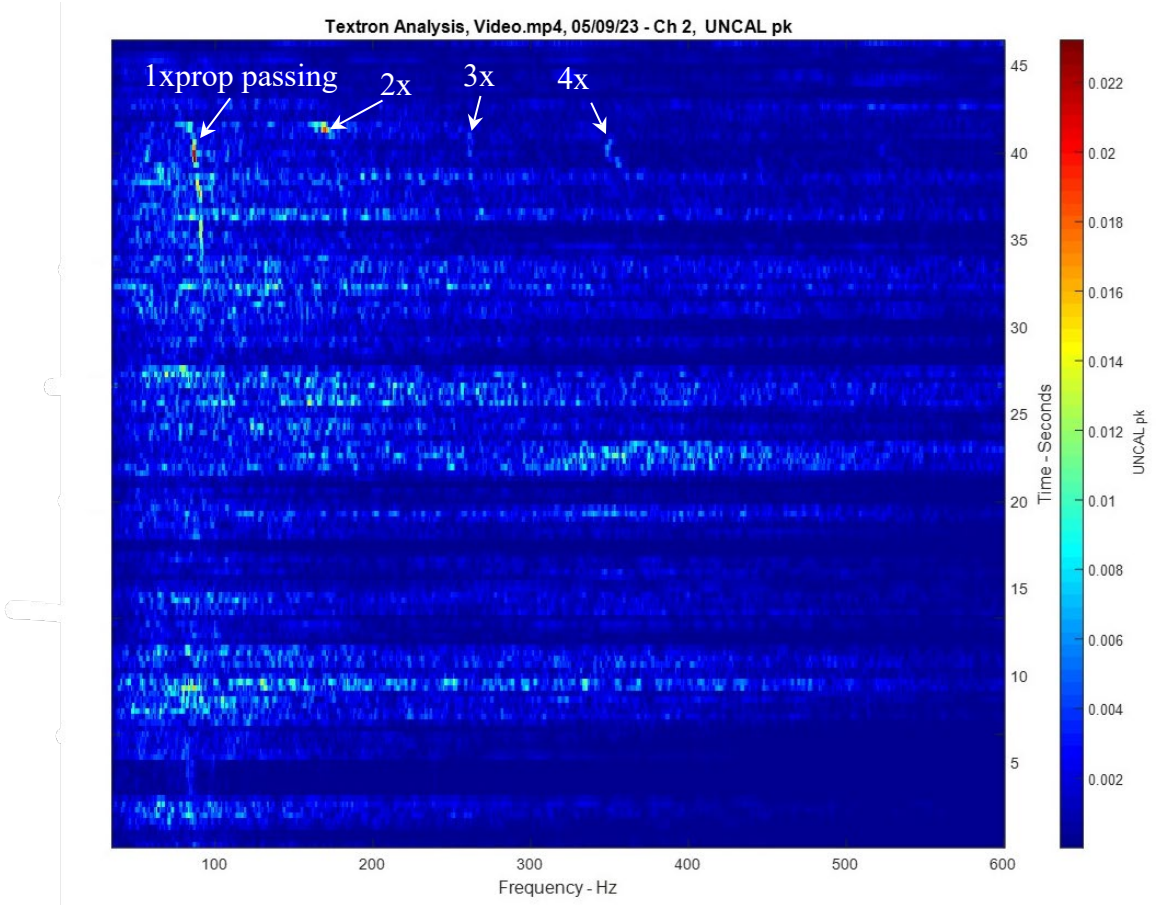
Textron Aviation Acoustics Group Analysis of Video.mp4

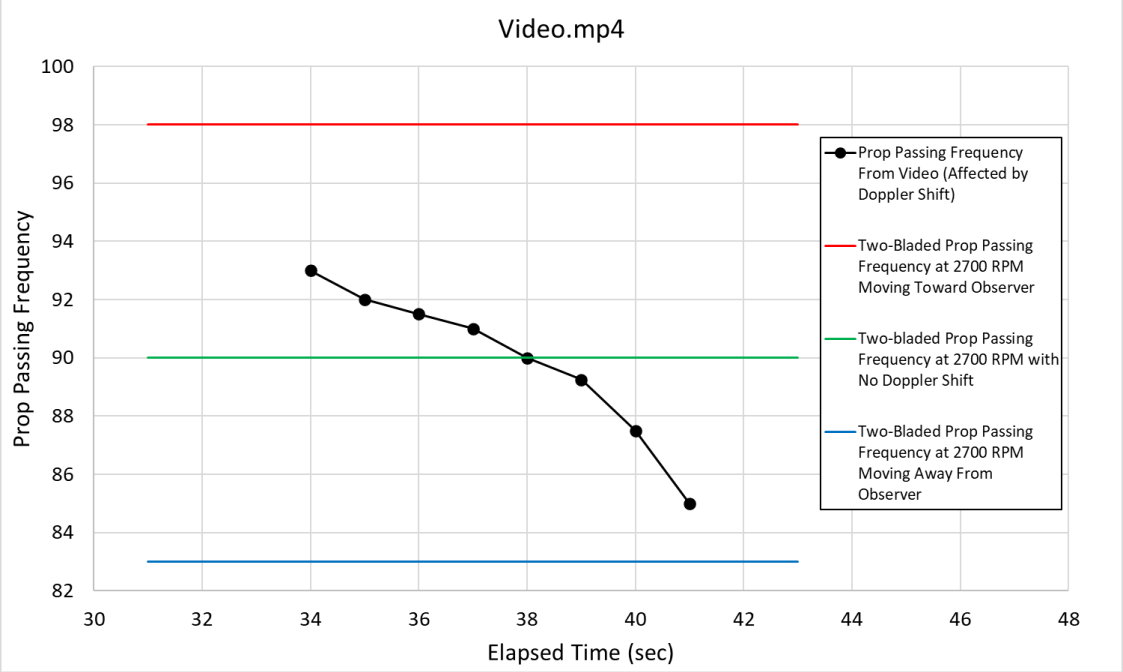
The plot below is a spectrogram from Channel 2 of the audio from file Video.mp4. This channel was used for analysis since the prop passing frequencies were more visible on this channel. Horizontal lines in the spectrogram are due to wind noise. Analysis was conducted on 5/9/2023.



Audio analysis shows the following prop passing frequencies:

Elapsed Time (sec)	Prop Passing Frequency (Hz)
34	93
35	92
36	91.5 (based on 2xprop passing = 183 Hz)
37	91
38	90
39	89.25 (based on 4xprop passing = 357 Hz)
40	87.5 (based on 4xprop passing = 350 Hz)
41	85

These prop frequencies are plotted versus elapsed video time below. Also included in the plot are rough estimates of frequencies for a 90 Hz sound source shifted due to doppler effects.



Conclusion:
The expected static prop passing frequency for the two-bladed prop operating at 2700 RPM is 90 Hz. The prop passing frequency extracted from the Video.mp4 file is affected by doppler shift due to motion of the airplane with respect to the camera and thus is not constant. The prop passing frequency is first detected in the spectrogram above at about 34 seconds elapsed time at 93 Hz and decreases with elapsed time, crosses through the static prop passing frequency of 90 Hz at about 38 seconds, and continues to decrease to 85 Hz at about 41 seconds elapsed time when the prop passing frequency is no longer visible in the spectrogram. The amount of doppler shift could not be determined due to unknown speed, direction, and distance of the aircraft relative to the camera. For a 90 Hz noise source moving near stall speed of a small aircraft directly toward an observer, a frequency shift to approximately 98 Hz could be expected. With no relative velocity toward or away from the observer, for instance when the noise source is abeam the observer, the 90 Hz noise source would appear at 90 Hz. For a noise source moving near stall speed of a small aircraft directly away from an observer, a frequency shift to approximately 83 Hz would be expected. The portion of the video in which prop passing frequencies could be extracted from the spectrogram appears to show the aircraft not moving directly toward nor directly away from the camera, so the prop passing frequencies are within the range of doppler shift effects for a 90 Hz source. However, an offset to higher or lower frequencies in the above plot due to the prop not rotating at 2700 RPM or not remaining constant could not be ruled out. The observed frequencies could have also been obtained for instance from an 85 Hz source (2550 RPM for a two-

bladed prop), which could result in a 93 Hz frequency if moving directly toward the camera, and an 85 Hz frequency when directly abeam the camera.