Appendix E
Boeing-Recommended Training and Procedures

Boeing is taking two steps to help flight crews better recover from in-flight upsets, regardless of the cause:

- Unusual attitude training.
- Improved flight crew procedures.

Unusual Attitude Training

Exhaustive investigation into the two 737 accidents led to an extensive review of virtually all flight crew-reported upset events during the past three years. The investigation revealed that many airplane upset events occur as a result of atmospheric conditions such as windshear, mountain rotors, turbulence, or wake vortices of other airplanes. Boeing is working with industry representatives to develop an Airplane Upset Recovery Training Aid, which is scheduled for release in late 1997. Intended to support education and training for flight crews of large swept-wing airplanes, this training aid will provide effective methods for recovering from in-flight upsets, whatever their cause.

Boeing recommends that the training aid should stress the technique of prioritizing roll control as the method for recovering from large nose-down bank upsets. This technique assumes the airplane is not stalled. If it is stalled, the flight crew must first recover from the stall condition before recovering from the upset. The nose-down upset recovery technique requires the flight crew to:

- Reduce airplane angle-of-attack, allowing the airplane to accelerate, which improves lateral-control ability.
- Roll wings level, using all available flight controls.
- Apply up elevator to recover toward the desired airplane pitch attitude and airspeed.

Recovery techniques will be discussed more thoroughly in the training aid. Operators may adapt and tailor the training aid to meet their individual program needs.

Improved Flight Crew Procedures

In January 1997, the FAA mandated changes to the Airplane Flight Manual that require revisions to the existing yaw or roll procedures and a new procedure for a jammed or restricted rudder. In February 1997, Boeing issued an operations manual bulletin that provided specific recommendations to operators on how to implement the changes. The bulletin was the direct result of an industrywide effort to enhance the existing procedures. Participants included the Air Transport Association (ATA), Airline Pilots Association (ALPA), FAA, and several airlines.

The revised *Uncommanded Yaw or Roll Procedure* recognizes that timely and appropriate response to large lateral/directional disturbances can significantly reduce the resulting bank angle. It employs the Boeing-recommended technique of prioritizing roll control as the method for recovering from large, nose-down lateral upsets. Rolling wings level significantly reduces the chance of an accelerated stall.

The new *Jammed or Restricted Rudder* Procedure is more extensive than the previous jam procedure. It addresses recovery from a jammed or restricted rudder, taking into account all potential causes—known and hypothetical—of a rudder system malfunction. The procedure emphasizes the importance of first restoring control (wings level flight), using all available flight controls, before trying to isolate the suspected cause of an uncommanded yaw or roll event.

The procedure is based on three concepts:

- The flight crew may not know the exact fault.
- Following the procedure eliminates the effect of the fault conditions in a sequence that leaves the most normal configuration for continued safe flight and landing.
- While neutralizing the faults, the flight crew takes no steps that would jeopardize safe flight.

The new procedure was validated through ground and flight tests at Boeing before it was released.

In addition to this procedural change, some operators have adopted a 10-knot increase for block speeds for certain flap settings, where block speeds are the minimal maneuvering speed for a given flap setting. An increase in these block speeds above the Boeing-

recommended levels, although not required, will provide a marginal increase in lateral-control capability relative to directional (rudder) control capability. Boeing has no technical objection to this technique.