / 4096 \text{ ACP}) = \pm 0.176^\circ$ in azimuth, ± 50 ft in altitude, and $\pm 1/16$ NM in range. Also included are select air traffic control (ATC) communications between the accident pilot and Nellis Tower.

3.0 Weather

Weather reported at LSV at the time of the accident was calm winds, temperature of 82°F (28°C), dewpoint 25°F (-4°C). The skies were clear. Barometric pressure was 30.01 inHg.

4.0 Flight Path

Figure 1 shows the end of the accident flight with time and altitude above mean sea level (msl) indicated for selected points, along with some ATC communications. The airplane was attempting to land on runway 3R at Nellis Air Force Base (LSV). At 14:15:08 Nellis Tower instructed the pilot "right break runway three right". The overhead break, or run and break, maneuver is used by high-performance aircraft to avoid spending too long at low speed in an airport's traffic pattern. The pilot aligns the airplane with the runway then "breaks" and performs a 180° turn downwind, configures the airplane for landing, and then then performs a second 180° turn to land on the runway. Drag during the turns causes a rapid deceleration to a safe speed for landing.

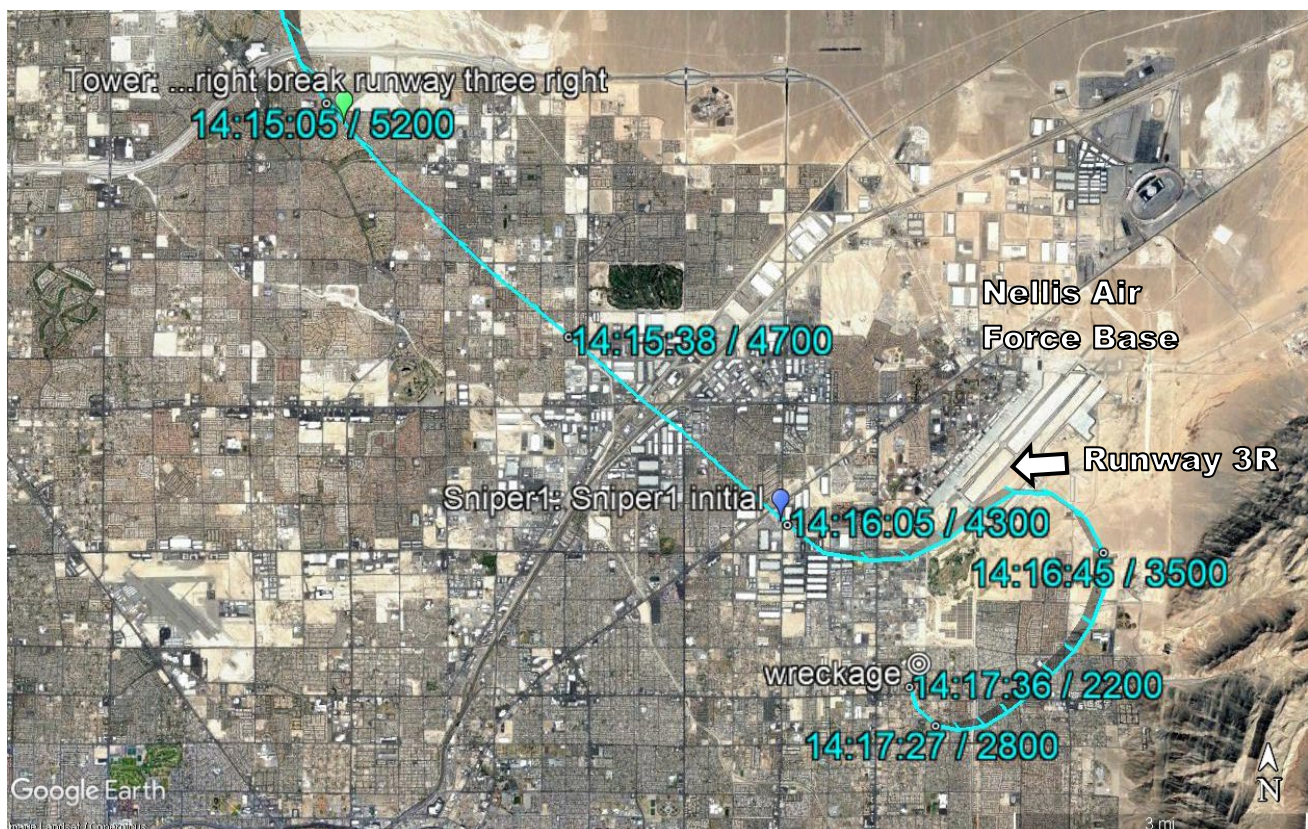


Figure 1. Flight path with time and altitude (msl) for selected points and some ATC communications.

The pilot called "initial" at 14:16:05 just before beginning a left turn onto the heading for runway 3R. At 14:16:26 the airplane aligned with runway 3R while 2,000 ft above ground level and at an airspeed of about 260 kts (Figure 2). The airplane broke right, and speed decreased. At 14:17:12, the pilot radioed "Tower Sniper1 is gonna be a low approach and ugh proceed out to Flex" as the airplane began the final 180° turn toward the intended runway heading. The airplane was approximately 1,400 ft above the terrain and at a calibrated airspeed of 170 kts and slowing. Shortly after, the

airplane's descent rate increased from the previous 1,000 fpm to more than 3,000 fpm (Figure 3).

The Flight Manual [1] reports the airplane's low-speed limitations as 160 kts without flaps and 130 kts with flaps. Additionally, the Flight Manual advises that if the flaps do not lower, to land at a speed between 195 and 215 kts. At 14:17:20 the pilot said "...we are having a ugh flap issue" and the tower responded "...are you declaring [an emergency]" to which at 14:17:28 the pilot responded "Sniper1 affirm". At 14:17:20 and the airplane's calibrated airspeed dropped below 160 kts and its final calculated airspeed at 14:17:36 was 135 kts and slowing. Because of the post-crash condition of the airplane and the absence of onboard recorded data, the nature of the flap issue reported by the pilot could not be determined, but the airplane was slower than the listed low-speed limitation without flaps for the final 14 seconds of flight and slowing to below the low-speed limitation with flaps. The final radar altitude was 400 ft above the ground. The wreckage location was about 1,300 ft to the northeast of the final radar location.

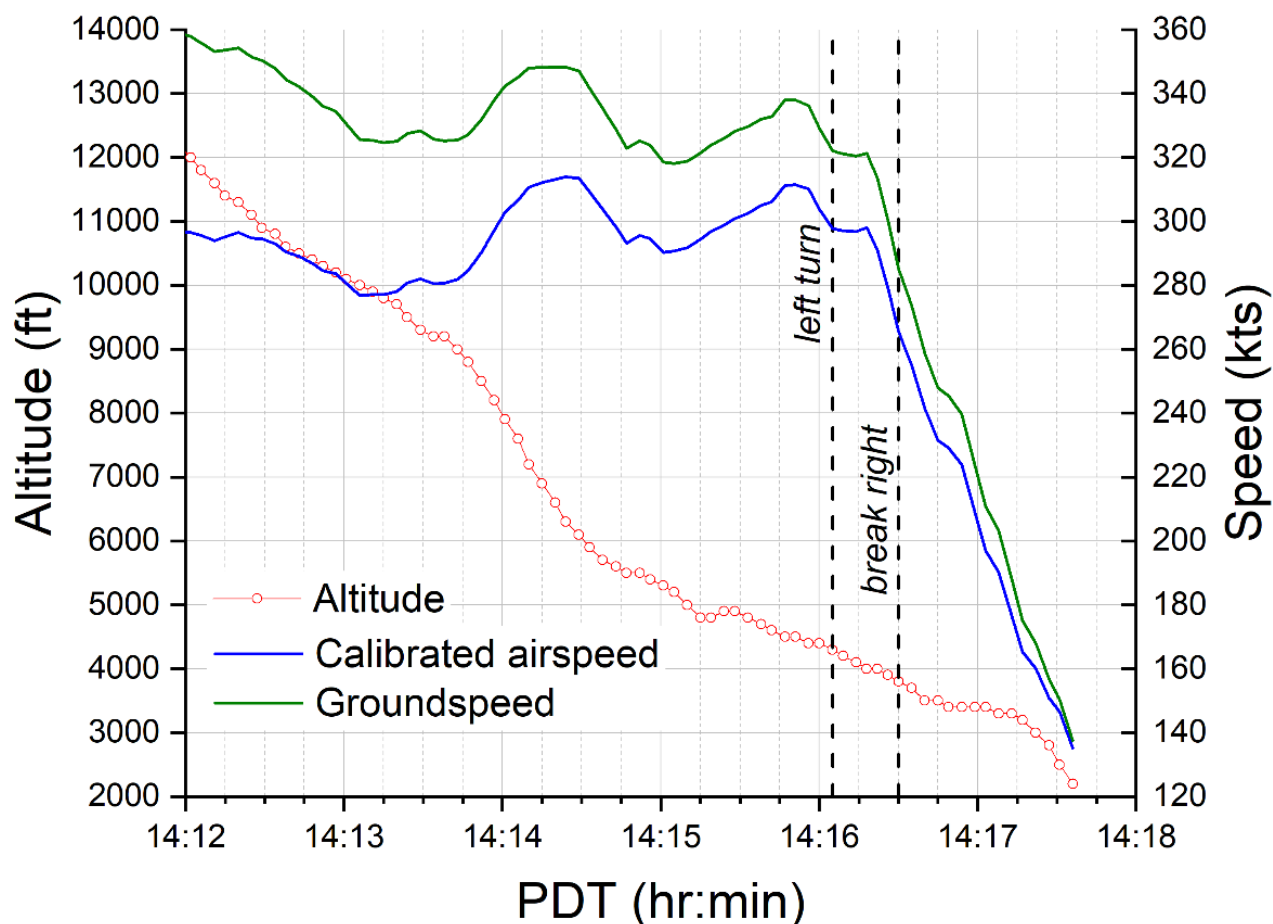


Figure 2. Altitude (msl), calculated groundspeed, and calibrated airspeed for end of flight.

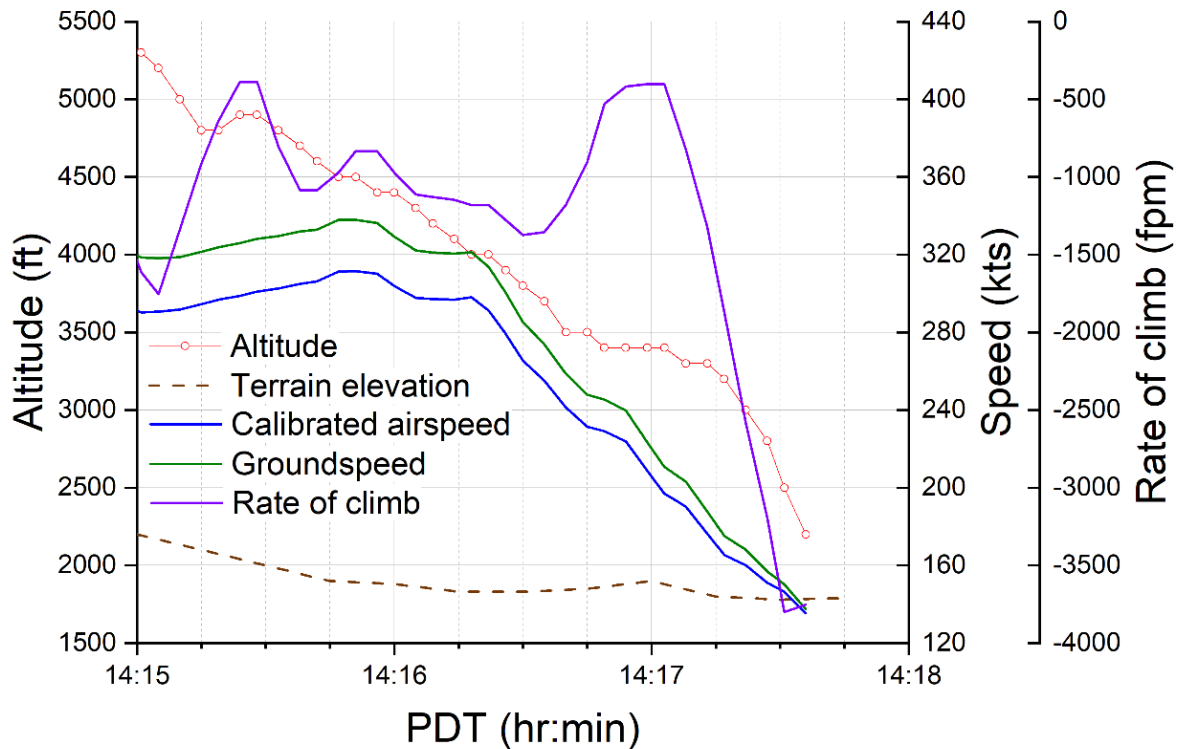


Figure 3. Altitude (msl), calculated groundspeed and calibrated airspeed, and calculated rate of climb for end of flight.

Of interest was the loading of the airplane during the final series of turns. Figure 4 shows the end of the flight path and the radius of four turns: the initial turn onto the runway heading (radius of 7,450 ft), the break over the runway (3,600 ft), the turn onto the downwind leg (5,400 ft), and the airplane's final turn (2,800 ft). Airplane load factor, n , often called g-loading is a function of the airplane's bank angle, ϕ ,

$$n = \frac{1}{\cos(\phi)}$$

And bank angle is a function of the radius of the turn, the true airspeed, v , and gravity, g

$$\phi = \tan^{-1} \left(\frac{v^2}{g * radius} \right)$$

Returning to Figure 3, the first turn, while the widest, was also the fastest. Winds at the time of the accident were calm, so true airspeed was equal to groundspeed. At 14:16:14 the airplane's groundspeed or true airspeed was 320 kts which resulted in a needed bank angle of 51° and a load factor of 1.6. The break over the runway was at a speed of 285 kts, needing a bank angle of 63° , and a load factor of 2.2. The final turns

were at true airspeeds of 259 and 170 kts and resulted in bank angles and load factors of 47° (1.5 g) and 41° (1.3 g) respectively.

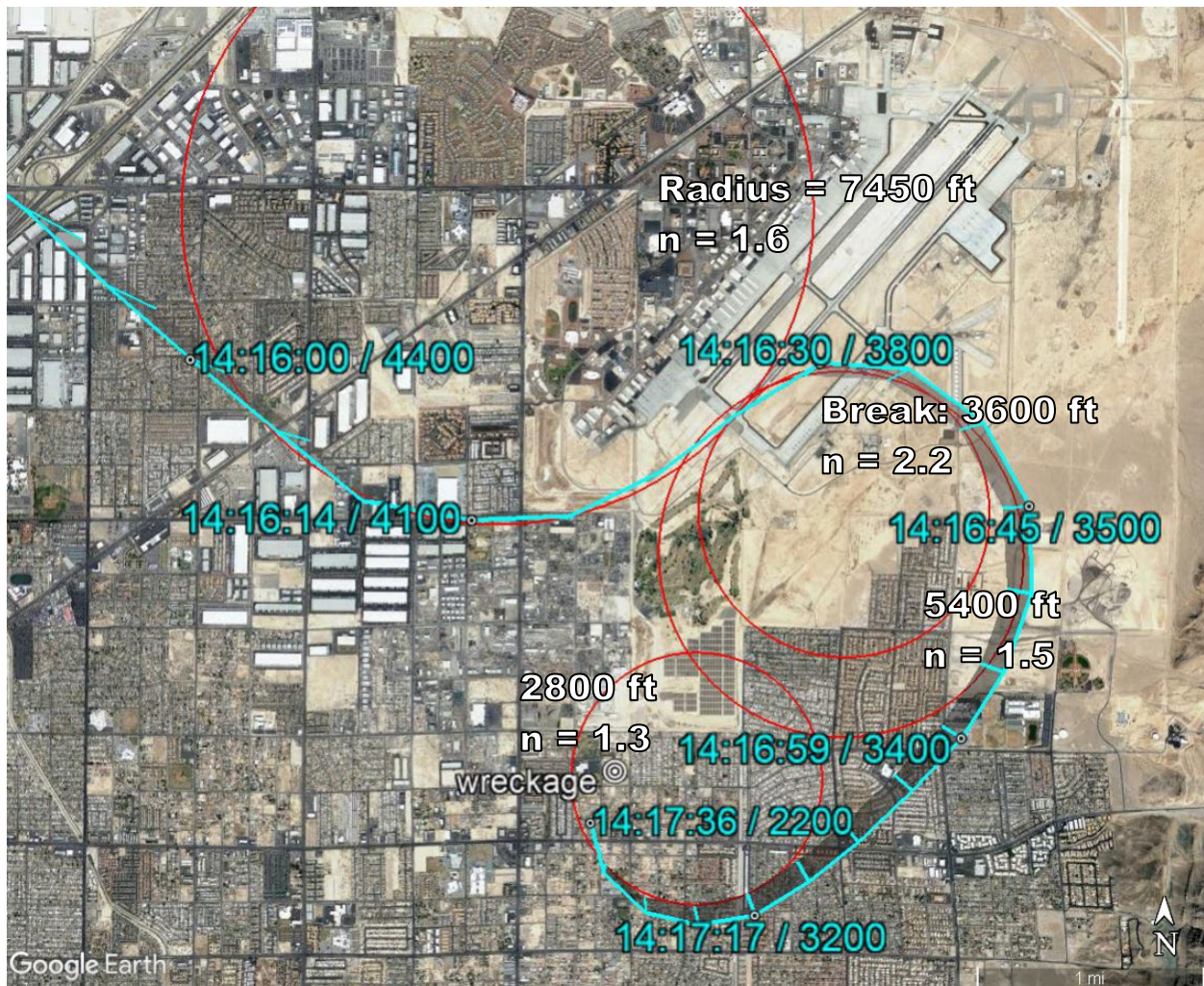


Figure 4. Radius of final four turns with flight path.

D. SUMMARY

The airplane performed a right overhead break over runway 3R. During the maneuver, the pilot reported a problem with the flaps. The airplane's speed dropped below the low-speed limitation with no flaps and was quickly slowing through the low-speed limitation with flaps.

E. REFERENCES

1. Flight Manual, 1F-F1K50EM-1-1, Performance and Configuration of the Aircraft Mirage F1, Issued 1975, Major Revision 2000.

Submitted by:

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