F. FDR ANALYSIS & INTERPRETATIONS

- The FDR for this airplane does not include control wheel or rudder, so an analysis tool was used to calculate the amount of wheel and rudder which would cause the flight path recorded on the FDR. Comments in the following paragraphs relative to the wheel and rudder required to cause the events are based on the results of using this analysis tool.

  - Airplane _____ was on a steady heading of 330 degrees just prior to the event. The analysis indicates that the flaps were up at this time and probably were not extended to flaps 1 until after an elapsed time of 195 seconds. At time 167 the bank angle and heading started drifting slowly to the right, most likely due to wind changes aloft. The autopilot reacted with a left wheel command which caused a gentle roll to the left. At a time of 177, however, the bank angle and heading again moved to the right. This is also believed to have been caused by a change in the winds aloft. The autopilot continued to put in wheel to the left to try to capture the desired heading. The aircraft responded to autopilot command by rolling to the left. Just before time 189, the roll rate increased rather sharply to 7 degrees per second. The cause of this increased roll rate cannot be determined from the available data. The crew initially responded to the increased left roll rate with a right rudder input, starting at time 189.5. The right rudder input also caused a reduction in the heading rate prior to the aircraft reaching the selected heading. At time 193, the rudder had reached a maximum value of 6 degrees, and at time 194.5 the control wheel moved to the right rather rapidly, which contributed to the aircraft return to wings level and the apparent overcorrection. During this time the rudder was returned to neutral causing the heading rate to increase to the left. During the next heading change, only the wheel was used to maneuver the aircraft.

  - This explanation of the event is consistent with the indications of wind from the FDR (Note that "wind" is not recorded by the FDR on this airplane). At the start of the event, FDR traces of airspeed, normal load factor and longitudinal acceleration become noticeably more noisy, with the magnitude of the noise increasing as the event unfolds. All three of these parameters, for example, move sharply at the same time that the roll rate increases just before time 189. They also move sharply at time 200 when the roll overshoot to the right occurs. These variations would not be caused by aircraft control movements, but are most likely related to atmospheric disturbances.

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A. PILOT LOG BOOK REPORT

- "At 4000 feet 210 knots, autopilot channel B in heading select - no traffic in area, in the clear - aircraft turned >30 degree bank left with pilot response of turning aileron to right, A/C began uncommanded roll to right - autopilot disengaged by pilot - A/C returned to control - F/A's in back said felt like being in the wake of a heavy."

B. POST FLIGHT CREW COMMENTS

- "DCA Flt crew reported that while on base leg, 4000 ft alt, 210 KIAS, flying straight and level, flaps at 1 unit, A/P on HDG mode, B channel, they experienced an uncommanded roll left to approx 30 deg. They corrected manually and then turned off the autopilot. Yaw Damper was never turned off. There was no rudder pedal movement and A/C did not yaw."

C. MISCELLANEOUS INFORMATION FROM VARIOUS SOURCES   5

- On approach to Washington-National.
- Descending through 6000 feet, flaps up, with B autopilot engaged (FDR).
- Smooth air, clear, 7 knot tail wind, over White House.
- Bank angle and heading started drifting right, autopilot commanded left roll to capture 330 degrees heading (FDR).
- Airplane rolled left 18 degrees at max rate of 7 degrees/second (FDR).
- Crew took over and the first officer put in 6 degrees right rudder and then the captain put in right wheel to roll the airplane 14 degrees right (FDR and crew comments).
- Autopilot was manually disconnected and an uneventful landing accomplished.