Five Degrees[1]
A Sudden Gust at Touchdown

Lev Neymotin, PhD
N5Digital, Inc.

Upfront note.
This story is triggered by my recent personal experience. It is not intended to alarm the readers. Quite the opposite – I want to express admiration for the aviation industry and for the extremely safe travel environment it provides. The extreme rarity of events described below, with any real consequences, is the proof!

The Story.
A fully loaded Boeing 787 is landing after a twelve-hour overseas flight. The aircraft is stabilized on final approach, its speed reduced to about **140 knots** (roughly **160 mph**). Everything appears routine. The runway is dry. There is a **gusty crosswind**, peaking around **30 mph**, fluctuating but still **within certified limits**.

Touchdown.

At that very moment, a **sudden lateral wind gust** strikes. The aircraft experiences a sharp, unmistakable **side-jerk**, strong enough to alarm the passengers. For a brief instant, the airplane feels unstable.

Within **one to two seconds**, the pilots react. Rudder is applied, the fuselage is realigned with the runway, lateral drift is arrested, and the aircraft remains firmly on the centerline. The spoilers deploy, the wheels bite, and the airplane begins to decelerate normally.

From the cockpit, the incident is already over.

But how close was it to something far worse?

Some simple geometry suggests: **uncomfortably close**.

Measured from the fuselage centerline, the 787's wing extends approximately **98 feet** to each tip. A roll deviation of only **5 degrees** would lower the downwind wingtip enough to **strike the runway**—an event that would almost certainly be catastrophic.

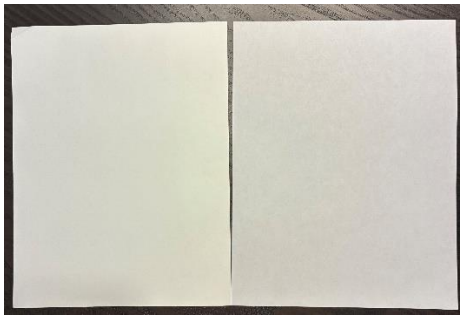
On the positive side, the airplane is much lighter than at takeoff. After twelve hours of flight, most of the fuel has been consumed, leaving on the order of tens of thousands of pounds of fuel rather than hundreds of thousands. This reduces structural loads on the airframe and landing gear, and also lowers the potential fire hazard in the event of an accident.

On the negative side, that same reduced mass means **less inertia**. The aircraft is **more easily accelerated sideways** by a sudden gust than it was earlier in the flight. (Passenger movement, contrary to intuition, is negligible compared to the mass of the aircraft and plays no meaningful role.)

Is **five degrees** really that much?

[1] A roll angle of approximately five degrees is not unusual as a brief transient during gusty crosswind operations. While such an attitude would not be sustained during landing, even a momentary excursion of this magnitude is geometrically sufficient to bring a wingtip close to the runway on a wide-body aircraft. Modern flight-control systems and pilot inputs are designed to correct such deviations rapidly.

Visually, it isn't. Place two standard sheets of paper side by side. Keep one flat. Slide **one corner** of the other sheet laterally by about **3/16 of an inch**, keeping the remaining corners fixed. The angle between the sheets is roughly **five degrees**. It looks trivial—almost nothing.



Yet for a wide-body jet at landing, it is the difference between normal rollout and disaster.

In this case, the gust was **brief**, the pilots were **fully ahead of the airplane**, and the control inputs were **precise and immediate**. Rudder straightened the fuselage, ailerons arrested roll, and the right wing—this time—never descended those critical five degrees toward the runway.

The incident passed.

The airplane taxied clear.

But for the passengers, imagination lingers longer than physics.
It takes time for the mind to stop replaying the "what ifs."