

USAir 427 — The Final Chapter



*John Cox (PHL)
Chairman, Central Air Safety Committee*

In March, the National Transportation Safety Board (NTSB) held their final meeting (known as a “Sunshine Meeting”) before releasing the report on USAir 427. The findings of the NTSB were clear: a rudder reversal caused the tragedy. Further, the Board said that the crew “took immediate action to attempt a recovery, but did not successfully regain control of the airplane.” After 1658 days the investigation was over.

This was the most extensive investigation in aviation history. Countless hours of effort by the parties (ALPA, US Airways, NTSB, FAA, Boeing and Parker Hannifin) resulted in this report. In the final days, each party worked extensively with the NTSB. As expected, the report is lengthy and very technical. In over 500 pages, the NTSB carefully details the investigation.

Not since the very early 1960s have accident investigators faced such a challenge. In 1959 and 1962, two Lockheed Electras disintegrated in flight. Finding the cause proved to be exhaustive. The parties involved in the research slowly came to understand an effect known as “whirl mode.” It caused the wing to flutter and then fail. It took 15 months to prove how the failure occurred and to devise a fix.

After two and a half years, the investigators of USAir 427 were still searching for answers. The key to understanding what happened on that night in September 1994 was unveiled by an Eastwinds B-737 landing in Richmond, Virginia. The Eastwinds crew experienced a rudder hardover. They were flying faster than USAir 427 so they could control the aircraft while they sought a solution. As suddenly as the hardover appeared it disappeared. Analysis of the flight data recorder confirmed the flight crew’s re-

port. We then had hard evidence that the rudder could go hard over but the question of why remained unanswered.

The NTSB Systems Group searched for suggestions for additional tests that would show how the Main Rudder Power Control Unit (MRPCU) could cause a hardover. One of the experts that the Systems group located suggested that if we cooled the MRPCU and sent hot fluid through it, we might find an answer. This test produced unexpected results. The MRPCU not only failed to work properly, it reversed.

Further testing proved that with a very cold unit and hot fluid, the rudder would go in the opposite direction from the direction commanded by the pilots. Boeing argued that the tests were outside the normal operating envelope. The tests were within the design specification of the MRPCU. Therefore, the FAA required modifications so that a reversal could not occur again. This was the key to unlocking the mystery of USAir 427.

After learning of the rudder reversal possibility, the Human Performance Group began to analyze all aspects of the flight crew’s performance. The pieces began to fit together. The comments of both pilots were consistent with what one would expect pilots to say as they encountered an unheard of failure. Additionally, the First Officer grunted as he pushed on a rudder that was not only jammed, but also reversed. The timing of his grunts were timed perfectly with the reversal.

Even with a hardover rudder, why was the airplane not responding to the controls? The B-737 has a unique characteristic. In some places in the flight envelope there is not sufficient lateral control (aileron and flight spoilers) to

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counteract a fully deflected rudder. The speed where there is a balance between the rudder and the lateral control system has become known as “crossover” speed. The B-737 minimum maneuvering speed for the flap settings of 1, 5, and 10 were very close to crossover speed.

Flight tests proved that there should be an increase in the minimum maneuvering speeds. US Airways led the industry in adopting these increases. ALPA began a worldwide campaign to show operators the need for a 10-knot increase. One-by-one, airlines began to adopt the speed increase. Finally, the FAA issued a notice that urged a speed increase. With the maneuvering speed increase, the B-737 has a similar margin above crossover speed as other jets.

The issue of how the B-737 was certified became of interest. It was clear that after 1967 the flight control system was not updated to meet the standards in place in 1984 when the B-737-300 model was certified. If a fully redundant rudder system had been required for the -300, and later models, we would have avoided many problems. ALPA supports (and has supported for many years) the elimination of the derivative certification process. All aircraft should meet a single standard when they apply for FAA certification. The ability to “grandfather” to another airplane’s certification standard can result in a reduction in the standards and in safety.

The lessons learned from USAir 427 are many. As an industry, we can take those lessons

and apply them so that we will never again face such a mystery as a result of this kind of catastrophe. In the case of USAir 427, we were fortunate. All of the parties involved persevered in their research and doggedly pursued unanswered questions. NTSB Chairman Jim Hall would not give up and continued to provide appropriate funding the search. The investigator in charge, Tom Hauter, would not quit. The System Group Chairman, Greg Phillips, was also determined to unravel the mystery. His knowledge of the very complex MRPCU, gave us an edge, as he was able to educate others on how it works. The Human Performance Chairman, Dr. Malcomb Brenner, found the link between the pilot’s comments and the rudder’s reversal. And finally, in spite of differences in opinion, each member of the team coordinated his efforts with the others, allowing all parties involved to take an active role in unraveling the mystery. Without all of these resources, the investigation may not have been as successful.

All of those involved in the investigation have my sincere thanks and gratitude. Without their efforts, we would have had to wait until another rudder reversed to solve this mystery. Instead, the B-737 is safer today than in the past. In the future, it will be even safer as additional modifications are made to the rudder system.

We have written the final chapter of USAir 427. It is proof that the U.S. method of aircraft accident investigation (the party system) works, no matter how difficult the accident.

