

National Transportation Safety Board

Office of Research and Engineering

Washington, D.C. 20594

Performance Study

Specialist Report

Marie Moler

A. ACCIDENT

Location:	Arlington, Indiana
Date:	July 6, 2018
Time:	1720 EDT
Airplane:	Bell 47G / N96195
NTSB Number:	CEN18FA258

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On July 6, 2018, about 1720 eastern daylight time, a Bell 47G-2 helicopter, N96195, was substantially damaged when it impacted a corn field near Arlington, Indiana. A post impact fire ensued. The commercial pilot was fatally injured. The aerial application flight was conducted under the provisions of 14 *Code of Federal Regulations* Part 137. Visual meteorological conditions prevailed and no Federal Aviation Administration (FAA) flight plan had been filed for the flight. The local flight departed a loading platform at a farm one mile northwest of the accident location at about 1655.

D. PERFORMANCE STUDY

As discussed in the Non-Volatile Memory Devices Factual Report [1], the accident aircraft had two onboard data recording devices. The accident flight was captured by the Lowrance Airmap 2000c which only records latitude and longitude points and does not record time or altitude data. Consequently, little performance work could be done with this data. However, five other flights from the day of the accident were recorded on the Trimble Trim Flight 3 device, which records time, altitude, latitude, longitude, groundspeed, and a variety of other agricultural application related parameters. These five earlier flights are the focus of this performance study as the pilot's flying technique was of interest to the investigation.

Performance Study
CEN18FA258, Bell 47G / N96195

The five earlier flights were from July 6, 2018 near Milford, Indiana, about 20 miles south of the accident. The respective flight lengths were 15 minutes, 47 minutes, 12 minutes, one hour 17 minutes, and one hour two minutes. Figure 1 shows these flights.

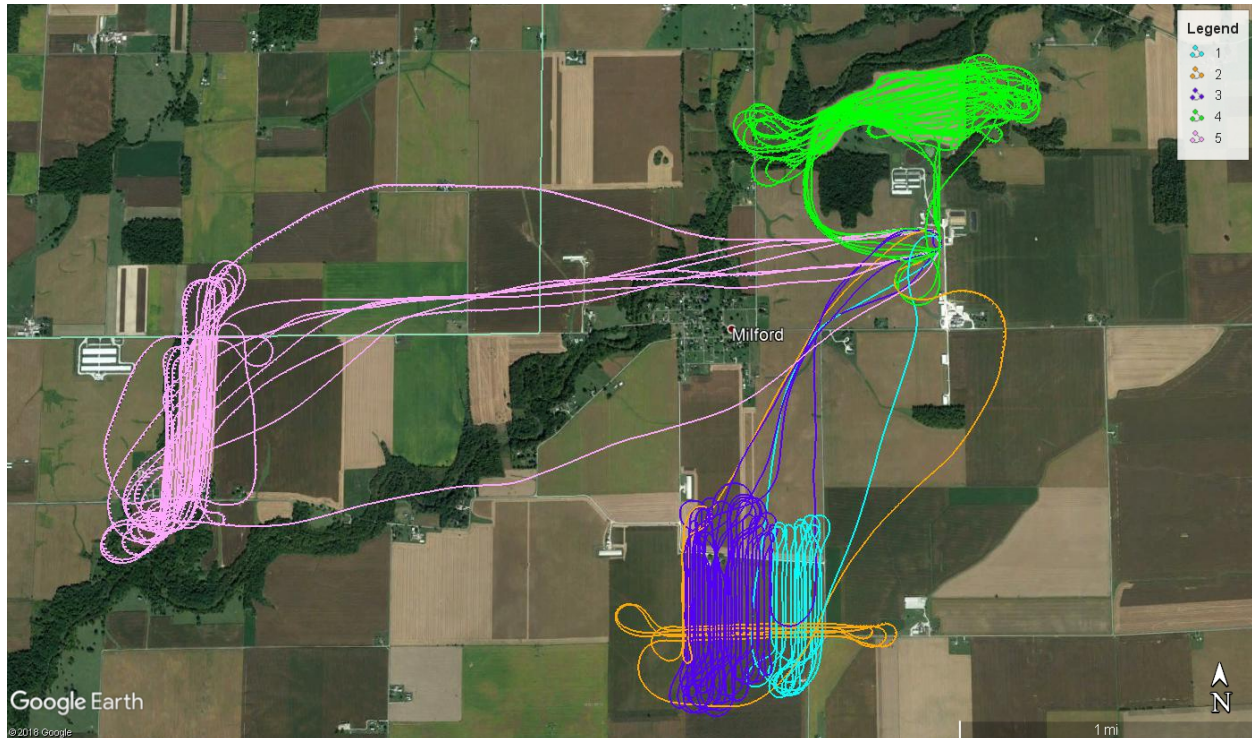


Figure 1: Five flight paths from July 6, 2018 on the Trimble Trim Flight 3.

Altitude (Figure 2) and groundspeed (Figure 3) were consistent for the five flights. The aircraft stayed between 100 and 150 ft above the ground and groundspeeds varied between 40 and 60 kts. The aircraft's reported cruise airspeed is 73 kts and its maximum speed is 91 kts.

Performance Study
CEN18FA258, Bell 47G / N96195

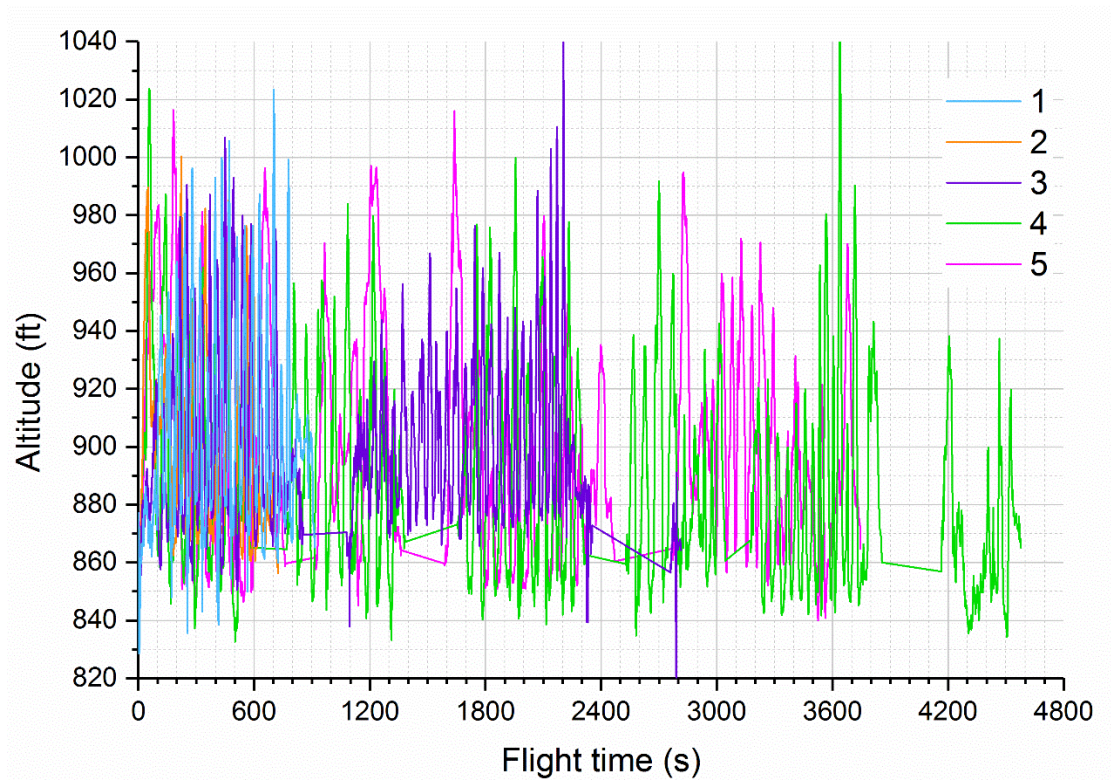


Figure 2: Altitude versus flight time. Ground level in the area was between 820 ft and 850 ft.

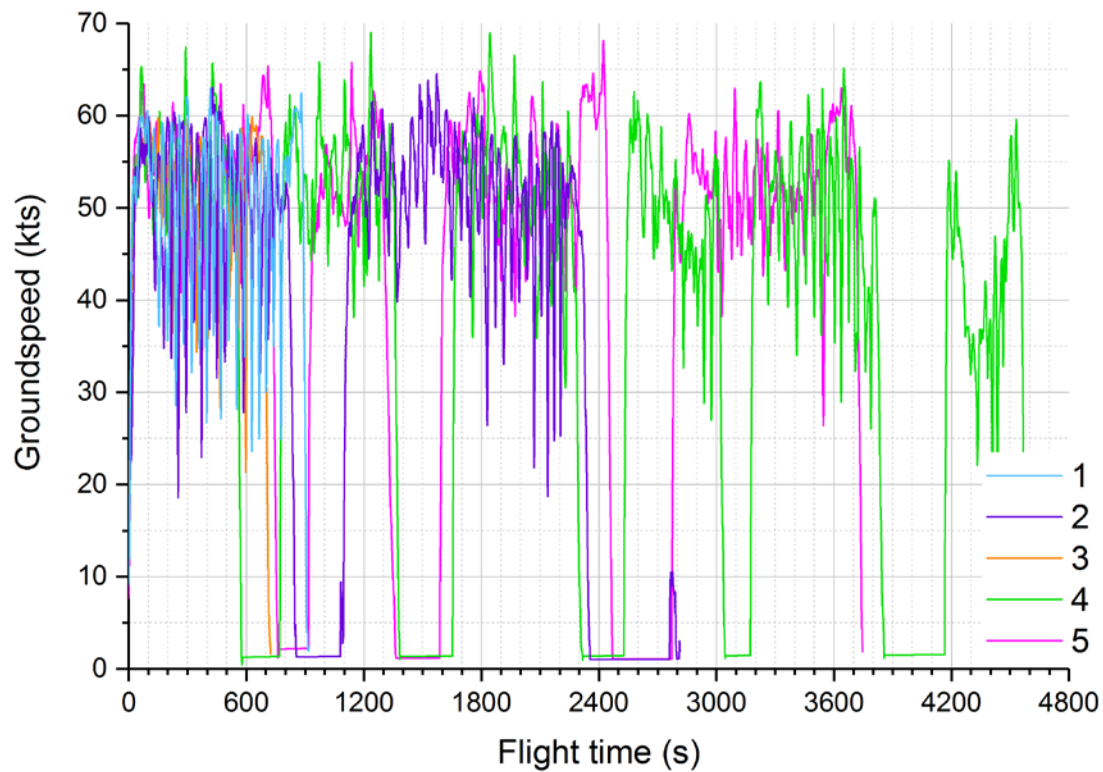


Figure 3: Groundspeed versus flight time.

Calculated Load Factors

Of specific interest were the load factors experienced by the aircraft during these flights, especially during turns. Since neither the load factors nor the bank angles were recorded and a model of the aircraft was not available, the bank angle, θ , for a standard rate turn was calculated as

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

Where g is the gravitational constant. The radius of the turn was calculated for each flight location using the preceding points to describe a circle. Using the calculated bank angle, the load factor in a turn was calculated as

$$load\ factor = \frac{1}{\cos \theta}$$

Figure 4 shows the groundspeed, load factor, and track angle for flight 3, the shortest of the recorded flights. The load factor increased during turns when the track angle was changing. For this flight, the smoothed load factor did not exceed about 1.25 g's. Figure 5 through Figure 8 show the groundspeed and load factor for the other four flights. The track angle was omitted from these long flights for clarity. Some flights show peak turning load factors of 1.45 g's, but this is considered within the range of normal flight as most helicopters can sustain a load factor between 2 and 2.5 g's.

Performance Study
CEN18FA258, Bell 47G / N96195

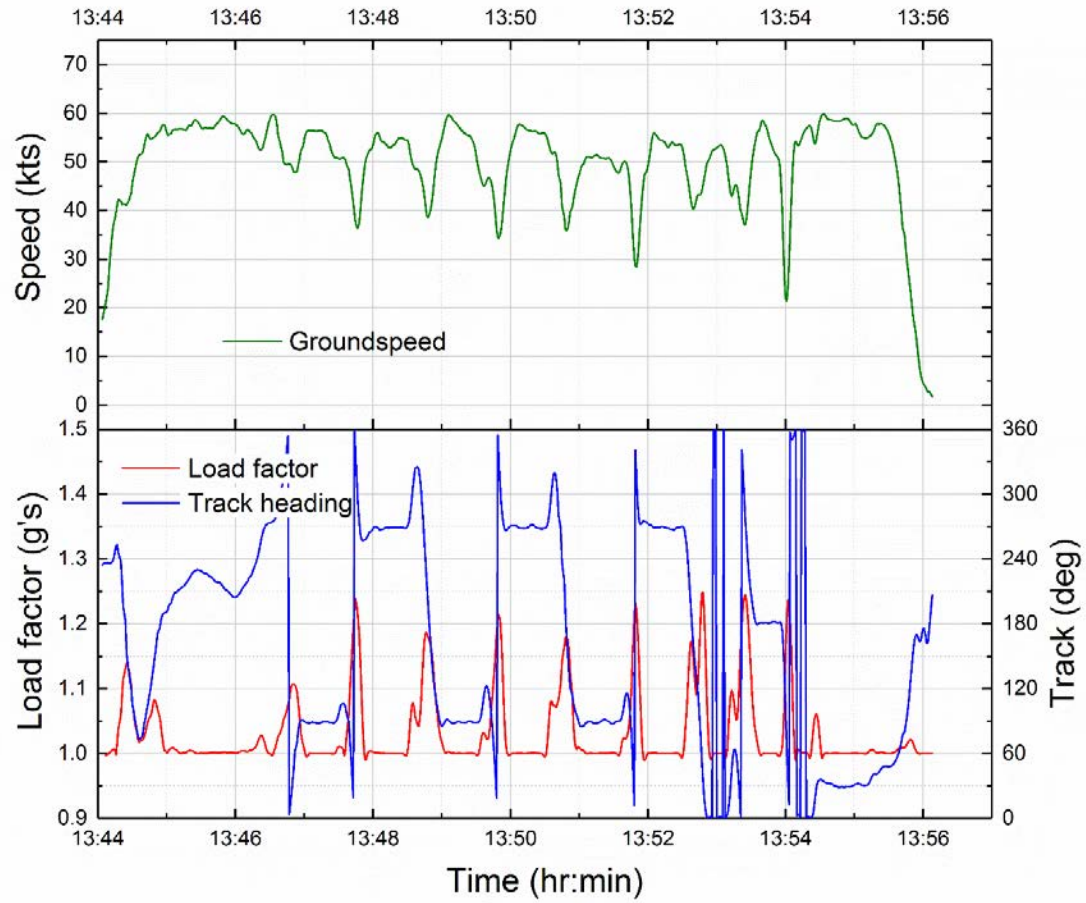


Figure 4: Groundspeed, load factor, and track angle versus flight time for flight 3.

Performance Study
CEN18FA258, Bell 47G / N96195

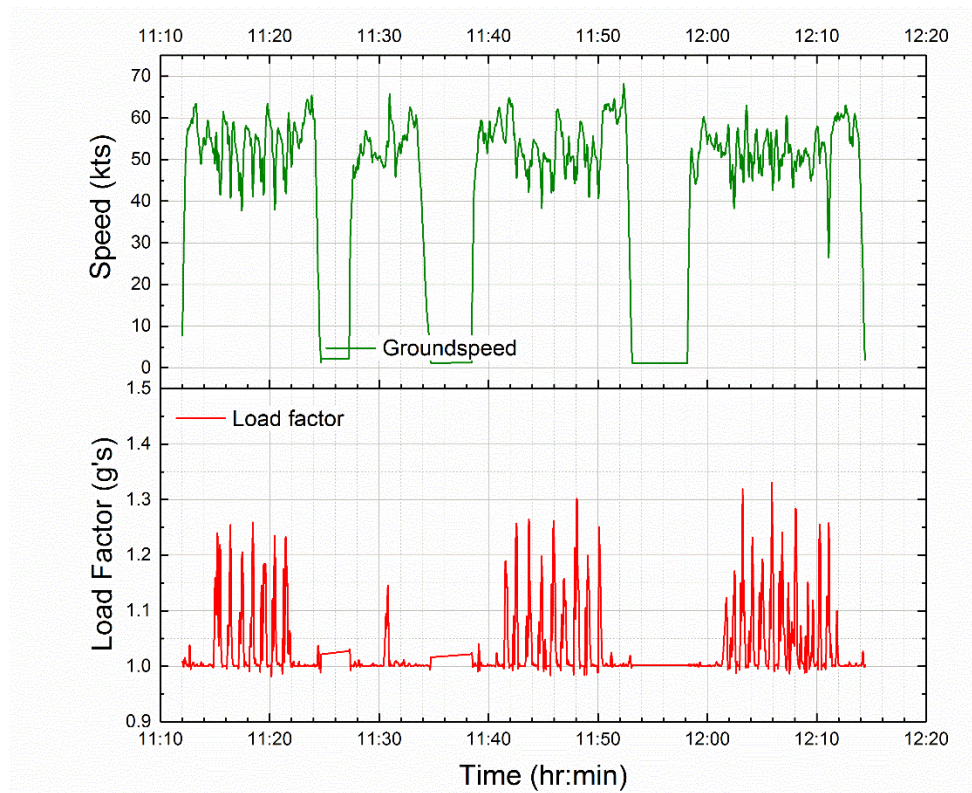


Figure 5: Groundspeed, load factor, and track angle versus flight time for flight 1.

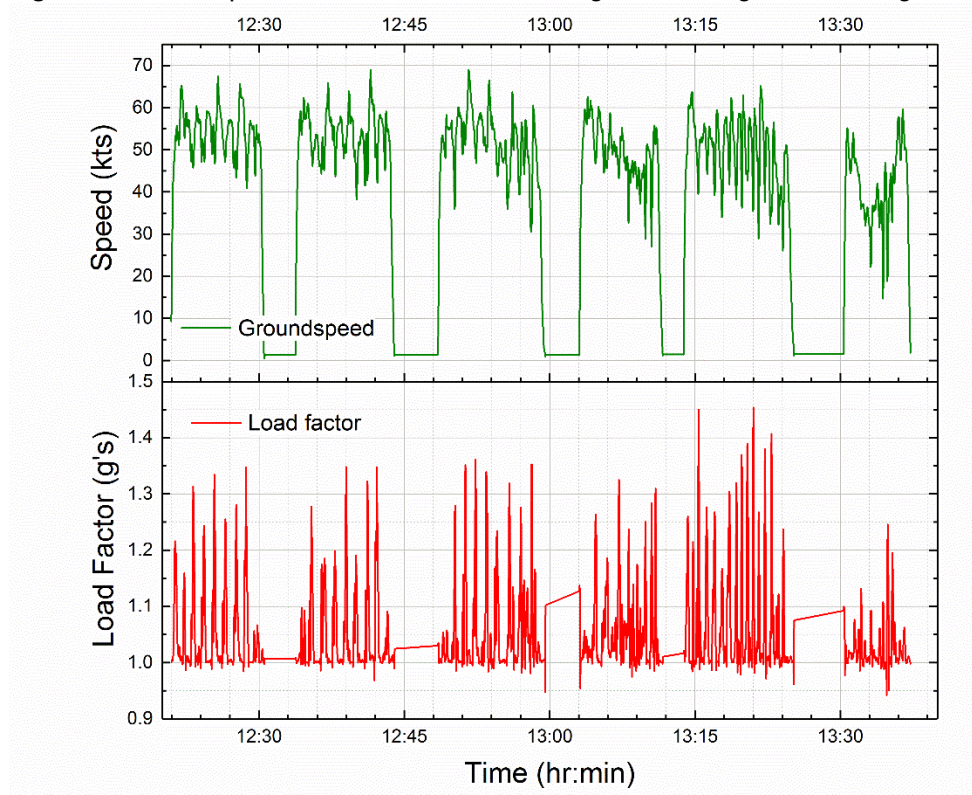


Figure 6: Groundspeed, load factor, and track angle versus flight time for flight 2.

Performance Study
CEN18FA258, Bell 47G / N96195

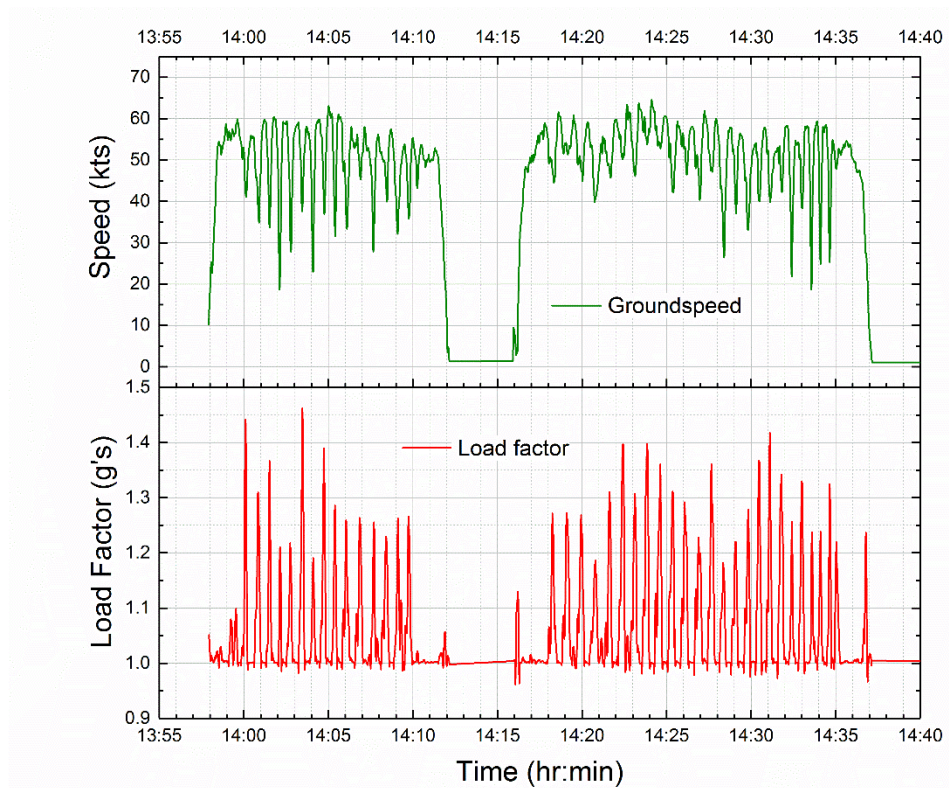


Figure 7: Groundspeed, load factor, and track angle versus flight time for flight 4.

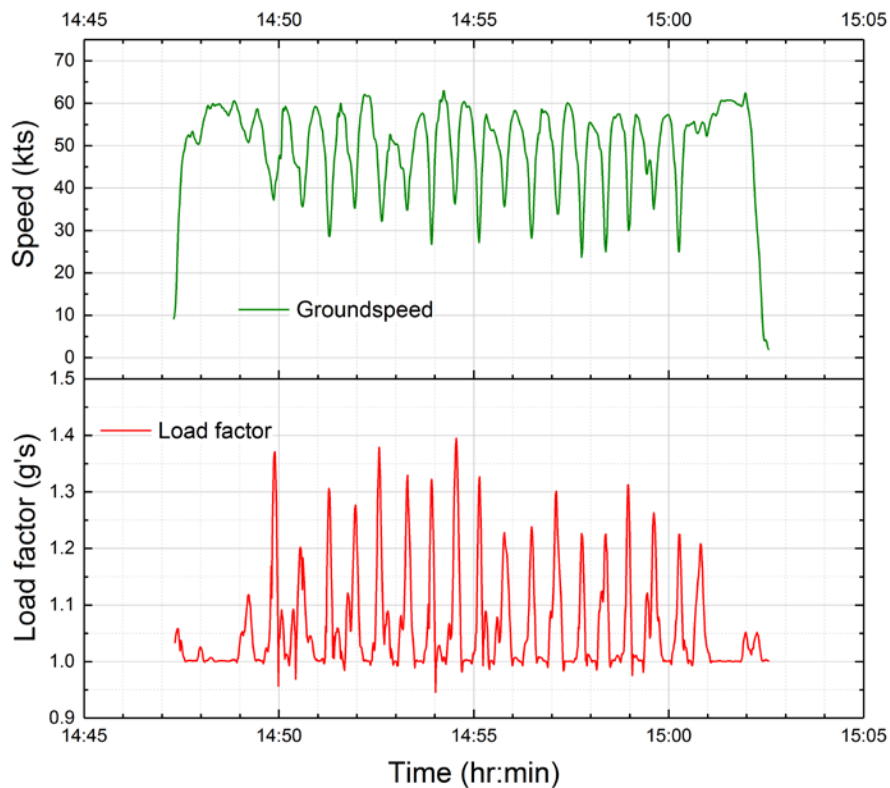


Figure 8: Groundspeed, load factor, and track angle versus flight time for flight 5.

E. CONCLUSIONS

The five flights recorded prior to the accident flight do not appear to have been flown beyond the speed or load factor performance envelope of the aircraft.

Marie Moler
Specialist – Airplane Performance
National Transportation Safety Board

F. REFERENCES

1. Non-Volatile Memory Devices Factual Report, CEN18FA258, National Transportation Safety Board, 2019.