

National Transportation Safety Board

Office of Research and Engineering

Washington, D.C. 20594

Radar Study

Specialist Report

Marie Moler

A. ACCIDENT

Location:	Galveston Bay, TX
Date:	October 23, 2013
Time:	1125 CDT, 1625UTC
Airplane:	North American P-51D, N4151D
NTSB Number:	CEN14LA015

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On October 23, 2013 about 1130 central daylight time, a North American P-51D airplane, N4151D, impacted water near Galveston Bay near Galveston, Texas. The airline transport pilot and passenger were fatally injured and the airplane was substantially damaged. The airplane was registered to the Texas Aviation Hall of Fame, Galveston, Texas, and operated by Lone Star Flight Museum, Galveston, Texas. Visual meteorological conditions prevailed and a flight plan was not filed for the 14 Code of Federal Regulations Part 91 flight. The flight originated from the Scholes International Airport (KGLS), Galveston, Texas, about 1120.

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D. RADAR PERFORMANCE STUDY

Radar data of the aircraft flight was provided to the NTSB and is used in this report. Times are reported in the UTC of the radar data. The radar data used in the study are secondary returns from an Airport Surveillance Radar (ASR) at George Bush Intercontinental Airport (IAH) (ASR-9). This 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. The IAH ASR-9 was approximately 50 to 53 NM away from the aircraft during the accident flight.

Weather Observation

Meteorology provided winds using the output of the North American Mesoscale (NAM) computer model at location of the aircraft wreckage. Wind direction and magnitude was interpolated between the NAM output at 1500Z and 1800Z for estimated winds at the time of the accident.

Table 1. Winds at the time of the accident.

Altitude	Wind Direction	Wind Magnitude
1000 ft msl	10°	7.0 kts
2000 ft msl	30°	13.8 kts
3000 ft msl	32°	15.9 kts
4000 ft msl	29°	16.7 kts
5000 ft msl	32°	18.5 kts
6000 ft msl	35°	21.0 kts

Airplane Ground Track, Altitude, Airspeed, and Attitude

The aircraft took off from Scholes International Airport (KGLS) and flew out over Galveston Bay, as shown in Figure 1.

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Figure 1. Aircraft radar track with selected times and altitudes marked.

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Using a basic aerodynamic model of the North American P-51D, the speeds, forces, and attitude of the aircraft were estimated for coordinated flight through the radar points. Below, Figure 2 shows the calculated rate of climb, airspeed, and groundspeed of the aircraft. Since these speeds were calculated averages between radar points rather than continuous records of speed, there was a level of uncertainty for all speed calculations. Throughout the flight the aircraft gained speed, approaching 300 kts near the end of the recorded flight. The reported cruising speed for a P-51 is approximately 315 kts with a rate of climb of 3,200 ft/min.

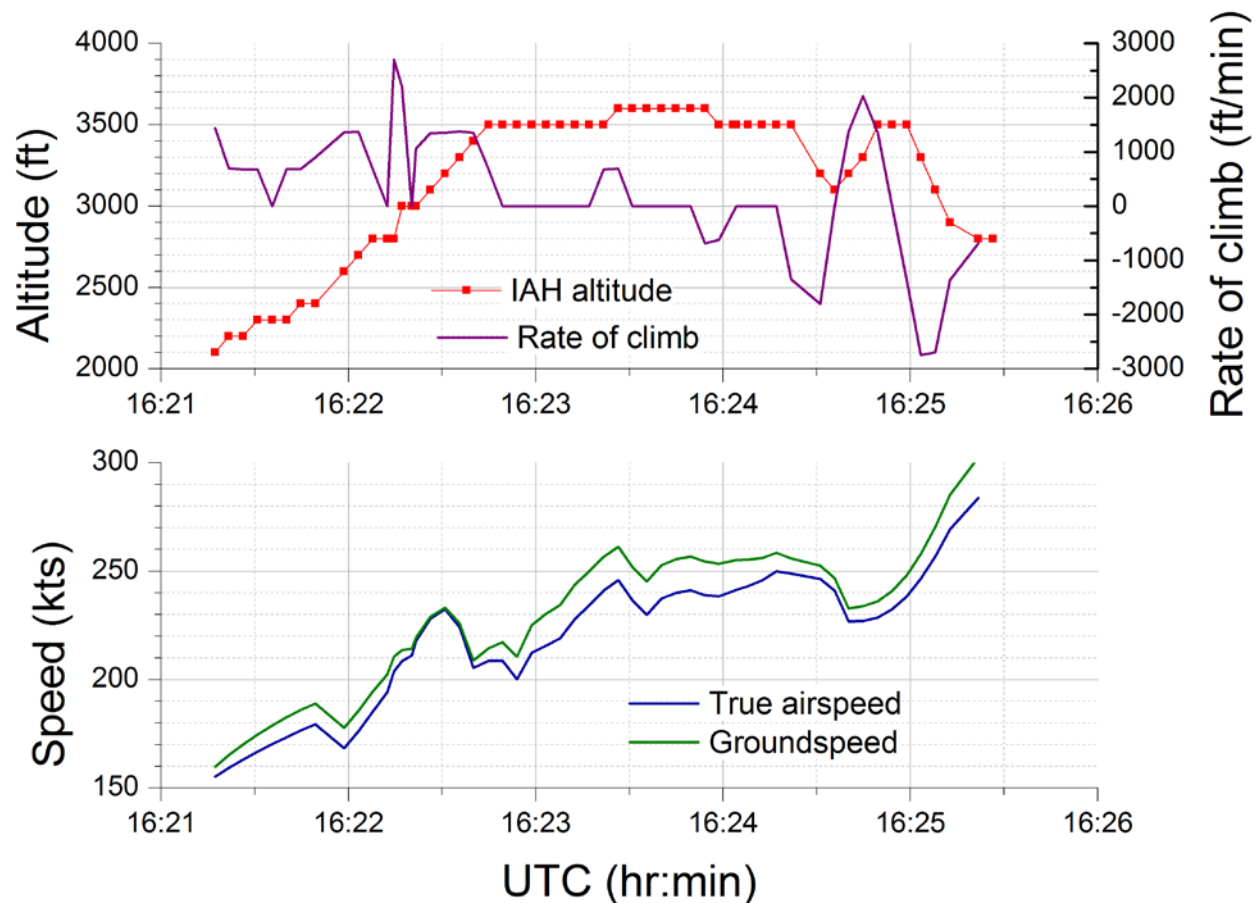


Figure 2. Aircraft altitude, rate of climb, airspeed, and groundspeed.

Figure 3 shows the calculated normal load factor, roll, and pitch during the flight. Earlier in the flight around 16:22:15, the aircraft's normal load factor decreased during a pitch up and left roll maneuver. For the rest of the recorded flight the normal load factor remained near the expected value of 1 g. The aircraft's roll and pitch behavior were not unusual or extreme throughout the flight.

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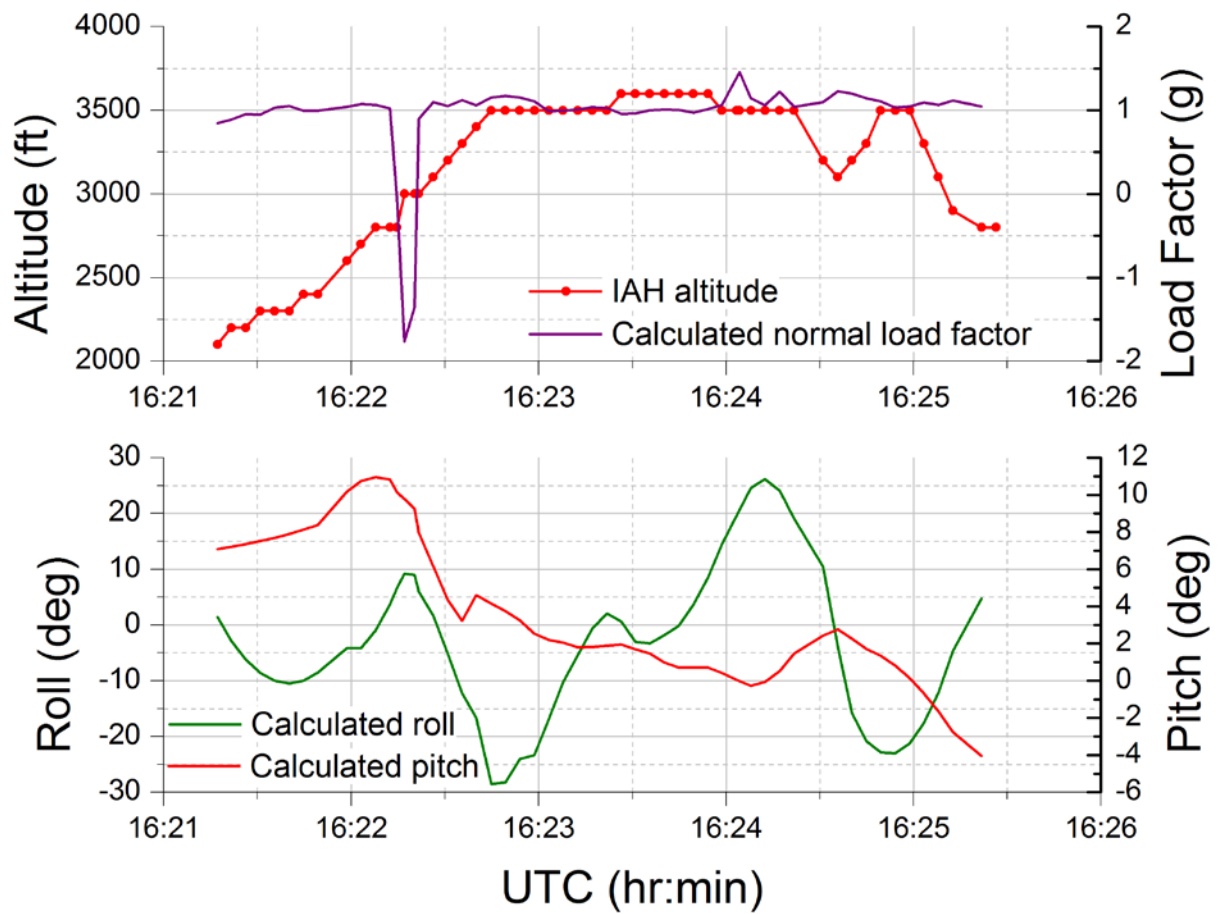


Figure 3. Aircraft altitude, normal load factor, pitch, and roll.

Figure 4 shows the radar track in Easting and Northing with KGLS at the origin. The aircraft's radar-recorded flight path was approximately 16 NM long and lasted a little over four minutes.

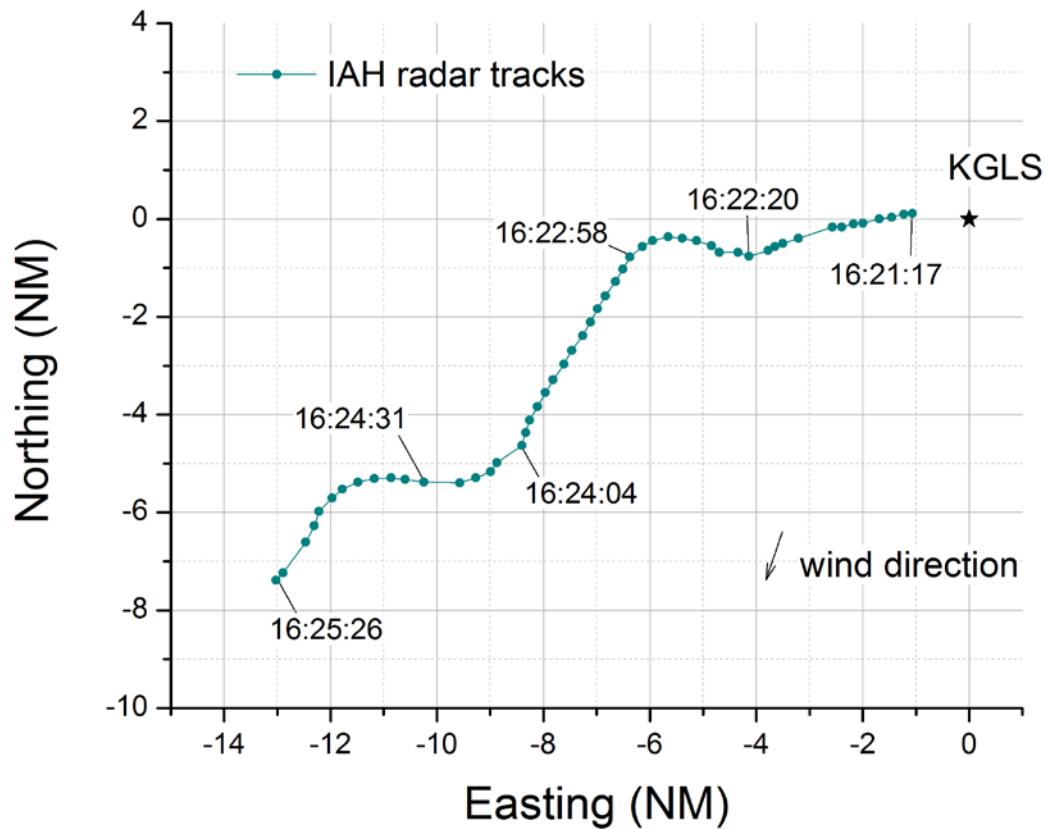


Figure 4. Aircraft radar track with selected times.

E. CONCLUSIONS

Calculated roll, pitch, climb rate, vertical load factor, and speed of the aircraft were well within its performance envelope for the recorded duration of the flight. There were no anomalies in the flight to indicate that there were any airplane performance problems during the accident flight.

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