

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA23FA256

AIR TRAFFIC CONTROL (ATC) AUDIO SOUND SPECTRUM DATA

Specialist's Factual Report

October 24, 2024

TABLE OF CONTENTS

A. ACCIDENT.....	3
B. AIR TRAFFIC CONTROL (ATC) AUDIO SOUND SPECTRUM DATA SPECIALIST	3
C. DETAILS OF THE INVESTIGATION	3
1.0 ATC AUDIO FILE DESCRIPTIONS.....	3

A. ACCIDENT

Location: Montebello, Virginia
Date: June 4, 2023
Time: 15:23 EDT
19:23 UTC
Airplane: Cessna Citation 560, N611VG

B. AIR TRAFFIC CONTROL (ATC) AUDIO SOUND SPECTRUM DATA SPECIALIST

Specialist Charles Cates
Mechanical Engineer/Recorder Specialist
National Transportation Safety Board (NTSB)

C. DETAILS OF THE INVESTIGATION

A Sound Spectrum group was not convened.

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received electronic files containing the Atlanta Air Route Traffic Control Center (ARTCC ZTL) ATC audio data recorded from controller stations communicating with N611VG.

1.0 ATC Audio File Descriptions

Two files of ATC audio from stations at ARTCC ZTL contained communications from ATC to N611VG. Many airplanes were traversing those sectors and communicating with the controllers, therefore the communications between the controllers and N611VG were spliced sequentially to create one file detailing only the communications with N611VG.¹ The waveform and spectrogram of the single file containing only communications to and from N611VG are shown in Figures 1 and 2, respectively. These exchanges are separated by the splice and annotated on the waveform and spectrogram. The spectrogram shows frequencies from 0-4 kHz, with 4 kHz being the Nyquist frequency of the recording.²

¹ For the transcript of communications between ATC and N611VG, see the Air Traffic Control Partial ATC Voice Transcript, available in this docket. Communications referenced in this report are reported as N611VG, ZTL45, and ZTL43, from 17:15:41 UTC to 17:25:47 UTC.

² The recordings were sampled at 8 kHz, therefore 4 kHz is the highest frequency that can accurately be represented without aliasing the signal.

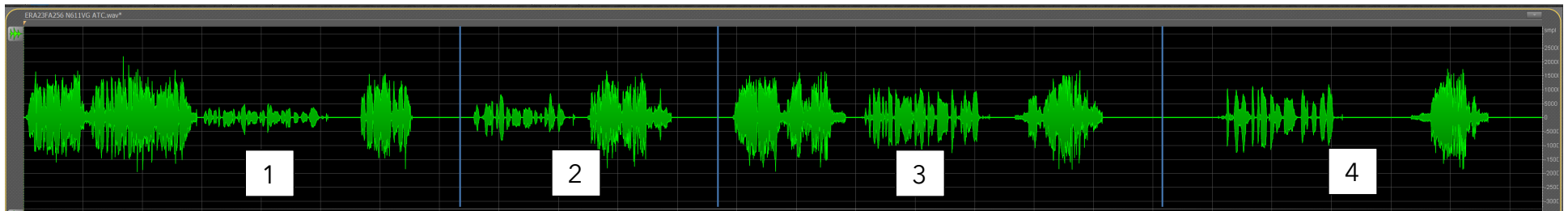


Figure 1. Waveform of sequential communications between ARTCC ZTL and N611VG.

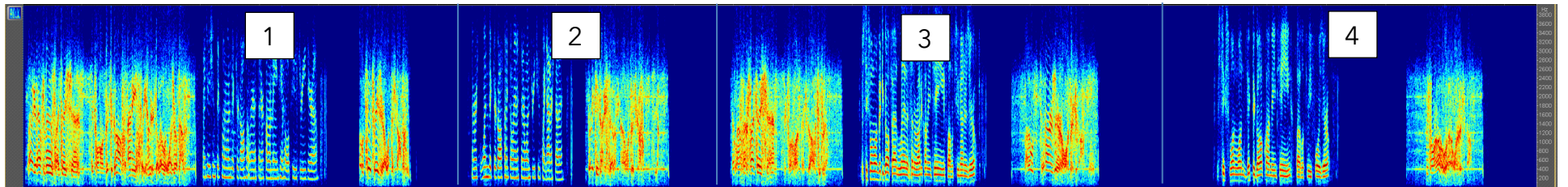


Figure 2. Spectrogram of sequential communications between ARTCC ZTL and N611VG.

Exchanges annotated on figures 1 and 2 are as follows:

Exchange	Time (UTC)	Ident	Transmission
1	17:15:41	N611VG	Atlanta good afternoon citation six one one victor golf ninety three hundred to level at one zero thousand.
	17:15:46	ZTL45	citation six one one victor golf Atlanta center climb and maintain flight level two three zero.
	17:15:52	N611VG	two three zero one victor golf.
2	17:20:59	ZTL45	november one victor golf contact Atlanta center one three two point niner seven.
	17:21:02	N611VG	thirty two ninety seven uh one victor golf see ya.
3	17:22:19	N611VG	Atlanta center citation six one one victor golf two three oh.
	17:22:23	ZTL43	six one one victor golf Atlanta center roger climb and maintain flight level two niner zero.
	17:22:29	N611VG	flight level two niner zero one victor golf.
4	17:25:40	ZTL43	november six one one victor golf climb and maintain flight level three four zero.
	17:25:47	N611VG	three four oh uh one victor golf.

Exchanges 1 and 3 were initiated by the pilot, while exchanges 2 and 4 were initiated by ATC. This means that in exchanges 2 and 4 the pilot was monitoring the radio and had to respond to a request from ATC. In exchange 2, the pilot keyed his radio to respond about 0.5 seconds after the end of the ATC transmission and began to verbally respond about 0.6 seconds after the end of the ATC transmission. In exchange 4 with the aircraft at a higher altitude, the pilot keyed his radio to respond about 2.3 seconds after the end of the ATC transmission and began to verbally respond about 3.0 seconds after the end of the ATC transmission.

At 17:28:30, controller ZTL43 attempted to contact N611VG on the same radio frequency as their previous communications to amend their altitude clearance, but there was no response from the pilot. Multiple further attempts were made to reach the aircraft by radio on this and other frequencies, however none were successful.

A vocal formant analysis of the pilot's speech patterns during the flight to investigate signs of impairment was considered; however, not enough speech data was available to provide statistically significant results to such an analysis.³ A vocal

³ Formant analysis is a method that has been shown to detect hypoxic impairment in otherwise healthy subjects. It typically requires full-range uncompressed recordings with multiple repeated vowels; neither requirement was met in this case. See for example J. Obrenović, "Formant structure of the voice during the intensive acute hypoxia", *Vojnosanit Pregl*, 2003 Mar-Apr.

intensity study was also considered; however, it was contraindicated due to the compression scheme that affected the dynamic range of the recording.⁴

Submitted by:

Charles Cates
Mechanical Engineer/Recorder Specialist

⁴ Audio dynamic range compression is an audio signal processing technique used to decrease the dynamic range of a recording by reducing the volume and intensity of loud sounds and amplifying the volume and intensity of quiet sounds in the recording. Therefore, the intensity of sounds measured in the recording may not be representative of the sounds as they were recorded.