

When Defenses Fail, Airplanes Can Crash

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January 2, 2016

Airplane crashes are not supposed to happen. When they do, they are not caused by “bad luck.” They are not caused by “fate.” They are not caused by “an act of god.” And while a lay person may irrationally ascribe the accident to some sort of divine intervention, the truth is, it was caused by something much more pragmatic and down to earth.

Millions of flights are conducted every year and almost every single one of them does not end with an accident. These flights are successfully completed because of a multi-layered defense system that, when working properly, should prevent an accident from happening. This system works as intended on *almost every single flight*. On an accident flight, one or more of these defenses has failed to work as intended. And when defenses fail, airplanes can crash.

The defense system is made up of many, many layers of safety nets. Safety nets are numerous and include, for example, **technology** (e.g., weather radar, TCAS, EGPWS), **regulations** (e.g., FARs/CARs), **procedures** (e.g., checklists, SOP’s, operations manuals), and **training** (e.g., CRM, LOFT).

Typically, there is nothing wrong with the defense system itself. In fact, in many of the accidents that have occurred over the years, there were adequate defenses in place—but those defenses (in this case, procedures) were just not being used. An example from the aircraft maintenance domain is the crash of Continental Express Flight 2574. The outgoing maintenance crew did not inform the incoming maintenance crew that 47 screws needed to be reinstalled on the horizontal stabilizer. On its second flight after its maintenance release, the aircraft

experienced an in-flight structural breakup and all perished. The NTSB investigation revealed that slack shift turnovers and departures from approved procedures were the norm. The shift turnover procedures were adequate; they were just not being used. If they were, the accident would not have happened.

From the flight operations domain, failed defenses are leading to serious accidents and incidents, such as runway excursions, which are occurring at an all-time high rate. In fact, as of this writing, runway excursions are the number two cause of accidents globally, behind only Loss of Control In-Flight (LOC-I). Runway excursions are typically (but not always) the result of unstablized approaches. There are adequate defenses in place to prevent and/or mitigate unstablized approaches and these are clearly stated in an airlines SOP's, which provide the pilots with a strict set of criteria (parameters) that determine whether an approach is stabilized or not (there is no guessing). Yet, data indicate that up to 90% of the time, pilots continue with approaches that are considered unstablized by the criteria set forth in their airline's SOP's. As with the previous maintenance example, the defense (stabilized approach criteria SOP) is adequate; it's just not being used properly, if at all. If it were, the vast majority of these runway excursions would not be happening.

If there are so many defenses in place, then why are they failing to prevent accidents? Primarily, it is not a problem with the defenses themselves; they are typically available and adequate. The root of the problem is human behavior. Whether it's pilots, mechanics, or flight attendants, there is an innate temptation to ignore or deviate from procedures (procedures that, when followed, are specifically designed to keep you out of trouble). Thus, it comes as no surprise that the majority of modern-day accidents are caused not by inadequate defenses, but rather the human responses to how, or if, those defenses are used.

All of this raises a very good fundamental question. How do we get people to actually apply the systemic defenses that can invariably prevent a large proportion of today's accidents? Many of you may immediately think it's a training issue. It's not. Think about the pilots that have had multiple courses on CRM and CFIT, yet the next day they go out and bust minimums on a low IFR approach and crash short of the runway, killing all onboard. The pilots should have executed a missed approach at DH (the defense), but instead they decided to descend "just a little lower" to see if they could find the runway environment. This was not a training issue, nor was it ignorance. Was the defense adequate? Yes. Did the pilots adhere to the defense? No (If they did then this accident would not have happened). So if this is not a training issue, then what is it?

Most of the problems are due to human factors. In other words, these non-adherence issues are mostly psychologically influenced (as opposed to some kind of training, technical, or proficiency problems). Most of these pilots are "good sticks" and they perform consistently well in line checks. However, human factors issues can, at any time, override good stick and rudder skills and put the crew and aircraft at risk. Reasons why crews may fail to adhere to the systemic defenses are as follows (non-exhaustive and in no particular order):

- High risk-taking propensity
- Macho
- Rushed
- Complacency
- Pressure
- Fatigue
- Perceived importance
- Bad attitude
- Apathy

As previously mentioned, training in these areas would have a limited effect. Even if there was substantive training on these individual subjects, these are mostly things that people can learn about, be aware of, and test well on, but when they go out in the real world there is a

much different dynamic. We have strong evidence of this in the thousands of Line Operations Safety Audit (LOSA) observations we have in our LOSA database. So then how do we implore our crews to follow the procedures and make our defenses truly effective in preventing preventable accidents? I will leave that question for you to ponder for now...

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