

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division

March 10, 2016

Cockpit Voice Recorder Maintenance History

Specialist's Factual Report
By Bill Tuccio, Ph.D.

1. EVENT SUMMARY

Location: Akron, Ohio
Date: November 10, 2015
Aircraft: British Aerospace HS 125-700A, Registration N237WR
Operator: Execuflight, "Zipline" Flight 1526
NTSB Number: CEN16MA036

On November 10, 2015, about 1452 eastern standard time (EST), Execuflight flight 1526, a British Aerospace HS 125-700A, N237WR, departed controlled flight while on approach to land at the Akron Fulton International Airport (AKR) and impacted a 4-plex apartment building in Akron, Ohio. The pilot, co-pilot, and seven passengers were fatally injured; there were no reported ground injuries. The airplane was destroyed by impact and postimpact fire. The airplane was registered to Rais Group International NC LLC., and operated by Execuflight, as a Title 14 *Code of Federal Regulations* (CFR) Part 135 on-demand charter flight. Instrument meteorological conditions prevailed at the time of the accident, and the flight was operated on an instrument flight rules (IFR) flight plan. The flight originated from Dayton-Wright Brothers Airport (MGY), Dayton, Ohio, at 1413 EST and was destined for AKR. A tape cockpit voice recorder (CVR) was sent to the National Transportation Safety Board (NTSB) Vehicle Recorder Division for evaluation.

2. GROUP

A group was not convened.

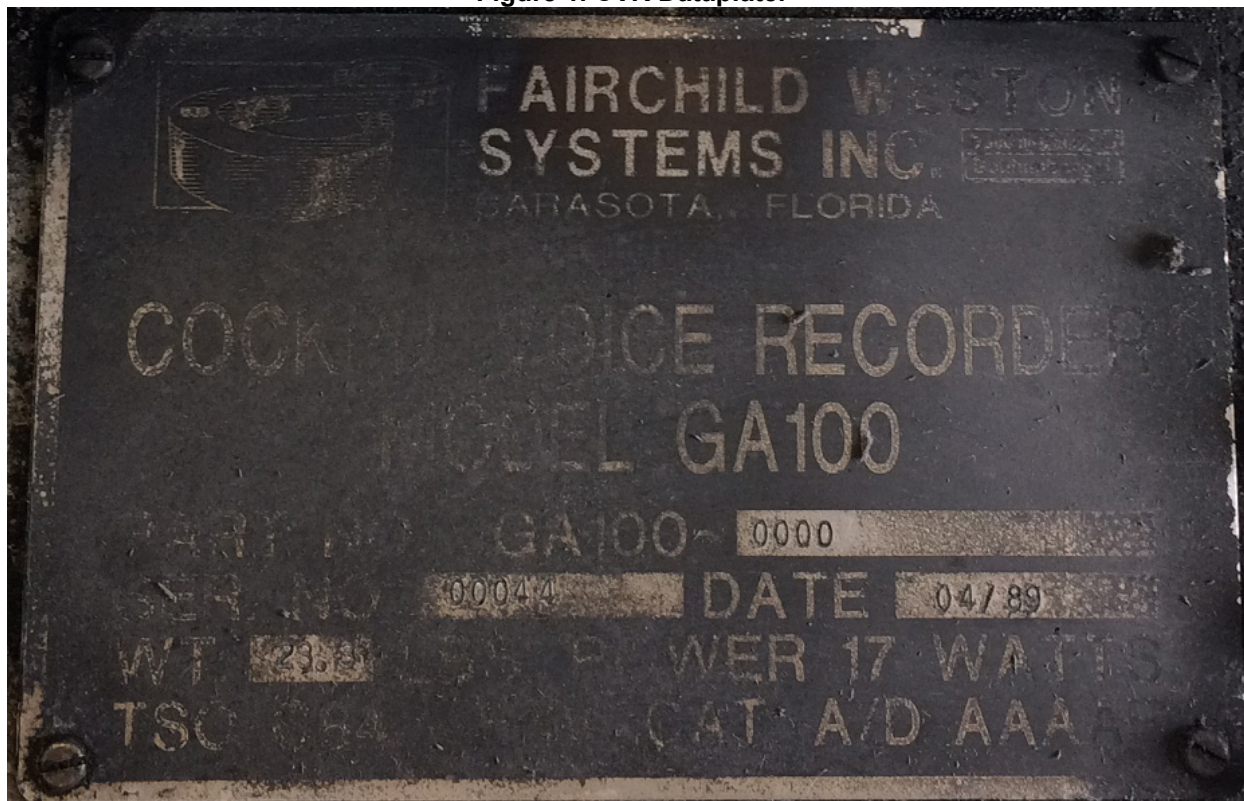
3. CVR Maintenance and Oversight

Download of the tape-based Fairchild GA-100 CVR, serial number 00044, revealed all channels were of degraded quality. This report details the maintenance history of the CVR, manufacturer maintenance guidelines, summaries of personnel interviews, and regulatory guidance and oversight.

3.1 Actual CVR Maintenance Timeline

Figure 1 shows the CVR dataplate. The CVR was manufactured in April, 1989 by Fairchild Weston Systems Inc. Fairchild was acquired by L-3 Communications, Aviation Recorders ("L-3"). L-3 is responsible for support of Fairchild recorders.

Figure 1. CVR Dataplate.



The CVR was overhauled by Duncan Aviation, Lincoln, Nebraska, on July 16, 2009. The FAA Form 8130-3 returned the CVR to service. The 8130-3 is provided as attachment 1 to this report. Table 1 summarizes key maintenance milestones related to the CVR. Based on the times in table 1, the aircraft had operated 1,589.3 hours with the overhauled CVR.

Event	Date	Aircraft Time Since New	Aircraft Cycles Since New
Overhauled CVR installed in N237WR	7/21/2009	13,358.4	10,102
Last 12-month avionics inspection	5/13/2015	14,818.8	10,992
Accident	11/10/2015	14,947.7	11,075

3.2 L-3 Recommended Maintenance Timeline

When the Fairchild GA-100 recorder was first manufactured, the overhaul period was 8,000 CVR operating hours. According to L-3, for every 1 aircraft operating hour, the CVR is expected to operate for 1.7 hours because the CVR is typically powered by ground power when the aircraft engines are not operating. Thus, the original time between overhauls of the Fairchild GA-100 recorder was about 4,700 aircraft operating hours.

Sometime before 2009, the original tape material used in the Fairchild GA-100 recorder was no longer available and L-3 (who acquired Fairchild) found a replacement tape

material. The replacement tape material decreased the tape life from 8,000 CVR operating hours to 4,000 CVR operating hours. Applying the 1.7 conversion factor, this resulted in an overhaul interval of about 2,353 aircraft operating hours.

In addition to the overhaul interval, the thermodynamic water pack used to protect the tape survivability during a post-crash fire was required to be weighed during each maintenance interval. Typically, the water packs last about 10 years.

3.3 Execufight Maintenance Plan

Execufight maintained the CVR in accordance with an Approved Aircraft Inspection Program (AAIP). The AAIP listed items to be checked. Figure 2 shows the AAIP as signed off on May 13, 2015. There were two items on the AAIP related to a cockpit voice recorder: a Fairchild G-1000 and Fairchild GA-100. The aircraft only had a Fairchild GA-100 installed and Fairchild never manufactured a “G-1000.”

Figure 2. Excerpt of AAIP, as signed off on May 13, 2015.

23.	Cockpit Voice Recorder a. functional check per manufacture's procedures	Fairchild G-1000	[Redacted]	←
24.	Angle of Attack System a. functional check per manufacture's procedures	Teledyne	[Redacted]	
29.	Cockpit Voice Recorder a. functional check per AC43.13-1B CHG. 1 Chapter 12	Fairchild GA-100	[Redacted]	←

3.4 Other Information About Execufight

Execufight operated another Hawker aircraft, N880RG, similar to the accident aircraft. After the accident, Execufight was asked about the CVR in N880RG. Execufight reported that the CVR was inoperative.

According to Execufight's Director of Maintenance (DOM), the contract avionics provider determined the CVR in N880RG was unserviceable. The DOM said the contract avionics provider informed Execufight the CVR, "was not testing," and was replaced with an overhauled CVR. Subsequently, N880RG was returned to service after operational checks were performed by the contract avionics provider.

As part of the investigation, the NTSB requested that Execufight provide the CVR and/or recording from N880RG's inoperative CVR. The purpose of the request was to determine if there were similar audio quality issues as on the accident aircraft. On January 12, 2016, Execufight denied the request.

3.5 Execufight Operational Checks (related to flight crew)

The flight crew was required to check the CVR as part of the Before Starting Engines Checklist, shown in figure 3. The checklist item is read by the pilot monitoring and performed and replied "Tested" by the pilot flying. The CVR test is done before the engines are started.

According to Excuflyght's Chief Pilot, the CVR test was performed as follows, "To perform a Pre-flight Functional check, push and hold the remote green 'TEST' switch for a minimum of five seconds. The green test 'OK' annunciator will remain illuminated until the button is released. This would be considered a Pass." The Chief Pilot indicated this procedure was based on guidance from Fairchild, shown in figure 4.

Figure 3. Flight crew CVR checklist item.

- PF ~~Pilot flying.~~ Pilot Flying. The pilot responsible for controlling the airplane. Performs tasks and responds to checklist challenges.
- PM Pilot Monitoring. Reads checklist challenges.
- (BOTH) ... PF and PM both perform the task and respond to the challenge.
- LH Left Hand task that can be completed from left hand seat only.
- RH Right Hand task that can be completed from right hand seat only.

BEFORE STARTING ENGINES CHECK

PM	PF
Landing Gear Handle	DOWN
Emergency U/C Handle	IN
Emergency Gyro/Battery	CHECKED
Battery Voltage	CHECKED
Battery Switch	ON
Fuel Quantity	CHECKED
Emergency U/C Pump Handle	LOCKED
APU	STARTED
Bus Tie	CLOSED
Inverters	CHECKED/ON
Rear Bulkheads	CHECKED
Side Panels	CHECKED
Pedestal	CHECKED
Flight Instrument Panels	CHECKED
Center Instrument Panel	CHECKED
Pressurization	SET
Radios/Radar	ON/STBY
FMS NAVAIDS and V Bars	SET
TCAS / GPWS	TEST
Landing and Taxi Lights	OFF
Fire Warning Panel	CHECKED
Overhead Panel	CHECKED
Landing Lights	OFF
Windshield Wipers	OFF
Main Air Valves	CLOSED
Flight Deck Heat	CLOSED
Cabin Temperature	AUTO/SET
Pressurization O/Ride Switch	AUTO
Cabin Fan	OFF
Flood Flow	AS REQUIRED
Cockpit Fan	AS REQUIRED
Engine Synchronizer	OFF
Engine Computers	AUTO
Ignition	OFF
Engine Anti-Ice	OFF
Ice Detector	AUTO
Test Panel	CHECK ALL SYSTEMS
Pitot Heat	OFF
Windshield Ait/Heat	OFF
Interior Lights	SET
Emergency Lights	ARMED
Cockpit Voice Recorder	TESTED



Figure 4. Fairchild GA-100 pre-flight functional check.

3.1 PRE-FLIGHT FUNCTIONAL CHECK

The Pre-flight Functional Check is used to assure the operator that the equipment is serviceable. Therefore, it is to be performed before every flight or whenever maintenance has been performed on the aircraft or rotorcraft which may have affected the performance of the Cockpit Voice Recorder or its associated Audio System interface, accessories, or components..

To conduct the Pre-flight Functional Check, push and hold the remote green "TEST" switch or "TEST" switch on the Control Unit for a minimum of five seconds. The green test "OK" annunciator will remain illuminated until the button is released. If the test annunciator does not illuminate within 6 seconds, the recorder must be removed from the aircraft for servicing.

3.6 FAA Oversight of Execufight related to the CVR

Execufight operations were overseen by a FAA Principle Maintenance Inspector (PMI), a Principle Avionics Inspector (PAI), and a Principal Operations Inspector (POI). Maintenance oversight of the CVR was primarily conducted by the PAI. Operational (i.e., flight crew) oversight was conducted by the POI.

3.6.1 FAA PMI

Since the CVR was considered an avionic, FAA maintenance oversight questions were addressed by the PAI rather than the PMI.

3.6.2 FAA PAI

The PAI stated that he had ramp checked the accident aircraft about four months prior to the accident; however, at that time no power was available to power the aircraft so no CVR check could be performed. The PAI indicated that during maintenance inspections, FAA policy was that inspections should not create additional work or level of risk to the operator. For example, checking the CVR with the engines running was not the kind of test the FAA would perform; further, the PAI indicated he would not expect an operator to perform a maintenance inspection of the CVR with the engines running.

The PAI commented that when he has the opportunity to check a CVR, he prefers to plug a headset into the CVR test jack to hear the quality of the recording as opposed to using the built-in test performed by the CVR test pushbutton.

The PAI noted most CVR maintenance checks are considered to be "go/no-go" operational checks rather than an in-depth check that follows the CMM (for example, excerpted in figure 5 for the Fairchild GA-100). The PAI confirmed that Execufight CVR maintenance was performed by a third-party avionics repair shop.

Figure 5. Fairchild GA-100 CMM recommended test.

3.2 COMPLETE AUDIO SYSTEM TEST

A test of the Cockpit Area Microphone can be accomplished with a 600 Ohm headset inserted into the remote "HEADSET" jack or into the "HEADSET" jack on the Control unit. Speak in a normal voice 6" away from the Cockpit Area Microphone, and determine audible clarity after approximately a 1/2 second delay without any significant distortion. This test ensures the Cockpit Area Microphone is operating.

A complete Audio System Interface test must be completed during each annual inspection or specified maintenance period on the aircraft or rotorcraft whenever unscheduled maintenance is performed on the aircraft or rotorcraft which may have effected the performance of the Cockpit Voice Recorder system. To accomplish this test, the Pilot's, Co-pilot's, Cockpit Area Microphone, and Third Crewmember or Public Address System inputs must be individually checked for their operational integrity with the Cockpit Voice Recorder. Upon satisfactory achievement of this test, an entry shall be made in the maintenance records of the aircraft or rotorcraft.

Asked about the Execuflight AAIP including an item for the Fairchild G-1000, the PAI attributed this entry to a typographical error.

The PAI commented generally on tape-based recorders as follows: (a) he was aware tape-based recorders have quality issues, so when possible he tries to hear the quality of CVR recordings through the CVR headset test jack; (b) he believed the replacement tape overhaul interval was 1,500 hours; (c) there was an industry issue tracking CVR time-in-service when CVRs were swapped between aircraft; (d) he was concerned as older aircraft were retired, the tape-based CVRs may be sold and used in aircraft, perpetuating quality issues related to tape-based CVRs; and (e) he was concerned whether tape-based recorders ought to be designated as obsolete by manufacturers.

The PAI also commented on the FAA's switch to risk-based maintenance oversight in 2015. When asked if a CVR would ever be classified as anything other than a low risk item, the PAI thought CVRs would always be considered low risk since they cannot impact the safety of flight.

3.6.3 FAA POI

The FAA POI said he had no responsibility for oversight of the CVR. Any training of flight crews regarding CVR operational test procedures would have been done during initial and recurrent training events.

Asked if he was familiar with FAA SAFO 06019, issued November 8, 2006 (see appendix A), the POI indicated he was not familiar with the SAFO and the SAFO was a recommended action only.

4. Interview Summaries

The interview with the Execuflight Chief Pilot was conducted via email and is included as attachment 1 to this report. The interview with the FAA POI was conducted via email and is included as attachment 2 to this report. The interview with the FAA PAI was conducted with the NTSB Maintenance Group Chairman and notes of that interview are included in the Maintenance Group Chairman's report available in the public docket.

APPENDIX A

SAFO

Safety Alert for Operators



U.S. Department
of Transportation
**Federal Aviation
Administration**

SAFO 06019
DATE: 11/8/06

Flight Standards Service
Washington, DC

http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo

A SAFO contains important safety information and may include recommended action. SAFO content should be especially valuable to air carriers in meeting their statutory duty to provide service with the highest possible degree of safety in the public interest.

SUBJECT: Functional Test of the Cockpit Voice Recorder (CVR) Prior to the First Flight of the Day

PURPOSE: This SAFO emphasizes the importance of operators ensuring they have procedures and training for the functional test of the CVR.

BACKGROUND: Accident investigations have revealed that some of the CVRs in use by the operators are not being tested in accordance with the Aircraft Flight Manual, which would have shown them to be either malfunctioning or inoperative prior to the first flight of the day.

DISCUSSION: The importance of performing the functional test of a CVR prior to the first flight of the day is not only required, but essential to providing an accident investigation tool in case of a mishap or accident.

RECOMMENDED ACTION: All Directors of Operations and Chief Pilots should ensure that all training requirements for testing of CVRs are emphasized during initial and recurrent training. All pilots of aircraft equipped with a CVR should test the function of the CVR before the first flight of each day as part of an approved aircraft checklist.

Questions concerning this SAFO should be directed to the Commuter, On Demand, and Training Center Branch, AFS-250, at 202-267-8166.