28 seconds of horror

GRAPHICS BY DOUGLAS E. JESSMER AND BOB NEWELL
TRIBUNE-REVIEW

The 132 people aboard USAir Flight 427 from Chicago didn't know what hit them. In less time than a television commercial, the Boeing 737-3B7 plummeted from its approach to Pittsburgh International Airport into a Hopewell hillside. Based on flight data, here's what experts believe happened Sept. 8, 1994.

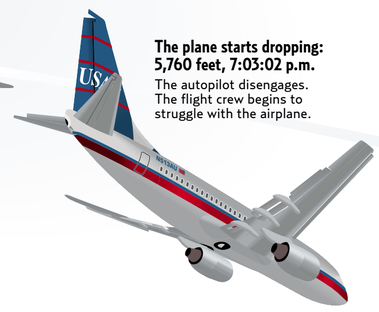
How events unfolded

USAir 427 was on approach to Pittsburgh International Airport Runway 28 Right. The Boeing 737-3B7 left Chicago with 127 passengers, three flight attendants and a pilot and co-pilot. How the disaster happened:

SEA-LEVEL ALTITUDES AND TIMES TAKEN FROM NTSB DOCUMENTS

On approach from Chicago: 5,920 feet, 7:02:24 p.m.
USAir 427 is directed by approach control to change heading. The flight crew is directed to watch for departing traffic — a smaller airliner — taking off from Pittsburgh and headed in 427's direction.

Flying through wake turbulence, the problem starts: 5,820 feet, 7:02:55 p.m.
Flight 427 flies into wake turbulence from an airplane in the approach pattern about 70 seconds, or four miles, in front of them. Turbulent air blows the plane to its left. Pilot correction, including right rudder, isn't enough as the rudder snaps hard left, to its fatal "blowdown" position. The airplane was already slow to fit in the landing pattern — the crew remarked just minutes before that Pittsburgh's approaches are slow. The airplane is flying at a "crossover speed," where rudder use may only slow the plane to a stall.



The plane starts dropping: 5,760 feet, 7:03:02 p.m.
The autopilot disengages. The flight crew begins to struggle with the airplane.

Intended path of Flight 427

Airplane approaches stall: 5,570 feet, 7:03:07 p.m.
After the autopilot disengages, the airplane's wings loses lift — a situation called a stall. An airplane stays aloft as long as air pressure under its wings is dense enough to support the plane's weight. When the air under the wings isn't dense enough — when the plane flies too slow to produce sufficient air density — the plane stalls.

An altitude alarm sounds and the vibrating sound of the stick shaker is heard in the cockpit.

Dropping below stall speed: 4,050 feet, 7:03:15 p.m.
The pilot declares an emergency, as Flight 427 plummets.

Final moments: 1,880 feet, 7:03:21 p.m.
As the pilot and co-pilot fight the controls, Flight 427 hopelessly drops toward a wooded ravine in Hopewell. The plane corkscrews downward at 260 knots — about 300 mph.

Crash site

Impact: 7:03:23 p.m.
The plane shatters on impact.

CAROLINE HIRT/TRIBUNE-REVIEW

US Airways' fleet

Boeing 737s are the most numerous aircraft in US Airways' fleet. Most of them are 737-300s:

Model	Total
Boeing 737-300	70
Airbus 319	66
Boeing 737-400	45
Boeing 757-200	31
Airbus A321	28
Airbus A320	24
Boeing 767-200ER	10

About the Boeing 737

The Boeing 737 long has been the airline industry's workhorse.

"Baby Boeing": Called the "Baby Boeing" when it rolled out in 1968, the 737 was designed for short- to medium-range flights and was engineered to serve smaller airports.

Capabilities: It can fly at cruise speeds of 580 mph and take off from runways shorter than 6,000 feet. Some of the planes feature built-in airstairs for airports without airstairs or jetways. For unpaved airstrips, some 737s have gravel deflectors for landing gear, vortex dissipators for engine nacelles and special protective paint.

How many are flying? More than 4,000 have been delivered (and 5,372 ordered) to more than 219 airline operators in 100 nations. On average, about 283 are in the air at any times; one takes off about every five seconds. All the 737s made have carried more than 7 billion passengers on more than 90 million flights.

A lot of parts: A new 737 has about 367,000 parts, excluding rivets and bolts. About 50 gallons of paint go on an average 737, and about 33 miles of wire go inside.

The 737-300

The 737 model that crashed in Hopewell was a second-generation, stretched Model 737-300, equipped as a 737-3B7.
Length: 109 feet, 7 inches
Wingspan: 94 feet, 9 inches
Height: 36 feet, 4 inches (empty)
Fuselage width: 148 inches
Interior width: 139.2 inches
Interior height: 84.6 inches
Maximum takeoff weight: 137,000 pounds (68.5 tons)
Maximum landing weight: 114,000 pounds (57 tons)
Maximum seating capacity: 149 passengers
Maximum fuel capacity: 5,803 gallons

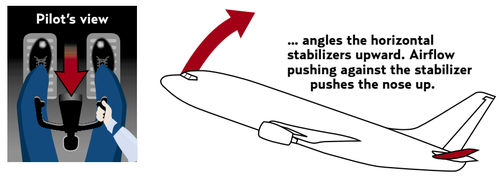
SOURCES: NATIONAL TRANSPORTATION SAFETY BOARD; BOEING; US AIRWAYS; FEDERAL AVIATION ADMINISTRATION; TRIBUNE-REVIEW RESEARCH; GANNETT NEWS SERVICE

Control surfaces: Ins and outs

Airplanes maneuver in the three dimensions of flight by adjusting airfoils — panels attached to wings and stabilizers.

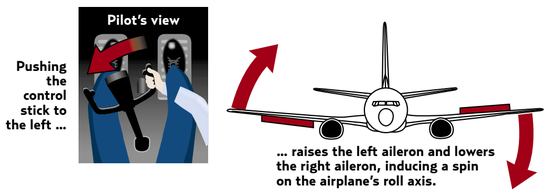
Pitch

By pulling back on the airplane's control stick or wheel, a pilot changes the angle of the horizontal stabilizer. As air pushes against the stabilizer, it forces the plane's nose up. If the pilot pushes forward on the stick, the opposite happens.



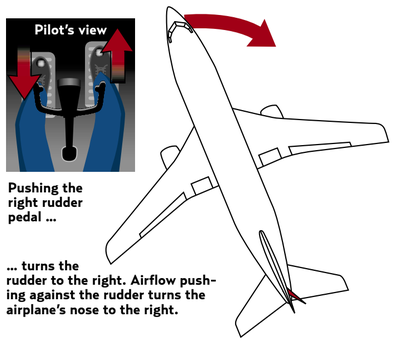
Roll

The control stick also controls an airplane's roll axis. When the pilot moves the stick to the left, as shown at right, the airplane rolls to the left. Just as air pushes against the horizontal stabilizer to push the nose up or down, it pushes ailerons — which act opposite each other — to spin the airframe on its roll axis.



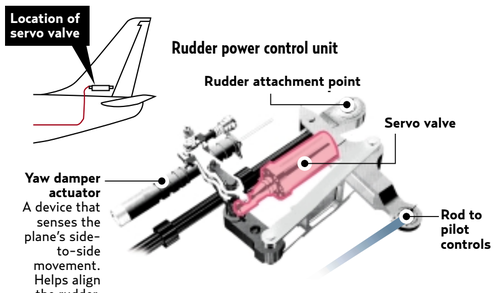
Yaw

The yaw axis isn't controlled by the control stick, but instead by pedals under the pilot's feet. Pushing the right rudder pedal, as demonstrated here, will turn the rudder to the right. Air pushing against the rudder pushes the airplane's nose in the direction the pilot commands.



Rudder valve blamed for crash

When the pilots commanded Flight 427's rudder to swing right, it instead swung fully to its left and stuck. The rudder servo valve, a hydraulic valve that's part of the rudder power control unit, reversed and jammed. After numerous tests by the National Transportation Safety Board, USAir, Boeing and the valve's maker, Parker Hannifin, investigators concluded the valve malfunctioned because of particles in the hydraulic fluid and temperature changes.



Rudder changes mandated

The Federal Aviation Administration recently issued an airworthiness directive mandating changes to the 737 rudder.

Boeing says it's due in large part to the NTSB's post-Flight 427 recommendation that the rudder control system must be made more "reliably redundant."

Boeing says it's ahead of schedule in providing the parts to 737 operators.

In 2000, the company issued cockpit procedures to 737 operators for conditions involving jammed or restricted rudders, and after that, new maintenance procedures for the rudder were employed.

Wreckage of plane was returned to airline

BY JIM RITCHIE
TRIBUNE-REVIEW

The remaining pieces of Flight 427 were given back to US Airways, but the airline won't specifically say what became of the parts.

After its investigation, the National Transportation Safety Board returned the pieces of jet that its investigators recovered from the Beaver County crash site. The airline will not say what happened to them.

"We turned it over to our insurer," said airline spokeswoman Amy Kudwa. "It has since been disposed of."

The insurer, Global Aerospace Inc., based in London, declined to comment. Kudwa would not specify what she meant by "disposed of."

The NTSB routinely returns planes involved in crashes to their owners following the agency's investigation, said spokesman Terry Williams. When the plane belongs to an airline, as Flight 427 did, it is returned to the airline, he said.

So Flight 427 was returned to US Airways sometime after the NTSB finished its investigation in 1999. The airline then gave it to Global Aerospace, which has an American office in Short Hills, N.J.

The remains of planes involved in accidents are often sold as scrap.

JAMES M. KUBUS/TRIBUNE-REVIEW FILE

As wreckage from Flight 427 was recovered in the weeks after the crash, investigators assembled a two-dimensional reconstruction of the plane in Hangar 1 at the old Greater Pittsburgh International Airport.