

### 3. AIRPLANE

JULY 95

#### A. PILOT LOG BOOK REPORT

- "Aircraft on FMC coupled VOR approach A autopilot mode. Started abrupt right roll kicked off autopilot. Disconnected yaw damper. Had to hold nearly one-half yoke to left to control roll to right. Checked rudder trim - Zero. Checked aileron trim. Did not correct problem. Landed and maintained control to landing still holding left aileron control. Altitude 2000 feet MSL descending to 1700 feet MSL."

#### B. POST FLIGHT CREW COMMENTS

- "Departed 20 minutes late. APU inop on MEL. Manually flew airplane up to 10,000, then engaged A autopilot and FMC. Before engaging autopilot, the airplane was in trim with 0.05 left rudder trim, the fuel load was balanced. On descent into RIC, disengaged autopilot around 10,000 feet, and manually flew airplane. Slowed airplane and accomplished a VOR/DME approach to runway 20 RIC."
- "First officer programmed FMC for a direct intercept and engaged A autopilot. Airplane was 20 degrees off centerline which was 188 degrees. Captured - jump to right (abrupt capture?) right turn with roll to 30 degrees bank. Captain disconnected autopilot using yoke switch, depressed three times (just to be sure). Physically banked airplane and returned to wings level. Flaps at 5 units, airspeed approximately 175 knots. Airplane required one-half yoke aileron input until touch down. Turn yaw damper off - no effect - re-engaged yaw damper. Used speed brake to check for spoiler float, it did not appear to have any effect. Input left aileron trim for several seconds, it did not appear to have any effect. Autothrottle operation normal. Note: airplane rolled prior to lowering landing gear. There was no yaw, no turbulence, smooth, hazy - same conditions at departure. Landed with flaps 40, no flap asymmetry indications, leading edge slats OK, landed uneventful. Normal speed brakes deploy. Thrust reverser OK on landing, ground spoilers down."

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#### C. MISCELLANEOUS INFORMATION FROM VARIOUS SOURCES

- On approach to
- Descending through 1700 feet with A autopilot engaged on VOR approach.
- While making left turn to intercept, airplane banked right approximately 30 degrees over 50 second time period (FDR).
- Crew disconnected autopilot and used left wheel and left rudder to regain their desired approach path (FDR).
- Crew reported left wheel forces were required to maintain wings level.
- On ground aileron trim at 3.5 units right with wheel and control surfaces displaced accordingly.
- When trim set to zero by mechanic after landing, wheel returned to center and control surfaces to neutral.

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#### **F. FDR ANALYSIS & INTERPRETATIONS**

- The FDR on this airplane records more parameters than the other events summarized here. Aileron, rudder and many autopilot command discretes were recorded making the analysis more precise and accurate.
- The initial events here appear to be explained by the procedures used relative to autopilot operation. Once the crew disconnected the autopilot, recovery back to wings level was accomplished using both wheel and rudder in the correct direction. The rudder, however, was not removed after reaching wings level which required that opposite wheel be applied to maintain wings level. For the remainder of the flight, the crew flew with crossed controls (The rudder varied from 5.5 to 1.5 degrees in a direction to roll the aircraft left, and the wheel varied from 30 to zero degrees roll right). Simulated steady sideslips at flaps 10, 25, 30 and 40 showed that for the conditions of this flight the wheel applied was appropriate for the amount of rudder recorded.
- The position of the ailerons following landing indicates that about 5.5 degrees of aileron trim was applied following the event which is equivalent to approximately 22 degrees of wheel. This amount of trim would require about 8.8 seconds of trim actuation. Depending on when the trim was applied, the recorded aileron would have resulted in a wheel force to the left (due to the aileron artificial feel and centering mechanism) even though the wheel deflection was actually to the right.

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