NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Vehicle Recorder Division
Washington, DC 20594

GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

DCA17FA021

By
Christopher Babcock

WARNING

The reader of this report is cautioned that the transcription 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 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.

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January 17, 2017

Cockpit Voice Recorder

Group Chairman's Factual Report
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1. EVENT

Location:	Chicago, Illinois
Date:	October 28, 2016, 1432 Central Daylight Time (CDT)[1]
Aircraft:	Boeing 767-300
Operator:	American Airlines, Flight 383
Registration:	N345AN
NTSB Number:	DCA17FA021

On October 28, 2016, at about 1432 Central Daylight Time (CDT), American Airlines flight number 383, a Boeing 767-300, registration N345AN, experienced an uncontained high pressure turbine failure of the right engine and subsequent fire during the takeoff ground roll on runway 28R at the Chicago O'Hare International Airport (ORD), Chicago, Illinois. The flightcrew aborted the takeoff and stopped the aircraft on runway. The airplane was evacuated while stopped on the runway. The fire was extinguished by airport rescue and firefighting (ARFF) after the evacuation started. There were 161 passengers and 9 crew members on board and all were evacuated; 20 passengers were transported to local hospitals to receive treatment for their injuries and all were released within 24 hours. One of the transported passengers was reported to have received a serious injury, while the rest of the injuries were reported as minor. The airplane received substantial damage as a result of the fire, with the majority of the fire damage contained to the right engine, the right wing, portions of the right fuselage, and the right horizontal stabilizer. The flight was operating under the provisions of 14 *Code of Federal Regulations* (CFR) Part 121 and was a scheduled flight from Chicago to Miami International Airport (MIA), Miami, Florida. The solid-state cockpit voice recorder (CVR) from the aircraft was sent to the National Transportation Safety Board's Audio Laboratory for evaluation. The CVR group meeting convened on July 26, 2013, and a complete transcript was prepared for final 2 minutes and 42 seconds of the recording.

2. GROUP

A group was convened on November 3, 2016.

[1] All times are expressed in local CDT, unless otherwise noted

Chairman:	Christopher Babcock Aerospace Engineer National Transportation Safety Board
Member:	Captain Robert F. Aaron, Jr. Senior Safety Pilot The Boeing Company
Member:	Captain Larry K. Abernathy Manager, Flight Training and Standards American Airlines
Member:	John C. Chiros Aviation Safety Inspector Federal Aviation Administration
Member:	Captain Randy Davenport Boeing 757/767 Check Airman Allied Pilots Association

3. DETAILS OF INVESTIGATION

On October 30, 2016, the NTSB Vehicle Recorder Division's Audio Laboratory received the following CVR:

Recorder Manufacturer/Model: **L-3/Fairchild FA2100-1020**
Recorder Serial Number: **158589**

3.1. Recorder Description

Per federal regulation, US registered aircraft operating under 14 *CFR* Part 121, must be equipped with a CVR that records a minimum of the last 2 hours of audio data; this is accomplished by recording over the oldest audio data. When the CVR is deactivated or removed from the airplane, it retains only the most recent 2 hours of aircraft operation. This model CVR, the L-3/Fairchild FA2100-1020, records at least 2 hours of digital audio on a continuous loop tape in a 5-channel format.

According to the Boeing 767 Maintenance Manual, the CVR is powered from the right AC bus.

3.2. Recorder Damage

Upon arrival at the audio laboratory, it was evident that the CVR had not sustained any heat or structural damage and the audio information was extracted from the recorder normally, without difficulty.

3.3. CVR Channels

The recording consisted of five channels of audio information. Three of the channels contained excellent quality audio information from the pilot's, copilot's, and

auxiliary audio panels of 30 minutes duration.[2] One channel contained good quality CAM audio information of 2 hours duration. One channel contained excellent quality audio information from the three audio panels mixed together of 2 hours duration. Figure 1 shows a schematic of the channels recorded.

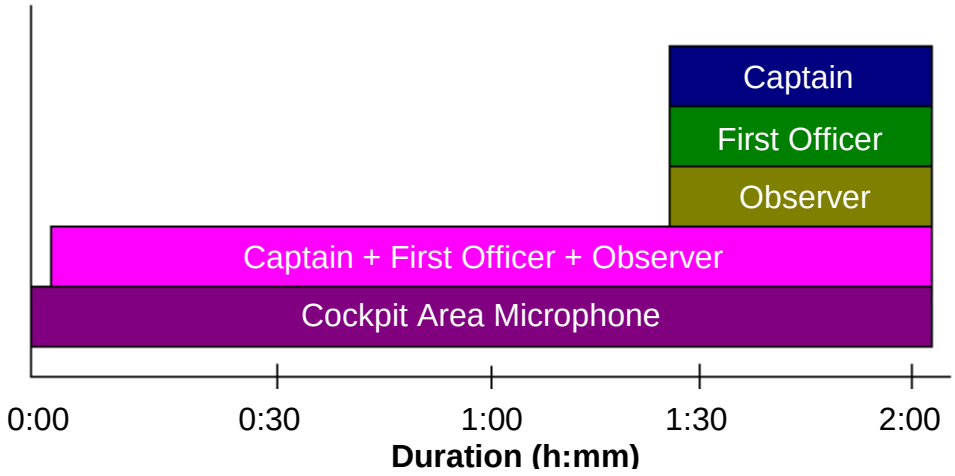

Figure 1. CVR channel schematic.

3.4. Timing and Correlation

Timing on the recording was determined by synchronizing the VHF radio transmissions from the aircraft recorded on the CVR with the corresponding activations of the Key-VHF1 parameter on the flight data recorder (FDR). A 5 hour offset was applied to convert from the Time-UTC parameter on the FDR to local CDT.

Timing on the transcript was established by correlating the last five radio transmissions from the aircraft with the corresponding activations of the Key-VHF1 parameter on the FDR. Each of the radio transmissions acted as an anchor point for a linear interpolation between the remaining CVR events. A linear function of the form

$$FDR\_SRN = m * CVR + b, \quad \textbf{(1)}$$

was fit to the data where *m* is the slope of the interpolation and *b* is the offset. Using the values in Table 1 the correlation between CVR elapsed time and FDR subframe reference number (SRN) is:

$$FDR\_SRN = 1.0 * CVR + 197997.0 \quad \textbf{(2)}$$

Using the recorded Time-UTC value from the FDR, 50528.0 seconds were added to the CVR elapsed time to reach the local CDT time of the accident.

[2] See Attachment I for the CVR Quality Rating Scale

Table 1. Begin and end times of events used to correlate CVR and FDR (times are in seconds).

FDR Start[a] (SRN)	FDR Stop[a] (SRN)	CVR Start (elapsed)	CVR Stop (elapsed)
199702.0	199704.0	1705.4	1707.4
199731.0	199735.0	1734.4	1738.5
199778.0	199781.0	1781.9	1784.1
199785.0	199786.0	1788.2	1789.7
199788.0	199790.0	1791.7	1793.1
199812.0	199813.0	1815.4	1816.7

[a] Transmissions recorded on the FDR are discrete events sampled once per second. The actual transmission may have begun up to 1 second prior to the indicated FDR Start time and may have ended up to 1 second after the indicated FDR Stop time.

3.5. Summary of Recording Contents

The recording contained events from the preflight, taxi, takeoff roll, and accident sequences. The preflight and taxi contained no events out of the ordinary. The transcript began at 1430:29 CDT, just prior to the aircraft turning on to the runway. The recording and transcript ended at 1433:11 CDT, shortly after the engines were shut down.

Attachment I

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 cockpit voice recorder installed on an American Airlines Boeing 767-300 (N345AN) that experienced an uncontained engine failure at O'Hare International Airport, Chicago, Illinois.

LEGEND

CAM	Cockpit area microphone voice or sound source
HOT	Flight crew audio panel voice or sound source
TWR	Radio transmission from O'Hare Tower controller
-1	Voice identified as the captain
-2	Voice identified as the first officer
-?	Voice unidentified
#	Expletive
[ ]	Editorial insertion

Note 1: Times are expressed in Central Daylight Time.

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

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

TIME and SOURCE	INTRA-COCKPIT COMMUNICATION CONTENT	TIME and SOURCE	AIR-GROUND COMMUNICATION CONTENT
14:30:29.4 **START OF TRANSCRIPT**			
		14:30:29.4 **TWR**	American three eighty three heavy runway two eight right at november five line up and wait. winds two zero zero at one four.
		14:30:33.5 **RDO-2**	line up and wait American three eighty three heavy.
14:30:35.6 **HOT-1**	okay checklist.		
14:30:36.4 **HOT-2**	map display?		
14:30:37.3 **HOT-1**	and checked at two eight right.		
14:30:40.3 **HOT-2**	takeoff PA?		
14:30:41.2 **HOT-1**	complete.		
14:30:42.3 **HOT-2**	packs?		
14:30:44.0 **HOT-1**	are auto.		
14:30:45.2 **HOT-2**	lights?		
14:30:46.2 **HOT-1**	set.		

TIME and SOURCE	INTRA-COCKPIT COMMUNICATION CONTENT	TIME and SOURCE	AIR-GROUND COMMUNICATION CONTENT
14:30:46.6 **HOT-2**	checklist complete.		
		14:30:57.2 **TWR**	American three eighty three heavy turn left heading two two zero runway two eight right at november five cleared for takeoff.
14:31:00.5 **CAM**	[sound of five clicks, similar to light switches]		
		14:31:02.5 **RDO-2**	left turn to two two zero cleared for takeoff American three eighty three heavy.
14:31:06.5 **HOT-1**	cleared for takeoff two twenty heading.		
14:31:17.1 **HOT-1**	and engage.		
14:31:19.2 **CAM**	[sound similar to engine rpm increase]		
14:31:19.6 **HOT-2**	clock's running.		
14:31:24.8 **HOT-2**	thrust set.		
14:31:32.0 **HOT-2**	eighty knots.		
14:31:32.8 **HOT-1**	checked.		
14:31:43.5 **CAM**	[sound of bang]		

TIME and SOURCE	INTRA-COCKPIT COMMUNICATION CONTENT	TIME and SOURCE	AIR-GROUND COMMUNICATION CONTENT
14:31:44.4 **HOT-1**	whoa.		
14:31:44.7 **CAM**	[sound of click, similar to throttles contacting idle stops]		
14:31:45.1 **CAM**	[sound similar to engine rpm decrease]		
		14:31:50.0 **RDO-2**	American three eighty three heavy stopping on the runway.
		14:31:52.4 **TWR**	roger roger. fire.
14:31:54.0 **CAM**	[sound of two clicks]		
		14:31:56.2 **RDO-2**	do you see any smoke or fire?
14:31:57.0 **HOT**	[sound similar to master caution]		
		14:31:58.0 **TWR**	yeah fire off the right wing.
		14:31:59.7 **RDO-2**	okay send out the trucks.
14:31:59.9 **CAM**	[sound similar to engine fire warning]		
		14:32:02.1 **TWR**	sending em.
14:32:04.1 **HOT-1**	okay let's run the uh checklist.		

TIME and SOURCE	INTRA-COCKPIT COMMUNICATION CONTENT	TIME and SOURCE	AIR-GROUND COMMUNICATION CONTENT
14:32:04.4 **HOT-2**	alright.		
14:32:06.7 **HOT-2**	checklist.		
14:32:06.9 **HOT-1**	we can shut it—		
14:32:08.3 **HOT-2**	just shut it down and get— pull the handle?		
14:32:09.4 **CAM**	[sound similar to engine fire warning]		
14:32:10.6 **HOT-1**	pull it yeah.		
14:32:11.2 **CAM**	[sound of click, similar to fire handle being pulled]		
14:32:11.8 **CAM**	[sound similar to engine fire warning]		
14:32:12.9 **CAM**	[sound of three clicks]		
14:32:15.6 **HOT-2**	checklist for engine fire.		
		14:32:17.9 **TWR**	American three eighty three can you give us any information right now?
14:32:17.9 **HOT-1**	#.		

TIME and SOURCE	INTRA-COCKPIT COMMUNICATION CONTENT	TIME and SOURCE	AIR-GROUND COMMUNICATION CONTENT
14:32:21.3 **CAM**	[sound similar to engine fire warning]		
		14:32:23.4 **RDO-2**	uh stand by.
14:32:25.9 **CAM**	[sound similar to master caution]		
14:32:26.0 **HOT-2**	just the—		
14:32:28.3 **CAM-2**	engine fire severe damage.		
14:32:30.7 **CAM**	[sound similar to engine fire warning]		
14:32:31.0 **HOT-2**	*.		
14:32:32.5 **HOT-2**	okay.		
14:32:32.9 **HOT-1**	you didn't— you didn't fire the bottle.		
14:32:34.6 **HOT-1**	did ya?		
14:32:34.9 **HOT-2**	I did. I pushed it twice.		
14:32:35.6 **CAM**	[sound of click]		
14:32:35.7 **HOT-1**	which one?		

TIME and SOURCE	INTRA-COCKPIT COMMUNICATION CONTENT	TIME and SOURCE	AIR-GROUND COMMUNICATION CONTENT
14:32:36.3 **HOT-2**	oh I didn't twist it. there we go.		
14:32:36.5 **CAM**	[sound of click]		
14:32:37.3 **HOT-1**	oh.		
14:32:38.2 **HOT-2**	okay.		
14:32:39.1 **CAM**	[sound of two whooshing sounds]		
14:32:40.2 **CAM**	[sound similar to engine fire warning]		
14:32:40.9 **HOT-2**	alright.		
14:32:40.9 **CAM-1**	oh look at the smoke— check out the smoke.		
14:32:41.7 **HOT-1**	[sound of rustling noise, similar to headset being moved]		
14:32:42.6 **HOT-2**	okay.		
14:32:44.0 **HOT-2**	uhh.		
14:32:45.2 **CAM-1**	do the evacuation checklist.		
14:32:46.6 **HOT-2**	okay evacuation checklist.		

TIME and SOURCE	INTRA-COCKPIT COMMUNICATION CONTENT	TIME and SOURCE	AIR-GROUND COMMUNICATION CONTENT
14:32:49.2 **CAM-1**	#.		
14:32:49.7 **CAM**	[sound similar to engine fire warning]		
14:32:53.4 **HOT-1**	okay I'm going both ways. go.		
14:32:54.8 **HOT-2**	okay.		
14:32:55.1 **HOT-1**	go.		
14:32:55.5 **HOT-2**	parking brake set?		
14:32:56.5 **HOT-1**	set.		
14:32:57.3 **HOT-2**	cabin altitude mode selector manual?		
14:32:59.2 **CAM**	[sound similar to engine fire warning]		
14:33:00.8 **HOT-1**	okay.		
14:33:01.1 **HOT-2**	uh cabin altitude control hold in climb.		
14:33:05.2 **HOT-1**	okay. what about the—		
14:33:06.7 **HOT-2**	fuel control switches both cutoff.		

TIME and SOURCE	INTRA-COCKPIT COMMUNICATION CONTENT	TIME and SOURCE	AIR-GROUND COMMUNICATION CONTENT
14:33:06.9 **CAM**	[sound similar to master caution]		
14:33:08.6 **CAM**	[sound similar to engine fire warning]		
14:33:09.7 **HOT-2**	PA evac this is the captain—		
14:33:11.0 **CAM**	[sound of thunk]		

14:33:11.7
END OF TRANSCRIPT
END OF RECORDING