neously, CAB and Government agents were collecting debris from the accident site, hauling it 40 miles to Miami and rebuilding the jet's carcass in a $100,000 search for clues or causes.

Northwest Airlines, in conjunction with the Battelle Institute, set out to assess all the evidence.

Northwest Capt. Paul Soderlind toured the country warning fellow pilots not to actuate the pickle switch in turbulence, warning them not to chase their airspeed indicators in violent up- and downdrafts. Airspeed indicators, he reminded them, are notorious for flipping back and forth across a 200-knot speed band even while the airplane proceeds at a constant speed.

How should they penetrate thunderstorms? Slow the jetliner, keep it straight and level and ignore pressure-sensing instruments, Soderlind said.

In November, 1963, Boeing distributed to all airlines a handbook entitled "Flying in Severe Turbulence," which elaborated on earlier company telegrams. Recommendations in both had already been incorporated into all pilot training programs.

An urgent advisory from Boeing's Renton, Wash., headquarters instructed airlines to limit maximum possible stabilizer movement by about 25 per cent.

A BASIS FOR ACTION

In the case of Northwest Airlines, tragedy triggered a massive response. But must the aviation establishment await the impetus of tragedy before ridding air transportation of hazards long identified by engineers and pilots? The question was put to Lee Warren, deputy director of FAA's Western Regional Office.

"You can't junk the whole (air transportation) system just because you've developed a mathematical model that predicts the likelihood of an accident," he said. In promulgating safety rules, Warren added, "FAA holds its ground best when it has precise facts in hand."

To justify a safety regulation that *costs* big money, FAA must demonstrate that the regulation will *save* big money, as did the mandatory installation of airborne radar during the 1950s. Or FAA must show that the regulation will save lives. If no lives have been lost in the regulation's absence, the agency often must backtrack. For example:

Many within FAA believe that today's heavy jets are being flown from runways too short for safety. Airline pilots agree overwhelmingly. But neither the agency nor the pilots have mustered enough statistical evidence to convince U.S. airlines or the operators of U.S. airports that a hazard exists. Unfortunately, that evidence is beginning to collect.

A UNIQUE SPEED

On Nov. 6, at 6:41 p.m., a controller in Cincinnati's traffic tower cleared a Trans World Airlines 707 for takeoff. Unknown to the TWA pilot, another jetliner was mired in the mud alongside the takeoff runway, hidden in the darkness.

Like a car accelerating in high, the TWA jet rumbled down the runway, slowly gaining speed. Again and again, the eyes of its pilot, Capt. V. D. Matheny, returned to the airspeed indicator before him. At this point in the takeoff sequence, he was concerned with one speed and one speed only—the speed pilots call V1.

V1 is a unique speed, one that varies with the weight of an airplane, the length of its runway and the temperature of the day. It's the precise speed to which a pilot can accelerate, suffer failure of an engine and still do one of two things:

He can stop on the runway remaining, or he can continue the takeoff with only three engines operating. If engine failure occurs before V1, he must stamp on the brakes and stop on the runway. Should it occur after V1—even one knot after—the pilot continues aloft with three good engines, circles the field and lands.

As Matheny approached V1 for Cincinnati, 132 knots, he saw the other jetliner "loom up in my landing lights." Its silhouette appeared dangerously close to the runway. The TWA 707 sped by the stationary DC–9 and at that precise moment the TWA pilots heard what sounded like a cannon shot, or the sound of metal ripping into metal.