NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division

March 31, 2015

Cockpit Voice Recorder

Specialist's Factual Report
By Bill Tuccio

1. EVENT SUMMARY

Location:	Marco Island, Florida
Date:	March 1, 2015
Aircraft:	Bombardier CL-600-2A12, Registration N600NP
Operator:	Six Hundred NP, LLC
NTSB Number:	ERA15LA140

On March 1, 2015, about 1615 eastern standard time, a Bombardier CL-600-2A12, N600NP, registered to and operated by Six Hundred NP, LLC, experienced a landing overrun and subsequent collapse of the nose landing gear at the Marco Island Airport (MKY), Marco Island, Florida. Visual meteorological conditions prevailed at the time and an IFR flight plan was filed for the 14 *Code of Federal Regulations* Part 91 personal flight from the Florida Keys Marathon Airport (MTH), Marathon, Florida. The airplane sustained substantial damage. The airline transport pilot, co-pilot, 1 flight attendant, and 4 passengers were not injured; 1 passenger sustained serious injuries, and 1 passenger sustained minor injuries. The flight originated from MTH about 1554. 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. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Division received the following CVR:

Recorder Manufacturer/Model:	**Fairchild A-100A**
Recorder Serial Number:	**55248**

3.1 CVR Carriage Requirements

Per federal regulation, multiengine turbine engine powered aircraft operating under 14 CFR Part 91 and manufactured before April 7, 2010, must be equipped with a CVR that records a minimum of the last 30 minutes of aircraft operation, which is accomplished by recording over the oldest audio data. The accident aircraft was manufactured in 1983. When the CVR is deactivated or removed from the airplane, it retains only the most recent 30 minutes or 2 hours of CVR operation, depending on CVR model.

3.2 Recorder Description

This model CVR, the Fairchild A-100A, records a minimum of 30 minutes of analog audio on a continuous loop tape in a four-channel format: one channel for each flight crew, one channel for a cockpit observer, and one channel for the cockpit area microphone (CAM).

3.3 Recorder Damage and Maintenance History

Upon examination at the NTSB Vehicle Recorder Division, it was evident that the CVR had not sustained any heat or structural damage. When the CVR housing was opened to remove the analog tape, it was observed the Mylar drive belt was broken, as shown in figure 1 (with the Mylar belt highlighted in the figure's inset). An assembly covering the drive mechanism was removed, which further revealed the broken Mylar drive belt, as shown in figure 2 (with break in Mylar belt annotated).

According to the CVR manufacturer:

- When the Mylar drive belt is broken, the CVR will not record because the drive belt is part of the mechanism to rotate the analog recording tape.
- When the CVR test button on the flight deck is pressed with a broken Mylar drive belt, the CVR test will fail.
- This model CVR should be overhauled every 4,000 CVR operating hours[1].

According to the Investigator-in-Charge:

- The CVR was last overhauled April 30, 2008 when the accident aircraft had approximately 13,897.6 hours total aircraft time (TAT).
- An operational test of the CVR system was last performed January 14, 2015 when the aircraft had 15,737.0 hours TAT.

Despite the CVR being inoperative, recorded content was downloaded without difficulty.

[1] As a rule-of-thumb, the CVR manufacturer assumes for every 1 flight hour the CVR will operate 1.7 hours.

Figure 1. Broken Mylar drive belt.

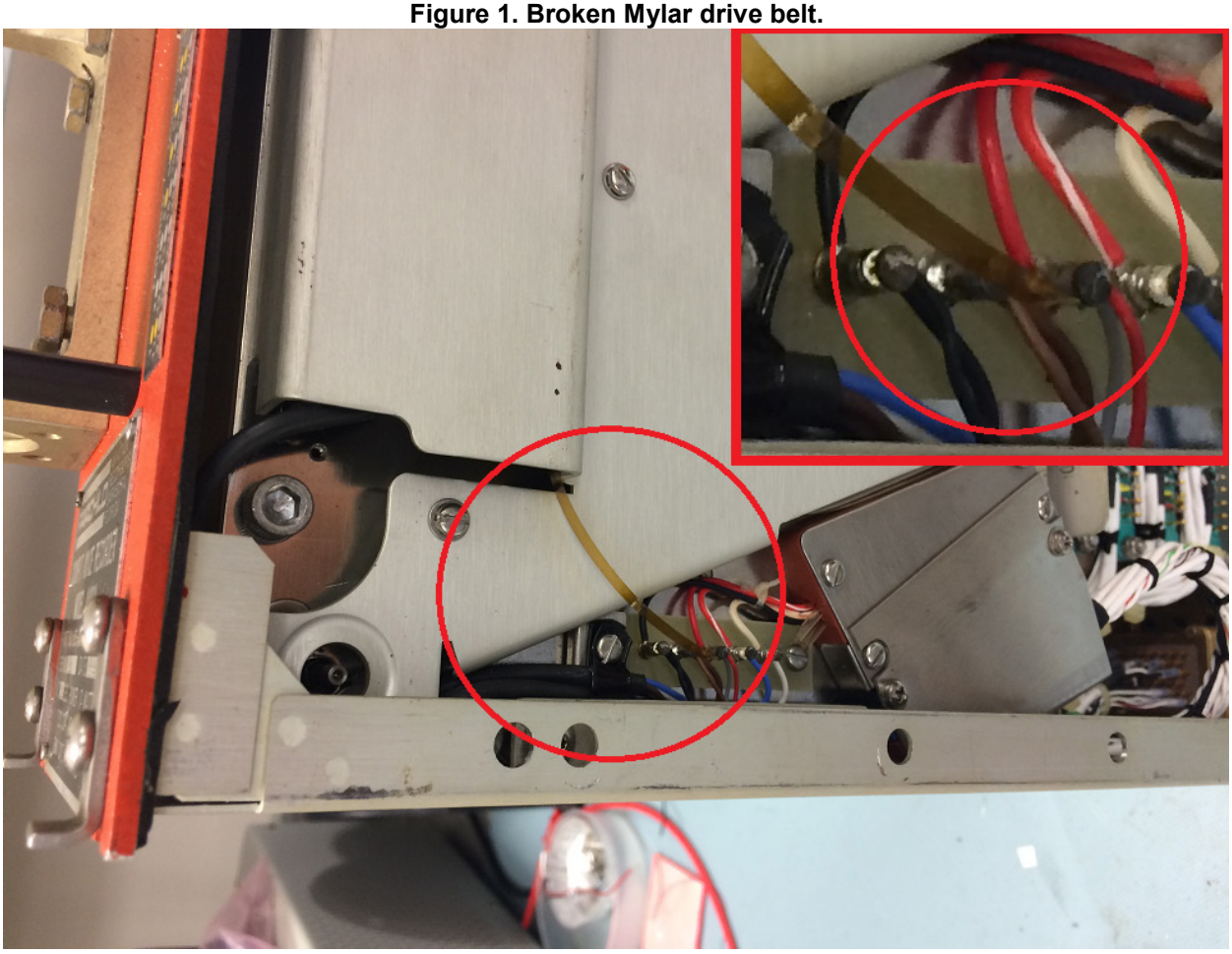
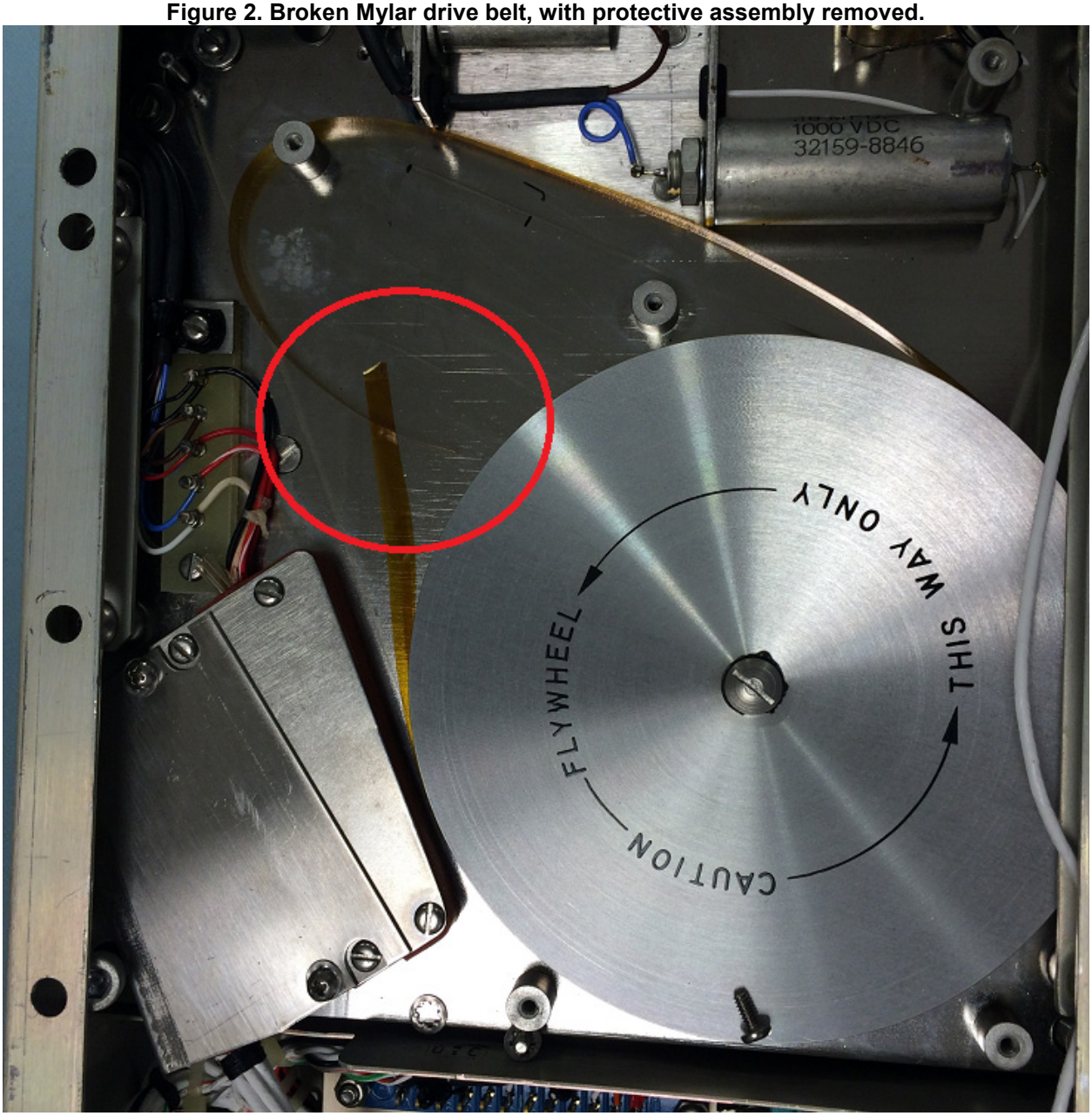


Figure 2. Broken Mylar drive belt, with protective assembly removed.



3.4 Audio Recording Description

The recording consisted of four channels of audio information; however, none of the audio was pertinent to the accident investigation. Recorded content was of a prior flight on an unknown date with these features:

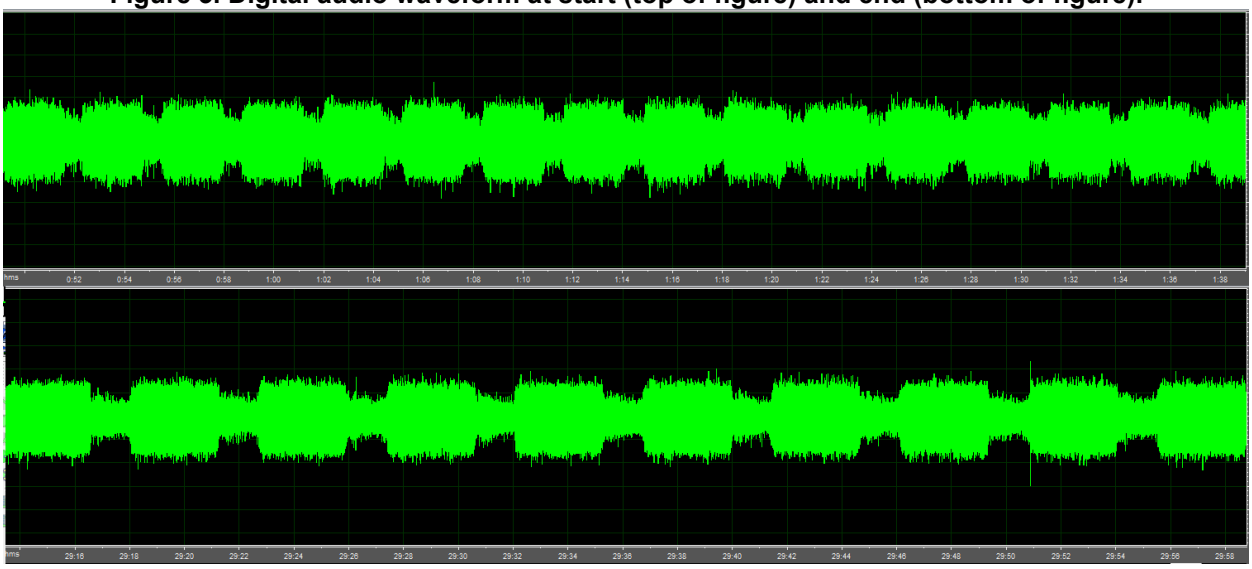
- A cold-weather, Visual Flight Rules (VFR) flight from Chicago Midway International Airport (MDW) to Gary/Chicago International Airport (GYY) operated at about midnight, local time.
- The recording covered events prior to engine start at MDW, engine start, taxi, takeoff from MDW, landing at GYY, and taxi to parking at GYY.

- Other than the accident aircraft (N600NP), the only other aircraft on the frequency was a Cessna Citation, N562LD, which departed MDW for an unknown destination.
- The end of the recording had acoustic distortion consistent with a variation in tape speed.

Additionally, the audio pattern on all channels was consistent with the CVR bulk erase feature[2] being activated after the tape mechanism had stopped moving; it is not possible to determine precisely when the bulk erase feature was activated after the MDW-GYY flight was recorded.

Figure 3 shows the digital audio waveform pattern at the start and end of the recording; in both images the time scale major increment is 2 seconds. The amount of content erased was smaller at the start of the recording and larger at the end of the recording; this phenomenon is consistent with the CVR erase mechanism (which spans the radius of the tape) causing more erasure farther from the center of the tape. Figure 4 shows the analog tape, illustrating the relationship between the physical tape and the waveform.

Figure 3. Digital audio waveform at start (top of figure) and end (bottom of figure).



[2] 14 CFR 91.609(f) states "an approved cockpit voice recorder having an erasure feature may be used, so that at any time during the operation of the recorder, information recorded more than 15 minutes earlier may be erased or otherwise obliterated." 14 CFR 91.609(g) states "In the event of an accident or occurrence requiring immediate notification to the National Transportation Safety Board under part 830 of its regulations that results in the termination of the flight, any operator who has installed approved flight recorders and approved cockpit voice recorders shall keep the recorded information for at least 60 days…"

Figure 4. Analog tape with start and end of recording annotated.