

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



**GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION**

**DCA19MA086**

**By  
Sean Payne**

**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

December 18, 2019

## **Cockpit Voice Recorder**

### **Group Chairman's Factual Report By Sean Payne**

#### **1. EVENT SUMMARY**

Location: Baytown, Texas  
Date: February 23, 2019  
Aircraft: Boeing 767-375BCF, Registration N1217A  
Operator: Atlas Air Cargo, Flight 3591  
NTSB Number: DCA19MA086

On February 23, 2019, at 1239 central standard time (CST), Atlas Air flight 3591, a Boeing 767-375BCF, N1217A, entered a rapid descent from 6,000 feet and impacted a marshy bay area about 40 miles southeast of George Bush Intercontinental Airport (KIAH), Houston, Texas. The airplane was destroyed and highly fragmented. The two pilots and one nonrevenue jumpseat pilot were fatally injured. The domestic cargo flight was operating under Title 14 *Code of Federal Regulations* Part 121 from Miami International Airport (KMIA), Miami, Florida to KIAH

A solid-state cockpit voice recorder (CVR) was sent to the National Transportation Safety Board (NTSB) Vehicle Recorder Division for evaluation.

#### **2. GROUP**

A group was convened on March 5, 2019, at the NTSB's Vehicle Recorder Division laboratory in Washington, D.C. The group was later reconvened for a second listening session of the recording on November 14, 2019. The group consisted of the following individuals:

Chairman:	Sean Payne Sr. Mechanical Engineer/Investigator NTSB
Member:	David "Andrew" Runyon Aircrew Program Designee (APD) – B767 Atlas Air
Member:	Len "Wesley" Thompson Captain – B767 International Brotherhood of Teamsters (IBT)

Member: Rich Lee  
Safety Pilot  
Boeing

Member: Patrick Lusch  
Air Safety Investigator  
Federal Aviation Administration (FAA)

### 3. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Division received the following CVR:

Recorder Manufacturer/Model: **Honeywell 6022**  
Recorder Serial Number: **61829**

#### 3.1 CVR Carriage Requirements

Per federal regulation, turbine engine powered aircraft operating under 14 *CFR* Part 121 must be equipped with a CVR that records a minimum of the last 2 hours of aircraft operation; 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 CVR operation.

#### 3.2 Recorder Description

This model CVR, the Honeywell 6022, 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 3-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 3 channels of audio information: one channel for the captain's hot-mic, one channel for the first officer's hot-mic and one channel for a cockpit observer. When the 30 minute portion of the CVR is downloaded, the same 2 hour CAM channel is also recovered. This two hour CAM channel is the same CAM channel that is recorded on the two hour portion of the recorder.

#### 3.3 Recorder Damage

Upon arrival at the laboratory, it was evident that the CVR's crash survivable memory unit (CSMU) had separated from the recorder chassis. Furthermore, the acoustic locator beacon had separated from the CSMU. Figure 1 is a photo of the recorder immediately upon recovery from Trinity Bay in Baytown, Texas. The CSMU was immediately placed and stored in fresh water for transport to the Vehicle Recorder Division in Washington, D.C.



**Figure 1. The CVR as recovered from Trinity Bay, Baytown, Texas.**

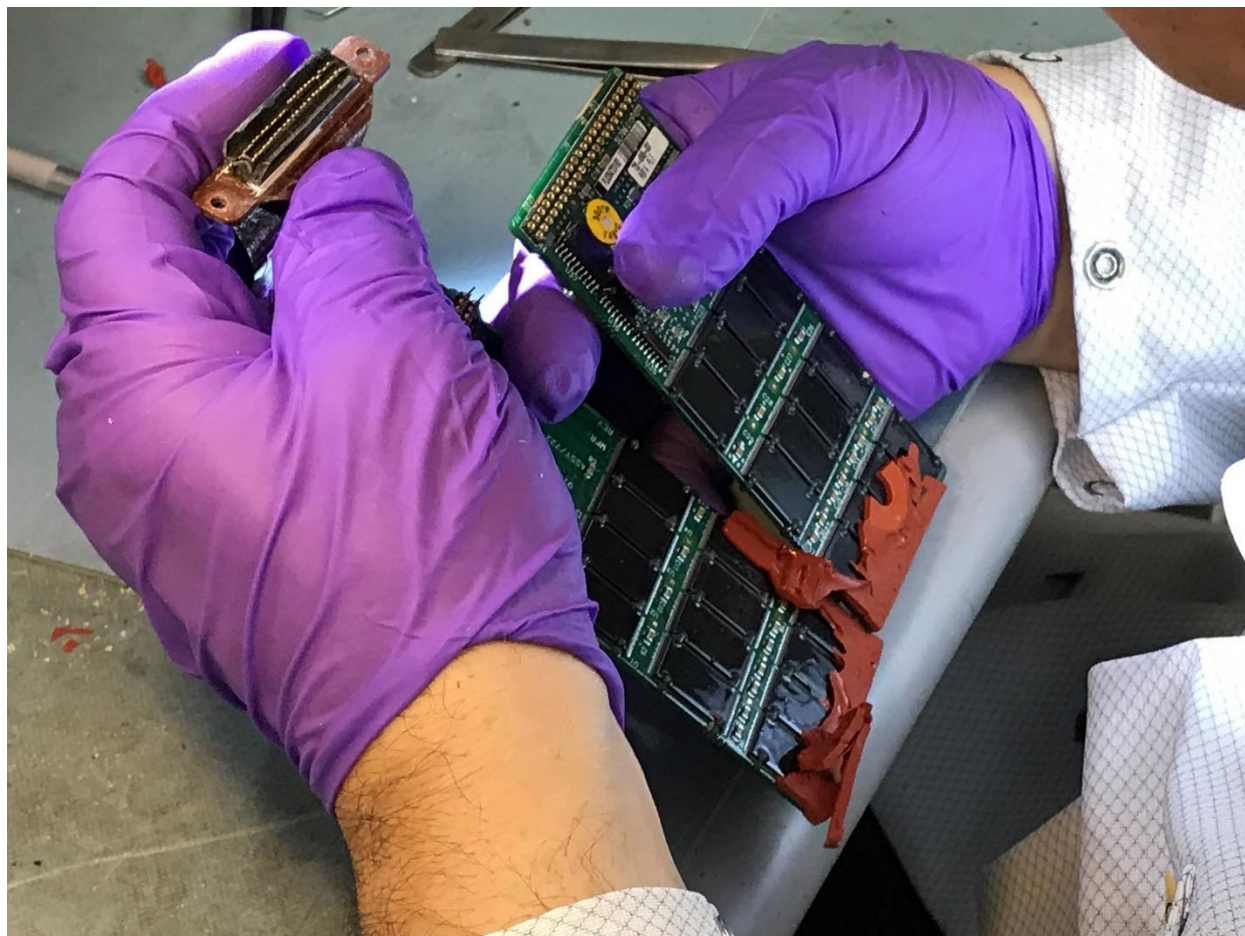
Upon arrival to the laboratory, the CVR's CSMU was rinsed in reverse osmosis filtered fresh water. The recorder was removed from the water and the CSMU was disassembled on a laboratory work bench. The CSMU did not appear to have any heat damage and the memory board was retrieved from inside the unit (figure 2).



**Figure 2. The internal memory board being removed from the CSMU.**

The protective red silicon-like coating was removed from the internal memory board (figure 3) and the internal memory board was inspected. The memory board within the CSMU was checked for heat or structural damage and none was found, however, when

the red silicon-like coating was removed, water was released that was trapped inside, which indicated that the red silicon-like material did not protect the internal memory boards. The boards were found to be covered in conformal coating. An inspection of the conormal coating revealed no anomalies or defects and the electrical components were likely successfully protected by the conformal coating protection.



**Figure 3. The internal memory board being stripped of it's protective coating.**

The internal memory boards were stripped entirely of the red silicon-like coating and were rinsed in reverse osmosis filtered water for approximately one hour. The internal memory boards were then removed and inspected. The internal memory boards were then placed inside a vacuum drying oven and dried in accordance with laboratory procedures.

After the drying procedure was complete, the CSMU's cable was replaced using components from the manufacturer supplied accident investigator's kit. The repaired CSMU was installed in a working surrogate CVR unit of the same model. The internal memory boards circuitry was checked in accordance with the manufacturer's recommended procedure before power was applied and the internal memory was downloaded.

The digital audio was successfully downloaded from the internal memory boards and is covered later in this report.

### 3.4 Audio Recording Description

The CVR's downloaded audio information was not pristine. Specifically, on both the two-hour portion and the 30-minute portion of the recovered audio files, crew hot-mic information was mixed with VHF radio traffic. This is not uncommon, as squelch and volume settings can affect these conditions. Any time there was a VHF transmission on the same frequency as the accident aircraft, crew hot-mic information was obscured. In general, the VHF information was recorded at a higher signal level which made crew hot-mic information more difficult to discern. Only during times in which no VHF radio transmissions were present, was the crew audio information from the hot channels intelligible.

For the two-hour CAM portion, the first 1 hour 43 minutes and 12.6 seconds of the recording was characterized as "fair."<sup>1</sup> At 1 hour 43 minutes and 12.6 seconds into the recording (12:21:19 CST), the quality of the CAM channel degraded. The CAM channel dropped in recorded signal level and remained at this level for the remainder of the recording. At this time, CAM audio information was characterized as "poor." The time for when this situation occurred is specifically noted in the transcript.

For the 2 hour mixed hot mic track, the quality was rated as poor due to the mix of recorded VHF communications which interfered with the quality of crew communications via hot mic on this channel.

For the 30-minute portion of the recording, each channel's audio quality is indicated in Table 1.

For the two-hour portion of the recording, each channel's audio quality is indicated in Table 2.

**Table 1:** Audio Quality for 30 minute portion.

Channel Number	Content/Source	Quality	Duration
1	Jumpseat Position (un-used)	N/A	30m33s
2	First Officer	Fair	30m33s
3	Captain	Fair	30m33s

**Table 2:** Audio Quality for two-hour portion

Channel Number	Content/Source	Quality	Duration
1	Captain, First Officer and Jumpseat	Poor	2h05m16s
2	Cockpit Area Microphone (CAM)	Poor	2h00m56s

### 3.5 Timing and Correlation

Timing on the transcript was established by correlating the CVR events to common events on the flight data recorder (FDR). Specifically, the last three radio transmissions that the aircraft made were correlated to the radio transmit microphone key parameter from the FDR. Each of the three radio transmissions acted as an anchor point for a

<sup>1</sup> See attached CVR Quality Rating Scale.

linear interpolation between the remaining CVR events. Once a correlation between the recorders were established, a reference to local time was determined using additional timing information from the FDR. The resolution of the recorded mic keys on the FDR was 1 Hz.

All times are given in CST.

### **3.6 Description of Audio Events**

In agreement with the Investigator-In-Charge, a CVR group was convened.

The portion of the recording from 10:33:47.7 to 11:57:59.2 (the first 1 hour, 24 minutes and 11 seconds) were summarized by the CVR group. This portion of the recording captured the aircraft's climb during departure and the entire cruise portion of the flight.

The portion of the recording from 11:57:59.2 until the loss of audio information at 12:39:03.9 were transcribed by the group. This portion of the recording captured the aircraft's descent from flight level (FL) 400 until the loss of audio information at 12:39:03.9.

The summary of events from the CVR follows.

#### **Summary**

All times are given in CST.

The recording began at 10:33:47.7 with the 2 hour and 5-minute mixed hot mic track as the only track available for the first 4 minutes and 19.4 seconds of the recording.

Around 10:34:09, the captain checked in with Miami Departure that they were climbing from 3,000 feet to 5,000 feet. Miami Departure assigned the aircraft 7,000 feet.

Around 10:35:04, Miami Departure assigned the aircraft a left turn to a heading of 360 degrees.

Around 10:36:27, Miami Departure issued a traffic call for the aircraft. Moments later the captain reported the traffic in sight to Miami Departure.

Around 10:36:41, Miami Departure assigned the aircraft a left turn to a heading of 320 degrees.

Around 10:37:29, Miami Departure assigned the aircraft 9,000 feet.

Around 10:37:44, Miami Departure assigned the aircraft direct BORLE intersection.

At 10:38:7.065, the cockpit area microphone (CAM) track began.

Around 10:39:29, Miami Departure assigned the aircraft 11,000 feet.

Around 10:40:18, the captain and first officer started the after-takeoff checklist.

Around 10:40:51, Miami Departure assigned the aircraft 16,000 feet.

Around 10:42:07, Miami Departure issued a frequency change for the aircraft to Miami Center.

Around 10:42:55, the captain checked in level at 16,000 feet, Miami Departure then assigned the aircraft 23,000 feet.

Around 10:43:16, Miami Center canceled a speed restriction for the aircraft.

Around 10:43:52, the aircraft was handed off to Miami Center on a different frequency.

Around 10:44:14, the captain and first officer completed the after-takeoff checklist.

Around 10:44:31, the captain checked in with Miami Center at 19,000 feet climbing to 23,000 feet. Miami Center then assigned the aircraft 27,000 feet.

Around 10:46:57, Miami Center assigned the aircraft 28,000 feet.

Around 10:48:07, Miami Center assigned the aircraft 30,000 feet.

Around 10:49:01, Miami Center assigned the aircraft 40,000 feet. The aircraft continued a routine climb.

Around 10:49:18, the captain and first officer discussed a possible center fuel tank fuel migration issue. The captain and first officer determined the possible migration was minor and agreed to monitor the possible migration issue for the remainder of the flight.

Around 10:50:26, Miami Center issued a frequency change. Moments later, the captain checked in with Miami Center on another frequency at 34,600 feet climbing to 40,000 feet.

Around 10:53:13, Miami Center issued the aircraft direct REMIS.

Around 10:54:25, conversation between the captain and first officer indicated that the aircraft had leveled at 40,000 feet.

Between approximately 10:54:48 and approximately 11:04:38, the captain gave the first officer advice on material and study strategies for future captain upgrade training.

Around 11:02:19, Miami Center issued a frequency change. A few moments later, the captain checked in on the new frequency and reported level at 40,000 feet.

Around 11:05:48, the captain passed the radio monitoring duty to the first officer so the captain could go make coffee for himself, the first officer and the jumpseater. The



captain and first officer briefly discussed that the fuel migration issue seemed to be a non-issue for the flight.

Around 11:07:28, the first officer was briefly audible reading items consistent with training material.

Around 11:09:33, the first officer and the jumpseater began a conversation regarding aviation career related topics. The conversation topic changed to discuss how the first officer transitioned to the 767 airframe around 11:13:48. Comparisons were made to previous airplanes, the first officer discussed the transition being “not hard” and that “the box [Flight Management System (FMS)] is easy.” The jumpseater asked if the FMS is “pretty similar” and the first officer continued to explain that it was similar. The first officer continued to discuss with the jumpseater the basic functionality of the 767 FMS. The conversation continued, the first officer mentioned “so for me, I had to get my [instrument] scan back... but it flies good.” The first officer continued to comment about the “extra performance” of the 767. Later, the jumpseater asked if the 767 could be started with “the packs on” and the first officer began a discussion about the start procedure of the aircraft.

Around 11:17:18, Miami Center issued a frequency change to Jacksonville Center.

Around 11:17:38, the first officer checked in with Jacksonville center. The first officer initially misspoke the altitude as 41,000 feet. In the next few exchanges, the controller issued the aircraft a new squawk code and the misspoken altitude was not caught by the controller.

Around 11:18:34, the first officer resumed the conversation with the jumpseater and stated, “pretty easy plane to fly... very, very stable.” The first officer then discussed with the jumpseater international flights he conducted with the 767, the conversation then became non-aviation related in nature.

Around 11:21:05, Jacksonville Center cleared the aircraft direct GIRLY. The first officer acknowledged and was heard making comments consistent with programming the FMS.

Around 11:21:17, Jacksonville Center asked if “any aircraft on frequency [were] at flight level four one zero.”

The captain was briefly audible in the cockpit area around 11:21:36.

Around 11:21:48, the first officer discussed the jumpseater’s new job at a different airline. The first officer and the jumpseater discussed upgrade opportunities, basing, scheduling and salaries at different carriers. The conversation ended around 11:28:33 when the captain returned to the cockpit. The first officer gave the captain a briefing on flight route and status changes since the captain had left the cockpit.

The captain, first officer and jumpseater then began a conversation about basing and different international destinations. During the conversation, the captain asked an unknown person in the area of the cockpit, “can you tear that off for me?” The three

personnel continued to discuss the aviation industry and upgrade opportunities. The first officer made favorable comments about upgrade opportunities and the lifestyle of his current employment when speaking to the jumpseater.

Around 11:31:43, the captain was heard stating “they’re landing on two-sixes right now.” The first officer and captain discussed the possibility of the arrival changing. They continued to discuss arrival options and briefly mentioned weather at the destination. Around 11:42:40, the aircraft was handed off from Jacksonville Center to Houston Center.

Around 11:42:56, the captain checked in with Houston Center at FL400.

Around 11:44:34, the first officer began a conversation with the captain about weather at the destination and expected assigned arrival. The captain and first officer planned for a 26L or 26R arrival at IAH. The captain mentioned an ATIS update would be available shortly. The first officer calculated crosswind component on runway 26 L/R in relation to the available weather. The first officer discussed his preference for flaps 25 at landing.

Around 11:46:26, the jumpseater asked the first officer if he “use[s] flight level change very much?” The first officer and captain discussed how they use the FMS to descend. The captain discussed his preference for a system where control wheel steering was available. The conversation was mostly unremarkable, with the exception of the first officer stating his reluctance to use the “descend now” function, especially while issued a restriction during a descent phase. The first officer then stated, “you have to be careful with that.”

Around 11:49:46, the captain, first officer and jumpseater discussed various Embraer models, their cockpits and flight characteristics. A portion of the conversation then discussed the differences between Boeing aircraft and other manufacturer’s products. Overall, the specifics of the conversation were unremarkable.

Around 11:51:48, the jumpseater asked, “does this have auto-land?” The captain and first officer discussed that the aircraft was equipped auto-land CAT III C and discussed their experiences with the system.

Around 11:53:42, the first officer asked to use the restroom and performed an exchange of controls with the captain.

Around 11:57:43, the aircraft was issued a frequency change by Houston Center, the captain checked in level at 40,000 feet.

Transcript of a Honeywell 6022 solid-state cockpit voice recorder, serial number 61829, installed on an Atlas Air Cargo Boeing 767-300 (N1217A), which crashed in Baytown, Texas.

## LEGEND

<b>CAM</b>	Cockpit area microphone voice or sound source
<b>APR</b>	Radio transmission from Houston approach controller
<b>CTR</b>	Radio transmission from Houston center controller
<b>HOT</b>	Flight crew audio panel voice or sound source
<b>RDO</b>	Radio transmissions from N1217A
<b>-1</b>	Voice identified as the captain.
<b>-2</b>	Voice identified as the first officer.
<b>-3</b>	Voice identified as the jumpseater
<b>-?</b>	Voice unidentified
<b>*</b>	Unintelligible word
<b>#</b>	Expletive
<b>@</b>	Non-pertinent word
<b>( )</b>	Questionable insertion
<b>[ ]</b>	Editorial insertion

Note 1: Times are expressed in CST.

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. Typically, this is used in place of a person's name which has been redacted.

Note 5: An en dash (–) denotes when a speaker was cut off by a noise or another speaker.

## Intra-Aircraft Communication

11:58:12.6  
**CAM-1**     alright- um...

11:58:45.2  
**CAM**       [Sound similar to lavatory door lock being operated.]

## Over-the-Air Communications

11:57:59.1  
**RDO-1**     Houston good afternoon Giant thirty-five ninety-one heavy  
four zero zero.

11:58:03.6  
**CTR**       Giant thirty-five ninety-one Houston Center good – uh good  
afternoon sir- expect light chop.

11:58:09.0  
**RDO-1**     roger yeah we've been pickin' up a little bit- just intermittent.

11:58:11.8  
**CTR**       okie doke.

11:58:15.2  
**CTR**       Giant thirty-five ninety-one advise when you're ready.

11:58:24.3  
**RDO-1**     okay uh Giant thirty-five ninety-one we're ready.

11:58:27.5  
**CTR**       Giant thirty-five ninety-one after uh GIRLY after GIRLY  
cleared to the terminal via LINKK ONE arrival LINKK ONE  
maintain flight level four zero zero.

11:58:35.8  
**RDO-1**     alright after GIRLY LINKK ONE and we'll stay four zero zero  
thanks Giant thirty-five ninety-one.

## Intra-Aircraft Communication

## Over-the-Air Communications

11:59:07.6  
**CAM-2** okay.

11:59:28.3  
**CAM-1** uh there's GIRLY.

11:59:33.2  
**CAM-1** okay.

11:59:39.7  
**CAM-1** alright LINKK ONE.

11:59:41.0  
**CAM-2** yeah.

11:59:42.3  
**CAM-2** (so) go ahead (go ahead) put that in the box LINKK ONE arrival.

11:59:47.2  
**CAM-1** two six right?

11:59:47.8  
**CAM-2** two six right.

11:59:48.8  
**CAM-1** I mean that's what I'm thinkin'.

11:58:53.8  
**CTR** \* Giant thirty-five ninety-one read back broke up a little bit uh GIRLY LINKK ONE arrival four zero zero. got it?

11:58:58.9  
**RDO-1** yes sir uh GIRLY LINKK ONE arrival and four zero zero thirty-five ninety-one.

11:59:03.8  
**CTR** great. thanks.

## Intra-Aircraft Communication

## Over-the-Air Communications

11:59:49.4  
**CAM-2** ummm- using flap twenty five. autobrakes  
(three/basically)–

11:59:53.6  
**CAM-1** GIRLY.

11:59:54.3  
**CAM-2** yup.

11:59:55.8  
**CAM-1** and I'm gunna leave that by you probably do ZAPPO  
but I'll leave it like it is for now.

11:59:59.0  
**CAM-2** okayyy.

11:59:59.8  
**CAM-1** so let's go to legs.

12:00:04.7  
**CAM-1** BBQUE.

12:00:08.6  
**CAM-1** if you watch yours I'll - I'll read 'em out.

12:00:10.0  
**CAM-2** okay.

12:00:10.5  
**CAM-1** alright at BBQUE at uh speed two eighty. two ten or  
below.

12:00:15.2  
**CAM-2** yes.

12:00:15.7  
**CAM-1** LINKK at two fifty between twelve and fifteen.

12:00:18.3  
**CAM-2** roger.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:00:18.9  
**CAM-1** GILL at eight between eight and ten and two forty.

12:00:21.8  
**CAM-2** yeap.

12:00:22.5  
**CAM-2** then GARRR.

12:00:23.7  
**CAM-1** and then vectors.

12:00:25.0  
**CAM-2** \* six thousand's the bottom altitude.

12:00:26.7  
**CAM-1** alright.

12:00:28.8  
**CAM-1** confirm?

12:00:29.6  
**CAM-2** execute.

12:00:31.8  
**CAM-1** alright autobrakes what?

12:00:33.0  
**CAM-2** (uh/auto) two.

12:00:35.8  
**CAM-1** flaps twenty-five. okay.

12:00:36.8  
**CAM-2** \*.

12:00:37.1  
**CAM-1** let me get the new ATIS and I'll get us set up.

## Intra-Aircraft Communication

12:00:47.6  
**CAM-2** you can put also put uh- two seven in also.

12:01:29.2  
**CAM-?** [Sound similar to yawn.]

12:01:42.0  
**CAM-2** \*.

12:01:44.1  
**CAM-1** what's that?

12:01:45.2  
**CAM-2** just yawning.

12:01:49.2  
**CAM-1** would you grab that uh-

12:01:50.7  
**CAM-2** (huh/oh)?

12:01:52.1  
**CAM-1** ATIS please.

12:01:57.0  
**CAM-1** thank ya sirrr.

12:01:59.9  
**CAM-1** alright two thirty fourrr.

12:02:06.9  
**CAM-1** two eleven eight. aaand eighteen four.

## Over-the-Air Communications

12:00:53.6  
**CTR** attention all aircraft hazardous information Houston Center weather advisory two zero five for Mississippi Alabama region available on HIWAS Flightwatch flight \* \* -.



## Intra-Aircraft Communication

## Over-the-Air Communications

12:02:19.3  
**CAM-1** two- zero two thirty four. two three zero point two.

12:02:27.7  
**CAM-1** double bug one twenty six.

12:02:31.4  
**CAM-1** uhhs and so on ref speed-

12:02:37.9  
**CAM-1** you wanna add twenty to that? well let's see what's it doin' now?

12:02:40.3  
**CAM-2** that's where the winds are first.

12:02:42.6  
**CAM-1** and now it's just three two- three two zero at fourteen.

12:02:45.8  
**CAM-2** oh okay not that bad.

12:02:48.8  
**CAM-2** winds are-

12:02:50.6  
**CAM-2** three two zero at fourteen so-

12:02:52.7  
**CAM-2** sixty two two oh [zero] two. are the flaps...

12:02:55.7  
**CAM-1** huh?

12:02:57.6  
**CAM-2** (on the five- plus five-) add five to that.

12:03:00.8  
**CAM-2** so like uh one.

## Intra-Aircraft Communication

12:03:01.6  
**CAM-1** so you want me to put it on here do you wanna put it?

12:03:03.4  
**CAM-2** (let's/plus twelve) let's put it on here.

12:03:04.7  
**CAM-1** okay so what we got? one twenty six?

12:03:07.2  
**CAM-2** one twenty six.

12:03:07.7  
**CAM-1** (plan) one thirty two or something like that.

12:03:09.5  
**CAM-2** plan one thirty two.

12:03:11.6  
**CAM-2** let's just call it one thirty five.

12:03:13.2  
**CAM-2** one—

12:03:13.5  
**CAM-1** one thirty five.

12:03:13.7  
**CAM-2** one thirty five—

12:03:14.1  
**CAM-2** call it (like that).

12:03:15.3  
**CAM-1** I just put this that's my reminder.

12:03:16.7  
**CAM-2** ohh okay \* \*-

## Over-the-Air Communications

## Intra-Aircraft Communication

## Over-the-Air Communications

12:03:17.4  
**CAM-1** (to) set that for ya.

12:03:18.0  
**CAM-2** (okay).

12:03:18.8  
**CAM-1** uhhh- okay.

12:03:21.0  
**CAM-1** let me do this now.

12:04:04.2  
**CAM-1** ahhh sooo- put two seven instead of two six right.

12:04:11.8  
**CAM-2** \* two six right and two seven (I believe) one of those two. what'd you think?

12:04:16.8  
**CAM-1** what I think it'll either be the left side- the left or the bottom- I think.

12:04:23.0  
**CAM-2** \* (left/land) (and)-

12:04:26.6  
**CAM-1** two six left or two seven.

12:04:28.2  
**CAM-2** yeah.

12:04:28.6  
**CAM-1** I'm hoping they'll get tho-those two- the top two. they'll probably give it to us- we'll ask for it.

12:04:32.6  
**CAM-2** yup. okay.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:04:33.6  
**CAM-1** if we need to I'll get- I'll get a different one.

12:04:36.2  
**CAM-2** that sounds good.

12:04:38.7  
**CAM-1** I mean two seven's--

12:04:39.6  
**CAM-2** I agree I agree.

12:04:40.6  
**CAM-1** two seven's even longer so we'll be good.

12:04:42.1  
**CAM-2** \* \* \*.

12:04:44.6  
**CAM-2** yes.

12:04:46.0  
**CAM-2** yeah those two close to where we are.

12:05:11.8  
**CAM** [Chime. Sound similar to ACARS information arrival for landing data.]

12:06:28.3  
**CAM-1** like it?

12:06:28.9  
**CAM-2** \* (let's see / \* ).

12:06:32.8  
**CAM-1** let's see-

## Intra-Aircraft Communication

12:06:43.0

**CAM-1** which one (do you thin...)- I mean if they give me a choice- I'd take two six right 'cause we- we get-

12:06:54.5

**CAM-2** three five zero.

12:06:54.9

**CAM-1** three five zero set.

12:06:56.1

**CAM-2** yeah the last time I saw it was two six right and (what they) give us.

12:06:59.0

**CAM-1** so I'll set ya up with that- I'll change it-

12:07:00.2

**CAM-2** two six right.

12:07:01.2

**CAM-2** I agree.

## Over-the-Air Communications

12:06:48.2

**CTR** Giant thirty five ninety one traffic- descend and maintain flight level three five zero.

12:06:52.2

**RDO-1** descend three five zero Giant thirty five ninety one.

12:07:24.9

**CTR** Giant thirty five ninety one contact Houston Center one three four point niner two so long.

12:07:29.2

**RDO-1** thirty four ninety two have a good weekend

## Intra-Aircraft Communication

12:07:40.7

**CAM-2** set.

12:07:45.8

**CAM-2** \* \* (set). [FO speaking under his breath.]

12:07:47.3

**CAM-?** (ugh/yeah).

12:07:57.1

**CAM-1** (let's get the)–

12:07:57.7

**CAM-2** doin' two eighty in the descent–

12:08:06.8

**CAM-1** thirty-four set.

## Over-the-Air Communications

12:07:35.3

**RDO-1**

Houston good afternoon- Giant thirty five ninety one is uh four zero zero descending uh thirty five- three five zero. thanks.

12:07:48.5

**CTR**

who made that last call?

12:07:49.9

**RDO-1**

yes sir Giant thirty five ninety one is uh three nine zero descending three five zero.

12:07:57.7

**CTR**

Giant uh [Sound similar to radio interference.] thirty five ninety one roger- descend and maintain flight level three four zero. [Sound similar to radio interference.]

12:08:04.1

**RDO-1**

descend three four zero Giant thirty five ninety one.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:08:07.3  
**CAM-2** think we're good.

12:08:07.8  
**CAM-1** what do you—

12:08:07.9  
**CAM-2** what'd he- what'd he said two eight zero?

12:08:10.1  
**CAM-1** yeah it's fine.

12:08:15.3  
**CAM-1** damn.

12:08:17.0  
**CAM-1** allright. eleven fifty-five-

12:08:19.5  
**CAM-2** okay so-

12:08:20.2  
**CAM-1** two sixty seven.

12:08:25.6  
**CAM-2** okay.

12:08:26.6  
**CAM-1** uhhh let's see. minimums.

12:08:28.8  
**CAM-2** minimums are gunna be three- four ninety-six I guess.

12:08:32.2  
**CAM-2** three ninety-six.

12:08:33.7  
**CAM-1** three ninety-six- four hundred.

## Intra-Aircraft Communication

12:08:30.4  
**HOT-2** four ninety-six I guess.

12:08:32.4  
**HOT-1** three ninety-six.

12:08:32.5  
**HOT-2** oh three ninety-six.

12:08:33.7  
**HOT-1** three ninety-six four hundred.

12:08:35.5  
**HOT-1** 'bout four hundred's close enough.

12:08:36.6  
**HOT-2** 'kay four hundred is close.

12:08:40.2  
**HOT-2** speed.

12:08:43.0  
**HOT-2** (gunna) be small (seven three).

12:08:50.5  
**HOT-2** confirm.

12:08:51.2  
**HOT-1** execute.

12:08:53.3  
**HOT-2** okay.

12:08:54.2  
**HOT-1** # man I'm bleeding.

12:08:55.6  
**HOT-2** (is it) 'cause the clouds?

## Over-the-Air Communications



## Intra-Aircraft Communication

## Over-the-Air Communications

12:08:57.2  
**HOT-1** yeah.

12:08:58.6  
**HOT-1** I'm bleeding.

12:08:58.6  
**HOT-2** ('turb) ohhh.

12:09:00.4  
**HOT-1** I think my - I don't know which one it is but I hit my head every time I get out and I've got like a permanent scar now.

12:09:05.5  
**HOT-2** ohhkay.

12:09:08.3  
**HOT-2** back to two eighty- confirmed.

12:09:10.0  
**CAM-1** #.

12:09:16.2  
**HOT-1** I (don't/no) like-a da bumps. [Spoken in an accent.]

12:09:20.8  
**CAM** [Sound of click.]

12:09:33.3  
**HOT-1** [Sound of groan/yawn.]

12:09:41.3  
**HOT-2** okay - I'm gunna giva ya controls when you're ready.

12:09:45.2  
**HOT-1** alright one second.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:09:53.9  
**CAM** [Sound of click.]

12:09:58.4  
**HOT-1** alright I got controls.

12:09:59.4  
**HOT-2** alright your controls LNAV VNAV center autopilot command. we're level - we're thousand feet to go- a thousand to level.

12:10:03.9  
**HOT-1** thousand level off.

12:10:05.6  
**HOT-2** your controls.

12:10:15.6  
**HOT-1** come on baby.

12:10:22.4  
**HOT-2** it's always \* \* \*.

12:10:22.4  
**HOT-1** let's go.

12:10:26.3  
**HOT-2** sooo.

12:10:27.7  
**HOT-1** why is it not descending?

12:10:42.3  
**HOT-1** ohhh VNAV. [Sound of chuckle.]

12:10:43.6  
**HOT-2** okay.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:10:44.3

**HOT-1** there we go.

12:10:46.3

**HOT-2** ohhh 'kayyy.

12:10:50.6

**HOT-2** so we have - (it's listed as) GIRLY BBQUE at two eighty flight level two ten. twenty-one thousand feet LINKS [LINKK] uh two fifty between fifteen and twelve thousand feet. then we have GILLL two forty um at or above ten thousand and eight - and then two ten at six thousand- at uhh- GARRR (I'm sorry)- two ten at seven thousand. so seven thousand will be the bottom altitude.

12:11:30.4

**HOT-1** seven's the bottom?

12:11:31.4

**HOT-2** yes.

12:11:32.1

**HOT-1** okay.

12:11:32.2

**HOT-2** (so) let's confirm that- two six left.

12:11:36.9

**HOT-2** two huh two seven and six thousand.

12:11:39.2

**HOT-1** yeah 'cause we're goin' to GARRR.

12:11:40.3

**HOT-2** yeah. and two ten. okay?

## Intra-Aircraft Communication

## Over-the-Air Communications

12:11:48.8

**HOT-1** well unless they change it we're goin' to two seven- oh we're changin' it in here then-

12:11:51.8

**HOT-2** okay.

12:11:52.5

**HOT-1** and then it'll be six- but they'll- they'll let us know.

12:11:53.8

**HOT-2** then it'll be six [two six]. yes.

12:11:55.9

**HOT-2** sooo we are planning I-L-S runway two-six right- into Houston seventy-one dash six is what I have. eleven point five five and two sixty-seven on the final approach course. we have OWELL and uhhh- OWELL- uhh two thousand feet- and the published gunna be- four- uhhh three ninety-six- we have four hundred set. we have uh a touchdown of ninety-six and an M-S-A of twenty-four hundred in the west side thirty one hundred east side.

12:12:29.2

**HOT-1** okay.

12:12:29.4

**HOT-2** if we go missed- in the event we have to go missed- it's gunna be climbing to six hundred feet- six hundred feet- um- outbound- up to right turn three thousand feet. and and on the three forty four.

12:13:02.7

**HOT-2** three forty-four radial to PEPBI intersection which I saw that there- PEPBI intersection and hold three thousand.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:13:11.2  
**HOT-2** or directed by A-T-C. the transition is eighteen thousand feet. we have the requirements-

12:13:15.7  
**HOT-1** yeah I can't hear ya man.

12:13:17.7  
**HOT-2** huh?

12:13:18.2  
**HOT-1** it's hard to hear ya.

12:13:18.7  
**HOT-2** ohh the transition is-

12:13:19.8  
**HOT-1** ya talkin'- ya talkin' to the front of the plane so.

12:13:21.7  
**HOT-2** ahh okay transition is eighteen thousand feet so we have that is all done. ummm.

12:13:29.3  
**HOT-2** ahh we have A-L-S-F lighting system on this one- no PAPIs on the uhh-

12:13:33.6  
**HOT-2** (we have \* captain) \* \* (we're adding a hundred to (our) mins three ninety-six. we have all the requirements we have more than enough visibility to shoot this approach. um- upon landing- two six right-come back down. foxtrot alpha- foxtrot alpha foxtrox-oh #-

12:13:55.8  
**HOT-2** foxtrot alpha- foxtrot hotel- foxtrot echo probably (delta/down) this way.

## Intra-Aircraft Communication

12:14:00.1

**HOT-2** sooo-

12:14:00.7

**HOT-1** perfect.

12:14:01.4

**HOT-2** yeap.

12:14:02.0

**HOT-2** and umm as far as my uhh technique in landing this plane- umm a thousand feet- I'll take the autopilot off- roughly. at five hundred feet or below ill probably take the auto throttles off when I come in I pretty much keep my power in until around thirty feet or so- and that's when I start leveling off- then coming back slowly on the power so- um you can expect that. um other than that- if we have to go missed it's gunna be go around- flaps twenty- positive climb. go gear up. um at a thousand feet eh you know we go uh speed-select speed.

12:14:36.4

**HOT-1** flight level change.

12:14:36.9

**CTR**

Giant thirty-five ninety-one contact Houston Center one three three point eight.

12:14:37.0

**HOT-2** flight level change set speed.

12:14:41.3

**RDO-1**

one three three decimal eight Giant eh thirty five ninety one.

12:14:45.9

**HOT-2** I'm staying at flaps five.

## Over-the-Air Communications

## Intra-Aircraft Communication

## Over-the-Air Communications

12:14:47.4  
**HOT-1** no questions. good brief.

12:14:48.7  
**HOT-2** okay.

12:14:51.2  
**HOT-1** alright. uhhh so. three four zero center autopilot command your controls.

12:14:55.9  
**HOT-2** my controls (let's) go recall review descent checklist.

12:15:00.9  
**HOT-1** no items.

12:15:01.8  
**HOT-2** okay.

12:15:04.3  
**HOT-1** alright. pressurization.

12:15:07.0  
**HOT-2** uhh it's set.

12:15:08.5  
**HOT-1** it iss set for Houston. I'll do the crossfeed real quick.

12:15:13.0  
**HOT-2** okay.

12:15:17.2  
**HOT-1** cross- alright crossfeed's been checked uhh recall's been checked. autobrakes two is set. landing data V ref of one twenty-six- we'll go one thirty-five uhh on our speed all the way down. and uh minimums are four hundred feet set and approach brief complete descent check complete.

## Intra-Aircraft Communication

12:15:32.0  
**HOT-2** (roger/all done.) checklist complete.

12:15:40.7  
**HOT-1** cool.

12:15:42.7  
**HOT-1** it's all good like butter on a biscuit.

12:15:43.6  
**HOT-2** eh yuppp.

12:16:40.6  
**CAM-1** once they hand us off to approach I'll ask 'em which runway their gunna give us so.

12:16:47.1  
**CAM-1** they should tell us- sometimes they don't.

12:16:49.8  
**HOT-2** yeah.

## Over-the-Air Communications

12:15:32.6  
**RDO-1** Houston. good afternoon. Giant thirty-five ninety-one. three four zero.

12:15:37.2  
**CTR** Giant thirty-five ninety-one Houston Center roger.

12:18:45.4  
**CTR** Giant thirty-five ninety-one descend via LINKK one arrival Beaumont altimeter two niner eight eight.

12:18:53.0  
**RDO-1** alright two niner eight eight descend via the uh LINKK one arrival Giant uhh- any idea which runway we can expect?



## Intra-Aircraft Communication

## Over-the-Air Communications

12:19:02.5  
**HOT-2** (seven) thousand.

12:19:19.8  
**HOT-1** yeah I don't know if they don't understand or- 'cause it does make a difference on your altitude- which runway you get.

12:19:26.2  
**HOT-2** really doesn't matter.

12:19:27.3  
**HOT-1** whatever- we get closer.

12:19:45.8  
**HOT-2** and it's especially worse if you planned it the other way around like having six in- and then they change it to seven and you don't (know/notice) so then you missed it.

12:19:56.8  
**HOT-1** yup.

12:19:56.9  
**HOT-2** so high to low is not so bad- ya know.

12:19:59.3  
**HOT-1** yeah I'd rather be higher--

12:20:00.0  
**HOT-2** I'd rather be higher than lower. yea.

12:18:59.2  
**CTR** uhhh there should be a note I don't issue a transition.

12:19:01.9  
**RDO-1** okie doke.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:20:00.6  
**HOT-1** higher than lower. [In unison with HOT-2.]

12:20:02.0  
**HOT-2** ya know but- but-

12:20:19.8  
**CAM** [Sound of clunk similar to an unknown cockpit item being moved.]

12:20:31.2  
**HOT-2** well I think the difference in altitude is only 'cause- ya gunna be at- the shorter distance-

12:20:37.6  
**HOT-1** it's shorter distance- yeah.

12:20:38.5  
**HOT-2** but they wanna get ya down lower that's all.

12:21:18.9  
**CAM** [Change in CAM signal to noise ratio. The CAM recorded at a lower decibel level for the remainder of the recording.]

12:23:45.4  
**HOT-2** approaching top of descent.

12:23:49.9  
**HOT-1** say again?

12:23:50.9  
**HOT-2** I said ap- I said approaching top of descent.

12:24:52.7  
**HOT-2** okay (\*ing) three four zero.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:25:06.6  
**CAM** [Sound similar to increase in pack airflow noise.]

12:25:57.6  
**HOT-1** he didn't give us a speed did he? alright. [This comment came immediately after ATC issued a speed restriction for another aircraft on frequency which is not transcribed.]

12:26:02.6  
**HOT-1** make sure I didn't miss something.

12:26:04.1  
**HOT-2** (this)- this- two eighty and (uhh so).

12:26:07.8  
**HOT-1** yeah but you put that in there.

12:26:09.1  
**HOT-2** huh?

12:26:09.7  
**HOT-1** you put that in there right?

12:26:11.3  
**HOT-2** what?

12:26:11.7  
**HOT-1** two eighty. he didn't give us two eighty.

12:24:54.2

**RDO-1** and Giant thirty-five ninety-one three four zero's beginning our descent.

12:24:58.1

**CTR** Giant thirty-five ninety-one roger.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:26:13.8

**HOT-2** no two eighty's on the approach I just put the descent so I just put it in as a- it can go ta- you can descend faster and then have it transition to two eighty when it's time but-

12:26:22.0

**HOT-1** so what you wanna go three ten?

12:26:23.4

**HOT-2** uhyeah.

12:26:24.7

**HOT-1** ummm.

12:26:26.9

**HOT-2** when we were doin' the first of the descent it was like-

12:26:29.3

**HOT-1** right.

12:26:29.4

**HOT-2** – overspeeding- so-

12:26:31.4

**HOT-1** good.

12:26:33.2

**HOT-1** three ten?

12:26:34.0

**HOT-2** execute.

12:28:03.7

**HOT-2** BBQUE at two eighty (so).

12:28:06.0

**HOT-1** what's that?

## Intra-Aircraft Communication

## Over-the-Air Communications

12:28:06.5

**HOT-2** BBQUE at two eighty so we gotta- \*.

12:28:07.8

**HOT-1** yup

12:28:11.3

**HOT-1** should be slowin' down.

12:28:12.7

**HOT-2** umm I don't know so may- may have to put it in yourself.

12:28:17.7

**HOT-1** yeah we're (on/armed)- yeah it should.

12:28:18.9

**HOT-2** okay.

12:28:19.4

**HOT-1** should be alright.

12:28:21.5

**HOT-2** I think it should.

12:28:59.2

**HOT-2** \* (\* / eighty).

12:29:01.2

**HOT-2** put (it/the) (three/two) eighty in for the des—

12:29:03.7

**HOT-2** confirm.

12:29:04.7

**HOT-1** execute.

## Intra-Aircraft Communication

12:29:13.4  
**CAM** [Sound similar to soft clack.]

12:29:30.6  
**CAM** [Sound similar to soft clack.]

12:29:47.0  
**HOT-1** it should slow down.

12:29:48.5  
**HOT-2** yeahh.

12:29:49.9  
**HOT-2** I think the thermal is causing these uplift(in/and)–

12:29:52.5  
**HOT-1** yeah we're way below our path anyway so-

12:29:54.1  
**HOT-2** yeahh.

12:29:57.9  
**CAM** [Sound similar to soft clack.]

12:30:07.7  
**CAM-2** (transition altitude.)

12:30:09.4  
**CAM-1** two eight niner eight eight

## Over-the-Air Communications

12:30:13.1  
**CTR** Giant thirty-five ninety-one contact Houston Approach one one niner point six two.

12:30:17.9  
**RDO-1** nineteen sixty-two good weekend.

## Intra-Aircraft Communication

12:30:23.6

**CAM** [Sound similar to soft clack.]

12:30:52.9

**CAM** [Sound similar to two mic clicks.]

12:30:53.5

**HOT-1** ninety-one.

12:30:54.5

**HOT-2** set.

12:30:55.5

**HOT-1** ninety-one.

12:30:56.4

**HOT-2** okay.

12:30:58.4

**HOT-1** two six left and do do do do the departure.

12:31:04.7

**HOT-1** LINKK two six left.

## Over-the-Air Communications

12:30:31.3

**RDO-1** Houston good afternoon Giant ah thirty-five ninety-one seventeen eight descending via the LINKK and we have sierra.

12:30:37.7

**APP** Giant thirty-five ninety-one- heavy- Houston- good afternoon- it looks like tango is current. altimeter is two niner niner one and they might be updating that as well. you can fly the runway two six left transition.

12:30:49.9

**RDO-1** two six left transition thank you much and ninety-one on the meter.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:31:10.2  
**HOT-1** ahhh...

12:31:15.8  
**HOT-1** GARRR?

12:31:16.9  
**HOT-2** yeah.

12:31:18.3  
**HOT-2** two six left.

12:31:20.8  
**HOT-2** so then the-

12:31:23.3  
**HOT-2** GARRR.

12:31:24.6  
**HOT-2** GARRR at seven thousand.

12:31:27.7  
**HOT-1** I mean you should still be GARRR- right?

12:31:28.9  
**HOT-2** yeah. still GARRR.

12:31:29.7  
**HOT-1** yeah.

12:31:30.5  
**HOT-2** yeah,

12:31:34.7  
**HOT-1** VANNN- LINKK GILLL GARRR VANNN MKAYE-  
that's good- okay.



## Intra-Aircraft Communication

## Over-the-Air Communications

12:31:37.9  
**HOT-2** I agree- same.

12:31:39.0  
**HOT-1** alright now- uhuh approach.

12:31:50.0  
**HOT-1** (chillin')

12:31:58.0  
**HOT-1** alright- altimeter's two nine nine one.

12:32:02.6  
**HOT-1** set- um- approach check's complete.

12:32:02.7  
**HOT-2** two nine-

12:32:05.0  
**HOT-2** checklist complete.

12:32:12.5  
**HOT-1** alright one oh nine seven.

12:32:15.1  
**HOT-1** two sixty-seven.

12:32:19.1  
**HOT-1** aaand...

12:32:30.9  
**HOT-1** evaluation looks fine- everything looks good so-

12:32:37.8  
**HOT-2** LINKK between fifteen and twelve.

12:32:42.6  
**HOT-2** I think it's doin' a bad job today (but)-

## Intra-Aircraft Communication

## Over-the-Air Communications

12:32:44.0  
**HOT-1** what's that I can't hear ya.

12:32:44.9  
**HOT-2** I sayyy LLL-LINKK between fifteen and twelve I think is doin' a bad job.

12:32:49.5  
**HOT-2** [sound of stutter.]

12:32:53.2  
**HOT-2** on this \*-

12:32:53.6  
**HOT-1** that looks to me like it's on glide.

12:32:55.6  
**HOT-2** yeahhh it's on glide buttt- I I think it-

12:32:59.0  
**HOT-1** it got confused back there cause we passed- two thousand feet above what it was planning on doing.

12:33:04.8  
**HOT-2** yeah.

12:33:05.5  
**HOT-1** I mean two- two thousand feet below.

12:33:06.2  
**HOT-2** oh okay- it's coming in now. it's dropping the speed- should have dropped the speed a little sooner than that I think.

12:33:14.3  
**HOT-2** it's within ten knots so it's good.

## Intra-Aircraft Communication

12:33:19.5  
**HOT-2** should be two fifth- two fifty.

12:33:25.9  
**HOT-1** yeah it's it's doin' it.

12:33:27.2  
**HOT-2** yeah.

12:33:27.6  
**HOT-1** we're just now LINKKs two fifty two so-

12:33:29.4  
**HOT-2** yeah.

12:33:32.8  
**HOT-2** eh the next one--

12:33:34.4  
**HOT-1** I'm like you though I don't trust this thing.

12:33:36.3  
**HOT-2** ohhh I (know)

12:33:37.3  
**HOT-1** too- too many years in the Embraer I don't trust all this automatic flight-

12:33:39.7  
**HOT-2** ah yeah.

12:33:41.9  
**HOT-1** we're in a tuna can [Tuna Can - company terminology for a 767-200.] the other day- it started pickin' up the glideslope- it started doin' thiss-

12:33:45.6  
**HOT-2** ohh yeah yeah.

## Over-the-Air Communications

## Intra-Aircraft Communication

12:33:46.1  
**HOT-1** and then- this thing was doin' way worse.

12:33:48.1  
**HOT-2** where- where were you goin'?

12:33:50.9  
**HOT-1** either into Cincinnati or Atlanta- I can't- I think we're goin' into Atlanta- at night.

12:33:53.8  
**HOT-2** Atlanta.

12:33:56.2  
**HOT-1** so finally at about four thousand feet I just cut- clicked it off and flew it.

12:34:01.6  
**HOT-2** GILL at two forty.

12:34:02.9  
**HOT-1** but it was very confused.

12:34:04.6  
**HOT-2** yeah.

## Over-the-Air Communications

12:34:08.8  
**APP** Giant thirty-five ninety-one heavy there is a little bit of light-well now it's showin' a little bit of heavy- light to heavy precipitation just west off it looks like VANNN and it is moving eastbound so once you get in closer if we need to go vectors around it and we'll we'll be able to accommodate that.

12:34:25.2  
**RDO-1** alright thanks for the heads up uh Giant thirty-five ninety-one.

12:34:29.6  
**RDO-?** [Sounds similar to two mic clicks.]

## Intra-Aircraft Communication

12:35:25.5  
**HOT-1** love you.

12:36:03.7  
**HOT-2** okay.

12:36:07.1  
**HOT-2** okay – I just had a ( \* / fff) [End of statement cut off by a quick exhale, or the sound of possible phonetic "F".]

12:36:09.4  
**HOT-1** [Sound of quick laugh.]

## Over-the-Air Communications

12:35:16.7  
**APP** Giant thirty-five ninety-one heavy contact approach on one two zero point six five.

12:35:21.3  
**RDO-1** twenty sixty-five have a good afternoon.

12:35:23.7  
**APP** you too.

12:35:39.6  
**RDO-1** hello approach Giant umm thirty-five ninety-one eleven four descending via the LINKK and we have uh tango.

12:35:47.4  
**APP** 'kay Giant thirty-five ninety-one Houston Approach it will be vectors runway two six left. how (do) you wanna get around this stuff? you wanna go- uh- to the east of it and go- join up on the north side or what do you wantin' to do?

12:35:59.3  
**RDO-1** one second I'll get right back with you.

## Intra-Aircraft Communication

12:36:09.9  
**HOT-2** your controls.

12:36:10.8  
**HOT-1** great. my controls.

12:36:11.8  
**HOT-2** ahh \*.

12:36:12.5  
**HOT-1** ahhh-

12:36:13.4  
**HOT-2** LNAV VNAV center autopilot.

12:36:14.2  
**HOT-1** want to go to- east side?

12:36:17.2  
**HOT-2** ehuh?

12:36:19.2  
**HOT-2** LNAV VNAV center autopilot.

12:36:19.3  
**HOT-1** alright we can go around it- alright my controls.

12:36:20.6  
**HOT-2** so- okay-

## Over-the-Air Communications

12:36:21.4  
**RDO-2** Giant uh thirty-five uh six- sorry thirty-five and ninety-one we will go on the west side.

## Intra-Aircraft Communication

12:36:40.4  
**HOT-1** we got lots of fuel so-

12:36:41.7  
**HOT-2** yeah.

12:36:55.2  
**CAM-1** three thousand set.

12:37:00.4  
**HOT-2** okay so one second. okay so we gunna hold off on that checklist. right?

## Over-the-Air Communications

12:36:28.9  
**APP** alright the only problem we have with that right now there's a bunch of departures departin' out right at ya so we're gunna do-

12:36:33.4  
**RDO-2** okay- depart- okay-

12:36:34.0  
**APP** all the way down.

12:36:34.9  
**RDO-2** okay then we'll go on the east side then that's fine just go ahead and direct us.

12:36:45.4  
**APP** Giant thirty-five ninety-one descend and maintain three thousand- hustle all the way down I'm gunna get ya west of this weather and northbound for a baseleg.

12:36:51.6  
**RDO-2** down to three thousand and all the way down Giant thirty-five uh ninety-one so we gunna delete the arrival just gunna go straight down.

## Intra-Aircraft Communication

12:37:07.2  
**HOT-2** E-fy. [EFI button.]

12:37:08.5  
**HOT-?** E-fy.

12:37:08.9  
**HOT-2** okay I got it back.

12:37:09.5  
**HOT-1** now it's back. [Sound of quick laugh.]

12:37:10.1  
**CAM** [Sound of quick two beeps. Frequency not discernible.]

12:37:11.5  
**HOT-2** I press the E-fy button- it fixes everything.

12:37:13.7  
**HOT-1** oh ya ya.

12:37:22.6  
**HOT-2** okay.

12:37:23.5  
**HOT-2** two seven zero.

12:37:23.9  
**HOT-1** alright your controls.

## Over-the-Air Communications

12:37:16.2  
**APP** and Giant thirty-five ninety-one turn left heading two seven zero.

12:37:19.5  
**RDO-1** left turn two seven zero Giant ninety-five er um thirty five ninety-one.



## Intra-Aircraft Communication

## Over-the-Air Communications

12:37:24.8  
**HOT-2** my controls.

12:37:27.4  
**HOT-1** alright so I will pull it out from- umm where see where they pull us in.

12:37:30.4  
**HOT-2** okay.

12:37:31.0  
**HOT-1** probably from JEPNI.

12:37:32.3  
**HOT-2** okay.

12:37:46.3  
**HOT-1** you want it out from JEPNI or GRIEG?

12:37:48.0  
**HOT-2** \* \*.

12:37:51.9  
**CAM-2** umm let's make it GRIEG.

12:37:54.7  
**HOT-1** GRIEG

12:37:58.2  
**HOT-1** GRIEG and two sixty-seven.

12:38:00.6  
**HOT-2** okay.

12:38:00.9  
**HOT-1** GRIEG two sixty-seven.

12:38:02.2  
**HOT-2** 'kay flaps one.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:38:04.8

**CAM** [Sound of mechanical click.]

12:38:05.1

**HOT-2** thank you.

12:38:06.1

**HOT-1** confirm. confirm.

12:38:07.3

**HOT-2** execute.

12:38:08.7

**HOT-1** LNAVs available.

12:38:09.9

**HOT-2** LNAV is...

12:38:14.3

**HOT-1** not on intercept heading.

12:38:15.0

**HOT-2** no (your on/it's on) a heading right?

12:38:16.7

**HOT-1** oh we're supposed to be on heading- yeah.

12:38:17.9

**HOT-2** yeah.

12:38:31.1

**CAM** [Sound of click.]<sup>2</sup>

12:38:35.1

**APP**

Giant thirty-five ninety-one in about another eighteen miles or so we'll cut you due north(bound) for a base leg.

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<sup>2</sup> The group was reconvened on November 14, 2019. This sound was not initially heard during the first transcription sitting of the group on March 5, 2019. After the generation of the Sound Spectrum Study, which can be found in the public docket for this accident, all members of the group were able to detect this sound when directed to the area of interest on the recording.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:38:40.3

**CAM** [Sound of four beeps within a duration of .75 seconds at a frequency of 1200 Hz.]<sup>3</sup>

12:38:41.4

**RDO-1** sounds good uh Giant thirty-five ninety-one.

12:38:43.6

**APP** it is severe clear on the other side of this stuff so you'll have no problem gettin' the airport \*(either).

12:38:43.6

**CAM-2** (oh)

12:38:44.0

**CAM** [Sound similar to a mechanical click.]

12:38:45.0

**CAM-2** woah. [Spoken in elevated voice.]

12:38:45.9

**CAM-2** (where's) my speed my speed [Spoken in elevated voice.]

12:38:46.9

**CAM** [Sound similar to louder mechanical click.]

12:38:47.3

**RDO-1** okay.

12:38:47.9

**CAM** [Sound similar to multiple random thumping noises.]

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<sup>3</sup> Refer to Sound Spectrum Study for a detailed examination of tones detected on the recording.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:38:48.0  
**HOT-2** we're stalling. [Spoken in elevated voice.]

12:38:50.5  
**HOT-2** stall. [Exclaimed.]

12:38:51.9  
**HOT-?** #.

12:38:52.3  
**HOT-2** oh Lord have mercy myself. [Spoken in elevated voice.]

12:38:53.3  
**CAM** [Sound similar to multiple random thumping noises.]

12:38:53.9  
**HOT-2** Lord have mercy. [Exclaimed.]

12:38:55.1  
**HOT-2** @Capt. [Spoken in elevated voice.]

12:38:55.7  
**HOT-1** what's goin' on?

12:38:56.0  
**HOT-2** (Lord)– [Spoken in elevated voice.]

12:38:56.3  
**CAM** [Sound of 1000 Hz series of beeps with approximately .25 second spacing begin. Group could not determine if audible sound lasted until end of recording.]<sup>4</sup>

12:38:56.4  
**HOT-2** @Capt. [Spoken in elevated voice.]

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<sup>4</sup> Refer to Sound Spectrum Study for a detailed examination of tones detected on the recording.

## Intra-Aircraft Communication

## Over-the-Air Communications

12:38:56.6  
**CAM-3** what's goin' on? [Spoken in an elevated voice.]

12:38:56.8  
**HOT-?** [Sound of rapid breathing.]

12:38:57.4  
**HOT-2** @Capt-

12:38:58.1  
**CAM** [Sound of quick series of four beeps at 1200 Hz.] <sup>5</sup>

12:38:58.9  
**CAM** [Sound of longer duration pulse tone about 1000 Hz, similar to Siren. Group could not determine if audible sounds lasted until end of recording.] <sup>6</sup>

12:38:59.4  
**CAM-3** \* pull up. [Shouted.]

12:39:00.9  
**HOT-2** [Unintelligible shout.]

12:39:02.0  
**HOT-?** (oh God). [Shouted.]

12:39:02.0  
**HOT-2** Lord \* \* you have my soul. [Shouted.]

1239:03.9 **END OF TRANSCRIPT**  
**END OF RECORDING**

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<sup>5</sup> Refer to Sound Spectrum Study for a detailed examination of tones detected on the recording.

<sup>6</sup> Refer to Sound Spectrum Study for a detailed examination of tones detected on the recording.

## Attachment I

### CVR Quality Rating Scale

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

<b>Excellent Quality</b>	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.
<b>Good Quality</b>	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.
<b>Fair Quality</b>	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.
<b>Poor Quality</b>	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.
<b>Unusable</b>	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.