

It is also a continuing process. As new transports build time in airline service, flaws appear inside them. Accidents investigations unearth other flaws, which manufacturers usually correct voluntarily. If industry fails to correct the flaws, FAA orders their correction with an "Airworthiness Directive" to the airlines or the manufacturer.

THE 'PICKLE SWITCH'

When engineers fail to anticipate causes of accidents during certification, aircraft crash. When the crash is fatal and its cause apparent, industry and Government move fast and forcefully to prevent a recurrence. For example:

On Feb. 12, 1963, a Northwest Airlines 720B climbed westward from Miami International Airport, over the Everglades, toward a gray forest of thunderstorms. While maneuvering to evade the squall line, the plane's pilots encountered massive updrafts. The jet's airspeed dropped rapidly as air currents thrust it upward through 17,000 feet, its nose cocked crazily skyward.

Embedded in the control column under the left thumb of the late Capt. Roy W. Almquist was a small black switch, called a "pickle switch" by pilots. It controlled an electric motor in the plane's tail section some 135 feet behind the cockpit.

The motor drove the jet's great slab-like stabilizer up or down to trim away bothersome control pressures. (A child adjusts, or "trims," the angle of his fingertips to porpoise his palm in the windstream outside a moving car.)

As the 173,000-pound plane rose, its air speed indicator warned that a stall was imminent. To avoid that lethal phenomenon, Almquist pushed his thumb against the pickle switch and held it forward for a total of eight seconds.

The stabilizer moved up in response—as far up as it could go.

At the same time, Almquist pushed forward on the control yoke, thus ordering his aircraft to dive away from the stall, to accelerate quickly. The jet responded in an instant. Its nose sliced through the horizon as the plane followed the roller coaster flight path used by the space agency to familiarize fledgling astronauts with the oddities of weightlessness.

Dust rose up in the cockpit. Almquist rose also, until the safety belt restrained him.

In about eight seconds, the jet's nose was pointed at the swamp below. But when Almquist hauled back on the controls, struggling to brake his descent, nothing happened. Aerodynamic loads on the jet's tail section made the movable stabilizer, and the elevator behind it, useless. The falling jet accelerated through its "never exceed" speed and disintegrated in flight.

All 43 aboard died.

A \$2 MILLION VERDICT

About two years after the accident, a five-week trial ensued in the Cook County (Chicago) Circuit Court. The jury, after deliberating five hours, awarded \$2 million to the widow of a passenger killed in the crash. The Boeing Co., builder of the aircraft, was ordered to pay \$1.6 million; Northwest Airlines the balance.

Attorneys for the plaintiff convinced the jury that the jet's stabilizer concealed a defect. They proved that the company knew of the defect from previous accidents. They showed that Boeing waited until after the Everglades accident to warn pilots against moving the huge metal slab while flying through turbulence, and that the manufacturer therefore was partly responsible for the tragedy.

In other words, the certification process had broken down, and in breaking down, had killed. Neither Boeing nor the FAA had spotted the potential hazard during the design, construction, testing and delivery of the 720B.

During the 1960-3 time span, the Civil Aeronautics Board reported 34 incidents in which turbulence damaged U.S. airliners or caused injury to their passengers. But only the Northwest accident proved fatal. Spurred by it, Government and industry put cost considerations aside and joined to tackle the turbulence problem.

A \$100,000 RESTORATION

As soon as the downed jet's flight recorder was recovered and analyzed, Boeing sent other 720Bs aloft to fly approximations of the fatal maneuver at higher altitudes and less critical speeds. Together with the CAB, company experts ran the results through a computer.

Meanwhile, space agency aerodynamicists borrowed the aft half of a 720B fuselage from Boeing and mounted it in a hangar-sized wind tunnel. Simulta-