

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

Airplane Performance Study

Specialist Report
Timothy Burtch

A. ACCIDENT

Location:	Moss Beach, California
Date:	November 18, 2016
Time:	1118 PST (1918 GMT)
Airplane:	Cessna C-172N, Registration N6610D
NTSB Number:	WPR17FA023

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On November 18, 2016, about 1118 Pacific standard time (PST), a Cessna 172N, N6610D, sustained substantial damage after impacting terrain and objects in a residential area near Moss Beach, California, following a loss of control while on final approach to Half Moon Bay Airport (HAF), Half Moon Bay, California. The private pilot sustained serious injuries, and the passenger was fatally injured. The personal cross-country flight was being operated in accordance with 14 *Code of Federal Regulation* Part 91, and a flight plan had not been filed. Visual meteorological conditions prevailed for the flight which originated from the Sacramento Executive Airport (SAC), Sacramento, California, at about 1015. HAF was the intended destination.

See Figures 1 and 2 for pictures of the accident airplane and the accident site, respectively.

D. PERFORMANCE STUDY

The accident airplane was not equipped with a data recorder. As a result, the airplane performance study is based largely on radar data. The specific radar data used in the study are secondary returns (transponder code 4533) from the short-range Airport Surveillance Radars (ASR-9) located in Oakland, CA, and Mountain View, CA. Short-range radar 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.

In addition, radar data (transponder codes 4533 and 1200) from the long-range Air Route Surveillance Radar site (ARSR-4) located on Mount Tamalpais in Mill Valley, CA, were used. Long-range radar data have approximately a 250 NM range and the same inherent uncertainty as short-range radar.

Times in the study are reported in PST as well as Greenwich Mean Time (GMT or “Z”): PST = GMT – 8 hr.

Weather Observation

Half Moon Bay Airport is an official weather reporting station and is only about 1,500 ft from the accident site. The winds aloft and surface weather from Half Moon Bay were used in the study. The weather report at HAF about three minutes before the accident is as follows:

METAR KHAf 181915Z AUTO 19010G14KT 10SM CLR 17/03 A3003 RMK AO2

Plain text: KHAf weather on the 18th at 1915 GMT / 1115 PST, the wind is from 190° (true) at 10 knots (kt) with gusts to 14 kt, visibility 10 statute miles (SM), clear, temperature 17° Celsius (C), dew point 3°C, altimeter 30.03 inches Hg. Remarks: Automated station with precipitation discriminator.

(See the Meteorology Weather Study for the accident for more detailed weather.)

Airplane Ground Track, Altitude, and Airspeed

N6610D approached HAF from the north and entered a 45° leg to the left upwind for runway 12. (See Figure 3 for an overview of the radar ground track.) The airplane was at about 86 kt calibrated airspeed (KCAS) and 1,000 ft mean sea level (msl) when the pilot completed the turn for a left downwind to runway 12. (These are typical numbers for a C-172 in the airport traffic pattern.)

Radar show that the airplane slowed to about 80 KCAS and descended to about 700 ft msl on the downwind leg. See Figure 4. The airplane then entered a continuous 180° left turn from downwind to final¹. Radar data indicate that, at 1116:20 PST, the airspeed was about 57

¹ The pilot did not fly a traditional “box” or rectangular traffic pattern. Instead, the pilot flew what he reported as a “180-degree sweeping turn (from downwind) to final”.

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KCAS, the altitude was 500 ft msl, and the airplane was at the apex of a 10° left turn to final. At this point the airplane pitched down (from 5° nose up to about -3° nose down) and accelerated as it descended until impact at about 1117:10 PST. Figures 5, 6, and 7 include time histories of the airplane's altitude, speed, and attitude as estimated from radar.

The pilot reported that the airplane was configured with full flaps (30°) and established at 60 kt and 500 ft msl. He also indicated that he felt he “would be vulnerable to strong buffeting at normal approach speed”, and he elected to land at a higher speed. As a result, he raised the flaps (from 30°) to “less than 20°”. He reported that “immediately after making these adjustments, I felt strong turbulence violently rock the plane”.

Figure 8 shows the stall speeds from the Airplane Performance Operating Handbook (POH). The airplane manufacturer estimates that the C-172N wing will stall somewhere between 31 KCAS and 40 KCAS depending on the flap deflection and airplane bank angle².

E. SUMMARY AND CONCLUSIONS

According to radar data, the reported steady state wind, and Cessna's published stalled speeds for the C-172N, N6610D maintained an airspeed above the airplane stall speed during the entire approach into Half Moon Bay airport.

However, the POH also recommends “slightly higher approach speeds under turbulent air conditions”. This is to compensate for any sudden loss in the headwind component which would result in a momentary loss in airspeed and could lead to stall above the published stall speed. While the POH does not define “slightly higher”, the FAA Airplane Flying Handbook recommends adding one-half of the reported surface wind gust to the normal final approach airspeed when landing in turbulent conditions³.

Finally, the pilot reported raising the airplane flaps on final approach. This can require significant and coordinated elevator and power inputs in order to maintain the desired glide slope. As a result, changes in flap deflection on short final are not recommended.

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² The stall speeds published in the POH assume power off, straight and level flight, and a maximum airplane gross weight of 2,300 lb. The accident airplane, on the other hand, had an estimated gross weight of 2,200 lb and likely was carrying some power. Both the lighter gross weight and power would lower the actual stall speed.

³ The winds were reported from 190° at 10 kt with gusts to 14 kt. As a result, the FAA Airplane Flying Handbook recommends adding 7 kt to the normal approach speed.

F. Figures



Figure 1: Accident Airplane N6610D, a 1980 Cessna C-172N “Skyhawk”



Figure 2: Accident Site

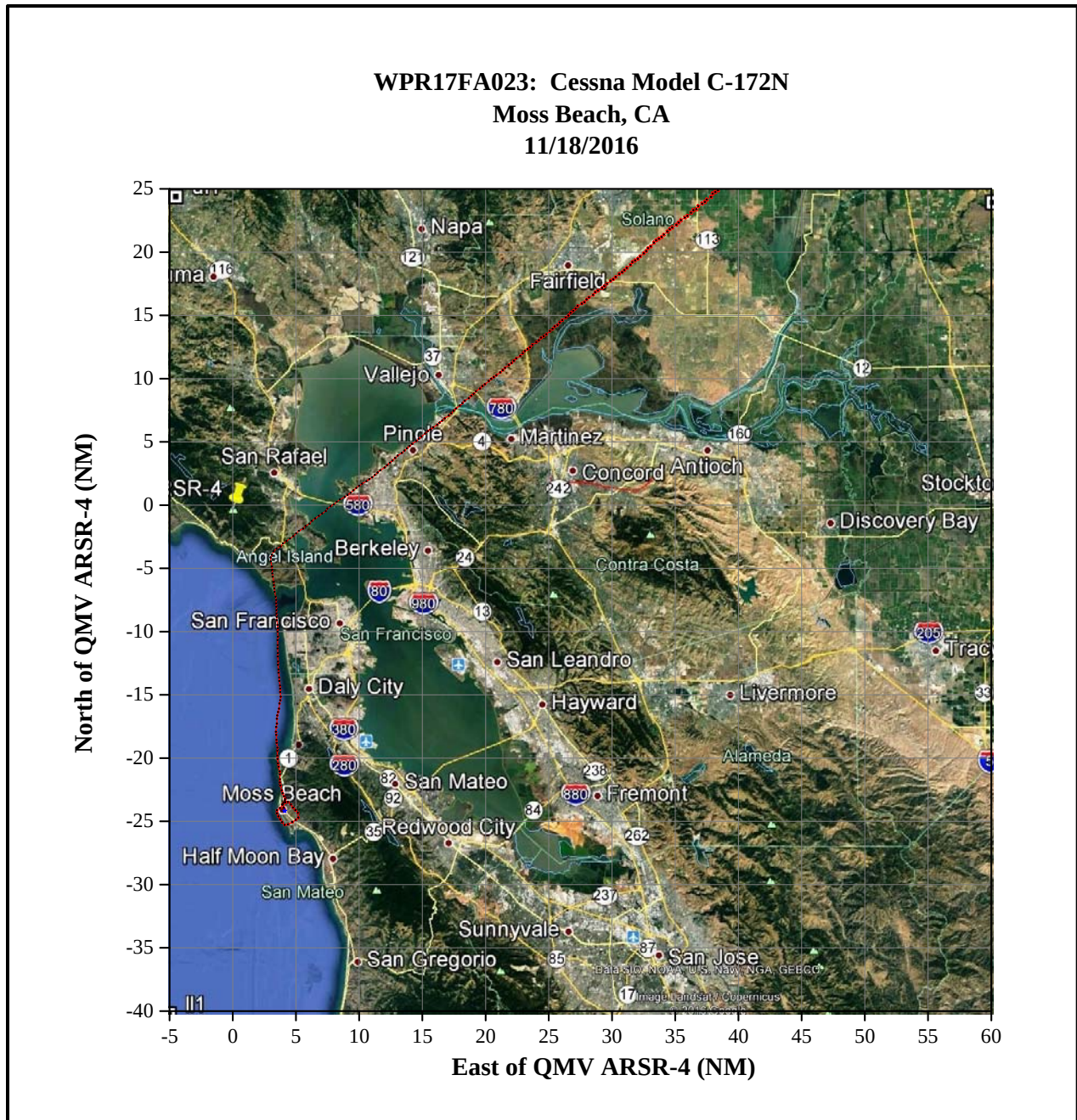


Figure 3: Radar Ground Track for Flight from SAC

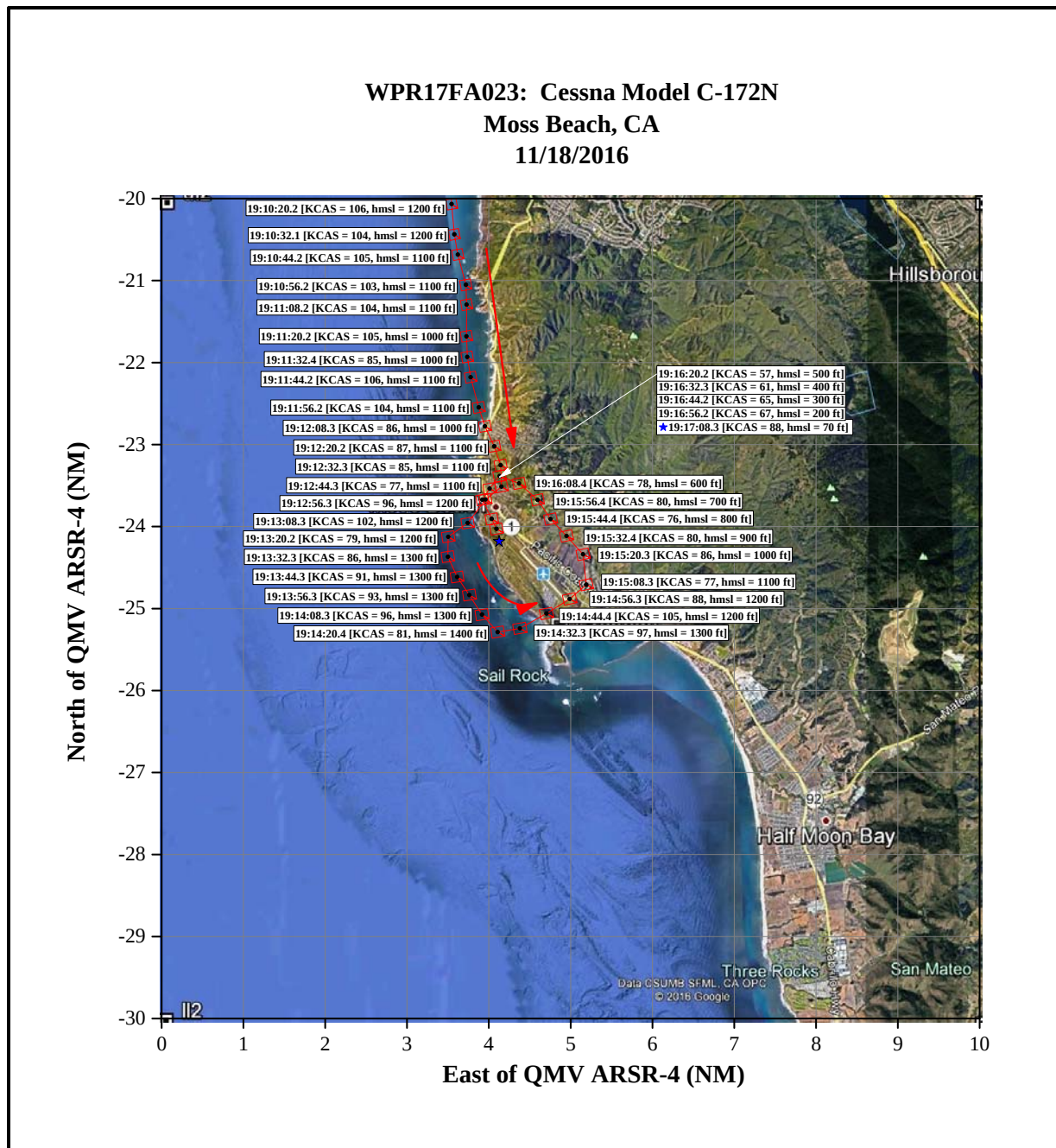


Figure 4: Radar Ground Track Near HAF with Estimated Airspeed and Altitude

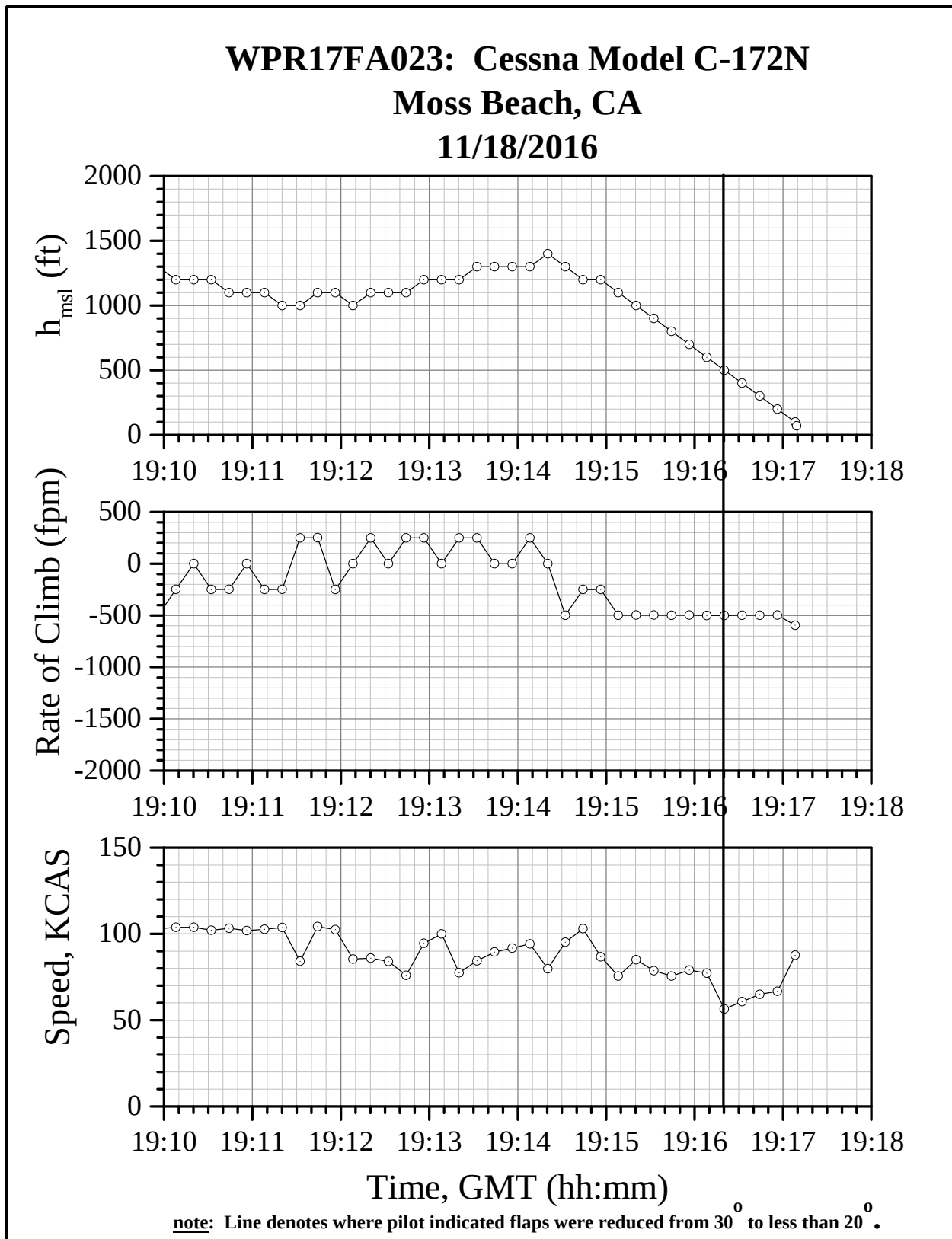


Figure 5: Altitude and Calibrated Airspeed Based on Radar

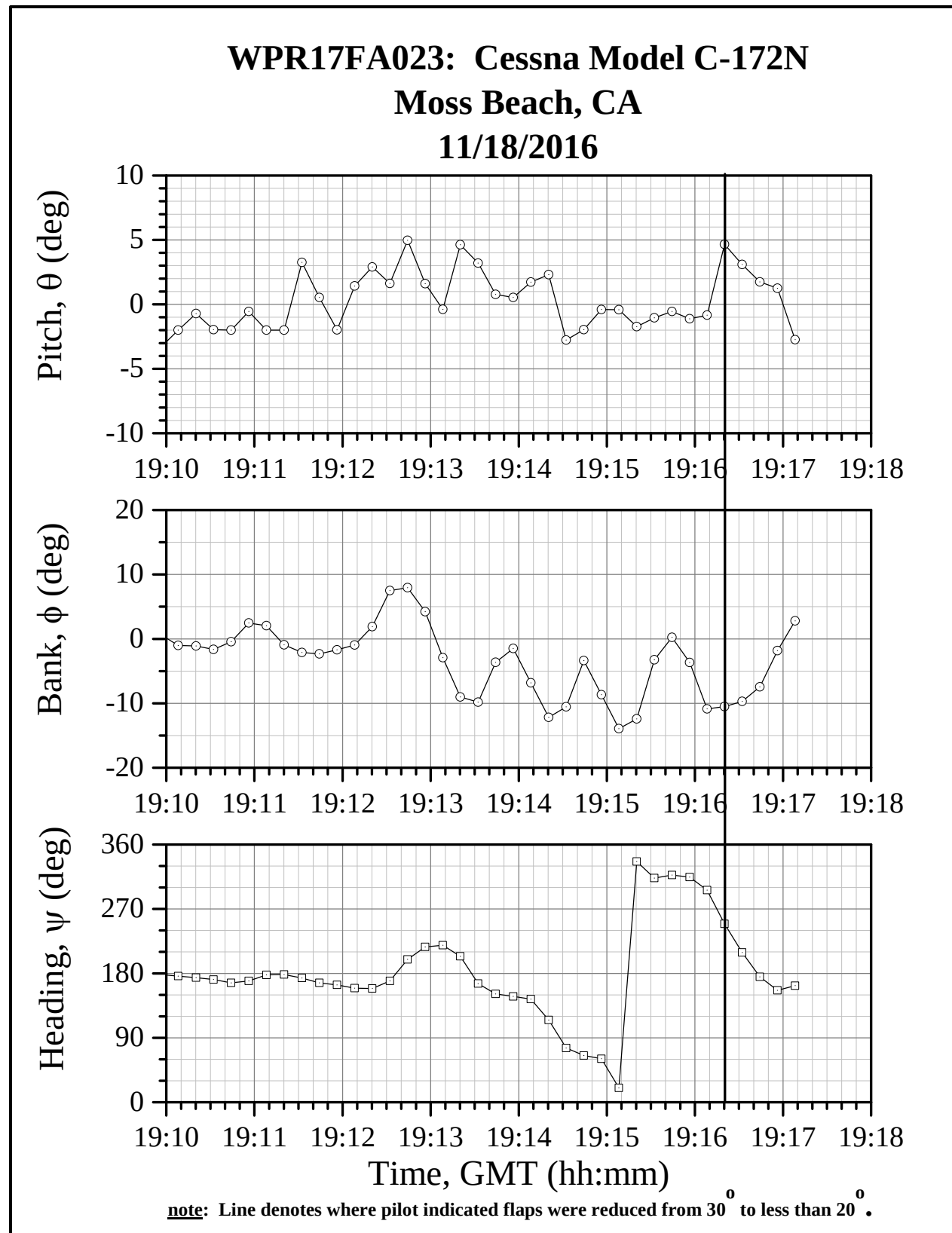


Figure 6: Pitch, Bank, and Heading Based on Radar

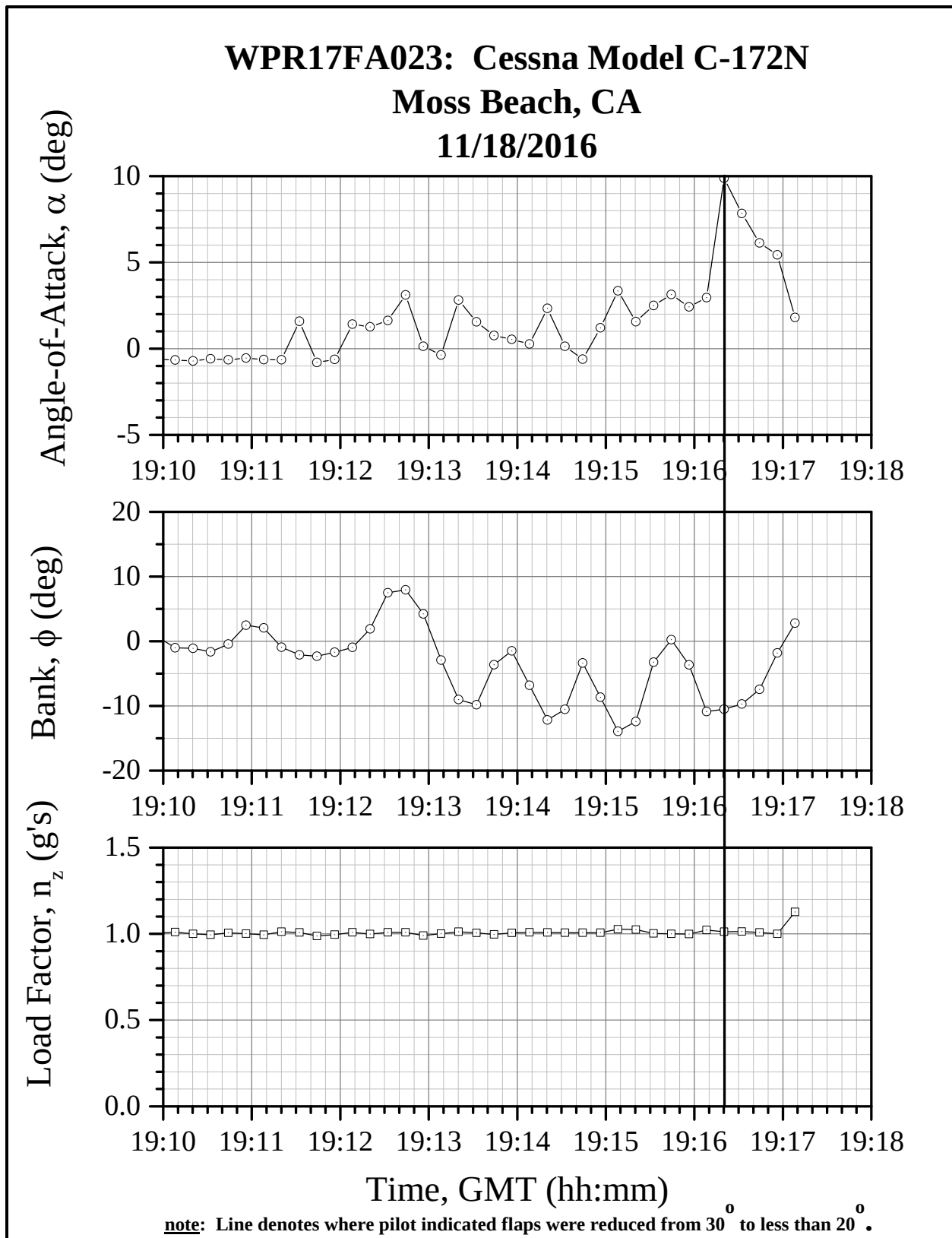


Figure 7: Estimated Angle-of-Attack, Bank Angle, and Normal Load Factor Based on Radar

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WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2300	UP	44	53	47	57	52	63	62	75
	10°	44	51	47	55	52	61	62	72
	40°	33	47	35	51	39	56	47	66

Figure 8: Stall Speeds for 2300 lb Gross Weight and Forward CG