

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



GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

DCA19MA143

**By
Joseph A. Gregor**

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

April 19, 2021

Cockpit Voice Recorder

Group Chairman's Factual Report
By Joseph A. Gregor

1. EVENT SUMMARY

Location: Jacksonville, Florida
Date: May 03, 2019
Aircraft: Boeing 737-800, Registration N732MA
Operator: Miami Air International, Flight 293
NTSB Number: DCA19MA143

On May 3, 2019, at 2142 eastern daylight time, Miami Air flight 293, a Boeing 737-81Q registration N732MA, was landing on runway 10 at Jacksonville Naval Air Station, Jacksonville, Florida, when it departed the end of the runway, contacted a stone embankment, and came to rest in shallow water in St. Johns River. The 2 pilots, 4 flight attendants, and 136 passengers were not injured; one crew member in the jumpseat received a minor injury. The airplane was substantially damaged. Flight 293 was a non-scheduled passenger flight from Leeward Point Field, Naval Station Guantanamo Bay, Cuba, operating under the provisions of 14 *Code of Federal Regulations* Part 121 Supplemental. Instrument meteorological conditions prevailed at the time of the accident, and rain was occurring during the landing. A CVR Group convened on May 13, 2019 and a transcript was prepared for the 2-hour, 5-minute, 31.5-second digital recording (see attached).

2. GROUP

Chairman: Joseph A. Gregor
Electronic Engineer
National Transportation Safety Board

Member: Ruben Payan
Electrical Engineer
National Transportation Safety Board

Member: David D. Thompson
Air Safety Investigator
Federal Aviation Administration

Member: Rich Lee
Safety Pilot, Flight Technical & Safety Training & Flight Services
Boeing

Member: Captain Anthony Klein
Pilot
International Brotherhood Teamsters 1224

Member: Captain David A. Ochsner
Chief Pilot
Miami Air

3. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Division received the following CVR:

Recorder Manufacturer/Model: **Honeywell 6022**
Recorder Serial Number: **1481**

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. The accident aircraft was manufactured in 2001.

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 30-minute portion of the recording contains 3 channels of audio information: one channel for each flight crew member, and one channel for a cockpit observer. The 120-minute portion of the recording is comprised of one channel that combines all three audio panels sources, and a second channel that contains the cockpit area microphone (CAM) source.

3.3 Recorder Damage

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

3.4 Audio Recording Description

Each channel's audio quality is indicated in Table 1.¹ Channel number three did not contain any audio information (nor was it required by federal regulations).

¹ See attached CVR Quality Rating Scale.

Table 1: Audio Quality.

Channel Number	Content/Source	Quality	Duration (nominal)
1	Pilot	Poor	<<30 min>>
2	First Officer (FO)	Poor	<<30 min>>
3	Other	Poor	<<30 min>>
4	CAM	Poor	<<120 min>>
5	COMB ²	Poor	<<120 min>>

The generally Poor audio quality noted in Table 1 resulted from two deficiencies: 1) extremely low to non-existent pilot headset HOT microphone modulation, and 2) an extremely low signal to noise ratio on the cockpit area microphone channel (especially during flight and engine operation).

At the time of the accident, N732MA had been modified to support a Supplemental Type Certificate being created for the installation of a newer model Honeywell Solid State Voice Recorder with ACARS message recording.³ This STC – ST04461AT – was eventually issued on September 24, 2019 to the Avionics Support Group, Inc., 13155 SW 132 Avenue, Miami, Florida, 33186. During the modification process, the CVR referenced in this report (s/n 01481) had been removed from the aircraft for the datalink recording upgrade - performed under work order (EO 218194-1) written by the Aviation Support Group – and a new CVR was installed (SN CVR-08092) to carry out the STC certification testing. After certification testing, this new CVR was removed under EO 218194-4 and sent to Honeywell for readout and the original CVR (s/n 01481) was reinstalled onto the aircraft. This CVR (s/n 01481) was installed onboard the aircraft at the time of the accident and is the one received in the recorder laboratory for readout after the accident.

Post, accident, the recording from the STC certification test CVR (s/n CVR-080892) was forwarded to the NTSB CVR laboratory for evaluation. However, only fragmented audio related to unspecified ground maintenance activities was recorded. Therefore, an evaluation concerning audio quality under operational conditions was not possible.

A third CVR recording, made with the same model CVR as s/n 01481, on a sister aircraft flying under operational conditions with the STC (ST04461AT) was forwarded to the NTSB recorder laboratory. The audio from this recording was evaluated. The three channels recording HOT microphone information from the crew positions (Pilot, FO, Other/Jumpseat) did contain both HOT mic and radio information. However, the radio information was distorted consistent with an overdriven signal amplifier. And, the crew HOT microphone information was recorded at a much lower level – on average 35 dB lower – than the radio information. This made crew conversation indiscernible (completely masked) whenever it took place simultaneous with reception of a radio signal. The CAM channel recorded consistent broadband white noise during the length of the recording that made any intra-cockpit communication unintelligible and most often indiscernible during flight, and virtually unintelligible while on the ground with the engines running.

² Combined channel containing audio from three audio panels sources: Pilot, First Officer, and Other.

³ See the SYSTEMS GROUP CHAIRMAN'S FACTUAL REPORT for DCA19MA143, p 21.

A fourth CVR recording, made with a Honeywell Model HFR5-V CVR (s/n CVR-08135) in an STC'd aircraft operating both on the ground and in-flight, was later forwarded to the NTSB recorder laboratory.⁴ The audio from this recording was evaluated at around the time of landing. The three channels recording HOT microphone information from the crew positions (Pilot, FO, Other/Jumpseat) did contain both HOT mic and radio information. On the Pilot channel, the HOT microphone audio was approximately 21 dB below the level of the radio transmissions, and automated EGPWS warnings were recorded approximately 8 dB below the radio transmissions. The strongest signal source on this channel utilized approximately 50% of the available dynamic range. On the First Officer channel, the HOT microphone audio was approximately 8 dB below the level of the radio transmissions, and automated EGPWS warnings were recorded approximately 9 dB below the radio transmissions. The strongest signal source on this channel utilized approximately 25% of the available dynamic range. On the CAM channel, the crew audio was approximately 2 dB above the level of the radio transmission during flight,⁵ and automated EGPWS warnings were recorded approximately 13 dB above the background noise. During ground spoiler operation on the ground on landing rollout, the background noise level rose to be 7 dB above that of any crew voice modulation.⁶ The strongest signal source on this channel utilized approximately 25% of the available dynamic range.

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, 27 radio calls were correlated to the times recorded by the FDR for 27 separate VHF keying events. Once a correlation between the two recorders was established, a reference to local time was determined using the UTC time recorded by the FDR, adjusted by -4 hours to be expressed in local eastern daylight time (EDT).

3.6 Description of Audio Events

The recording began at 1936:49 EDT with the CVR recording sounds of intermittently distinguishable speech in Spanish. Audible events are characterized and summarized in transcript-form up to the time 2120:36 EDT. Events after 2120:36 EDT are transcribed verbatim until the end of the recording, at 2142:21 EDT.

⁴ The HFR5-V is the model recorder specified to be used in conjunction with the new STC: ST04461AT.

⁵ This rendered crew statements discernable with difficulty – equivalent to a CVR quality scale rating of fair to poor, depending on the instantaneous noise level.

⁶ This would have in effect rendered crew statements indiscernible – equivalent to a CVR quality scale rating of unusable.

Attachment I

CVR Quality Rating Scale

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

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

Transcript of a Honeywell 6022 solid-state cockpit voice recorder, serial number 12609, installed on a Boeing 737-81Q (N732MA), which crashed upon landing at Jacksonville Naval Air Station, Jacksonville, Florida.

LEGEND

APR	Radio transmission from Jacksonville approach controller
CAM	Cockpit area microphone voice or sound source
CTR	Radio transmission from center controller
DISP	Radio transmissions from dispatcher
GCA	Radio transmission from Navy JAX Ground-Controlled Approach controller
HOT	Flight crew audio panel voice or sound source
PA	Flight crew audio from Public Address system
RDO	Radio transmissions from N732MA
-1	Voice identified as the pilot
-2	Voice identified as the first officer
-?	Voice unidentified
*	Unintelligible word
#	Expletive
@	Non-pertinent word
{{ }}	Words translated into English from Spanish
()	Questionable insertion
[]	Editorial insertion

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

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

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

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

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
1936:49			
	START OF RECORDING		
	START OF TRANSCRIPT		
1936:48 HOT	[intermittent speech in Spanish].		
1939:51 PA-1	[passenger briefing].		
2001:43 HOT	[sounds consistent with SIGMET 24-E 0155].		
2006:25 HOT	[intermittent inaudible speech in Spanish].		
		2031:29 RDO-?	[query concerning weather en-route and vectors around weather].
		2033:18 RDO-1	[call to Miami OPS requesting weather info].
2034:23 DISP	[latest METAR information relayed to flight wind 120 at 4 knots, visibility 10 statute miles, temperature two six, dewpoint and altimeter information, and remarks CB in the distance south west, west].		
		2039:35 RDO	[discussion of weather location and deviations for weather].
		2042:20 RDO	[radio calls pertaining to vectors around weather].
2043:28 PA-2	[passenger announcement].		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		2048:35 RDO	[request for weather deviation].
2052:28	[inaudible speech in Spanish].		
		2054:13 RDO	[deviation requested and granted for weather].
		2058:17 RDO	[flight requested and cleared direct Orlando].
2058:53	[partially audible speech in Spanish].		
2101:02 CAM	[sounds consistent with approach briefing].		
		2101:37 RDO	[contact with center and weather report received including altimeter setting of 29.99 in Hg].
2108:12 HOT	* * closed. attention all aircraft hazardous weather information for the JAX area available on * * or flight service frequencies, advise on initial contact you have information X-ray. Jacksonville international airport ATIS information X-ray, zero zero five six zulu, winds zero one zero at three, visibility one zero, few clouds at one thousand six hundred, seven thousand scattered, ceiling one one thousand broken. visual approach runway two six, and simultaneous approaches to runway two six and three two in use, landing and departing r-		
2108:50 CAM	[sounds consistent with descent and approach checklist].		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
2110:31 CAM	[partially audible speech in Spanish].		
		2112:24 RDO	[flight directed to squawk 2651].
2112:56 CAM-?	* * * * .		
2115:48 CAM-T	[sounds consistent with discussion of arrival procedures].		
2118:13 CAM-?	* * * * .		
2118:58 CAM-?	* * * * .		
2120:36. CAM-?	* * * * .		
2120:43 CAM	[sound of altitude alert].		
2120:45 CAM-1	give them the {{arrival check checklist}}.		
2120:58 PA-2	ah flight attendant arrival check please.		
2121:07 CAM	[sound of single chime].		
		2122:08 CTR	Biscayne two ninety three contact JAX approach one two four point niner.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		2122:13 RDO-2	one two four point nine Biscayne ah two nine three good night.
2122:17 HOT-?	*		
		2122:18 RDO-2	ah JAX approach ah Biscayne two nine three with you ah one three thousand.
		2122:22 APR	Biscayne two nine three JAX approach JAX altimeter two nine nine eight expect a R-NAV runway two eight Navy JAX arriving at golf.
		2122:29 RDO-2	ah we expect ah runway two eight ah R-NAV ah Biscayne two nine three.
2122:36 CAM	* * *		
		2122:39 APR	and Biscayne two nine three * * gonna be some ah light to moderate, actually (nah) moderate to heavy precipitation on the final of runway two eight.
2122:46 CAM	* * *		
		2122:49 RDO-1	ah what's the winds over there ah * * * we don't have, we don't have the ah, I couldn't pick up the ATIS.
		2122:55 APR	ah standby.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
2122:56 CAM-?	* * *.		
		2123:25 APR	Biscayne two nine three winds er ah (three) five zero at four.
		2123:29 RDO-1	ah any chance ah, I think it looks a lot better coming from ah runway one zero.
		2123:34 APR	ah runway one zero I'm showing ahm.
		2123:42 APR	R-NAV for one, one zero I'm showing the ah, I'm showing (ahm moderate to heavy) precipitation (is) well, ahm, it's kinda building on runway one zero as well it's starting at about a five mile final inbound to the airport.
2123:54 CAM-?	* * *.		
		2123:55 RDO-1	alright, ah le-, lets then stick with ah two eight, runway, ah R-NAV two eight Biscayne two ninety three thank you.
		2124:03 APR	(roger) *.
		2124:21 APR	Biscayne two ninety three fly heading ah, fly present heading descend and maintain five thousand.
		2124:26 RDO-2	descend and maintain present heading descend and maintain oh five thousand Biscayne two nine three.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
2124:29 CAM-?	* * *.		
		2125:45 APR	ah Biscayne two nine three just talked to Navy JAX tower he said ahm, both ah both runways look pretty ah, pretty bad, or pretty socked in ahm, showing ah moderate to heavy precipitation east and ah west of the airport, do you want to try to go for R-NAV two eight?
		2126:02 RDO-1	ah yes sir, what- whichever looks better and ah then when I get closer I check how it is.
		2126:07 APR	ah yes sir Biscayne two nine three turn right heading zero one zero descend and maintain three thousand.
		2126:11 RDO-1	* zero one-, eh right zero one zero and ah three thousand.
		2126:17 APR	*.
2126:53 CAM-?	* *.		
2127:05 HOT-?	* * *.		
2127:19 CAM-2	are you alright?		
		2127:55 APR	and Biscayne two nine three fly heading zero four zero.
		2127:57 RDO-2	zero four zero Biscayne two nine three.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
2128:16 CAM-?	* * *.		
2128:24 HOT-?	* runway two eight *.		
2128:50 CAM-?	* * *.		
2129:09 CAM-1	{{we are doing}} R-NAV?		
2129:11 CAM-2	two eight.		
2129:13 CAM-1	(thousand? *) six?		
		2130:01 APR	and Biscayne two nine * three ahm as you head northbound the ah precip is heading eastbound, you wanna try one, one zero that might be better?
		2130:09 RDO-1	I'm sorry which one, ah one zero?
		2130:12 APR	one zero.
		2130:13 RDO-1	yeah go ahead let's do it.
		2130:14 APR	Biscayne two nine three turn left heading zero, turn left ah heading two seven zero.
		2130:19 RDO-2	left heading two seven zero Biscayne two nine three.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
2130:21 CAM-1	alright * * runway, hold a second, two seven zero.		
2130:34 CAM-2	zero *.		
2130:37 HOT-?	* * transition * *.		
2130:38 CAM-1	* *.		
2130:48 CAM-?	* *.		
		2130:53 APR	Biscayne two nine three continue left turn two five zero.
		2130:56 RDO-2	left two five zero Biscayne two nine three.
2131:03 CAM-1	* * one zero, right * * *.		
2131:12 HOT-?	{{* put *}}.		
2131:19 CAM	[sound of altitude alert].		
2131:22 CAM-2	* thousand, four thousand.		
2131:55 CAM-2	* * *.		
2131:56 CAM-1	zero nine six, zero nine- * * *.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		2133:31 APR	Biscayne two nine three turn right heading two niner zero.
		2133:34 RDO-2	right two nine zero Biscayne two nine three.
2133:37 CAM-2	two nine zero.		
2133:40 CAM-1	two nine zero.		
		2135:56 APR	Biscayne two nine three turn right heading zero one zero.
		2135:58 RDO-2	right * * zero one zero Biscayne ah two nine three.
2136:20 CAM-1	flaps 1.		
2136:34 CAM-1	flaps 5.		
2136:46 CAM-?	* * *.		
		2137:06 APR	Biscayne two nine three turn right heading zero eight zero join the final.
2137:09 CAM-?	* * *.		
		2137:10 RDO-2	zero eight zero join the final Biscayne two nine three.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
2137:13 CAM-?	alright.		
2137:27 CAM-1	LNAV.		
2137:28 CAM-?	*		
		2137:34 APR	Biscayne two ninety three five miles, okay seven miles from final approach fix cleared for the R-NAV * runway one zero approach.
2137:40 CAM-?	* * *		
		2137:40 RDO-2	and we're cleared for the R-NAV one zero approach Biscayne two nine three.
2137:45 HOT-?	(cleared for the R-NAV).		
		2137:48 APR	Biscayne two nine three contact Navy JAX G-C-A three six three point zero.
2137:52 HOT-?	* * (contact tower).		
		2137:55 RDO-2	ah contact tower Biscayne two nine three.
		2137:57 APR	ah yes sir contact ah Navy JAX G-C-A three six three point zero.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		2138:02 RDO-1	ah you have a V-H-F one twenty five fifteen working?
		2138:05 APR	ah standby one second.
		2138:17 APR	Biscayne two nine three contact Navy JAX G-C-A one two seven point seven.
2138:20 CAM-?	* * * .		
		2138:21 RDO-1	twenty seven, seven thank you sir.
2138:31 CAM-?	* * * zero, R-NAV *. zero.		
		2138:32 RDO-2	ah JAX ah tower Biscayne two nine three with you R-NAV one zero.
		2138:37 GCA	Biscayne two nine three Navy JAX G-C-A altimeter two niner niner niner this will be a R-NAV approach utilizing P-A-R monitoring after landing rollout squawk standby contact Navy JAX tower.
		2138:49 RDO-2	yah after landing ah we contact JAX tower Biscayne two nine three.
		2138:53 GCA	Biscayne two nine three in event of a missed approach. missed approach procedure is climb to one thousand eight hundred, correction climb to five hundred and then climb to three thousand direct MADEN.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
2139:06 HOT	[sound of altitude alert].		
		2139:07 RDO-2	okay so climb out five hundred and then ah three thousand runway ah heading ah we understand Biscayne two nine three.
		2139:14 GCA	Biscayne two nine three be advised the short trip gear is rigged for runway one, one zero.
		2139:21 RDO-2	we understand Biscayne two nine three.
		2139:23 RDO-1	and that's for the ah first thousand feet, correct?
		2139:28 GCA	affirmative Biscayne two nine three.
		2139:30 RDO-1	ah roger.
		2139:33 GCA	Biscayne two nine three standby final controller at this time.
2139:38 CAM-?	whoa.		
		2139:38 GCA	Biscayne two nine three (JAX) final controller how do you hear me wheels should be down.
		2139:42 RDO-?	* *.
2139:42 CAM-?	* *.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		2139:44 RDO-2	yeah we got ah loud and clear Biscayne two nine three.
2139:45 CAM-1	gear down flaps fifteen.		
		2139:48 GCA	runway one, zero winds two four zero at one zero cleared to land.
2139:48 CAM	[sounds consistent with gear extension].		
2139:48 CAM-2	flaps fifteen.		
		2139:52 RDO-2	okay one zero (cleared) to land ah Biscayne two nine three.
2140:01 PA-2	ah flight attendant ah, landing checklist please.		
2140:04 HOT	[sound of altitude alert].		
		2140:08 GCA	* * *.
2140:13 CAM	[sound of single chime].		
2140:14 CAM-1	flaps thirty.		
		2140:15 GCA	you're well above glidepath.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
2140:25 CAM	[sound of autopilot disconnect warning].		
2140:31 CAM-1	landing checklist please.		
2140:33 CAM-2	* landing checklist. ** ah. *** speedbrakes ah armed, landing gear down three green, flaps thirty.		
		2141:09 GCA	report field in sight.
2141:10 CAM-1	field in sight. report it.		
		2141:12 RDO-2	field in sight Biscayne two nine three.
		2141:15 GCA	rog.
2141:16 HOT	five hundred [electronic voice].		
2141:17 HOT	approaching minimums [electronic voice].		
2141:23 HOT	minimums. [electronic voice].		
2141:35 HOT	sink rate, sink rate, sink rate, sink rate, sink rate [electronic voice].		
2141:36 CAM-1	I got it, I got it.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
2141:42 HOT	ten. [electronic voice].		
2141:42 HOT	sink rate [electronic voice].		
2141:44 CAM	[sounds consistent with touchdown]		
2141:52 HOT-1	oh.		
2141:52 CAM-?	*.		
2142:00 HOT-1	oh. * *.		
2142:01 CAM-?	* * *.		
2142:04 HOT-1	oh we're going *.		
2142:06 HOT-2	oh.		
2142:10 CAM	[sounds consistent with departure from prepared surface].		
2142:19 END OF TRANSCRIPT END OF RECORDING			