

NATIONAL TRANSPORTATION SAFETY BOARD

SYSTEMS GROUP CHAIRMAN FACTUAL REPORT ADDENDUM #2, AIRCRAFT CONTROL CABLE LENGTH

APRIL 17, 2003

A. ACCIDENT: DCA03MA022

LOCATION: Charlotte-Douglas International Airport, North Carolina

DATE: January 8, 2003, at about 0850 Hours (Local)

AIRCRAFT: Raytheon Model 1900D, N233YV, operated by Air Midwest Airlines, d.b.a. USAirways Express flight 5481

B. GROUP MEMBERS:

Group Chairman: Michael Hauf
Washington, DC

C. SUMMARY:

On January 8, 2003, at about 0848 Eastern Standard Time, Air Midwest flight 5481 (d.b.a. US Airways Express), a Beech 1900, N233YV, crashed shortly after takeoff from Charlotte-Douglas International Airport (CLT), Charlotte, North Carolina after a distress call was made by the Captain. The flight was a scheduled passenger flight to Greenville-Spartanburg, South Carolina. The 2 crewmembers and 19 passengers onboard were killed and one person on the ground received minor injuries. The airplane was destroyed due to impact forces and a post crash fire.

The length of the four primary pitch control system cables were previously measured at the NTSB Materials Laboratory¹. Three of the four cable measurements were within 0.3 inches of the specified drawing length.

Since a difference was measured between the length of the P/N129-524085-29 primary pitch control system cable and the drawing length requirement, it was re-measured at the NTSB Materials Laboratory on April 2, 2003. This report summarizes the cable re-measurement.

D. DETAILS OF THE INVESTIGATION:

1. NTSB Materials Lab Cable Measurement:

The primary pitch control system Airplane Nose Up (ANU) cable run consists of two cables connected together by a turnbuckle. Per the Beech Aircraft Corporation Drawings, the designed length for one cable is 514.12 inches and the

¹ Systems Group Chairman's Factual Report, dated March 18, 2003

other cable is designed to have a length of 106.25 inches. Both cables were previously measured at the NTSB materials lab.

NOTE: The drawing specifies that the cable length is the dimension from the distal end of the swaged, threaded terminal, to the proximal, inside, end of the ball portion of the swaged ball terminal. The cable length is depicted in Figure 1 as the dimension LT.

The length of the P/N 129-524085-29 primary pitch control system cable was determined by accomplishing the following steps:

Note: The length measurement, LT, could not be directly measured due to the ball-swaged terminal end of the cable being contained within the bellcrank, and the threaded terminal being used to secure the cable in place.

1. The control cable was placed on the floor; the threaded swaged terminal end of the cable was secured in place.
2. A mark was made on the floor adjacent to the base of the threaded terminal.
3. The cable was stretched, using hand pressure, until it was straight.
4. A second mark was made on the floor adjacent to the outside end of the ball-swaged terminal.
5. The distance between these two marks was measured, (L1)
6. The cable was removed from the floor and placed on a table.
7. The length of the ball-swaged terminal (L2), and the threaded swaged terminal (L3) was measured.

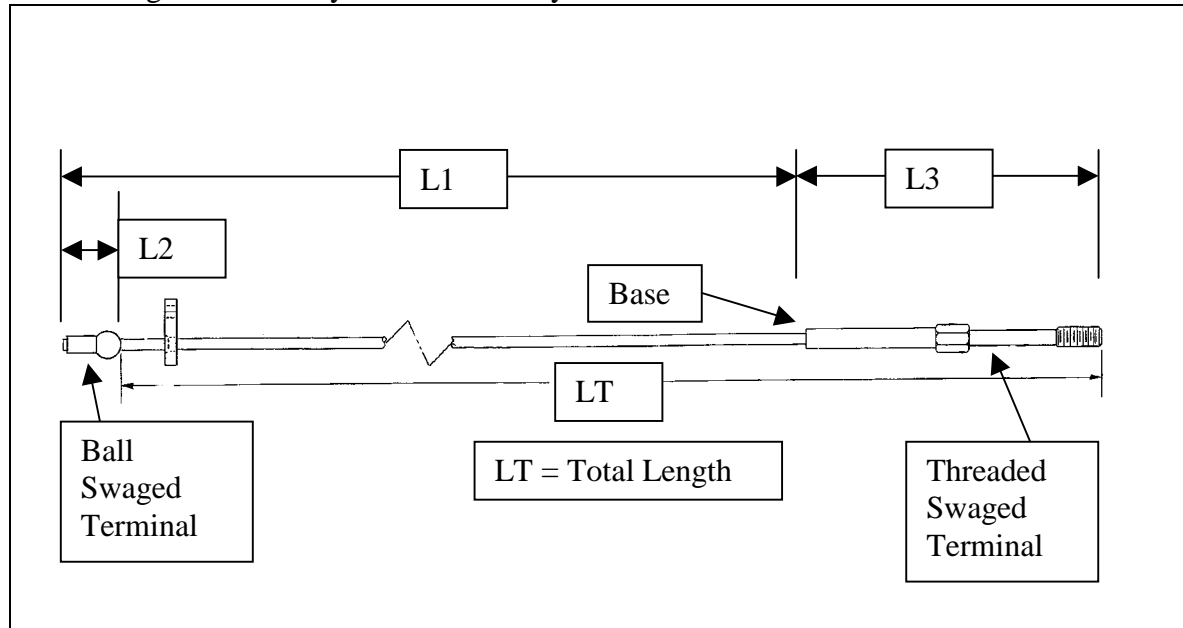
To compare the drawing specified cable length to the length measured in the lab, the following calculation was made: the length of the ball-swaged terminal was subtracted from the length measurement made between the two marks on the floor $L4=(L1-L2)$. The length of the threaded swaged terminal was added to this length, Total Length (LT)= (L3+L4). The result of this cable measurement is shown in Table 1.

NOTE: By using hand pressure to stretch the cable, the bends and kinks in the cable were reduced, but not eliminated.

Table 1. Primary Pitch Control, Aircraft Nose Up Cable Measurement.

Elevator Cable Part Number	Reference Measurement: Beech Aircraft Corporation "Drawings"	NTSB Lab Measurement: Total Length (LT)
Up Cable: P/N 129-524085-29	514.12 inches	513.81 inches

Figure 1. Primary Pitch Control System Cable



2. New Investigative Technique:

When initially measured, the measured length of one cable (P/N 129-524085-29) was less than the specified drawing length by almost an inch. An attempt was made to measure the length of the cables using an electronic hand held measuring device that was developed for electrical wiring. The Eclipse ESP Analyzer, manufactured by Eclipse International, of Corona, CA, was developed under license from the National Aeronautics and Space Administration. The device uses Standing Wave Reflectometry to locate open and short circuits in a wide variety of cable and wire types, but has never been used in this application.

The hand held analyzer was calibrated using a new elevator cable having a known length; Raytheon supplied the cable. The analyzer was calibrated to within 0.1 inch of the known cable length. Once calibrated, the analyzer was connected to the same part number cable from the accident aircraft. The length, of the accident aircraft cable, shown on the analyzer differed from that of the Raytheon supplied cable by more than 12 inches and consecutive measurements resulted lengths varying up to 5.0 inches. Following a discussion with the manufacturer's representative, this was attributed to three possible items: foreign material contained within the cable strands, heat damage, and inconsistent cable continuity due to stretched, broken wires and strands.