

**Docket No. SA-532**  
**Exhibit No. 12**

**NATIONAL TRANSPORTATION SAFETY BOARD**

**WASHINGTON, D.C.**

GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

COCKPIT VOICE RECORDER  
DCA09MA026

(47 Pages)

**NATIONAL TRANSPORTATION SAFETY BOARD  
Vehicle Recorder Division  
Washington, D.C. 20594**



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

**Cockpit Voice Recorder**

**DCA09MA026**

**by**

**Douglass P. Brazy  
Mechanical Engineer (CVR)**

**Warning**

The reader of this report is cautioned that the transcription of a CVR tape is not a precise science but is the best product possible from an NTSB group investigative effort. The transcript, or parts thereof, if taken out of context, could be misleading. The attached CVR 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  
Washington, D.C. 20594

April 22, 2009

## **Cockpit Voice Recorder - 12**

**Group Chairman's Factual Report  
by Douglass P. Brazy**

**NTSB Accident Number  
DCA09MA026**

### **A. ACCIDENT**

Location:	Weehawken, NJ
Date:	January 15, 2009
Time:	15:30 Eastern Standard Time
Aircraft:	Airbus Industrie A320-214, reg. N106US
Operator:	US Airways, Flight 1549

### **B. GROUP**

Chairman:	Douglass P. Brazy Mechanical Engineer (CVR) National Transportation Safety Board
Member:	Capt. Rudy Canto Director, Flight Operations Technical Airbus
Member:	Jeff Diercksmeier USAPA Accident Investigation Team US Airline Pilots Association
Member:	Capt. Chuck Pastene Check Airman Flight Training US Airways

Member: Floyd A. (Tony) James  
Air Safety Investigator, Office of Accident Investigation  
Federal Aviation Administration

Member: Andy Mihalchik  
Program Mgr. Technical Pilot, Flight Operations Support  
GE Transportation – Aircraft Engines

Member: Nicholas Marcou  
Deputy head, Investigations Department  
Bureau d'Enquetes et d'Analyses (BEA)

### **C. SUMMARY**

On January 15, 2009, about 1527 Eastern Standard Time, US Airways flight 1549, an Airbus A320-214, registration N106US, suffered bird ingestion into both engines, lost engine thrust, and landed in the Hudson River following take off from New York City's La Guardia Airport (LGA). The scheduled, domestic passenger flight, operated under the provisions of Title 14 CFR Part 121, was en route to Charlotte Douglas International Airport (CLT) in Charlotte, North Carolina. The 150 passengers and 5 crewmembers evacuated the aircraft successfully. one flight attendant and four passengers were seriously injured.

The Cockpit Voice Recorder (CVR) contained approximately thirty minutes and twelve seconds of audio. The recording began at about 15:00:32 EST as the crew was preparing for the flight, and ended at about 15:30:44 EST. A transcript of the entire recording can be found in Attachment II.

## **D. DETAILS OF INVESTIGATION**

### **Recorder Examination, Disassembly, and Preparation**

The NTSB Vehicle Recorder Division received an Allied Signal/Honeywell Solid State Cockpit Voice Recorder, model SSCVR part number 980-6020-001, serial number 2878. The CVR was shipped immersed in fresh water.



**Figure 1 - CVR as Received**



Figure 2- Data plate

The CVR had no apparent external damage, other than being wet. The underwater locator beacon (ULB Dukane Model DK100, s/n DM1661, battery expiration date October, 2009) did not function when tested. After shorting the center electrode to the case, no sound was detected using a Dukane Ultrasonic Test Set Model 42A12. The beacon was also tested using a Dukane Test Set Model TS100, which indicated “Open Probe/Batt.”

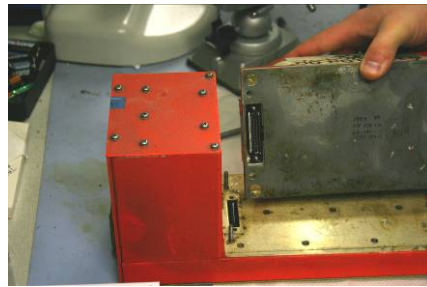


Figure 3 ULB and Test Set

The Crash Survivable Memory Unit (CSMU) was removed from the CVR chassis, and disassembled (Figures 4-6). The memory card inside the CSMU was removed and inspected for any damage (Figures 7-8). The red colored RTV<sup>1</sup> sealant surrounding the memory card was removed. The memory board was cleaned and dried. A visual (microscope) inspection of the memory card and the “flex cable” revealed no damage to the memory card or its components, nor to the flex cable or it’s connector. The resistance between the pins for ground and 5 VDC (at the memory board end of the flex cable) measured 2.8K ohms.



**Figure 4**



**Figure 5**



**Figure 6**



**Figure 7**



**Figure 8**

The memory board was connected to a surrogate Honeywell SSCVR chassis, and the audio was downloaded normally.

<sup>1</sup> Room Temperature Vulcanization- RTV is a commonly used sealant/adhesive.

## **CVR Channels**

The recording consisted of four separate channels of audio information. One channel contained the cockpit area microphone (CAM) audio information. The CAM is typically mounted in the overhead panel between the two pilots. It is designed to capture sounds and conversations in the cockpit area whenever the CVR system is powered.

Two of the channels contained audio information from the Captain's and First Officer's audio panels, respectively. The audio panels are essentially an interface between the pilot's headsets and the airplane's communication equipment. Radio transmissions (both transmitted and received), are captured on these channels. Additionally, "hot" microphone signals (when used) are captured through the audio panels on these channels. Hot microphones are the same microphones in the pilot's headsets that can be used for making radio transmissions. The "hot" means that they are always on and being recorded by the CVR, whether or not a radio transmission is being made. On this recording, it appears that hot microphones were used by both pilots. The fourth channel contained audio information from the aircraft's Public Address (PA) system.

## **Recording Quality<sup>2</sup>**

The recording quality was rated as Good to Excellent. At times, the pilot's voices were difficult to hear on their respective CVR channels, due to simultaneous VHF radio communications being monitored and recorded on the same CVR channel as each pilot's HOT microphone.

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<sup>2</sup> See Attachment I for a CVR Quality Ranking Scale.



## Group Activities

The CVR group convened January 22, 2009. The group reviewed the recording and prepared a transcript of the entire recording. Each channel was reviewed individually as well as in combination with the other channels. There was little difficulty identifying the sources of each comment, and the group agreed on the content of each comment and characterization of each sound in the attached transcript.

## Flight Crew Review of Recording and Transcript

On May 8, 2009 the Captain and First Officer, along with the USAPA CVR Groupmember, reviewed the recording and the attached transcript for accuracy. The crew made the following clarification:

In reference to the transcription at time 15:30:38, the transcribed phrase

“\* \* switch?”

The crew indicated that the First Officer was referring to a cabin emergency notification switch, which provides a signal to the cabin crew indicating an emergency.

The crew also made the following editorial comments:

At 15:19:03, the transcription of “check.” should be: “**checked.**”

At 15:20:42, the transcription of “on the hold.” should be: “**on to hold.**”

At 15:24:56.7, the transcription of “Cactus fifteen forty nine clear for takeoff.” should be: “*Cactus fifteen forty nine **cleared** for takeoff.*”

At 16:26:37, the transcription of “uh what a view of the Hudson today.” should be: “**and** *what a view of the Hudson today.*”

At 15:27:32.9, the transcription of “mayday mayday mayday. uh this is uh Cactus fifteen thirty nine hit birds, we’ve lost thrust (in/on) both engines we’re turning back towards LaGuardia.” should be: *“mayday mayday mayday. uh this is uh Cactus fifteen thirty nine hit birds, we’ve lost thrust **in** both engines we’re turning back towards LaGuardia”*.

At 15:28:19, the transcription of “(it’s/is) online.” should be: *“**it’s** online.”*

At 15:30:41.1 the transcription of “(fifty or thirty)” should be: *“**fifty**”*<sup>3</sup>

## Timing and Correlation

The times reported in the attached CVR transcript are Eastern Standard Time (EST)<sup>4</sup>, and represent the time that each comment or sound begins<sup>5</sup>. Time is specified to the nearest whole second, unless otherwise noted.

The CVR and FDR data were synchronized to one another by comparing the FDR “Key VHF” parameter with radio transmissions as heard on the CVR recording. By comparing the CVR elapsed time (time since the beginning of the CVR recording) for radio transmissions to the corresponding FDR Subframe Reference Number (SRN) for “Key VHF”, a relationship between the CVR elapsed time and the FDR SRN time can be developed.

Generally, a single keying event can be used to synchronize the CVR to the FDR to within +/- 1 second, due to the FDR’s 1 Hz sample rate for “Key VHF”. Using multiple keying events may increase the accuracy of the synchronization. In this case, the start and end times for six radio transmissions (12 keying events) were evaluated. Based on

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<sup>3</sup> It was difficult for the CVR group to differentiate this callout as being either “fifty” or “thirty”. According to the Flight Data Recorder, the last recorded radio altitude (Radio Altitude 2) prior to this callout, was 33 feet at time 15:30:40.26. The next recorded radio altitude (Radio Altitude 1) was 20 feet, at time 15:30:41.26.

<sup>4</sup> Based on the clock used by the FAA’s Airport Surveillance Radar at Newark.

<sup>5</sup> Except for outgoing radio transmissions. The time associated with these typically reflects the “key up” of the microphone or “click” that can often be heard before (and after) a radio transmission is made.

these 12 events, the resulting equation provided below is accurate within +/- 0.1 (one tenth) of a second.

$$\text{CVR Elapsed Time} + 63732.8 = \text{FDR SRN} \quad [\text{Eqn. 1}]$$

The time correlation from FDR SRN to Eastern Standard Time was provided by the Aircraft Performance Specialist:

$$\text{Eastern Standard Time} = \text{FDR SRN} - 9701.119 \quad [\text{Eqn. 2}]$$

(where Eastern Standard Time is expressed as seconds after midnight)

For more information, see the Aircraft Performance Study and the Flight Data Recorder Group Chairman's Factual reports for this investigation.

Douglass P. Brazy

Mechanical Engineer (CVR)

## **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.   |

## Attachment II – Transcript

Transcript of an Allied Signal/Honeywell model SSCVR cockpit voice recorder (CVR), s/n 2878, installed on an Airbus Industrie A320-214, registration N106US. The airplane was operated by US Airways as Flight 1549, when it ditched into the Hudson River, NY, on January 15, 2009.

### LEGEND

<b>ATIS</b>	Radio transmission from the Automated Terminal Information System
<b>RDO</b>	Radio transmission from accident aircraft, US Airways 1549
<b>CAM</b>	Cockpit area microphone voice or sound source
<b>PA</b>	Voice or sound heard on the public address system channel
<b>HOT</b>	Hot microphone voice or sound source <sup>1</sup>
<b>INTR</b>	Interphone communication to or from ground crew
	For RDO, CAM, PA, HOT and INTR comments:
-1	Voice identified as the Captain
-2	Voice identified as the First Officer
-3	Voice identified as cabin crewmember
-4	Voice identified as groundcrew
-?	Voice unidentified
<b>FWC</b>	Automated callout or sound from the Flight Warning Computer
<b>TCAS</b>	Automated callout or sound from the Traffic Collision Avoidance System
<b>PWS</b>	Automated callout or sound from the Predictive Windshear System
<b>GPWS</b>	Automated callout or sound from the Ground Proximity Warning System
<b>EGPWS</b>	Automated callout or sound from the Enhanced Ground Proximity Warning system
<b>RMP</b>	Radio transmission from ramp control at LaGuardia

<sup>1</sup> This recording contained audio from Hot microphones used by the flightcrew. The voices or sounds on these channels were also, at times, heard by the CVR group on the CAM channel and vice versa. In these cases, comments are generally annotated as coming from the source (either HOT or CAM) from which the comment was easiest to hear and discern.

<b>GND</b>	Radio transmission from ground control at LaGuardia
<b>CLC</b>	Radio transmission from clearance delivery at LaGuardia
<b>TWR</b>	Radio transmission from the Air Traffic Control Tower at LaGuardia
<b>DEP</b>	Radio transmission from LaGuardia departure control
<b>4718</b>	Radio transmission from another airplane (Eagle flight 4718)
<b>CH[1234]</b>	CVR Channel identifier 1=Captain 2= First Officer 3= PA 4= Cockpit Area Microphone
<b>*</b>	Unintelligible word
<b>@</b>	Non-Pertinent word
<b>&amp;</b>	Third party personal name (see note 5 below)
<b>#</b>	Expletive
<b>-, - - -</b>	Break in continuity or interruption in comment
<b>( )</b>	Questionable insertion
<b>[ ]</b>	Editorial insertion
<b>...</b>	Pause

Note 1: Times are expressed in Eastern Standard Time (EST), based on the clock used to timestamp the recorded radar data from the Newark ASR-9.

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.

Note 5: Personal names of 3<sup>rd</sup> parties not involved in the conversation are generally not transcribed.

### INTRA-COCKPIT COMMUNICATION

TIME and  
SOURCE

CONTENT

15:00:32 [Start of Recording]

15:00:32 [Start of Transcript]

15:02:19

**CAM-1** yes, thank you.

15:02:21

**CAM-1** so we should have two open seats (cause) the jumpseaters are gonna sit in the back.

15:02:25

**CAM-?** thank you.

15:02:26

**CAM-1** all right anytime.

### AIR-GROUND COMMUNICATION

TIME and  
SOURCE

CONTENT

15:00:32

**ATIS**

expressway visual runway three one approach in use. depart runway four, bravo four hold line in use. LaGuardia class bravo services available on frequency one two six point zero five. all pilots read back all hold short instructions and assigned altitudes. advise on initial contact you have information papa... LaGuardia airport information papa. one nine five one zulu. winds three four zero at one three, visibility one zero. ceiling three thousand five hundred broken. temperature minus six dewpoint minus one four. altimeter three zero two three. remarks A O two sea level pressure two three four. [ATIS repeats on ch2 until time 15:02:44.]

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:02:27  
**CAM-?** cool you bet.

15:02:30  
**CAM-?** ok.

15:02:35  
**HOT-2** the seats uh-

15:02:37  
**HOT-1** there you go.

15:02:45  
**CAM-?** do you mind if I keep my bag(s) up here?

15:02:47  
**CAM-1** no not at all.

15:02:48  
**CAM-?** thank you so much.

15:02:51  
**PA-1** a quick hello from the cockpit crew, this is fifteen  
forty nine bound for Charlotte. its a nice day for  
flying, be at thirty eight thousand feet mostly  
smooth about an hour and forty five minutes  
takeoff to landing, welcome aboard.

15:03:12  
**CAM-2** quite a difference in the flight time pretty in-  
credible, huh? fifty six minutes.

15:03:15  
**HOT-1** well we had a hundred and sixty knots of wind  
all the way up here. its a average headwind on  
this lists minus one ten.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**



**INTRA-COCKPIT COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
15:03:34 <b>HOT-1</b>	all right.
15:03:34 <b>PA-3</b>	if everyone would please take their seats.
15:03:39 <b>HOT-1</b>	* * .
15:03:57 <b>HOT-1</b>	ok... clear to push?
15:04:00 <b>HOT-2</b>	yeah.

**AIR-GROUND COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
15:03:40 <b>INTR-4</b>	hello cockpit ground's ready.
15:03:42 <b>INTR-1</b>	we'll give them a call.
15:03:42 <b>RDO-2</b>	(ground) fifteen forty nine like to push at uh gate twenty one.
15:03:47 <b>RMP</b>	Cactus (fifteen) forty nine....gate twenty one, spot twenty eight, ground * for your taxi.
15:03:55 <b>RDO-2</b>	ok uh. that's uh * what's wrong here. [may be multiple mic keys]
15:04:01 <b>INTR-4</b>	yes sir, you say you are clear to push?

### INTRA-COCKPIT COMMUNICATION

#### TIME and SOURCE

#### CONTENT

15:04:09  
**CAM-?** seated and stowed.  
15:04:11  
**HOT-1** thank you, all set.  
15:04:13  
**CAM** [sound similar to cockpit door closing]  
15:04:20  
**HOT-1** ok. that # door again.  
15:04:23  
**HOT-2** what's wrong?  
15:04:24  
**HOT-1** this-  
15:04:25  
**HOT-2** oh.  
15:04:25  
**CAM-1** (you) have to slam it pretty hard.

### AIR-GROUND COMMUNICATION

#### TIME and SOURCE

#### CONTENT

15:04:02  
**INTR-1** clear to push, spot twenty eight, brakes released.  
15:04:03  
**RDO-2** and that's uh spot twenty eight for Cactus uh nine- er fifteen forty nine, excuse me and over to ground twenty one seven.  
15:04:05  
**INTR-4** twenty eight, brakes released.  
15:04:09  
**RMP** affirmative.

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:04:29  
**CAM** [sound similar to cockpit door closing]

15:04:52  
**HOT-1** got the newest Charlotte.

15:05:04  
**PA-3** ladies and gentlemen all electronic devices have to be turned off at this time, anything with an on off button must be in the off position.

15:05:07  
**HOT-1** yeah too bad they aren't still using three one... for takeoff.

15:05:10  
**HOT-2** yeah.

15:05:11  
**HOT-1** I was hoping we could land on four and takeoff on three one, but it didn't quite work out that way.

15:05:22  
**HOT-2** well we can make an attempt to beat Northwest here anyways.

15:05:25  
**HOT-1** what's that?

15:05:26  
**HOT-2** so we can make an attempt to beat Northwest but he's already starting isn't he.

15:05:29  
**HOT-1** yeah. and we have to pull up before we can even start on this.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

### INTRA-COCKPIT COMMUNICATION

#### TIME and SOURCE

#### CONTENT

15:05:32

**HOT-2**

they start their number two engine first.

15:05:34

**PA-3**

good afternoon ladies and gentlemen welcome on board US Airways flight fifteen forty nine, with service to Charlotte. please take a moment to listen to this important safety information, in preparation for departure be certain that your seat back is straight up and your tray table is stowed. all carryon items must be secured completely underneath the seat in front of you, or stowed in an overhead compartment. please use caution when placing items in or removing them from the overhead bins. please ensure that all electronic devices are turned off, some devices such as cell phones, TVs, radios and any device transmitting a signal may not be used at anytime during flight. however you may be certain \* \* use other electronic devices when advised by your crew. please direct your attention to the flight attendants in the cabin, for everyone's safety regulations require your compliance with all lighted signs, placards, and crew-member instructions. whenever the seatbelt sign is illuminated please make sure that you seatbelt is fastened low and tight around your hips. to fasten insert the metal fitting into the buckle and tighten by pulling loose end away from you. to release lift the metal flap. during the flight the

### AIR-GROUND COMMUNICATION

#### TIME and SOURCE

#### CONTENT

## INTRA-COCKPIT COMMUNICATION

### TIME and SOURCE

### CONTENT

Captain may turn off the fasten seatbelt sign, however for safety we recommend that you keep your seatbelt fastened at all times. please review the safety instruction card in the seat-back pocket in front of you, it explains the safety features of this aircraft as well as the location and operation of the exit and flotation devices. your seat cushion serves as a flotation device, to remove your cushion, (pla)- take it with you to the nearest usable exit, when exiting the-[sound similar to power interruption 15:07:01] place both arms through the straps and hug it to your chest. flight attendants are pointing out there are a total of eight exits on this aircraft, two door exits in front of the aircraft, four window exits over the wings, and two door exits in the rear of the aircraft. once again, two door exits at the front of the aircraft, four window exits over the wings, and two door exits in the rear of the aircraft. each door is equipped with an evacuation slide if directed to exit... the aircraft jump onto the slide and move away from the aircraft. take a moment to locate the exit nearest you keeping in mind that the closest usable exit may be located behind you. if there is a loss of electrical power low level lighting will guide you to the exits indicated by illuminated exit signs. if needed oxygen masks will be released from the overhead, to start the flow of oxygen, reach up and pull the mask toward you, fully extending the

## AIR-GROUND COMMUNICATION

### TIME and SOURCE

### CONTENT

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

plastic tubing. place the mask over your nose and mouth, place the elastic band over your head. to tighten pull the tab on each side of the mask. the plastic bag does not inflate when oxygen is flowing. secure your mask before assisting others. as a reminder smoking is prohibited in all areas of the aircraft including the lavatories. federal regulations prohibit tampering with disabling or destroying a lavatory smoke detector. on behalf of your entire crew, its our pleasure to have you on board.... thank you for flying US Airways.

15:05:34

**HOT-1**

that's interesting.

15:05:41

**HOT-2**

did you always start number one or is that a uh America West thing?

15:05:44

**HOT-1**

no that's no its been that way ever since I've been on it, for six and a half years anyway.

15:06:13

**HOT-1**

he told me to wait.

15:06:15

**HOT-2**

he did?

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:06:09

**INTR-1**

confirm we're clear to start?

15:06:10

**INTR-4**

uh, one second.

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:06:16  
**HOT-1** yeah, this guy was giving the signal but I asked  
and he said no wait just a second.

15:06:17  
**HOT-2** yeah.... OK.

15:06:26  
**HOT-1** start engines.

15:06:44  
**HOT-2** wonder how the Northwest and Delta pilots are  
gettin on.

15:06:47  
**HOT-1** I wonder about that too, I have no idea.

15:07:01  
**CAM** [sound similar to power interruption]

15:07:01  
**CAM** [sound similar to increase in engine  
noise/frequency]

15:07:04  
**HOT-1** yeah hopefully better than we and West do.

15:07:11  
**HOT-2** be hard to do worse.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:06:25  
**INTR-4** kay. clear to start.

15:06:26  
**INTR-1** clear to start.

### INTRA-COCKPIT COMMUNICATION

<u>TIME and SOURCE</u>	<u>CONTENT</u>
15:07:13 <b>HOT-1</b>	yeah... well I hadn't heard much about it lately but I can't imagine it'd be any better.
15:07:20 <b>HOT-2</b>	I think that's just cause we're separate..... and there's nothing going on right now.
15:07:25 <b>HOT-1</b>	right.
15:08:15 <b>HOT-1</b>	okay wands up, wave off.
15:08:16 <b>HOT-2</b>	wands up.
15:08:17 <b>HOT-1</b>	flaps two, taxi.

### AIR-GROUND COMMUNICATION

<u>TIME and SOURCE</u>	<u>CONTENT</u>
15:07:28 <b>INTR-4</b>	kay set the parking brake.
15:07:32 <b>INTR-1</b>	parking brake set. disconnect.
15:07:34 <b>INTR-4</b>	brake set, disconnect.
15:08:36 <b>RDO-2</b>	ground Cactus uh fifteen forty nine spot twenty eight, taxi please.
15:08:40 <b>GND</b>	Cactus fifteen forty nine LaGuardia ground runway four uh, turn left alpha, short of golf, and uh did you call clearance?



**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:08:48

**HOT-1**

\*.

15:08:52

**HOT-1**

uh thirty five two. so its alpha short of golf is that right?

15:08:56

**HOT-2**

yup.

15:08:57

**HOT-1**

yeah I'll start taxiing while you do that.

15:08:58

**HOT-2**

ok.

15:09:44

**HOT-1**

you put it here.

15:09:46

**HOT-2**

what was that?... am I on the wrong one?

15:09:53

**HOT-1**

you switched me off of ground.

15:09:55

**HOT-2**

oh, sorry.

15:09:57

**HOT-?**

\* you wanna be there [heard on CH2]

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:08:48

**RDO-2**

(I'm) sorry forgot.

15:09:35

**RDO-2**

Cactus fifteen forty nine is uh over BIGGY seven one three four, and three sixty and up to five thousand.

**INTRA-COCKPIT COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
15:10:04 <b>HOT-1</b>	you were talking on number two but you switched number one.
15:10:07 <b>HOT-2</b>	ok.
15:11:05 <b>HOT-2</b>	ok.

**AIR-GROUND COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
15:10:11 <b>RDO-2</b>	I'm sorry I messed up my radio here Cactus fifteen forty nine, seven one three four and we're three sixty up to five thousand.
15:10:40 <b>RDO-2</b>	Cactus-
15:10:41 <b>RDO-2</b>	Cactus fifteen forty nine is uh squawking seven one three four and were uh runway four three sixty and five thousand.
15:10:48 <b>CLC</b>	(kay it's) fifteen forty nine LaGuardia clearance read *back correct, ground point seven verify information papa.
15:10:53 <b>RDO-2</b>	we have papa.
15:10:54 <b>RDO-2</b>	we have papa thank you Cactus uh * fifteen forty nine.
15:10:58 <b>CLC</b>	ground point seven.

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:11:06  
**HOT-1** ok no change.

15:11:08  
**HOT-2** I don't think my uh MIC switch works all the time here.

15:11:12  
**HOT-1** your trigger, your trigger?

15:11:12  
**CAM-2** \* \* transmit.

15:11:14  
**CAM-2** what's that?

15:11:15  
**HOT-1** your trigger on the stick? ... I'll write that up too.

15:11:18  
**CAM-2** so you don't hear me transmit... you might wanna jump in.

15:11:21  
**HOT-1** ok.... got it.

15:11:28  
**HOT-1** I'm calling on number two.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:11:25  
**RDO-1** and OPS, fifteen forty nine.

15:11:31  
**OPS** yeah, (sixteen) forty nine go ahead.

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:12:08  
**HOT-1**

all right... I'm still holding short of golf, and they're correcting the passenger count to one forty eight.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:11:33  
**RDO-1**

yeah fifteen forty nine if you want uh weight and balance uh corrected to total of passenger one forty eight and ACM [additional crew members] two.

15:11:42  
**OPS**

ok one forty eight.

15:11:51  
**RDO-1**

yeah for fifteen forty nine passenger count is one four eight, plus ACM two.

15:12:00  
**RDO-1**

so one forty eight, plus two ACM's.

15:12:02  
**OPS**

ok. copy that.

15:12:25  
**GND**

Cactus fifteen forty nine taxi foxtrot, bravo hold short echo, just gotta hold you there for about three minutes uh for your uh in trail into Charlotte.

15:12:31  
**RDO-2**

foxtrot, bravo, short of echo, Cactus fifteen forty nine.

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:12:35  
**HOT-1** ok, foxtrot, bravo, hold short of echo... and once we stop then, I'll do the flight control check.

15:12:57  
**HOT-1** did it uh, did it not uplink?

15:13:01  
**HOT-2** (well) I figured it was the old one.

15:13:04  
**HOT-1** what's that?

15:13:06  
**HOT-2** umm.... ok.

15:13:18  
**HOT-2** so do you want me to use this one?

15:13:19  
**HOT-1** oh... oh I see what you're saying, yeah I uh you can wait if you want I just thought we'd have something in there.

15:13:37  
**HOT-1** yeah we can wait, that's fine.

15:13:38  
**HOT-2** go with this one? ok.

15:13:40  
**HOT-1** cause we're going to be holding here for a minute anyway.... all right foxtrot, bravo, hold short of echo.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

**INTRA-COCKPIT COMMUNICATION**

**TIME and  
SOURCE**

**CONTENT**

15:14:15  
**HOT-1**

where is the uh, the portion of the release the-  
of the weight and balance part of it that was be-  
low what you tore off to put on here... or was  
there part of it.

15:14:24  
**HOT-2**

there was, I think I threw it away it just had  
names on it... its right here.

15:14:26  
**HOT-1**

ok thank you. I need this number, yeah I wanted  
this part... I'm gonna just call this guy directly  
cause I don't think this OPS guy knows what the  
# he's doin.

15:15:04  
**HOT-1**

I'm just gonna call our load control agent di-  
rectly, it's his number right here.

15:15:12  
**FWC**

[sound of single chime]

15:15:15  
**HOT-1**

yeah I'm the Captain on fifteen forty nine aircraft  
one zero six if you'll if you will please correct the  
passenger count we have a total of one four  
eight, plus two plus two ACM. [sounds as if this  
communication is by cellular telephone]

**AIR-GROUND COMMUNICATION**

**TIME and  
SOURCE**

**CONTENT**

15:15:19  
**GND**

Cactus fifteen forty nine follow the Northwest  
you can monitor tower.

**INTRA-COCKPIT COMMUNICATION**

**TIME and  
SOURCE**

**CONTENT**

15:15:32  
**HOT-1** that's it... thank you. runway four, thank you,  
bye. [sounds as if communication is by cellular  
telephone]

15:15:38  
**HOT-1** what did I miss?

15:15:40  
**HOT-2** follow Northwest.

15:15:41  
**HOT-1** all right here we go.

15:15:49  
**HOT-1** \* I talked to CLP [Central Load Plan] he's gonna  
send it.

15:15:54  
**HOT-1** all right, flight control check.

15:15:57  
**CAM-2** full up.....full down.

15:16:01  
**HOT-2** neutral.

15:16:03  
**HOT-2** full left.

15:16:06  
**HOT-2** full right.

**AIR-GROUND COMMUNICATION**

**TIME and  
SOURCE**

**CONTENT**

15:15:23  
**RDO-2** Cactus fifteen forty nine follow Northwest moni-  
tor tower, thank you.

**INTRA-COCKPIT COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
15:16:07 <b>HOT-2</b>	neutral.
15:16:09 <b>HOT-2</b>	full left.
15:16:11 <b>HOT-2</b>	full right.
15:16:13 <b>HOT-2</b>	neutral.
15:17:26 <b>HOT-1</b>	I'll go ahead and sit them down.
15:17:30 <b>PA-1</b>	flight attendants please be seated for takeoff.
15:17:33 <b>HOT-2</b>	kay.
15:18:03 <b>HOT-1</b>	okay, taxi check.
15:18:07 <b>HOT-2</b>	* *.
15:18:19 <b>HOT-2</b>	departure briefing, FMS. [Flight Management System]
15:18:21 <b>HOT-1</b>	reviewed runway four.
15:18:22 <b>HOT-2</b>	flaps verify. two planned, two indicated.
15:18:24 <b>HOT-1</b>	two planned, two indicated.

**AIR-GROUND COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
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**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:18:46  
**HOT-2** um. takeoff data verify... one forty, one forty five,  
one forty nine, TOGA. [Takeoff/Go Around]

15:18:53  
**HOT-1** one forty, one forty five, one forty nine, TOGA.

15:18:56  
**HOT-2** the uh weight verify, one fifty two point two.

15:19:00  
**HOT-1** one fifty two point two.

15:19:02  
**HOT-2** flight controls verify checked.

15:19:03  
**HOT-1** check.

15:19:04  
**HOT-2** stab and trim verify, thirty one point one per-  
cent... and zero.

15:19:08  
**HOT-1** thirty one point one percent, zero.

15:19:11  
**HOT-2** the uh.... engine anti-ice.

15:19:13  
**HOT-1** is off.

15:19:16  
**CAM-2** ECAM [Electronic Centralized Aircraft Monitor-  
ing] verify takeoff, no blue, status checked.

15:19:19  
**HOT-1** takeoff, no blue, status checked.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:19:22  
**PA-2** ladies and gentlemen at this time we're number one for takeoff, flight attendants please be seated.

15:19:25  
**HOT-1** \* \* .

15:19:27  
**HOT-2** takeoff min fuel quantity verify. nineteen thousand pounds required we got twenty one point eight on board.

15:19:32  
**HOT-1** nineteen thousand pounds required, twenty one eight on board.

15:19:35  
**HOT-2** flight attendants notified, engine mode is normal, the taxi checklist is complete sir.

15:19:40  
**HOT-1** below the line... oh you finished it all \* \* -

15:19:42  
**CAM-2** yeah.

15:19:42  
**HOT-1** -yeah kay thank you. we're good. holding short.

15:20:03  
**HOT-1** still possible.

15:20:06  
**CAM-2** oh yeah.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:20:42  
**HOT-1** on the hold.

15:20:44  
**CAM** [sound similar to increase then decrease in engine noise/frequency]

15:21:27  
**HOT-1** your brakes, your aircraft.

15:21:30  
**HOT-2** my aircraft.

15:21:48  
**HOT-1** he's gotta \*.

15:25:06  
**CAM** [sound similar to increase in engine noise/speed]

15:25:09  
**CAM-2** TOGA.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:20:37  
**TWR** Cactus fifteen forty nine, LaGuardia runway four position and hold. traffic to land three one.

15:20:40  
**RDO-2** position and hold runway four, Cactus uh fifteen forty nine.

15:24:54  
**TWR** Cactus fifteen forty nine runway four clear for takeoff.

15:24:56.7  
**RDO-1** Cactus fifteen forty nine clear for takeoff.

**INTRA-COCKPIT COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
15:25:10 <b>HOT-1</b>	TOGA set.
15:25:20 <b>HOT-1</b>	eighty.
15:25:21 <b>HOT-2</b>	checked.
15:25:33 <b>HOT-1</b>	V one, rotate.
15:25:38 <b>HOT-1</b>	positive rate.
15:25:39 <b>HOT-2</b>	gear up please.
15:25:39 <b>HOT-1</b>	gear up.
15:25:49 <b>HOT-2</b>	heading select please.

**AIR-GROUND COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
15:25:45 <b>TWR</b>	Cactus fifteen forty nine contact New York departure, good day.
15:25:48 <b>RDO-1</b>	good day.
15:25:51.2 <b>RDO-1</b>	Cactus fifteen forty nine, seven hundred, climbing five thousand.

### INTRA-COCKPIT COMMUNICATION

<u>TIME and SOURCE</u>	<u>CONTENT</u>
15:26:02 <b>CAM</b>	[sound similar to decrease in engine noise/speed]
15:26:07 <b>HOT-1</b>	fifteen.
15:26:08 <b>HOT-2</b>	fifteen. climb.
15:26:10 <b>HOT-1</b>	climb set.
15:26:16 <b>HOT-2</b>	and flaps one please.
15:26:17 <b>HOT-1</b>	flaps one.
15:26:37 <b>HOT-1</b>	uh what a view of the Hudson today.
15:26:42 <b>HOT-2</b>	yeah.
15:26:52 <b>HOT-2</b>	flaps up please, after takeoff checklist.

### AIR-GROUND COMMUNICATION

<u>TIME and SOURCE</u>	<u>CONTENT</u>
15:26:00 <b>DEP</b>	Cactus fifteen forty nine New York departure radar contact, climb and maintain one five thousand.
15:26:03.9 <b>RDO-1</b>	maintain one five thousand Cactus fifteen forty nine.

**INTRA-COCKPIT COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
15:26:54 <b>HOT-1</b>	flaps up.
15:27:07 <b>HOT-1</b>	after takeoff checklist complete.
15:27:10.4 <b>HOT-1</b>	birds.
15:27:11 <b>HOT-2</b>	whoa.
15:27:11.4 <b>CAM</b>	[sound of thump/thud(s) followed by shuddering sound]
15:27:12 <b>HOT-2</b>	oh #.
15:27:13 <b>HOT-1</b>	oh yeah.
15:27:13 <b>CAM</b>	[sound similar to decrease in engine noise/frequency begins]
15:27:14 <b>HOT-2</b>	uh oh.
15:27:15 <b>HOT-1</b>	we got one rol- both of 'em rolling back.
15:27:18 <b>CAM</b>	[rumbling sound begins and continues until approximately 15:28:08]
15:27:18.5 <b>HOT-1</b>	ignition, start.

**AIR-GROUND COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
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**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:27:21.3  
**HOT-1** I'm starting the APU.

15:27:22.4  
**FWC** [sound of single chime]

15:27:23.2  
**HOT-1** my aircraft.

15:27:24  
**HOT-2** your aircraft.

15:27:24.4  
**FWC** [sound of single chime]

15:27:25  
**CAM** [sound similar to electrical noise from engine igniters begins]

15:27:26.5  
**FWC** priority left. [auto callout from the FWC. this occurs when the sidestick priority button is activated on the Captain's sidestick]

15:27:26.5  
**FWC** [sound of single chime]

15:27:28  
**CAM** [sound similar to electrical noise from engine igniters ends]

15:27:28  
**HOT-1** get the QRH... [Quick Reference Handbook] loss of thrust on both engines.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

### INTRA-COCKPIT COMMUNICATION

<u>TIME and SOURCE</u>	<u>CONTENT</u>
15:27:30 <b>FWC</b>	[sound of single chime begins and repeats at approximately 5.7 second intervals until 15:27:59]
15:27:43 <b>CAM</b>	[sound similar to electrical noise from engine igniters begins]
15:27:44 <b>FWC</b>	[sound of single chime, between the single chimes at 5.7 second intervals]
15:27:50 <b>HOT-2</b>	if fuel remaining, engine mode selector, ignition.* ignition.
15:27:54 <b>HOT-1</b>	ignition.
15:27:55 <b>HOT-2</b>	thrust levers confirm idle.

### AIR-GROUND COMMUNICATION

<u>TIME and SOURCE</u>	<u>CONTENT</u>
15:27:32.9 <b>RDO-1</b>	mayday mayday mayday. uh this is uh Cactus fifteen thirty nine hit birds, we've lost thrust (in/on) both engines we're turning back towards LaGuardia.
15:27:42 <b>DEP</b>	ok uh, you need to return to LaGuardia? turn left heading of uh two two zero.
15:27:46 <b>RDO-1</b>	two two zero.



**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:27:58  
**HOT-1** idle.

15:28:02  
**HOT-2** airspeed optimum relight. three hundred knots.  
we don't have that.

15:28:03  
**FWC** [sound of single chime]

15:28:05  
**HOT-1** we don't.

15:28:05  
**CAM-2** if three nineteen-

15:28:14  
**HOT-2** emergency electrical power... emergency generator not online.

15:28:18  
**CAM** [sound similar to electrical noise from engine igniters ends]

15:28:19  
**HOT-1** (it's/is) online.

15:28:21  
**HOT-2** ATC notify. squawk seventy seven hundred.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:28:05  
**DEP** Cactus fifteen twenty nine, if we can get it for you do you want to try to land runway one three?

15:28:10.6  
**RDO-1** we're unable. we may end up in the Hudson.

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:28:25  
**HOT-1** yeah. the left one's coming back up a little bit.

15:28:30  
**HOT-2** distress message, transmit. we did.

15:28:36  
**TCAS** traffic traffic.

15:28:37  
**HOT-2** (he wants us) to come in and land on one three...for whatever.

15:28:45  
**PWS** go around. windshear ahead.

15:28:45  
**HOT-2** FAC [Flight Augmentation Computer] one off, then on.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:28:31  
**DEP** arright Cactus fifteen forty nine its gonna be left traffic for runway three one.

15:28:35  
**RDO-1** unable.

15:28:36  
**DEP** okay, what do you need to land?

15:28:46  
**DEP** Cactus fifteen (twenty) nine runway four's available if you wanna make left traffic to runway four.

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:28:59  
**TCAS** monitor vertical speed.

15:29:00  
**HOT-2** no relight after thirty seconds, engine master  
one and two confirm-

15:29:05  
**TCAS** clear of conflict.

15:29:07  
**HOT-2** -off.

15:29:07  
**HOT-1** off.

15:29:10  
**HOT-2** wait thirty seconds.

15:29:11  
**PA-1** this is the Captain brace for impact.

15:29:14.9  
**GPWS** one thousand.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:28:49.9  
**RDO-1** I'm not sure we can make any runway. uh  
what's over to our right anything in New Jersey  
maybe Teterboro?

15:28:55  
**DEP** ok yeah, off your right side is Teterboro airport.

15:29:02  
**DEP** you wanna try and go to Teterboro?

15:29:03  
**RDO-1** yes.

**INTRA-COCKPIT COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
15:29:16 <b>HOT-2</b>	engine master two, back on.
15:29:18 <b>HOT-1</b>	back on.
15:29:19 <b>HOT-2</b>	on.
15:29:21 <b>CAM-2</b>	is that all the power you got? * (wanna) number one? or we got power on number one.
15:29:26 <b>HOT-1</b>	go ahead, try number one.
15:29:27 <b>FWC</b>	[sound of continuous repetitive chime for 9.6 seconds ]
15:29:36 <b>HOT-2</b>	I put it back on.

**AIR-GROUND COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
15:29:21 <b>DEP</b>	Cactus fifteen twenty nine turn right two eight zero, you can land runway one at Teterboro.
15:29:25 <b>RDO-1</b>	we can't do it.
15:29:27 <b>DEP</b>	kay which runway would you like at Teterboro?
15:29:28 <b>RDO-1</b>	we're gonna be in the Hudson.
15:29:33 <b>DEP</b>	I'm sorry say again Cactus?

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:29:37  
**FWC** [sound of continuous repetitive chime for 37.4 seconds ]

15:29:37  
**HOT-1** ok put it back on... put it back on.

15:29:37  
**GPWS** too low. terrain.

15:29:41  
**GPWS** too low. terrain.

15:29:43  
**GPWS** too low. terrain.

15:29:44  
**HOT-2** no relight.

15:29:45.4  
**HOT-1** ok lets go put the flaps out, put the flaps out.

15:29:45  
**EGPWS** caution. terrain.

15:29:48  
**EGPWS** caution terrain.

15:29:48  
**HOT-2** flaps out?

15:29:49  
**EGPWS** terrain terrain. pull up. pull up.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:29:51  
**DEP** Cactus uh....

## INTRA-COCKPIT COMMUNICATION

## TIME and SOURCE

## CONTENT

15:29:55	
<b>EGPWS</b>	pull up. pull up. pull up. pull up. pull up. pull up.
15:30:01	
<b>HOT-2</b>	got flaps out.
15:30:03	
<b>HOT-2</b>	two hundred fifty feet in the air.
15:30:04	
<b>GPWS</b>	too low. terrain.
15:30:06	
<b>GPWS</b>	too low. gear.
15:30:06	
<b>CAM-2</b>	hundred and seventy knots.
15:30:09	
<b>CAM-2</b>	got no power on either one? try the other one.
15:30:11	
<b>HOT-1</b>	try the other one.
15:30:13	
<b>EGPWS</b>	caution terrain.

## AIR-GROUND COMMUNICATION

## TIME and SOURCE

## CONTENT

15:29:53  
DEP Cactus fifteen forty nine radar contact is lost  
you also got Newark airport off your two o'clock  
in about seven miles.

15:30:09  
4718 two one zero uh forty seven eighteen. I think he  
said he's goin in the Hudson.

15:30:14  
DEP Cactus fifteen twenty nine uh, you still on?

**INTRA-COCKPIT COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:30:15  
**FWC** [sound of continuous repetitive chime begins  
and continues to end of recording]

15:30:15  
**EGPWS** caution terrain.

15:30:16  
**HOT-2** hundred and fifty knots.

15:30:17  
**HOT-2** got flaps two, you want more?

15:30:19  
**HOT-1** no lets stay at two.

15:30:21  
**HOT-1** got any ideas?

15:30:23  
**EGPWS** caution terrain.

15:30:23  
**CAM-2** actually not.

15:30:24  
**EGPWS** terrain terrain. pull up. pull up. ["pull up" repeats  
until the end of the recording]

15:30:38  
**HOT-1** we're gonna brace.

**AIR-GROUND COMMUNICATION****TIME and  
SOURCE****CONTENT**

15:30:22  
**DEP** Cactus fifteen twenty nine if you can uh....you  
got uh runway uh two nine available at Newark  
it'll be two o'clock and seven miles.

**INTRA-COCKPIT COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
15:30:38 <b>HOT-2</b>	* * switch?
15:30:40 <b>HOT-1</b>	yes.
15:30:41.1 <b>GPWS</b>	(fifty or thirty)
15:30:42 <b>FWC</b>	retard.

15:30:43.7 [End of Recording]

15:30:43.7 [End of Transcript]

**AIR-GROUND COMMUNICATION**

<b><u>TIME and SOURCE</u></b>	<b><u>CONTENT</u></b>
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