NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

April 16, 1997

SYSTEMS GROUP CHAIRMAN'S FACTUAL REPORT

DCA-97-MA-017

A. ACCIDENT

Location : Monroe, Michigan

Date : January 9, 1997

Time : 1554 Eastern Standard Time

Airplane : Comair Flight 3272, Embraer EMB-120RT, N265CA

B. SYSTEMS GROUP

Chairman : John DeLisi
National Transportation Safety Board
Washington, DC

Member : Roger Beem
FAA - Detroit FSDO
Belleville, Michigan

Member : Marco Tulio Grassi
Embraer Aircraft Corporation
Brazil

Member : Todd Gunther
Air Line Pilots Association
Rivera Beach, Florida

Member : John McGann
Comair, Inc.
Orlando, Florida

C. SUMMARY

On January 9, 1997, at 1554 eastern standard time, a Comair Embraer EMB-120RT, N265CA, operating as flight 3272, crashed while being vectored for approach to Detroit Metropolitan Airport in Romulus, Michigan. All 29 people onboard received fatal injuries. The Systems group met at the accident site from January 10-15, 1997.

D. DETAILS OF THE INVESTIGATION

1. Flight Controls

The EMB-120 has cable-driven ailerons and elevators, and a hydraulically powered rudder. The flaps consist of three segments per wing, inboard, outboard, and nacelle, and are hydraulically actuated.

The tail section of the airplane, consisting of the vertical stabilizer, rudder, horizontal stabilizer, and elevators, was separated from the fuselage. All control cables remained attached to their respective surfaces and were broken at the point where the tail section had separated.

All inboard and outboard wing flap actuators were found in the retracted position. The left nacelle flap actuator was extended approximately 9 inches, a position consistent with a retracted flap, according to information provided by Embraer. The right nacelle flap actuator was found extended approximately 15 inches from rod end to the face of the actuator, however there were soot markings which indicated that the extension was less during the post crash fire. One nacelle mounted flap track was found separated from the nacelle with damage consistent with the flap roller being forced from the track in the flap up position. All other flap track segments were inspected and no witness marks were found that would have indicated flap extension at impact.

Both ailerons had separated from the wings. The left aileron balance tab was attached and could be moved by hand. Both aileron cables remained attached and were broken at a location consistent with the separation. The aileron trim tab remained attached to the aileron and was free to move. The chain-driven trim tab actuator was in the fully retracted position, however, the drive chain had been completely pulled away from the actuator.

The right elevator was found with the trim tab deflected approximately 11 degrees trailing edge down, relative to the underside of the elevator. There was a gap of 3/4 inch between elevator and tab at the trailing edge. When the access panel was removed, the elevator trim tab actuator was found extended 3/8 inch. The left elevator and tab were imbedded into tail structure and could not be moved. The outboard section of the left horizontal stabilizer (approximately 2 feet) was separated.

Both rudder sections remained attached to the vertical stabilizer and the hinges were movable. The rudder power control unit (PCU) was recovered from the wreckage with cable-driven rudder trim spool attached. The PCU rod ends were found extended as follows: lower: 8 inches, upper 8 inches, with an additional 1/8 inch exposed (with no signs of soot). The trim spool rod was extended with 1" of shaft exposed, 2" to the bolt midpoint. According to information provided by Embraer, this position corresponds to a rudder trim setting of 5° right. There was sheet metal damage at three of the four rudder hinge points consistent with the rudder traveling beyond its stop to the right. The soot pattern in this area was indicative of the rudder being in this over-travel position during the post crash fire.

2. Cockpit

The airplane was equipped with the Electronic Flight Instrument System (EFIS).

The flap control assembly separated from the cockpit and the handle was found in the FLAPS 0° position. The rudder trim wheel was found 3 ¼ units right and the aileron trim wheel was found 1 ¾ units right. The elevator trim wheels were damaged and the index was not readable.

The main instrument panel had severe crush damage that precluded obtaining readings from most cockpit gages. The only exceptions were the right engine fuel flow gage which was found indicating 600 lbs/hr, and the altitude alerter which was found set to 3900 feet.

The propeller autofeather switch, which is lever-locked, was in the ON position. The left electric feather switch guard was down and the switch was in the OFF position, while the right electric feather guard was up and the switch was broken and free-floating.

The throttle quadrant had extensive crush damage that precluded determining the position of the power or condition levers at impact. However, it was observed that the right condition lever was in the raised position, and the left condition lever was not raised.

The right engine fire handle was found in the extended and rotated position. The handle for the left engine was missing and only the shaft remained. The cases for both handles had crush damage. Disassembly of the cases revealed that the shaft of the right handle had been bent due to the crush of the case, while the left handle shaft remained straight. The internal lock mechanisms of both handles were in the locked (non-actuated) position.

Portions of the multiple alarm panel were recovered – however, no bulbs were intact. Indicator lights from the fuel panel, ice/rain protection panel, and the glareshield were recovered for filament analysis. Several of these bulbs showed evidence of stretched filaments. The lights were identified by their wire ID's as W202072424,

W202048024, and W202047922N. According to information provided by Embraer, the lights associated with these wires are the hydraulic "LOW PRESS" light, the propeller deicing "NORMAL" light, and the propeller deice "LEFT INOP" light. However, according to the electrical wiring design of the airplane, the propeller deice "NORMAL" light and the "LEFT INOP" light cannot be on simultaneously.

3. Landing Gear

All three nose and main landing gear were all found at the main wreckage site in the retracted position.

4. Deice System

The EMB-120 ice and rain protection system consists of:

1) Wing, horizontal stabilizer, and vertical stabilizer leading edge deice boots
2) Engine inlet and by-pass duct deice boots
3) Propeller anti-icing
4) Windshield heating and wiper blades
5) AOA, Sideslip, Pitot, Static, and Total air temperature probe heating

The wing, horizontal stabilizers, and vertical stabilizer are deiced by the use of pneumatic rubber boots which are inflated by engine bleed air. As the boots inflate, they crack the accumulated ice, which is then removed by the airstream. The following components comprise the leading edge deicing system: rubber boots, pressure regulator valves, water separators, check valves, ejector flow control valves, pressure switches, and two deice timers (1 and 2). The wing deice boots are divided into three segments (outboard, middle, and inboard), and the horizontal stabilizer boots are divided into two segments (inboard and outboard).

The leading edge deicing system is controlled by two toggle switches located on the Leading Edge control panel on the Ice and Rain Protection panel, the timer select switch and the cycle switch. The timer select switch is used to turn the system on and to select timer 1 or 2. Only one timer is in operation at a time and the other timer is available as a backup. The cycle switch has positions of Heavy and Light. During a heavy (1 minute) cycle, each deice boot is inflated for 6 seconds and deflated for next 54 seconds. During a light (3 minute) cycle, each deice boot is inflated for 6 seconds and deflated for 174 seconds. The inflation sequence is performed symmetrically beginning with outboard wings, then middle wings, inboard wings and inboard horizontal stabilizers, and finally outboard stabilizers. According to information provided by Embraer, if the de-ice timer is turned off in the middle of an inflation cycle, the inflation sequence will stop. The next time the de-ice timer is turned on, the inflation cycle will start at the beginning of the cycle.

The deice timers are solid state devices manufactured by AVITECH Corporation. Both were found in the wreckage with severe crush damage that prevented any functional testing. According to the manufacturer, the units do not contain any non-volatile memory that would indicate if a timer was on at the time of impact.

All leading edge sections were examined and the deice boots were found with no evidence of preimpact damage. The following leading edge deice system components were identified in the wreckage: two horizontal stabilizer pressure switches, two wing pressure switches, the vertical tail pressure switch, one pressure regulator, and one pressure relief valve.

5. Autopilot

The airplane was equipped with an APS-65 autopilot system, manufactured by the Collins General Aviation Division of Rockwell International. The system consists of two autopilot computers (pilot's and co-pilot's), an autopilot control panel, two flight control panels, two transfer control switches, and servos for pitch, roll, yaw, and pitch trim control. The autopilot operates in lateral modes of roll angle hold, heading hold, navigation, approach, back course, and go-around. The vertical operating modes are pitch hold, altitude hold, indicated airspeed hold, vertical speed hold, altitude preselect, descent, and climb.

According to the Collins APS-65 Instruction Manual, the autopilot will disengage if the airplane's roll attitude exceeds 45° or if the stall warning stick shaker activates. According to Embraer, a stick shaker activation will cause the autopilot to unclutch the servos, annunciate an amber "DIS" (for disengage) on the control panel, and activate an aural "Ding-Ding-Ding Autopilot" alert. An exceedence of the 45° roll angle limit will produce the same annunciations but will also include a red AP FAIL message.

Portions of several damaged autopilot servos were recovered from the cockpit wreckage. Two crushed avionics boxes, believed to be the autopilot computers, were recovered. Impact damage to these units prevented any functional testing.

6. Electrical System

Portions of the cockpit circuit breaker panels were recovered. The panels were damaged by heat and fire. Many of the identifying markings melted in the fire. Photos were taken to document these panels.

7. Flight Idle lockout System

Both flight idle lockout assemblies were recovered. The lock bellcranks appeared to be in the locked position. The left engine flight idle lockout circuit breaker was missing and the right engine flight idle lockout circuit breaker was found not tripped.

8. Miscellaneous

- Two valves, believed to be fuel crossfeed or motive flow valves, were recovered and both appeared to be in the closed position.

- The EMB-120 is equipped with a stall warning stick shaker and a stick pusher. According to information provided by Embraer, there is no intercommunication between the ice protection system and the stall warning system.

[redacted]
John DeLisi
Aerospace Engineer

4/16/97