

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



DCA24FA017

COCKPIT VOICE RECORDER

Specialist's Factual Report

August 27, 2024

TABLE OF CONTENTS

A. ACCIDENT	3
B. COCKPIT VOICE RECORDER SPECIALIST	3
C. FEDERAL CARRIAGE REQUIREMENTS.....	3
D. DETAILS OF THE INVESTIGATION	3
1.0 Recorder Description	3
1.1 Recorder Damage	4
1.2 Summary of Recording.....	4
1.3 Timing and Correlation	4
1.4 Impact Switch	4
1.5 CVR and Impact Switch Testing	4
1.5.1 Bench Testing.....	5
1.5.2 Aircraft Impact Continuity Switch and CVR Test.....	5
1.6 Results	6
APPENDIX A. CVR QUALITY RATING SCALE.....	7
APPENDIX B. CVR TEST PLAN	8
APPENDIX C. BENCH TEST SETUP AND RESULTS	21
APPENDIX D. COCKPIT VOICE CONTROL UNIT	23
APPENDIX E. AIRCRAFT IMPACT SWITCH AND CVR TEST SETUP AND RESULTS	24

A. ACCIDENT

Location: Houston, Texas
Date: October 24, 2023
Time: 1520 central daylight time (CDT)
2020 coordinated universal time (UTC)
Airplane 1: Textron Aviation 510, private, N510HM
Airplane 2: Raytheon Aircraft Company Hawker 850XP, private, N269AA

B. COCKPIT VOICE RECORDER SPECIALIST

Specialist: Steven Smith
Mechanical Engineer (Recorder Specialist)
National Transportation Safety Board (NTSB)

C. FEDERAL CARRIAGE REQUIREMENTS

The first event aircraft, N510HM, was operating under Title 14 *CFR* Part 91. The aircraft was manufactured in 2016 and was operating such that it was not required to be equipped with a cockpit voice recorder (CVR).

The second event aircraft, N269AA, was operating under Title 14 *Code of Federal Regulations* (CFR) Part 135. The aircraft was manufactured in 2006 and was operating such that it was required to be equipped with a CVR that records a minimum of the last 30 minutes of aircraft operation.

D. DETAILS OF THE INVESTIGATION

A CVR group was not convened. The NTSB Vehicle Recorder Division received the following CVR from the second event aircraft (N269AA):

Recorder Manufacturer/Model: Universal CVR-120
Part Number: 1603-02-12
Recorder Serial Number: 1626

1.0 Recorder Description

The Universal CVR-120, 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 4-channel recording of the last 30 minutes of operation. The 120-minute portion of the recording is comprised of one channel that combines three audio panel sources and a second channel that contains the cockpit area microphone (CAM) source. The 30-minute portion of the recording contains 4

channels of audio information: one channel for each flight crew, one channel for a cockpit observer, and one channel for the CAM.

1.1 Recorder Damage

Upon arrival at the NTSB Vehicle Recorder's Laboratory, it was evident that the CVR had not sustained any heat or structural damage and the audio information was extracted from the recorder normally, without difficulty. Each channel's audio quality is indicated in table 1.¹

Table 1. Audio Quality.

Channel Number	Content/Source	Quality	Duration
1	Pilot/Co-Pilot/Extra	Not Used	120 minutes
2	CAM	Fair	120 minutes

1.2 Summary of Recording

The recording consisted of two channels of 2-hour mixed audio information (pilot/co-pilot/extra and CAM) and four channels of 30-minute-high quality audio information (pilot, co-pilot, extra, and CAM). However, none of the audio from the two-channel download nor the four-channel download were pertinent to the accident investigation. The recorded audio was consistent with maintenance activities.

1.3 Timing and Correlation

No time correlation was conducted as the recorder did not contain any information pertinent to this accident.

1.4 Impact Switch

N269AA is equipped with an Inertia Switch Incorporated impact switch, part number 3LO-453/2, which is designed to remove power from the CVR when the aircraft experiences a 2 g longitudinal impact in order to preserve the recording. If the impact switch is tripped during normal flight operations, maintenance operations will manually reset the impact switch, which is located in the aft baggage/radio rack. The impact switch may only be reset at the switch with the aircraft power on. The switch cannot be reset from the cockpit.

1.5 CVR and Impact Switch Testing

In agreement with the operator, the Investigator-in-Charge, Textron Aviation, and Universal Recorders, the NTSB conducted a bench test on the CVR and ground testing on the impact switch, CVR, and CVR control unit. The results of the bench test

¹ Appendix A comprises the CVR Quality Rating Scale.

showed that there were no CVR anomalies that would prevent the CVR from properly functioning. The ground test showed that the impact switch had tripped. After the impact switch was reset, the CVR passed the self-test and audio was recorded. Appendix B presents the test plan and the results.

1.5.1 Bench Testing

On December 13, 2023, specialists performed bench testing on the Universal CVR (P/N 1603-02-12 and S/N: 1626) at the NTSB Vehicle Recorder's Laboratory in Washington, DC. The bench test consisted of connecting the recorder to Universal Avionics Test Set (P/N: 1623-01 and S/N: 156) and simulating the recorder's self-test feature, as if the recorder was onboard an aircraft. The Universal Avionics Test Set was configured per the manufacturer's procedure and the self-test was conducted. The total test time from setup to completion was 35 minutes. The recorder self-test lasted 5 seconds. The result of the test was a PASS. It was observed that the pass/fail lights did not alternate on the test set. After discussions with the manufacturer, the NTSB determined that the test was successfully conducted with the results showing that the recorder had no malfunctions or faults that would hinder the ability for the recorder to write. The manufacturer dismissed the test set alternating lights as an issue, and said it was possible that the lights were out on the test set. Appendix C presents figures of the bench testing setup and results (figures 1 through 4).

1.5.2 Aircraft Impact Continuity Switch and CVR Test

On December 19, 2023, testing was performed on the accident airplane, N269AA at Houston William P. Hobby Airport, Houston, Texas. A technical expert and an avionics technician, both from Textron Aviation, were present and witnessed the test. The purpose of the first test was to determine whether the impact switch was open (no power provided to the CVR) or closed (power provided to the CVR). The test showed that the impact switch was tripped and was open, resulting in no power being provided to the CVR.

The Hawker 850XP cockpit contains a CVR control unit and is shown in Appendix D, figure 5. The control unit allows pilots and maintenance personnel to perform a self-test of the CVR in order to ensure the CVR is functioning properly and recording audio. According to the operator, this test is to be performed by the crew before every flight during completion of the Before Engine Start checklist. A successful test is indicated by the solid illumination of the green PASS light at the completion of the test.

The second portion of the test was conducted after powering on the aircraft and pressing the self-test CVR feature on the control unit at the left seat. On the first activation of the CVR self-test, the control unit did not power on. After the self-test failed, the impact switch was manually reset. A click noise was observed and 26.2 VDC was measured at the terminals of the impact switch. A self-test was

conducted for a second time, which resulted in a pass. The total test time was one hour. Appendix E includes figures from the onsite testing (figures 6 through 8).

Upon returning to the NTSB's Vehicle Recorder Laboratory, the CVR was downloaded again, and the audio was examined. The last portion of the recording contained audio from the testing conducted on the aircraft on December 19, 2023, after the impact switch was reset.

1.6 Results

The bench and aircraft impact continuity switch and CVR test show the following:

1. The CVR bench test was a PASS.
2. Noted observations from the bench test were:
 - a. The pass/fail lights did not alternate on the test set,
 - b. Universal Avionics, the manufacturer of the CVR, was contacted in regard to the pass/fail lights not operating on the test set. Based on the messages displayed during the test, it was concluded that a successful bench test was conducted, and
 - c. The elapsed time of the test was 5 seconds.
3. Testing conducted on the aircraft and CVR showed the following on the first test:
 - a. The impact switch continuity was OPEN, and
 - b. The CVR self-test was a FAIL.
4. The impact switch was reset, and the test was repeated and showed the following:
 - a. The impact switch continuity was CLOSED, and
 - b. The CVR self-test was a PASS.
5. Notes and observations from testing on the accident vehicle:
 - a. The elapsed time of the onsite test was one hour,
 - b. No CVR fail annunciators were observed,
 - c. When the impact switch was reset, a clicking sound was observed from the device,
 - d. Aircraft power needs to be on in order to reset the impact switch, and
 - e. Experienced mechanics/avionic technicians noted that if no power was observed at the control unit, that they know to press the reset on impact switch.

Submitted by:

Steven Smith
Mechanical Engineer (Recorder Specialist)

APPENDIX A. 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.

APPENDIX B. CVR TEST PLAN

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COCKPIT VOICE RECORDER

Specialist's Test Plan

December 13, 2023

COCKPIT VOICE RECORDER
SPECIALIST'S TEST PLAN

DCA24FA017
PG 1 OF 13

TABLE OF CONTENTS

A. ACCIDENT.....	3
B. COCKPIT VOICE RECORDER SPECIALIST	3
C. TEST EQUIPMENT	3
D. PURPOSE.....	3
E. BACKGROUND.....	4
F. RECORDER DESCRIPTION.....	4
G. TEST PLAN.....	4
H. REFERENCES	4
I. CVR BENCH TEST.....	5
J. AIRCRAFT INERTIA CONTINUITY SWITCH AND CVR TEST	8

A. ACCIDENT

Location: Houston, Texas
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B. COCKPIT VOICE RECORDER SPECIALIST

Specialist: Steven Smith
Mechanical Engineer (Recorder Specialist)
National Transportation Safety Board (NTSB)

C. TEST EQUIPMENT

Recorder Manufacturer/Model:	Universal CVR-120
Part Number:	1603-02-12
Recorder Serial Number:	1626
Bench Test Equipment:	Universal Avionics Test Set
Part Number:	1623-01
Serial Number:	156
Impact Switch:	Inertia Switch, Inc
Part Number:	3LO-453/2
Computer:	9-Pin RS-232 Port with PuTTY
DC Power Supply:	As Required
Headset (TSO'd):	As Required
Multimeter:	As Required
Recording Device:	Cell Phone with Video/Photo Camera

D. PURPOSE

The purpose of this document is to detail the testing procedures for a bench test, impact switch continuity test, and a cockpit CVR test. The bench test shall be conducted at NTSB headquarters in Washington, DC and the continuity and cockpit CVR test shall be conducted on the accident vehicle. The testing results will provide information to why N269AA CVR did not record the accident and cues that may have been available to indicate the CVR was not recording.

COCKPIT VOICE RECORDER
SPECIALIST'S TEST PLAN

DCA24FA017
PG 3 OF 13

E. BACKGROUND

The second event aircraft, N269AA, was operating as Title 14 *Code of Federal Regulations* (CFR) Part 135. The CVR was removed from the accident vehicle and shipped to NTSB headquarters. The CVR arrived at headquarters on Friday October 27, 2023. The recorder was successfully downloaded in two different channel formats.

F. RECORDER DESCRIPTION

This model CVR, the Universal CVR-120, 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 4-channel recording of the last 30 minutes of operation. The 120-minute portion of the recording is comprised of one channel that combines three audio panels sources and a second channel that contains the cockpit area microphone (CAM) source. The 30-minute portion of the recording contains 4 channels of audio information: one channel for each flight crew, one channel for a cockpit observer, and one channel for the CAM.

G. TEST PLAN

The following pages provide step by step guidance on conducting each test, starting with the bench test, and finishing with the impact switch and CVR test on the accident vehicle. The bench test will take place at the NTSB Vehicle Recorder Laboratory and the impact switch/CVR test will take place on the accident aircraft. **Note:** for each test where the CVR is used, approximately 25 seconds of the oldest memory will be overwritten.

H. REFERENCES

- Universal Avionics Systems Corporation CVR-30B and CVR-120 Solid State Cockpit Voice Recorder Installation Manual (23-70-03, Revised: 01/20/1998, Page 405)
- Universal Avionics Systems Corporation CVR-30B and CVR-120 Solid State Cockpit Voice Recorder Data Retrieval Manual (23-70-04, Revised: May 5, 1999)
- Raytheon Aircraft Hawker 800XP Maintenance Manual Addenda Universal CVR-120 CVR Adjustment/Test (23-70-35, Revised Feb 25/00)

Submitted by:

Steven Smith
Mechanical Engineer (Recorder Specialist)

COCKPIT VOICE RECORDER
SPECIALIST'S TEST PLAN

DCA24FA017
PG 4 OF 13

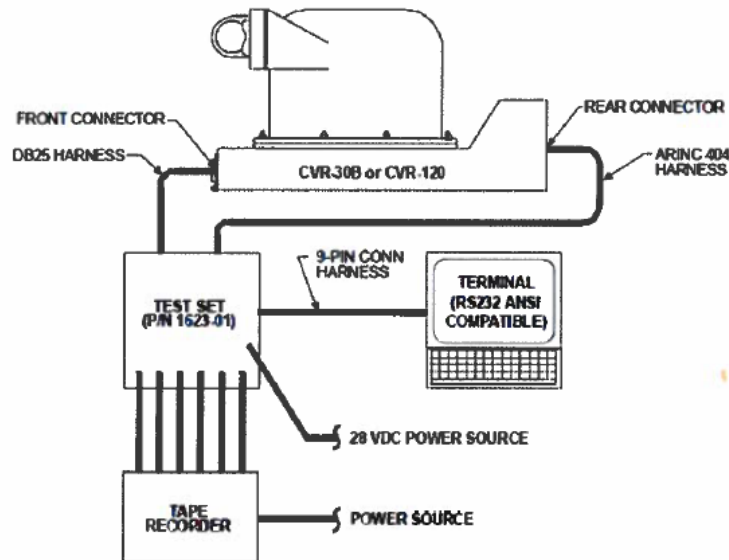
I. CVR BENCH TEST

Date: 12/13/2023 Start of Test: 10:05 AM EST End of Test: 10:40 AM EST

Required Equipment:

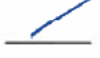
- Universal CVR (P/N: 1603-02-12 and S/N:1626)
- Universal Avionics Test Set (P/N: 1623-01 and S/N: 156)
- Cell Phone (photos/video)
- DC Power Supply
- Computer (with 9-Pin RS-232 Port with PuTTY Software)

Test setup diagram:



1623-01 Test Set Connections

Step Number	Procedure	Result
1.	Connect the large serial cable from the test set to the front of the CVR. (mark as complete)	✓
2.	Connect the ARINC connector labelled 'CVR' to the rear of the connector. The CVR is powered by the Test Set Box - not by the rack. (mark as complete)	✓
3.	Connect the 9-pin cable labeled 'CVR' coming from the test set into an available PC com port. (mark as complete)	✓

Step Number	Procedure	Result
4.	Use the multi-color cable (contained in the cable drawer) to hook up to the HI-level audio outputs. In order from left to right, the color scheme is: Yellow, Red, Black, Blue, Green, White. Connect the other part of the cable into the far-left side of the black panel. (mark as complete)	
5.	Start PuTTY and set for: VT100 terminal emulation (or Serial>>Terminal), 9600 baud, 8 bit one stop, Parity none, XON/XOFF. Make sure COM-1 is the port being used. (mark as complete)	
6.	Confirm the following switch positions on the Test Set: a) TEST SET POWER - Off b) CHANNEL SELECT Switches • PA - Off • COPILOT - Off • PILOT - Off • MIXED - Off • AREA MIC - Off • HI-FI AREA MIC - Off c) GND EQ INTLK - On d) REC ON - On e) 24dB, 12dB and 6dB - Off f) All other switches - Off (mark as complete)	      
7.	Attach the 28 VDC to the test set, Turn power on for the test set and ensure that the 'EXT CVR-FDR PWER' switch is 'on'. Note: The CVR should draw about 400 ma. As the CVR powers up, the terminal window on the computer should populate with information with various controls. (mark as complete)	
8.	On the computer, type in 5 (Self Test) and ENTER to initiate self test. (mark as complete)	
9.	Self test will take approximately 15 seconds to perform. During self test, the PASS and FAIL Lights on the CVR controller will alternatively illuminate. MODE on the terminal screen will read SELF TEST. OPERATION will read TESTING. No incoming audio will be recorded during self test. (mark as complete)	

Step Number	Procedure	Result
10.	At the end of a successful self test, the MODE will read "RECORD" and OPERATION will become "STOP". (mark as complete)	✓
11.	TEST RESULTS will be displayed as follows: a) Audio Ch1, Ch2, Ch3, Ch4, Ch5, and Ch6 will read PASS b) Flash Memory will read OK c) Power Supply will read PASS (mark if PASS, note if they FAIL)	PASS OK PASS

RESULT OF TEST (circle one): PASS/FAIL

OBSERVATIONS (describe below):

- The pass/fail lights did not alternate on the test set
- Elapsed time was 0:05 seconds
- will contact Universal to confirm results

Test Director:

Print Name: Steven Smith
 Signature: [Redacted]
 Date: 12/13/2023

Engineer:

Print Name: Chris Babcock
 Signature: [Redacted]
 Date: 12/13/23

J. AIRCRAFT INERTIA CONTINUITY SWITCH AND CVR TEST

Date: 12/19/2023 Start of Test: 0900 CST End of Test: 1000 CST

Required Equipment:

- Universal CVR (P/N: 1603-02-12 and S/N:1626)
- Cell Phone (photos/video)
- Multimeter
- Impact Switch (affixed to the aircraft)
- TSO'd Headset

Test setup diagram:



Step Number	Procedure	Result
1.	Test Director is required to brief maintenance and operation team regarding the steps and goal of the test. Note: NTSB personnel are not to handle any operations or maintenance related tasks. (mark as complete)	
2.	Open the aft baggage/radio rack where the CVR is located during normal flight operations. (mark as complete)	

COCKPIT VOICE RECORDER
SPECIALIST'S TEST PLAN

DCA24FA017
PG 8 OF 13

Step Number	Procedure	Result
3.	Identify the Inertia Switch. Note the terminal locations and the reset button. WARNING: DO NOT PRESS THE RESET BUTTON! (mark as complete)	
4.	Attach a lead to each terminal. Note: the aircraft does not need to be powered on. (mark as complete)	
5.	Set the multimeter dial to Ohms symbol. Note: if continuity exists, then the switch has not tripped. (circle open or closed for continuity)	OPEN  CLOSED
6.	Place the CVR into the aft baggage/radio rack. (mark as complete)	
7.	Power on the aircraft and record the start-up, noting if any CVR errors are observed. (mark as complete)	 No annunciators for the CVR
8.	If there is a prolonged period before starting the test, pull the CVR circuit breaker. (mark as complete - As Required)	NOT REQUIRED
9.	Put on the headset and plug into the control unit headphone jack. (mark as complete)	
10.	Prior to pressing the TEST button on the control unit, verify that the CVR circuit breaker has been placed back in the proper location. (mark as complete - As Required)	
11.	Press the TEST button and record and monitor the control unit. Note: the test should take approximately 15 seconds. Note: if the impact switch is open, no power will be provided to the control unit and the test will not run. (mark as complete)	No power to the Control Unit
12.	The CVR self test will begin. During self test, the PASS and FAIL lights will come on alternately, indicating that the self test is in progress. (mark as complete)	FAIL No power to the Control Unit
13.	Speak into the headset (10 seconds after completion of self test). Note: Cockpit conversation will be heard through headset and visible on the SIGNAL LEVEL indicator. The test tone audio will be heard. No audio will be recorded during self test. (mark as complete)	FAIL no power to the Control Unit

Step Number	Procedure	Result																																								
14.	Once the test has been completed, power down the aircraft only if the impact switch was in the CLOSED position. (mark as complete)	Power remained ON																																								
15.	Note the test result status: <table border="1"> <thead> <tr> <th>Number of FAIL flashes</th><th>CVR Conditions</th><th>FAIL light</th><th>PASS light</th></tr> </thead> <tbody> <tr> <td>None</td><td>Pass</td><td>Off</td><td>On</td></tr> <tr> <td>1</td><td>Channel 1 fail</td><td>On</td><td>Off</td></tr> <tr> <td>2</td><td>Channel 2 fail</td><td>On</td><td>Off</td></tr> <tr> <td>3</td><td>Channel 3 fail</td><td>On</td><td>Off</td></tr> <tr> <td>4</td><td>Channel 4 fail</td><td>On</td><td>Off</td></tr> <tr> <td>5</td><td>Flash memory fail</td><td>On</td><td>Off</td></tr> <tr> <td>Steady</td><td>General Fail (Note 1)</td><td>On</td><td>Off</td></tr> <tr> <td>Alternating</td><td>System Test In progress</td><td>Alt</td><td>Alt</td></tr> <tr> <td>Simultaneous</td><td>Bulk erase</td><td>Sim</td><td>Sim</td></tr> </tbody> </table> Note: General fail is a misc. failure of channel 5, 6, Frequency Shift Keying (FSK), ARINC Channels etc. The BITE status code indicates which function has failed. Please contact Universal Avionics for assistance with determining a particular BITE status failure indication. Note: Should self test fail and it is desired to do another self test, the TEST button must be pressed firmly for at least one second to engage self test.	Number of FAIL flashes	CVR Conditions	FAIL light	PASS light	None	Pass	Off	On	1	Channel 1 fail	On	Off	2	Channel 2 fail	On	Off	3	Channel 3 fail	On	Off	4	Channel 4 fail	On	Off	5	Flash memory fail	On	Off	Steady	General Fail (Note 1)	On	Off	Alternating	System Test In progress	Alt	Alt	Simultaneous	Bulk erase	Sim	Sim	PASS/FAIL (if the self test is FAIL, mark which channels have failed below): _____ Note: If impact switch is OPEN (step 5), no power will be provided to control unit and the test will not run.
Number of FAIL flashes	CVR Conditions	FAIL light	PASS light																																							
None	Pass	Off	On																																							
1	Channel 1 fail	On	Off																																							
2	Channel 2 fail	On	Off																																							
3	Channel 3 fail	On	Off																																							
4	Channel 4 fail	On	Off																																							
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Steady	General Fail (Note 1)	On	Off																																							
Alternating	System Test In progress	Alt	Alt																																							
Simultaneous	Bulk erase	Sim	Sim																																							
16.	NOTE: If the inertia switch was CLOSED (as marked in step 5) the test is complete and no additional testing is required! Open the aft baggage/radio rack where the CVR is located during normal flight operations. (mark as complete)	✓																																								
17.	Identify the inertia switch. Note the terminal locations and the reset button.	✓																																								

Step Number	Procedure	Result
18.	Attach a lead to each terminal. Note: remove the CVR as required to reach the terminals and the reset button (mark as complete)	✓ CVR removed in place
19.	Set the multimeter dial to Ohms symbol and verify the loop is OPEN. (mark as complete)	✓ still open
20.	Verify, using a good ground, that there is approximately 28 VDC at the terminals of the impact switch. (mark voltage level)	26.2 VDC Good Ground ✓
21.	Press the reset button on the impact switch and verify that the loop is CLOSED. NOTE: AIRCRAFT POWER MUST BE ON TO RESET THE IMPACT SWITCH! Note: place the CVR back into the aircraft if removed in step 18. (mark as complete)	✓ Click sound was heard when reset button was pressed
22.	If there is a prolonged period before starting the test, pull the CVR circuit breaker. (mark as complete - As Required)	Not Required
23.	Put on the headset and plug into the control unit headphone jack. (mark as complete)	✓
24.	Prior to pressing the TEST button on the control unit, verify that the CVR circuit breaker has been placed back in the proper location. (mark as complete - As Required)	✓
25.	Press the TEST button and record and monitor the control unit. Note: the test should take approximately 15 seconds. (mark as complete)	✓
26.	The CVR self test will begin. During self test, the PASS and FAIL lights will come on alternately, indicating that the self test is in progress. (mark as complete)	✓
27.	Speak into the headset (10 seconds after completion of self test). Note: Cockpit conversation will be heard through headset and visible on the SIGNAL LEVEL indicator. The test tone audio will be heard. No audio will be recorded during self test. (mark as complete)	✓
28.	Once the test has been completed, remove the CVR circuit breaker and power down the aircraft. (mark as complete)	✓

Step Number	Procedure	Result
29.	Note the test result status:	PASS/FAIL (if the self test is FAIL, mark which channels have failed below): N/A Test ran twice - Passed both times - Audio recorded to CVR needs to be verified in the lab
	Number of FAIL flashes	
	CVR Conditions	
	FAIL light	
	PASS light	
	None	
	Pass	
	Off	
	On	
	On	
30.	Channel 1 fail	
	Channel 2 fail	
	Channel 3 fail	
	Channel 4 fail	
	Flash memory fail	
	General Fail (Note 1)	
	System Test In progress	
	Alt	
	Alt	
	Sim	
31.	Sim	
	Simultaneous	
	Bulk erase	
	Sim	
	Sim	
	Note: General fail is a misc. failure of channel 5, 6, Frequency Shift Keying (FSK), ARINC Channels etc. The BITE status code indicates which function has failed. Please contact Universal Avionics for assistance with determining a particular BITE status failure indication.	
	Note: Should self test fail and it is desired to do another self test, the TEST button must be pressed firmly for at least one second to engage self test.	
	Remove the CVR from the aft baggage/radio rack. Place the CVR circuit breaker back in the proper location. (mark as complete)	
	Test Director to complete debrief of operations and maintenance teams. (mark as complete)	

RESULTS OF TEST #1 (circle one for each test):

- Inertia Switch Continuity Test: OPEN/CLOSED
- CVR Self Test: PASS/FAIL

→ won't even conduct the test

RESULTS OF TEST #2 (circle one for each test):

- Inertia Switch Continuity Test: OPEN/CLOSED/NOT REQUIRED
- CVR Self Test: PASS/FAIL/NOT REQUIRED

→ we passed the impact switch reset

OBSERVATIONS (describe below):

- Probed the terminals of the impact switch and observed Open Loop (aircraft power off)
- Powered on the aircraft, verified that the CVR and CVR circuit breaker were in
- CVR ~~control unit~~ ^{control unit} on left seat would not power on (fail)
- Probed Power/Ground by CVR and observed 28 VDC and good ground
- Pressed impact switch reset button and observed click sound and saw open loop change to closed (continuity)
- Went back to cockpit and did CVR self test (twice)
- CVR self test passed twice (recorded audio)
- Avionics noted that pilots should press in pre-flight on first flight of the day
- * Also noted that if no power was applied at CVR test, that they knew to press the reset on impact (inertia switch)
- Impact Switch may only be reset w/ power ON
- Did not observe any CVR/fail annunciators

*experienced

mechanic → Avionics techs

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SPECIALIST'S TEST PLAN

10/19/23

DCA24FA017
PG 13 OF 13

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10-19-23

APPENDIX C. BENCH TEST SETUP AND RESULTS

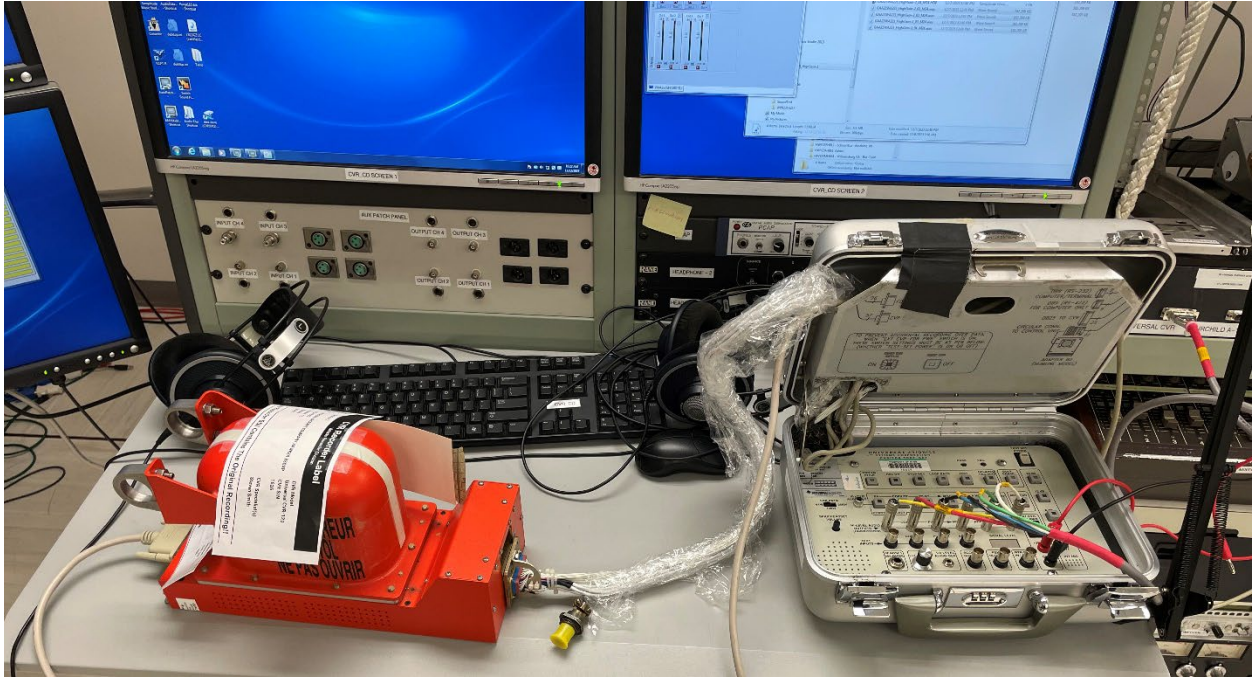


Figure 1. Bench Test Setup.

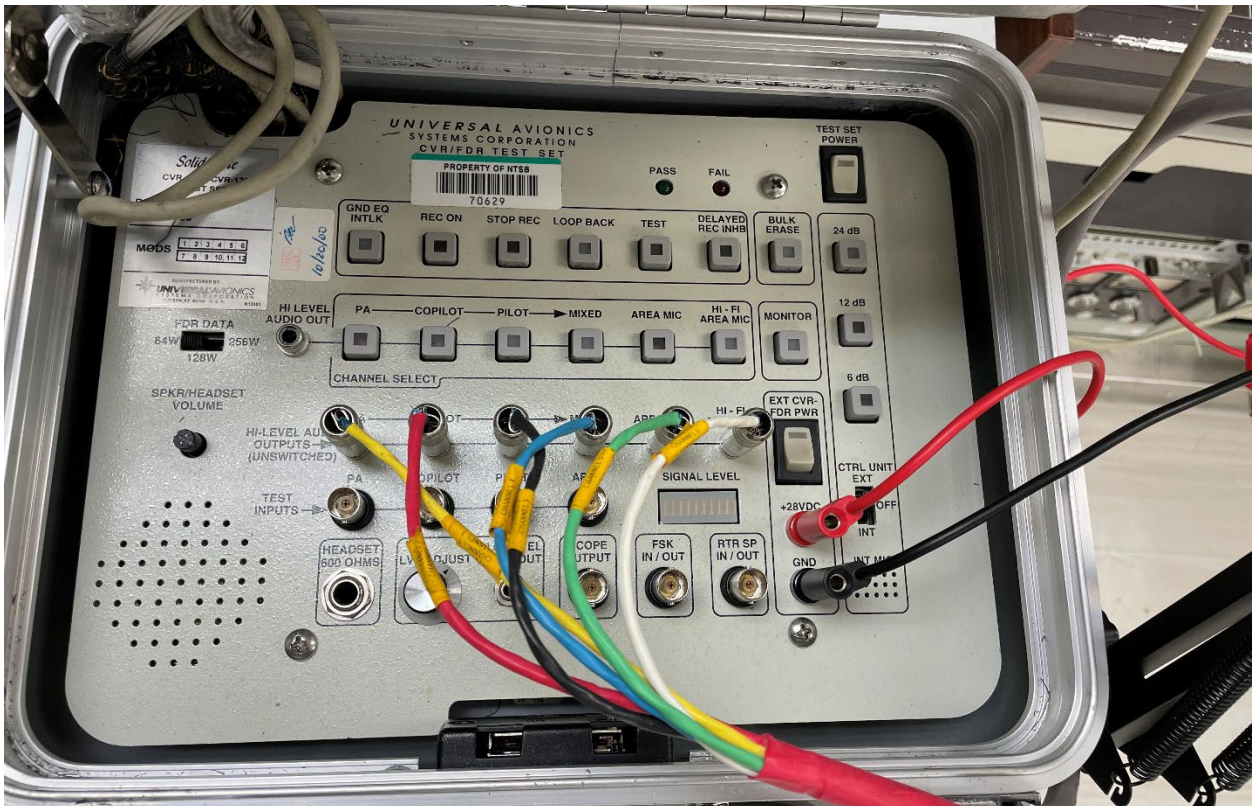


Figure 2. Universal Avionics CVR/FDR Test Set P/N: 1623-01 and S/N: 156.

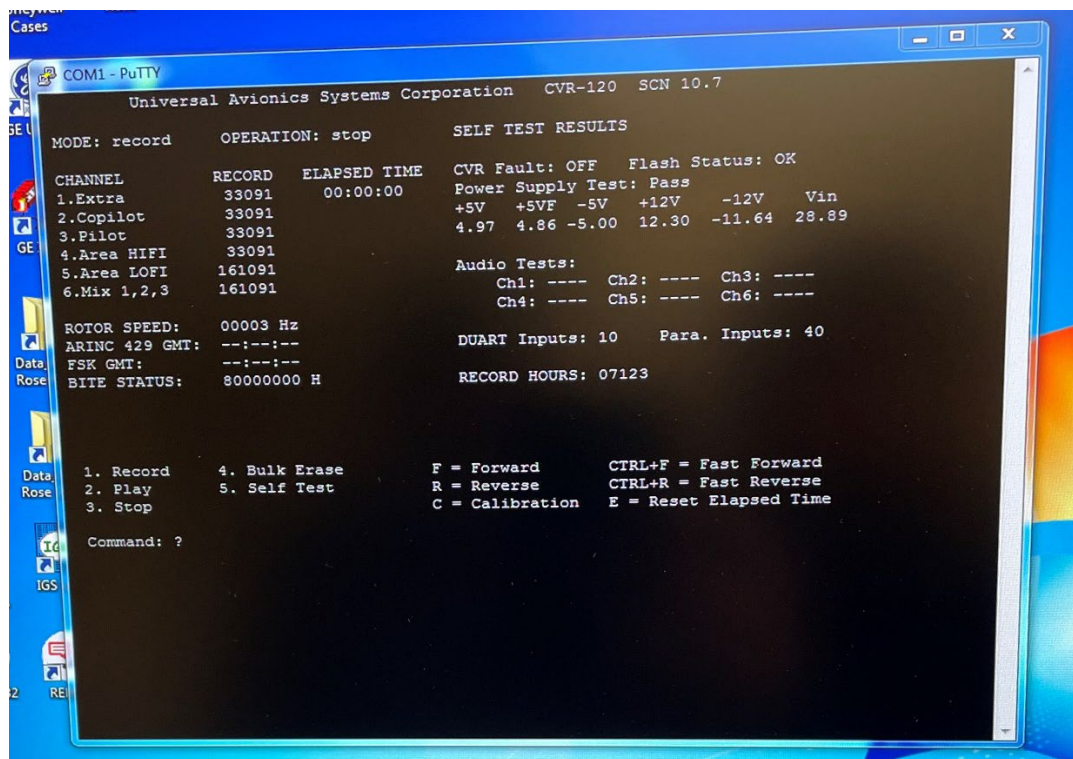


Figure 3. Test initialization prompt.

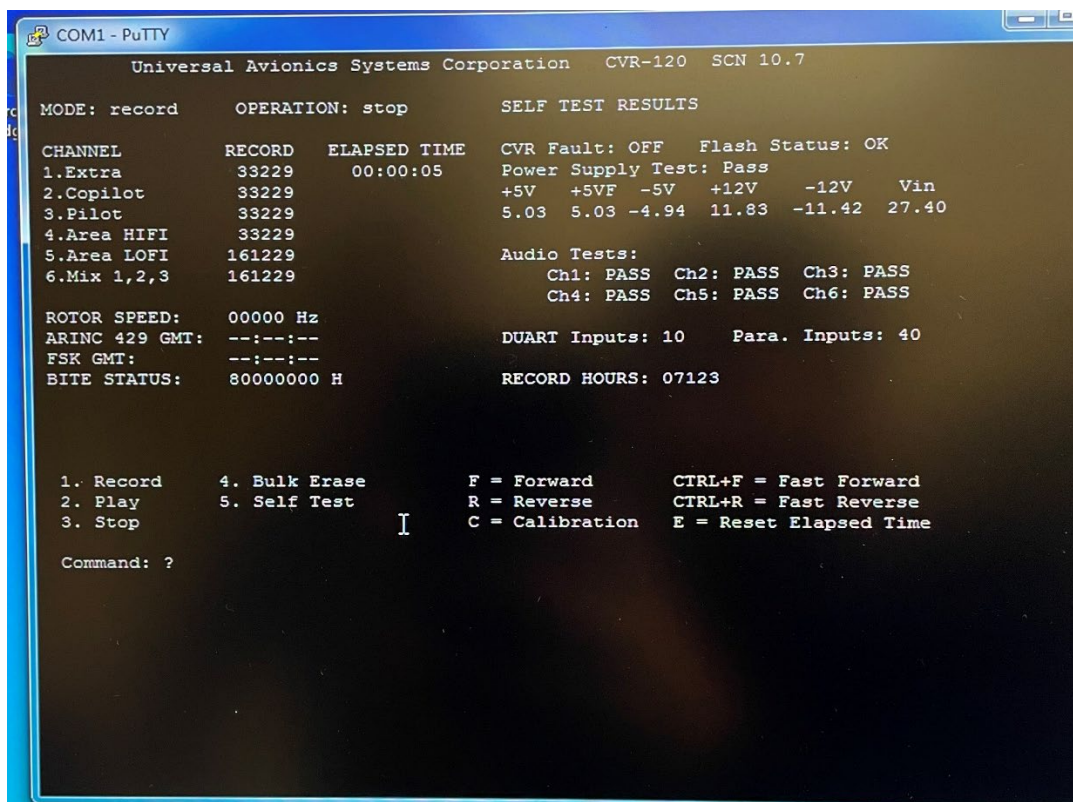


Figure 4. CVR bench test results displaying PASS results for all channels.

APPENDIX D. COCKPIT VOICE CONTROL UNIT

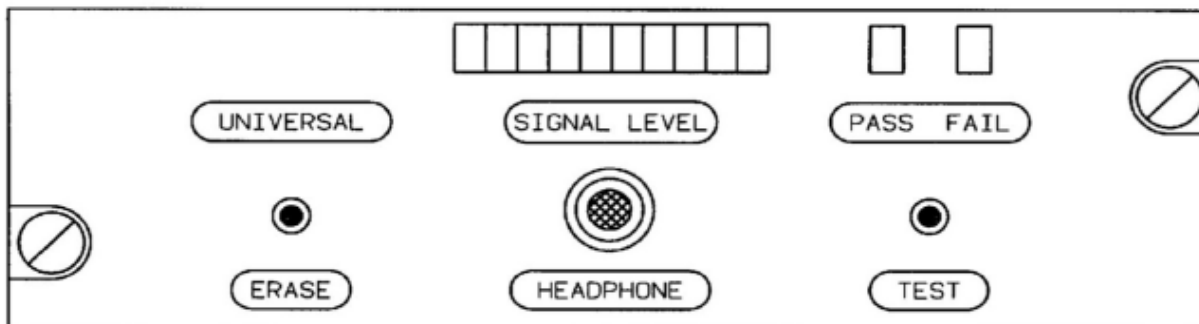


Figure 5. Cockpit voice control unit on the control unit.

Cockpit voice control unit buttons explained:

1. **ERASE:** Bulk erasure of the flash memory. May only be done on the ground with the weight on wheels relay made. Erasure button must be held for 5 seconds and will take 10 seconds to complete.
2. **TEST:** CVR self-test feature. The test circuit injects a signal, at a predetermined level, into each of the four record amplifiers alternately. This recording is played back through the monitor amplifier and can be monitored at the headset jack socket.
3. **PASS FAIL:** Will alternate during both the bulk erasure and CVR self-test. Any test result will display either a solid green (PASS) or solid red (FAIL) illumination.
4. **SIGNAL LEVEL:** Measures the audio signals sent to the headphone jack socket.
5. **HEADPHONE:** Headphone jack socket location.

Table 2. CVR self-test failure conditions.

Number of FAIL flashes	CVR Conditions	FAIL light	PASS light
None	Pass	Off	On
1	Channel 1 fail	On	Off
2	Channel 2 fail	On	Off
3	Channel 3 fail	On	Off
4	Channel 4 fail	On	Off
5	Flash memory fail	On	Off
Steady	General Fail (Note 1)	On	Off
Alternating	System Test In progress	Alt	Alt
Simultaneous	Bulk erase	Sim	Sim
Note: General fail is a miscellaneous failure of channel 5, 6, Frequency Shift Keying (FSK), ARINC Channels etc. The BITE status code indicates which function has failed. Please contact Universal Avionics for assistance with determining a particular BITE status failure indication.			
Note: Should self-test fail and it is desired to do another self-test, the TEST button must be pressed firmly for at least one second to engage self-test.			

APPENDIX E. AIRCRAFT IMPACT SWITCH AND CVR TEST SETUP AND RESULTS



Figure 6. Impact switch on N269AA located in the aft baggage compartment/radio rack.



Figure 7. DC power indicated at CVR after the impact switch was reset.



Figure 8. Control unit completing successful self-test after impact switch reset.