

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



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SOUND SPECTRUM

Specialist's Study

October 6, 2025

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A ACCIDENT

Location: Heber, Utah
Date: April 21, 2024
Time: 15:30 mountain daylight time, MDT
21:30 UTC
Airplane: Alexander Schleicher GMBH & Co ASH 26 E motor glider, N644CC

B SOUND SPECTRUM SPECIALIST

Specialist Carl Schultheisz
National Transportation Safety Board
Washington, DC 20594

C SUMMARY

On April 21, 2024, about 1530 mountain daylight time, an experimental Alexander Schleicher GMBH & Co ASH 26 E, N644CC, was substantially damaged when it was involved in an accident near Heber, Utah. The pilot was not injured. The motor glider was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to the pilot, he planned to practice takeoff and landings. During the second takeoff, the pilot realized that the motor glider was not climbing or maintaining altitude. He reported that he was wearing a headset and could not recall if the engine was running rough and did not recall what the engine rpm was. The pilot elected to perform a 180° left turn to land on the taxiway. Upon completion of the turn, the motor glider was to the right of the taxiway without adequate altitude to correct to the taxiway. The pilot elected to land straight ahead on hilly terrain. During the landing roll, the motor glider struck vegetation and came to rest upright. The pilot stated that he exited the motor glider without assistance and observed that the engine was not running.

D DETAILS OF THE INVESTIGATION

The objective of this Sound Spectrum Study was to estimate the airplane engine's speed based on a video recorded by a camera installed on an airport building, and on location and altitude data in Automatic Dependent Surveillance - Broadcast (ADS-B) data downloaded from ADS-B Exchange¹.

¹ [Serving the Flight Tracking Enthusiast - ADS-B Exchange](#)

Figure 1 is a frame from the video showing the accident flight. The video includes a date and time stamp in the upper left corner, along with a label "Hangar 1 SW". The video lasts 97 seconds, beginning at time stamp 15:34:56 and running through time stamp 15:36:33. The video had 1920 x 1080 resolution and an average frame rate of 15 frames per second (fps). Sound was recorded at a rate of 11025 samples per second. Wind noise overwhelmed the recorded sound at some times during the video. The sound of the engine decreased substantially about video time 34 s (time stamp 15:35:31), and it was undetectable thereafter. The sounds of ground impact were heard during video time 41 – 43 s (time stamp 15:35:37 – 15:35:39).

ADS-B broadcasts an aircraft's Global Navigation Satellite System (GNSS) position and other data to ground stations, where it is recorded approximately once per second. The GNSS position data is expected to have an uncertainty of approximately 20 m (65 ft) in horizontal and vertical dimensions. No ADS-B data was available from the Federal Aviation Administration, but it was possible to download ADS-B data for the aircraft from ADS-B Exchange. The ADS-B data extended from 15:24:30 to 15:35:34, and the data captured the initial flight and return to the airport, as well as the second takeoff leading to the crash. The GNSS-based altitude above the reference ellipsoid was corrected to the mean sea level (MSL) altitude above the geoid by adding 51 ft.

Figure 2 is an overhead view of Heber Valley Airport (KHCR), showing the position of the video camera and the ADS-B flight track for the second takeoff leading to the accident. Points are annotated with the time, MSL altitude in ft and groundspeed in kt. By comparing the position of the airplane relative to landmarks visible in the video with the ADS-B positions, it was estimated that the time stamp in the video is within 2 seconds of the ADS-B time.

The sound in the video was analyzed with the Fast Fourier Transform (FFT) algorithm, which made it possible to identify the propeller blade passage frequency (BPF) and engine rotation rate (RPM), along with higher harmonics. The FFT algorithm used 16384-point processing windows that were 1.4861 seconds wide. The frequency resolution was 40.4 CPM (cycles per minute).

The ASH 26 E employs a single-stage Wankel rotary engine identified as an Austro Engines AE50R, delivering a maximum of 37 kW (50 HP) at 7500 RPM [1]. The engine drives a two-bladed propeller through a toothed-belt transmission with a 1:2.78 reduction ratio [2]. As a result, the engine RPM would be 2.78/2 or 1.39 times the BPF. Maximum takeoff engine rotation is 7500 RPM (for 5 minutes), and maximum continuous engine rotation is 6900 RPM.

As an example, Figure 3 shows the spectrum from the window beginning at video time 3 s. The BPF of 5249 CPM is indicated with the letter B, and the engine

rotation rate of 7267 CPM is indicated with the letter E. The second, third and fourth harmonics of the BPF at 10457 CPM, 15706 CPM and 20954 CPM are indicated by 2B, 3B and 4B, and the second and third harmonics of the engine rotation at 14575 CPM and 21843 CPM are indicated by 2E and 3E.

Figures 4 through 7 show spectra from windows beginning every second starting from video time 0 s through video time 47 s (time stamps 15:34:56 through 15:35:43). The FFT magnitude in Figures 4 through 7 are auto-scaled to the largest values, so the magnitudes of separate graphs might not be directly comparable. The lower frequency components were sometimes overwhelmed by wind noise, but the second and/or third harmonics of the engine were generally identifiable. The decreased engine sound observed about video time 34 s correlates with the disappearance of the higher harmonic peaks in the spectra from windows beginning after video time 33 s. Figure 8 shows the engine rotation rate recorded in the video, as calculated from the second and third harmonics.

The airplane was moving relative to the camera, causing a Doppler shift to the frequencies. The ADS-B flight track data was used to estimate a Doppler correction, which varied between 0.936 and 1.068 during the video. The Doppler correction applied to the engine rotation is shown in Figure 8, and the Doppler correction itself is shown in Figure 9.

The data show that the engine was near the maximum takeoff rotation rate of 7500 RPM in the first 4 s of the video, subsequently decreasing to near the maximum continuous rotation rate of 6900 RPM between video times 12 s and 27 s (with a brief increase in rotation rate at video time 19 s). After that, the engine rotation rate decreased steadily until it was no longer heard after video time 34 s.

A very strong peak is visible in the spectra beginning in the window starting at video time 22 s and extending to video time 45 s. The frequency of that peak decreased approximately linearly from 7267 CPM at 22 s to 6622 CPM at 45 s. The peak is indicated in Figure 10, which shows the spectrum beginning at video time 33 s, just before the sound of the engine was no longer audible. The peak is labeled U for unknown in Figure 10, and it occurs at 6944 CPM. All the engine peaks and blade passage peaks are also still visible and labeled as in Figure 3; the unknown peak is not associated with the engine or propeller. This peak stopped appearing in the spectra after the sounds of ground impact, so it could have been a sound coming from the airplane, but it also might have had another source. A sound associated with that frequency peak was not readily apparent when listening to the audio. Figure 11 shows the recorded unknown peak frequency along with the engine data from Figure 8.

E DISCUSSION

Sound spectra showed the engine was near the maximum takeoff rotation rate of 7500 RPM in the first 4 s of the video, subsequently decreasing to near the maximum continuous rotation rate of 6900 RPM between video times 12 s and 27 s (with a brief increase in rotation rate to 7000 RPM at video time 19 s). After that, the engine rotation rate decreased steadily to 6568 RPM at video time 33 s. The engine was no longer heard nor were any peaks visible for the engine or propeller after video time 34 s (time stamp 15:35:31). The sounds of ground impact were heard during video time 41 – 43 s (time stamp 15:35:37 – 15:35:39). It was estimated that the time stamp in the video is within 2 seconds of the ADS-B time.

A strong peak from an unknown source was visible in the spectra from video time 22 s to video time 45 s. This peak was not associated with the engine or propeller. A sound associated with that frequency peak was not readily apparent when listening to the audio.

Submitted by:

Carl Schultheisz
Chief, Vehicle Performance Division

F REFERENCES

1. Engine Manual, Operation/Maintenance/Installation, AE50R, AE50RA, AE50RAB, Austro Engine GMBH, March, 2011.
2. Flight Manual for Powered Sailplane ASH 26 E, Alexander Schleicher GMBH & Co., July, 1995.



Figure 1. Frame from the video at video time 8s (time stamp 15:35:04). The airplane is indicated with an arrow.



Figure 2. Accident flight track from ADS-B data on a Google Earth background. The position of the camera on an airport building is indicated. Annotations on the flight track show the time MDT, altitude above mean sea level in feet and groundspeed in knots.

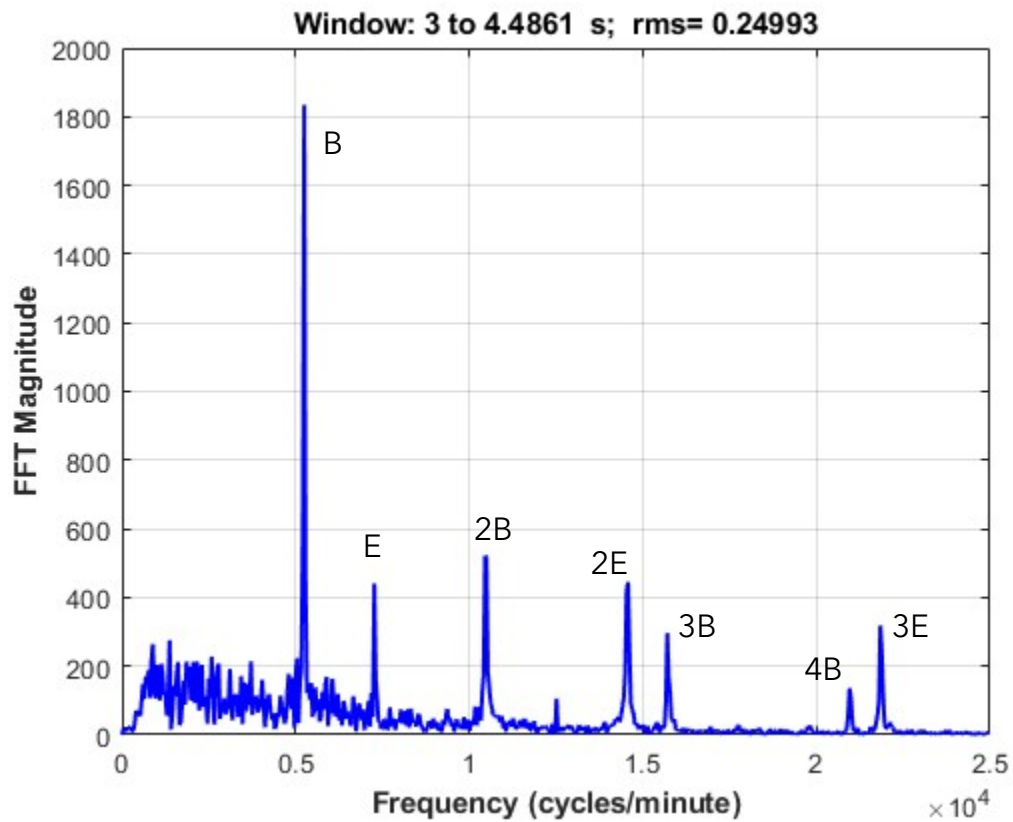


Figure 3. Example spectrum from the window beginning at video time 3 s. The blade passage frequency is indicated by the letter B, and the engine rotation rate is indicated by the letter E. Peaks for higher harmonics are indicated with numbers multiplying B or E.

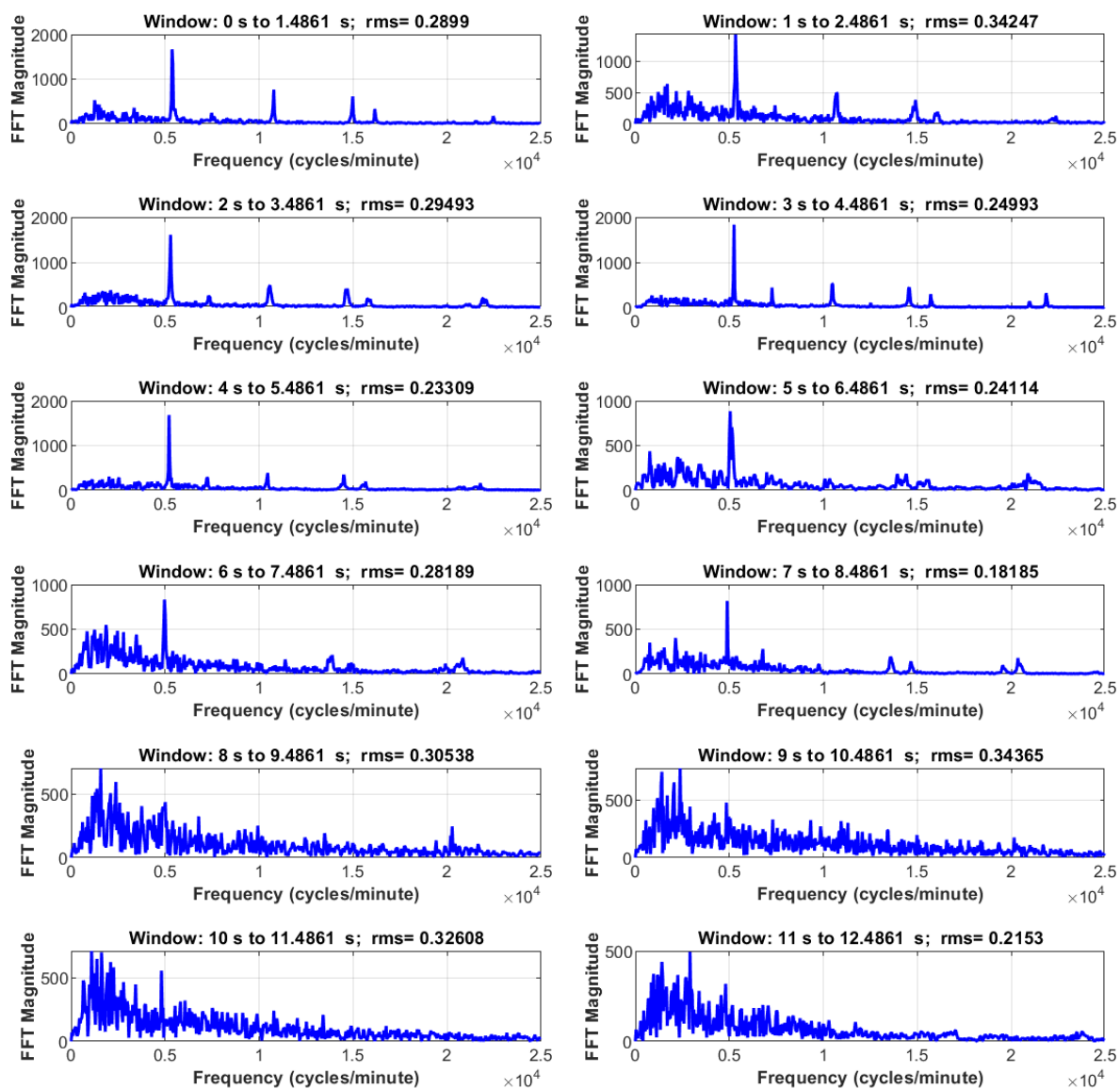


Figure 4. Spectra for windows beginning every second for video times 0 s through 11 s. FFT magnitudes are auto-scaled.

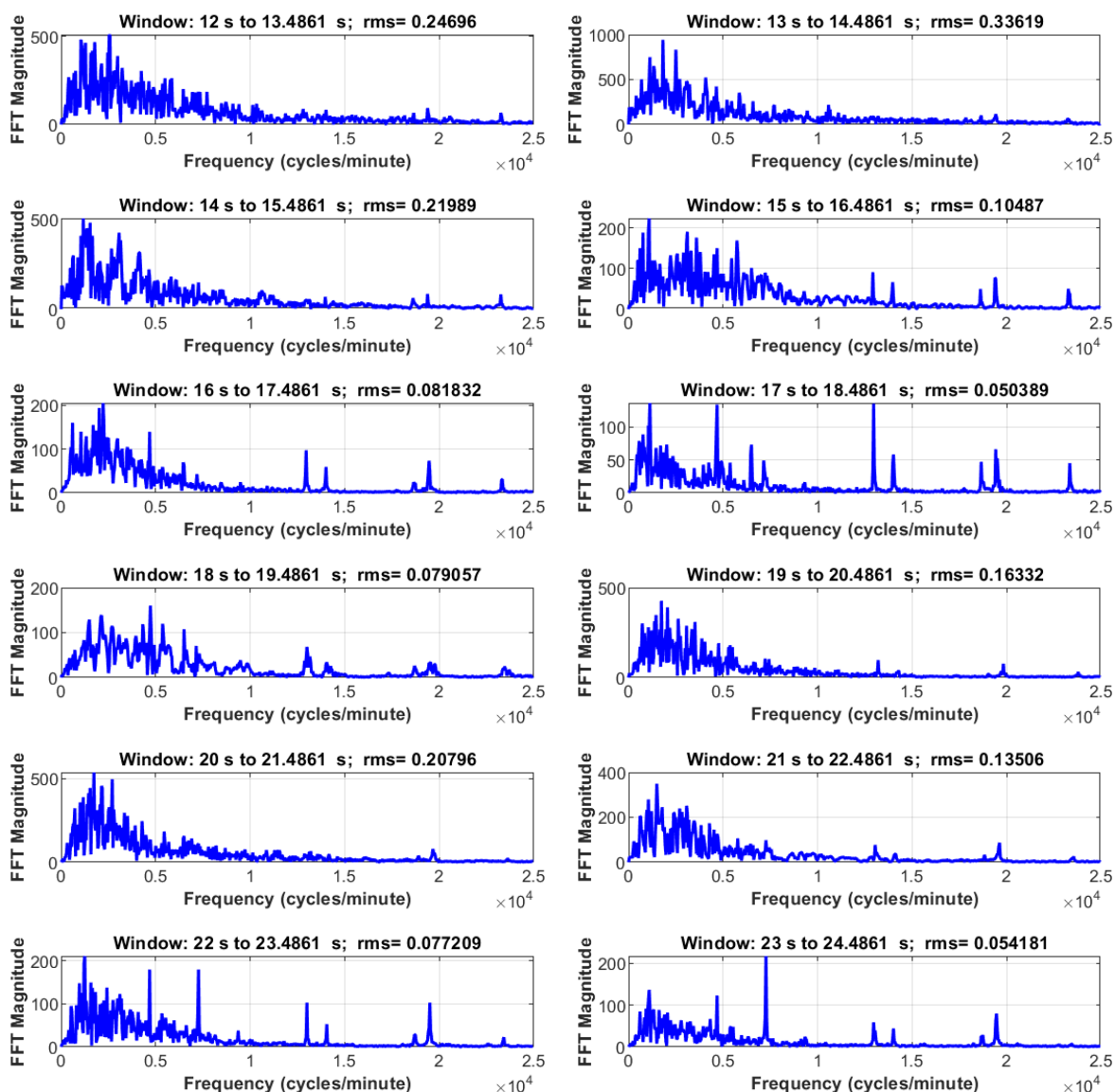


Figure 5. Spectra for windows beginning every second for video times 12 s through 23 s. A strong peak from an unknown source was observed beginning in the window at video time 22 s. FFT magnitudes are auto-scaled.

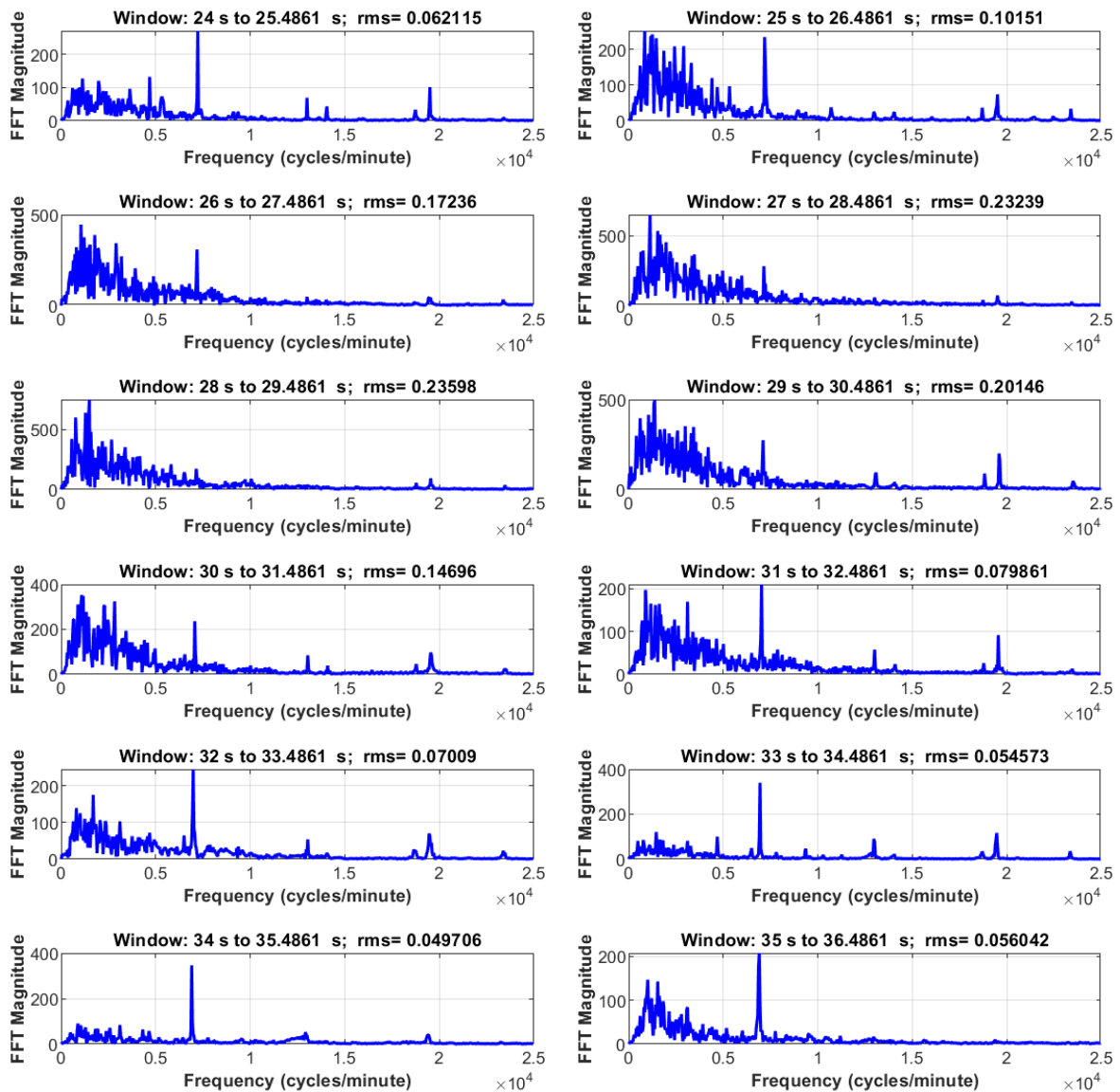


Figure 6. Spectra for windows beginning every second for video times 24 s through 35 s. Peaks for the engine and propeller were no longer observed after video time 34 s. FFT magnitudes are auto-scaled.

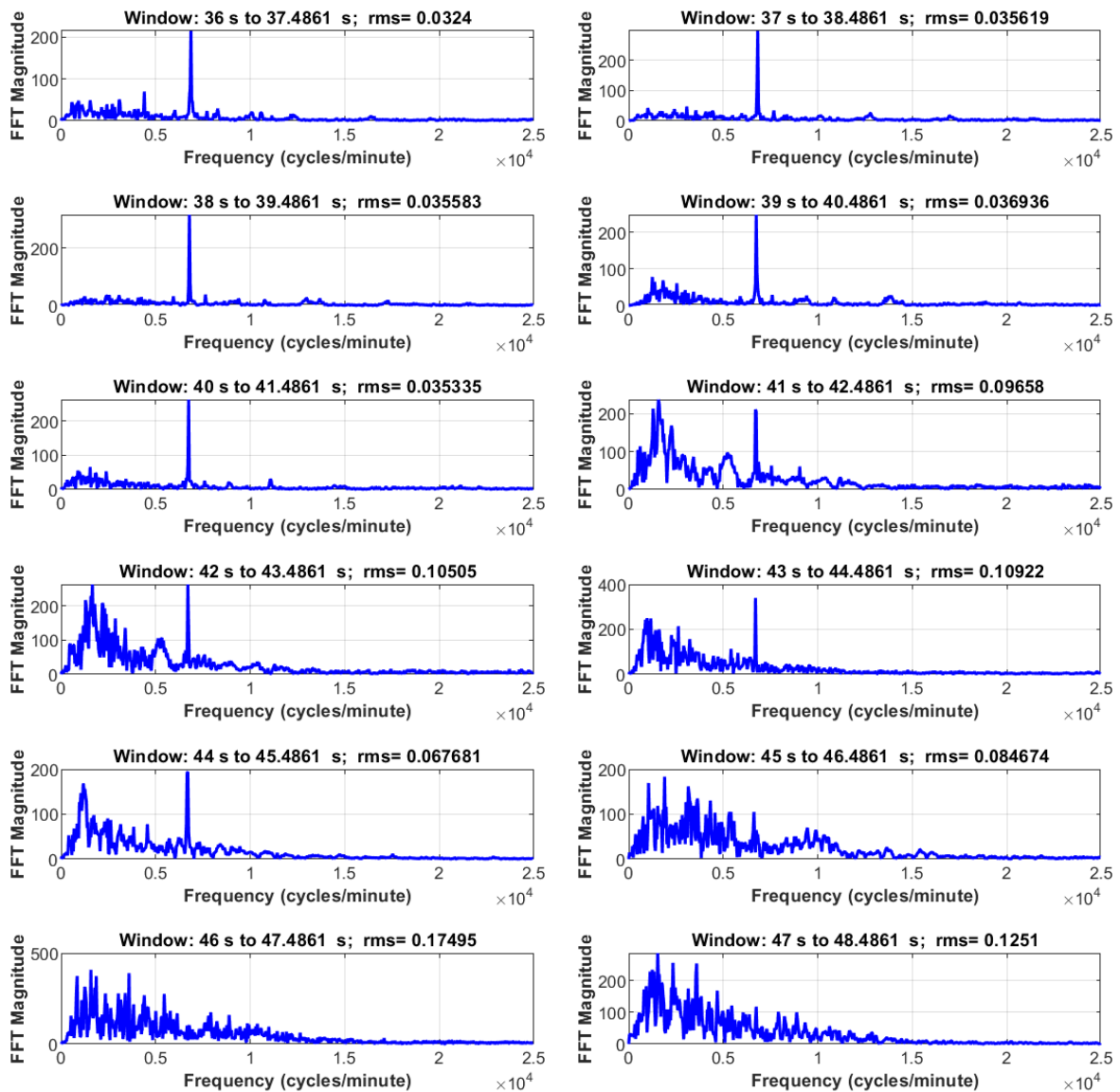


Figure 7. Spectra for windows beginning every second for video times 36 s through 47 s. Sounds of ground impact were heard during video time 41 – 43 s. FFT magnitudes are auto-scaled.

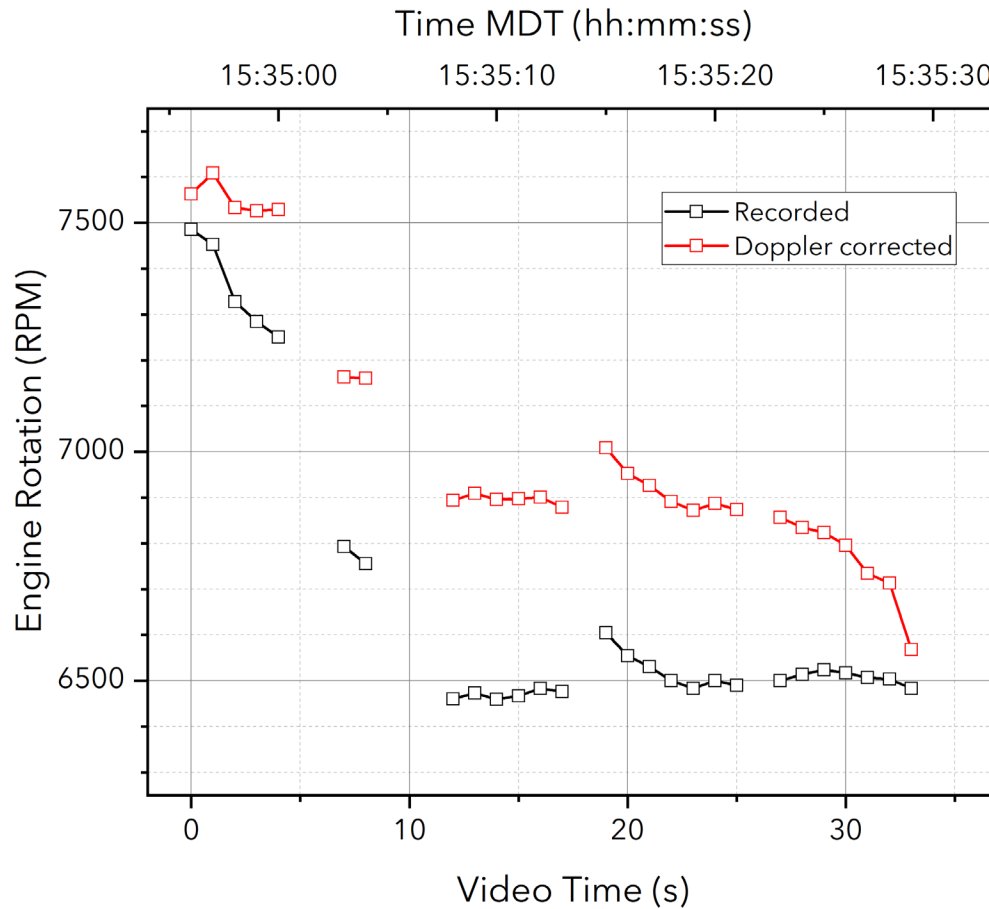


Figure 8. Recorded engine rotation rate calculated from the peaks for the second and third engine harmonics in the spectra shown in Figures 4 - 7, along with the engine rotation rate corrected for the Doppler shift as calculated from the ADS-B data.

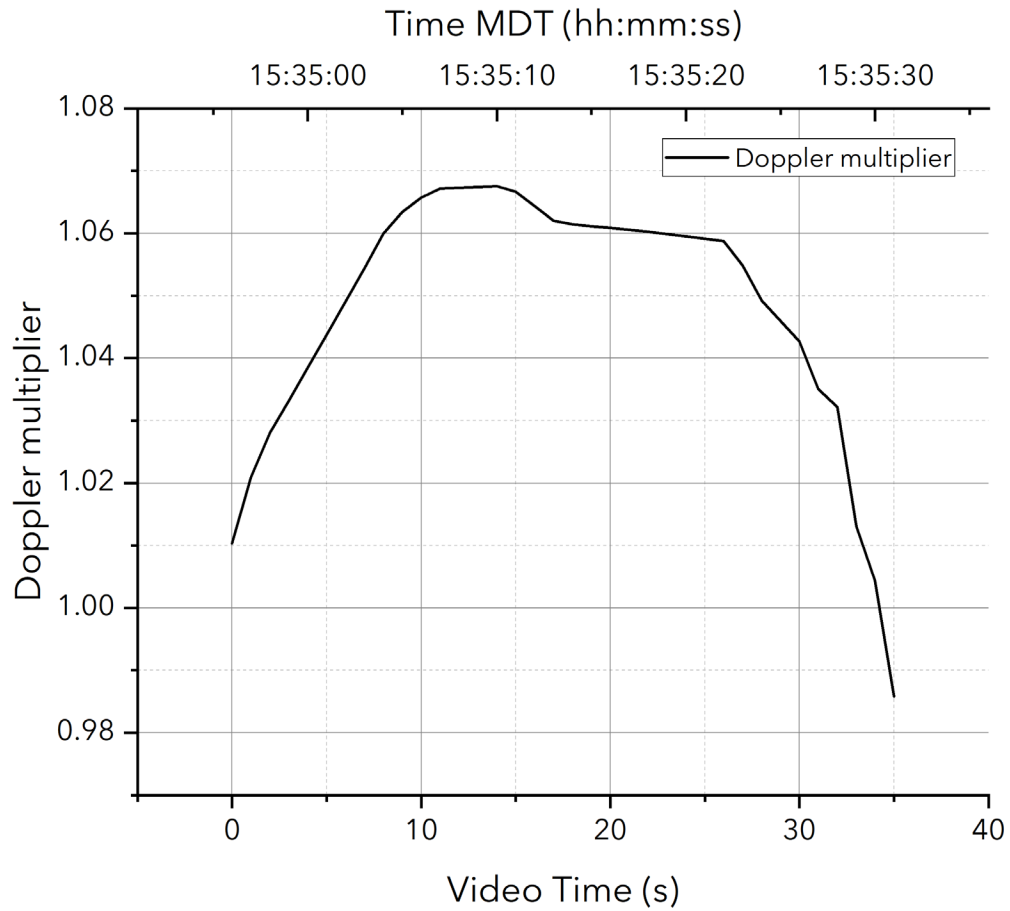


Figure 9. The Doppler multiplier used to correct the recorded engine rotation rate, as calculated from the ADS-B data.

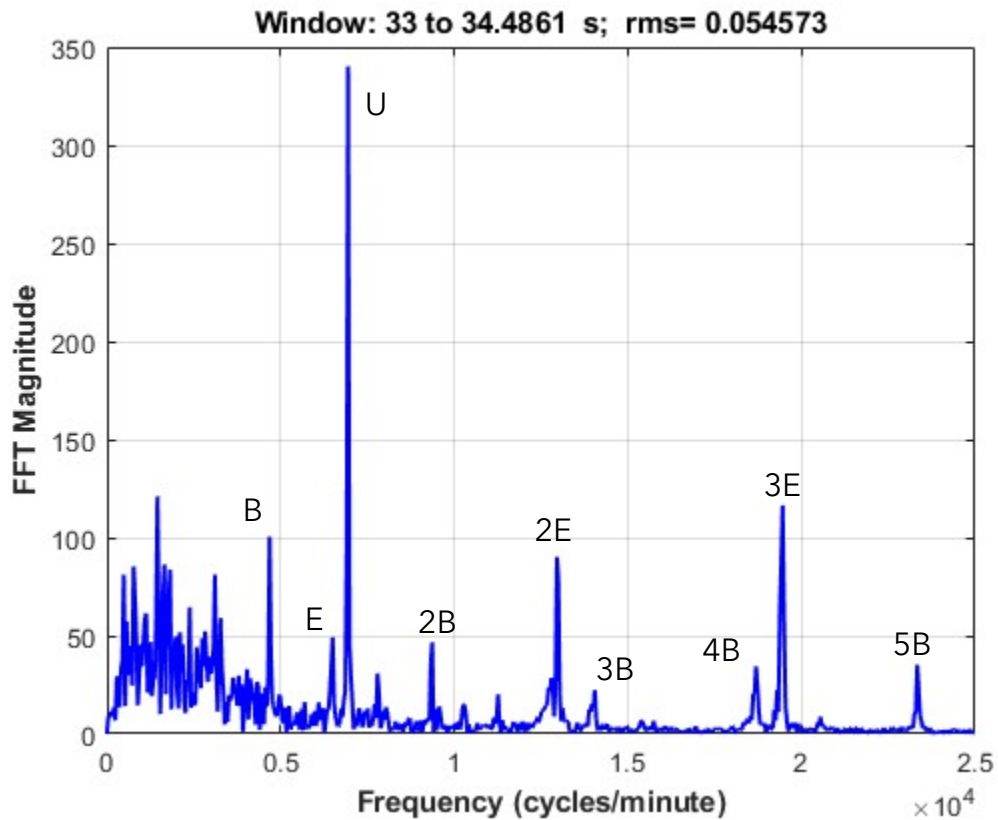


Figure 10. Example spectrum from the window beginning at video time 33 s, with a strong peak from an unknown source indicated by the letter U. The blade passage frequency is indicated by the letter B, and the engine rotation rate is indicated by the letter E. Peaks for higher harmonics are indicated with numbers multiplying B or E.

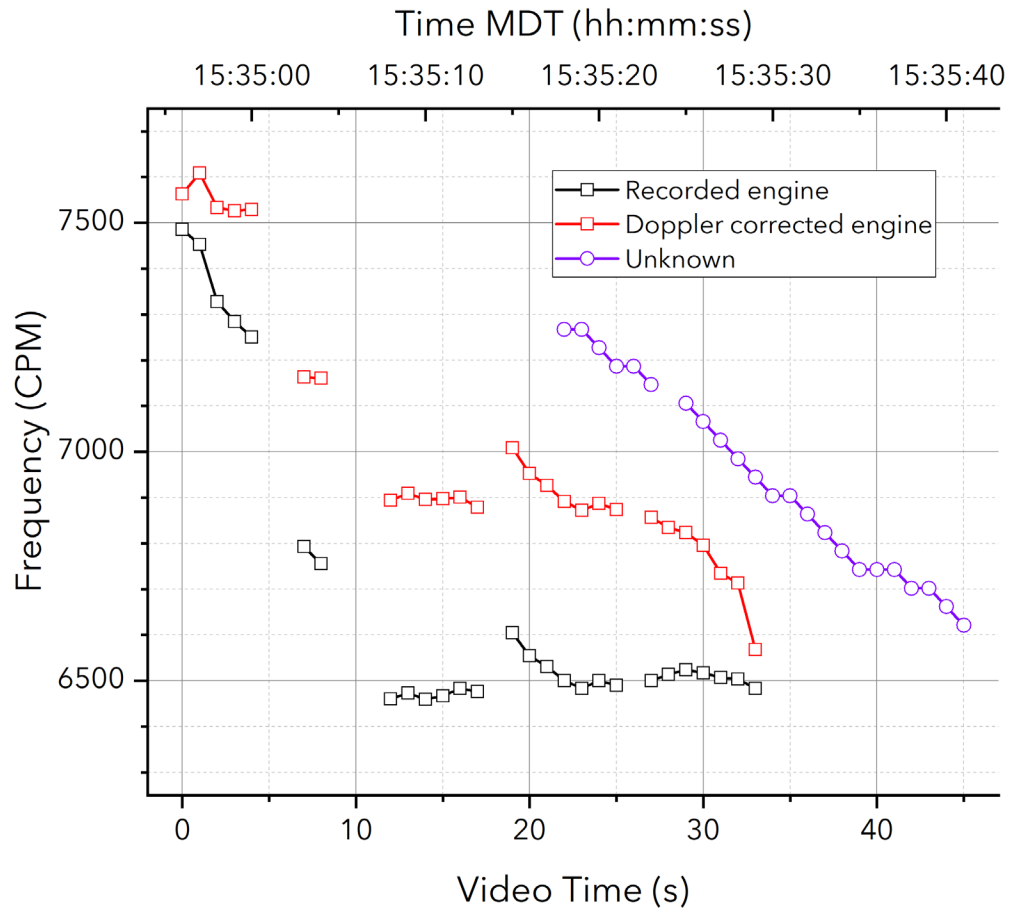


Figure 11. Frequency of the strong peak from an unknown source compared with the recorded engine rotation rate and the Doppler corrected engine rotation rate from Figure 8.