

**NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Vehicle Recorder Division
Washington, D.C. 20594**



GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

CEN19FA036

**By
Charles Cates**

WARNING

The reader of this report is cautioned that the transcript of a cockpit voice recorder audio recording is not a precise science but is the best product possible from a Safety Board group investigative effort. The transcript or parts thereof, if taken out of context, could be misleading. The transcript should be viewed as an accident investigation tool to be used in conjunction with other evidence gathered during the investigation. Conclusions or interpretations should not be made using the transcript as the sole source of information.

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division

May 13, 2021

Cockpit Voice Recorder

Group Chairman's Factual Report
By Charles Cates

1. EVENT SUMMARY

Location: Jeffersonville, Indiana
Date: November 30, 2018
Aircraft: Cessna 525A, Registration N525EG
Operator: Estoair LLC
NTSB Number: CEN19FA036

On November 30, 2018, about 1028 eastern standard time, a Cessna 525A (Citation) airplane, N525EG, collided with trees and terrain near Memphis, Indiana. The airline transport certificated pilot and 2 passengers were fatally injured, and the airplane was destroyed. The airplane was owned and operated by EstoAir LLC under the provisions of 14 *Code of Federal Regulations* Part 91 as a business flight. Visual meteorological conditions prevailed for the flight which operated on an instrument flight rules flight plan. The cross-country flight departed Clark Regional Airport (JVY), Jeffersonville, Indiana, about 1025, with Chicago Midway Airport (MDW), Chicago, Illinois, as the intended destination.

An L-3 FA2100 solid-state cockpit voice recorder (CVR) was sent to the National Transportation Safety Board (NTSB) Vehicle Recorder Division for evaluation. The CVR group meeting convened on May 29, 2019 and a partial transcript was prepared for the 2-hour digital recording (see attached).

2. CVR GROUP

Chairman: Charles Cates
Mechanical Engineer, Recorder Specialist
National Transportation Safety Board

Member: Dan J. Morris
Chief Pilot
Textron Aviation

3. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Division received the following CVR:

Recorder Manufacturer/Model: **L-3/Fairchild FA2100-1020**
Recorder Serial Number: **06141**

3.1 CVR Carriage Requirements

Per federal regulation, multiengine aircraft with more than six passenger seats and requiring two pilots manufactured prior to April 7, 2010, and operated under 14 CFR 91, must be equipped with a CVR that records a minimum of the last 30 minutes of aircraft operation; this is accomplished by recording over the oldest audio data. The accident aircraft was manufactured in 2009. When the CVR is deactivated or removed from the airplane, it retains only the most recent 2 hours of CVR operation.

3.2 Recorder Description

This model CVR, the L-3/Fairchild FA2100-1020, is a solid state CVR that records 120 minutes of digital audio. Specifically, it contains a 2-channel recording of the last 120 minutes of operation and separately contains a 4-channel recording of the last 30 minutes of operation. The 120-minute portion of the recording is comprised of one channel that combines three audio panels sources and a second channel that contains the cockpit area microphone (CAM) source. The 30-minute portion of the recording contains 4 channels of audio information: one channel for each flight crew, one channel for a cockpit observer, and one channel for the CAM.

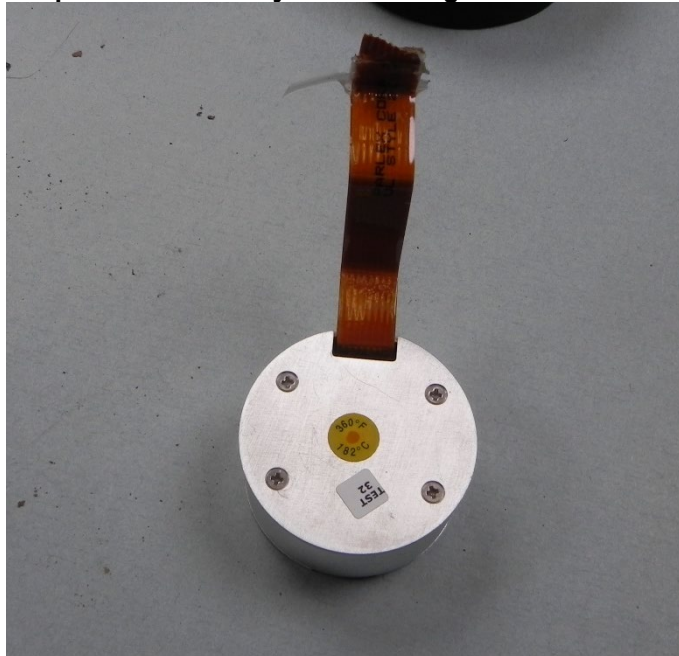
3.3 Recorder Damage

Upon arrival at the laboratory, it was evident that the CVR had sustained significant structural damage. The outer case was removed and the interior crash-protected case did not appear to have any heat or structural damage (see Figures 1 and 2). The memory board within the crash-protected case was checked for heat or structural damage and none was found. A new ribbon cable was attached to the module and the digital audio was successfully downloaded from the crash-survivable memory unit.

Figure 1. Exterior of crash-survivable memory, as received.



Figure 2. Crash protected memory unit showing no heat or structural damage.



3.4 Audio Recording Description

The two-hour recording did not contain any pertinent information so only the 30 minute four channel recording was used for the transcription. Each channel's audio quality is indicated in Table 1.¹ Channel number one did not contain any audio information (nor was it required by federal regulations).

¹ See attached CVR Quality Rating Scale.

Table 1: Audio Quality.			
Channel Number	Content/Source	Quality	Duration
1			<<30 min>>
2	HOT/RDO	Excellent	<<30 min>>
3	HOT/RDO	Excellent	<<30 min>>
4	CAM	Excellent	<<30 min>>

3.5 Timing and Correlation

Timing on the transcript was established by correlating the air traffic control recording transmission time to the corresponding CVR event. Specifically, the CVR time of the final radio transmission from N525EG was linked to the corresponding ATC local time, and all CVR events were offset to reflect the local eastern daylight time of the accident.

3.6 Description of Audio Events

The recording began at 0956:25 and the transcript began at 1014:54. At the start of the transcription passengers were on board and voices could be heard in the cabin on the Cockpit Area Microphone channel. Sounds similar to engine starts occurred at 1016:43 and 1017:19. The pilot donned his headset at 1018:04 and could be heard clearly in the hot mic running through aircraft checklists.

The pilot contacted Louisville approach for an IFR clearance and was released at 1022:45. The sound of increasing engine RPM for takeoff occurred about one minute 40 seconds later.

Following takeoff the pilot performed standard flight operations and contacted Louisville departure at 1025:40, reporting that the aircraft was leveling at 3,000 feet. The controller cleared the aircraft to 10,000 feet.

At 1026:26 the pilot began to recite the after-takeoff checklist. During the checklist the departure controller instructed the pilot to contact Indy center, which the pilot confirmed and then continued the checklist items.

At 1026:55 the sound of a click was recorded and an electronic voice said, "Autopilot", consistent with the autopilot disconnecting. Immediately afterward the pilot made an expression of surprise and confusion. Five seconds later a series of six GPWS automated bank angle warnings were recorded, followed by a beeping tone similar to the overspeed warning that continued until the end of the recording.

At 1027:18 the pilot made a mayday call and stated that the aircraft was in an emergency descent and he was unable to gain control of the aircraft.

The recording ended shortly thereafter at 1027:27.

Attachment 1

CVR Quality Rating Scale

The levels of recording quality are characterized by the following traits of the cockpit voice recorder information:

Excellent Quality	Virtually all of the crew conversations could be accurately and easily understood. The transcript that was developed may indicate only one or two words that were not intelligible. Any loss in the transcript is usually attributed to simultaneous cockpit/radio transmissions that obscure each other.
Good Quality	Most of the crew conversations could be accurately and easily understood. The transcript that was developed may indicate several words or phrases that were not intelligible. Any loss in the transcript can be attributed to minor technical deficiencies or momentary dropouts in the recording system or to a large number of simultaneous cockpit/radio transmissions that obscure each other.
Fair Quality	The majority of the crew conversations were intelligible. The transcript that was developed may indicate passages where conversations were unintelligible or fragmented. This type of recording is usually caused by cockpit noise that obscures portions of the voice signals or by a minor electrical or mechanical failure of the CVR system that distorts or obscures the audio information.
Poor Quality	Extraordinary means had to be used to make some of the crew conversations intelligible. The transcript that was developed may indicate fragmented phrases and conversations and may indicate extensive passages where conversations were missing or unintelligible. This type of recording is usually caused by a combination of a high cockpit noise level with a low voice signal (poor signal-to-noise ratio) or by a mechanical or electrical failure of the CVR system that severely distorts or obscures the audio information.
Unusable	Crew conversations may be discerned, but neither ordinary nor extraordinary means made it possible to develop a meaningful transcript of the conversations. This type of recording is usually caused by an almost total mechanical or electrical failure of the CVR system.

Transcript of a L-3/Fairchild FA2100-1020 solid-state cockpit voice recorder, serial number 06141, installed on an Estoair LLC Cessna 525A (N525EG), which crashed after departure from Clark Regional Airport in Jeffersonville, Indiana.

LEGEND

CAM	Cockpit area microphone voice or sound source
HOT	Flight crew audio panel voice or sound source
RDO	Radio transmissions from N525EG
APCH	Radio transmission from the Louisville approach controller
DEP	Radio transmission from the Louisville departure controller
*	Unintelligible word
#	Expletive
@	Non-pertinent word
()	Questionable insertion
[]	Editorial insertion

Note 1: Times are expressed in eastern daylight time (EDT).

Note 2: Generally, only radio transmissions to and from the accident aircraft were transcribed.

Note 3: Words shown with excess vowels, letters, or drawn out syllables are a phonetic representation of the words as spoken.

Note 4: A non-pertinent word, where noted, refers to a word not directly related to the operation, control or condition of the aircraft.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0956:25.0			
	START OF RECORDING		
	START OF TRANSCRIPT		
10:14:54.6			
CAM	[sounds of background conversation]		
10:15:43.4			
CAM	[sounds of clicks]		
10:16:15.3			
CAM	[sound similar to seatbelt buckle]		
10:16:43.3			
CAM	[sound similar to engine start]		
10:17:19.7			
CAM	[sound similar to engine start]		
10:17:50.9			
CAM	[sound of clicks]		
10:18:04.7			
HOT	[sound of beep]		
10:18:34.5			
HOT	g p u's been. hello, hello, hello?		
10:18:38.8			
HOT	side tone everything *. and just a touch		
10:18:43.2			
HOT	generators have been checked and online fadec's been pushed air source knob is on both. air conditioner.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
10:18:50.6 HOT	thats set to warm and fans are on. pressurization is set for the destination. flaps set takeoff and approach. trims have been checked.		
10:18:56.5 HOT	flight controls...		
10:19:00.1 HOT	are checked. flight instruments airspeed is readin zero. heading indicators are within two degrees. attitude indicators are spot on.		
10:19:07.2 HOT	meters are readin four sixty four sixty and four fifty.		
10:19:11.5 HOT	outta here and up to three thousand.		
10:19:15.0 HOT	have our takeoff, go around.		
10:19:18.8 HOT	f m s charts. f m s er chica er clark county * to midway off of three six.		
10:19:28.1 HOT	check the weather		
		10:19:30.2 RDO-ATIS	temperature one zero celsius dewpoint niner altimeter two niner niner niner
10:19:37.8 HOT	two nine nine nine		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		10:19:41.7 RDO-ATIS	clark county airport automated weather observation one six one niner zulu weather. wind calm visibility one zero. ceiling eight hundered overcast temperature one zero celsius dewpoint niner altimeter two niner niner niner.
10:19:43.4 HOT	charts.		
10:19:51.4 HOT	wind calm we'll still do three six.		
10:19:56.7 HOT	takeoff data. three thousand. one oh one one oh five one thirteen and one thirty two.		
10:20:05.2 HOT	annunciator panel is *.		
10:20:12.2 HOT	and passenger advisory.		
10:20:13.3 CAM	[sound of click]		
10:20:14.9 CAM	[sound similar to passenger safety chime].		
		10:20:20.0 RDO	clark county traffic citation five two five echo golf taxiing runway three six from a s i clark county.
10:20:38.9 CAM	[sound of three clicks]		
10:20:46.3 HOT	* * * * *.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
10:20:52.6 HOT	*.		
10:20:59.4 HOT	alrighty.		
10:21:20.9 CAM	[sound of click]		
10:21:21.4 HOT	oop.		
10:21:22.5 HOT	aaand lets see brakes have been checked anti ice de ice checked and not required.		
10:21:28.7 HOT	rudder bias has been tested. crew briefing this will be a rolling takeoff three six. anything below eighty knots i will abort. between eighty knots and vee one, uh one oh one abort for loss of engine, directional control, fire, or a red light. after vee one handle as an in flight emergency.		
10:21:50.6 HOT	fly the airplane, address the problem, get the autopilot on, talk on the radios, divert over to Stanford.		
10:21:56.9 HOT	on departure expect uh radar vectors to three thousand.		
		10:22:05.9 RDO	louisville clearance citation five two five echo golf number one for runway three six at clark county.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		10:22:13.4 APCH	citation five two five echo golf louisville approach i'll be right back with you on that release to midway.
		10:22:18.1 RDO	five echo golf.
10:22:18.8 HOT	[sound of two beeps]		
		10:22:45.1 APCH	citation five echo golf off runway three six at clark county you are now released. * * airspace cleared direct STREP. maintain three thousand. clearance void in five minutes. time now sixteen twenty two and three quarters.
		10:22:55.7 RDO	* we're cleared for release uh enter your controlled airspace direct STREP three thousand and void if not off in five minutes. five echo golf.
10:23:06.4 HOT	alrighty.		
10:23:10.8 HOT	alright. flaps. flaps are set fifteen indicated fuel is sufficient for the flight. we need two thou uh twelve hundred pounds got thirty three hundred.		
10:23:21.0 HOT	* * posted speeds are posted speedbrakes are checked * and trims are set in all three places.		
10:23:26.0 HOT	anti ice de ice is not required.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
10:23:29.2 HOT	we got pitot heat, strobes, landings are on.		
10:23:33.3 CAM	[sound similar to passenger safety chime].		
10:23:34.2 HOT	and transponder tee cas is on annunciator panel is ground idle only. passenger advisory. they're seated.		
		10:23:42.3 RDO	clark county traffic citation five two five echo golf departing runway three six i f r to the north. clark county.
10:24:25.7 HOT	this is three six.		
10:24:27.8 CAM	[sound similar to increasing engine rpm]		
10:24:31.9 HOT	power set.		
10:24:34.6 HOT	and made. engine instruments are in the green airspeed is alive and crosschecked.		
10:24:39.3 HOT	eighty knot check.		
10:24:43.3 HOT	vee one. rotate.		
10:24:48.3 HOT	positive rate gear up. selected.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
10:25:01.0 HOT	four hundred feet. flaps comin up.		
10:25:06.0 HOT	power is set to m c t. engine syncs on. yaw dampers on.		
10:25:13.4 HOT	gonna go nav. direct STREP. execute. vertical speed. up to three thousand.		
10:25:29.3 HOT	Altitude [electronic voice]		
10:25:29.7 HOT	lets go ahead we'll get autopilot on. and over to departure.		
		10:25:40.9 RDO	louisville departure citation five two five echo golf direct STREP leveling at three thousand.
		10:25:46.3 DEP	citation five two five echo golf louisville departure climb and maintain one zero thousand and ident. the louisville altimeter is two niner niner niner.
		10:25:52.2 RDO	two nine nine nine ident up to ten thousand five two five echo golf.
		10:25:58.0 DEP	citation five echo golf radar contact three miles north of the clark county airport.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		10:26:02.3 RDO	five echo golf.
10:26:03.8 HOT	ten thousand set.		
10:26:09.6 HOT	we'll let - let the power do its thing.		
10:26:26.0 HOT	after takeoff checklist.		
10:26:29.7 HOT	we have landing gear is up and indicating up flaps are up and indicating up engine sync is on yaw dampener and autopilot are both on.		
		10:26:36.2 DEP	citation five echo golf contact indy center one two four point seven seven.
		10:26:39.7 RDO	two four seven seven five echo golf.
		10:26:42.1 DEP	g'day.
10:26:45.5 HOT	uhhh lets seeee. pressurization pressurizing anti ice de ice systems are not required at this time.		
10:26:55.0 CAM	[sound of click]		
10:26:55.3 HOT	autopilot. [electronic voice]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
10:26:56.4 HOT	whoooooaaaaah .		
10:27:01.6 GPWS	bank angle [electronic voice].		
10:27:03.4 GPWS	bank angle [electronic voice].		
10:27:05.1 GPWS	bank angle [electronic voice].		
10:27:06.8 GPWS	bank angle [electronic voice].		
10:27:08.2 GPWS	bank angle [electronic voice].		
10:27:09.9 GPWS	bank angle [electronic voice].		
10:27:11.1 HOT	[pulsing beeping tone similar to overspeed warning alert, continues until end of recording].		
10:27:13.0 HOT	#. #. #. [shouted]		
10:27:14.0 GPWS	bank angle [electronic voice].		
10:27:15.6 GPWS	bank angle [electronic voice].		
10:27:18.5 HOT	may-.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		10:27:18.9 RDO	mayday mayday mayday citation five two five echo golf is in an emergency descent unable to gain control of the aircraft. [shouted]
10:27:23.0 GPWS	terrain terrain [electronic voice].		
10:27:27.2 CAM	[sound of impact]		
10:27:28.5 END OF TRANSCRIPT END OF RECORDING			