RUNWAY SAFETY-II

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Much has changed since 1977 when two jumbo jets collided on a foggy runway in Tenerife.

Globally, we have implemented many strategies to eliminate runway collisions but runway safety (RS) continues to be a concern. The nagging question remains: Are we doing everything we can to prevent runway collisions? No doubt our mitigations have positively affected runway safety but if you believe that there is any correlation between the number of runway incursions (RIs) and the likelihood of future runway collisions, you will be concerned about RI statistics.

Across the European region for example, there are two runway incursions every day, while United States towered airports average more than three. Those are only the runway incursions that we know about by the way. What exactly do these numbers tell us though? Do they really tell us anything about the likelihood of upcoming runway collisions?

While we should care about the number of RIs we are having, I think that a preoccupation with those numbers will actually do very little to prevent runway collisions. Instead, I think we would be better served by learning more about runway safety from the experts – pilots, air traffic controllers, and vehicle operators – who deal in runway safety all of the time. Two ways we can learn more from them are clearly within our grasp:

1. We can conduct better investigations that include as many of the people who were present at the time of any runway safety event. They can help us put ourselves into the situation they were in provided that they feel safe to do so. "Safe" means that the investigation cannot resemble a witch hunt in any way and that it strives to advance our runway safety learning.

2. Instead of limiting our investigations only to events in which something went wrong, let's start investigating routine operations in which everything goes right too. That means opening up our runway safety knowledge-base to probing not only the relatively minute number of runway safety incidents (bad things) that we look at today, but also exploring what goes right millions of times (good things).

First let's take a look at what we can learn from better investigations. On September 27, 2010, there was a runway incursion at O'Hare International Airport (ORD), involving AWE983 (US Airways 983), a B734 that began takeoff roll on runway 9R without a takeoff clearance. This put them in conflict with UAL942, a heavy jet rolling simultaneously on intersecting runway 32R (see figure 1).

On-the-job training (OJT) was in progress in the tower and the Local Control (LC) trainee and instructor immediately detected the conflict and instructed AWE983 to cancel takeoff. AWE983 had just started its departure roll and never got close to UAL942.

I was the Quality Assurance Manager at O'Hare Tower at the time and a cursory investigation revealed that AWE983 had apparently taken the departure clearance given to UAL942 heavy. Oddly though, AWE983 had never responded to any instruction given by LC on the tower frequency, 126.9. Listening to the recordings, no AWE983 takeoff acknowledgement was heard and the telltale "squeal" of two aircraft answering at once was also absent. However, when the LC trainee listened to the event on LiveATC.net later that night at home, she reported that AWE983 could be heard responding to every tower instruction! We were mystified as to how that could happen.

Had we chosen to end the investigation here, we would have concluded that we had some sort of communications equipment problem in the tower and that AWE983 was wrong nevertheless. We would have then written a pilot deviation, checked out the tower equipment and would have officially closed the door on an opportunity to learn more about runway safety. We instead conducted a comprehensive event review that included the AWE983 crew members, the controllers involved, and the O'Hare Tower Plans and Procedures, Quality Assurance, and Training managers.

From this we learned:

- That AWE983 was actually transmitting and receiving on 128.15, the ORD north tower frequency and not on the appropriate frequency, 126.9.
- That LC was transmitting on frequencies 126.9 and 128.15 (because the north tower was closed) but unknowingly was receiving only on frequency 126.9. They therefore could not possibly receive transmissions from AWE983 on 128.15.
- That the crew of AWE983 was unsure about the correct tower frequency and to avoid bothering a busy ground controller, instead looked up the frequency on the airport diagram. They mistakenly concluded that since they were taxiing to the north part of the airport, that the "north tower" frequency, 128.15, had to be the correct one. (Because of this RI, the charts have since been changed to include the associated runways for the O'Hare north and south tower frequencies.)
- That both the tower trainee and the instructor on LC both diligently scanned all intersecting runways after takeoff clearances and were especially wary of AWE983 because they were not completely communicating.

Knowing this, let's put ourselves on the flight deck and in the tower that night:

1. LC transmits "AWE983 position and hold runway 9R and be ready."
2. AWE983 hears this and acknowledges on frequency 128.15.
3. LC cannot hear this response but observes AWE983 taking position as instructed and does not demand a read back from the crew. That may not be a great technique but is frankly something that frequently happens when pilots try to break in to busy frequencies.
4. LC clears UAL942 heavy for takeoff on runway 32R on frequency 126.9. UAL942 heavy acknowledges this also on frequency 126.9. AWE983 cannot hear UAL942 acknowledge the takeoff clearance.
5. Hearing no other aircraft respond on 128.15 the crew of AWE983 thinks the takeoff clearance is for them. After twenty seconds, they respond "runway heading, cleared to go, AWE983", all on frequency 128.15. This transmission cannot be heard by LC or UAL942.
6. LC immediately spots AWE983 rolling, cancels their takeoff and gets no response but observes AWE983 slowing and exiting the runway.

What first seemed to be a straightforward pilot deviation turned into much more than that but only after closer inspection.

Had we ended our investigation sooner, we would not have learned that something as simple as the frequency verbiage used on an airport diagram could be misinterpreted and contributory towards a RI. We may not have considered that flight crews are really busy "multitasking" while taxiing and that both pilots and controllers sometimes feel the need to take shortcuts during busier traffic periods. We may have also ignored the fact that pilots often do not want to "bother" controllers even though doing so would be safer for everyone. Finally, we probably would not have learned that people, the controllers in this case, sometimes do (or don't do) certain things in response to the behaviors of other people in our system. They have a lot of good operating practices that should be passed on to others.

If all of this can be gleaned from one very complicated, isolated runway safety event where things went wrong, can you imagine what we could possibly learn from the millions of operations in which everything goes right? To advance runway safety further then, we also need to learn about why and how things go right almost all of the time. In other words, its time to think about runway safety differently as suggested by the Safety-II perspective spearheaded by Professor Erik Hollnagel.

While Safety-I, our traditional approach to safety, concentrates almost solely on looking at what went wrong (like the RI at ORD for example), Safety-II looks at all possible outcomes related to the daily routine of getting the job done. A key aspect of Safety-II is that it therefore includes looking at how people get things right so often, virgin territory for most safety professionals and particularly with respect to runway safety.

And people get things right almost always; millions of air traffic operations occur safely every day and that is because of the unseen things that pilots, controllers, and airport vehicle operators do to keep people safe. The trouble is that except for those very deep in the trenches, most people do not know exactly what is being done to keep the flying public safe. I guarantee that you will rarely find their actions documented anywhere, especially in the standard operating procedures (SOP). While this information may not reduce RI numbers, it will probably teach us a lot about preventing runway collisions.

Just what are people doing? Simple things like a controller choosing not to clear a departure for takeoff after hearing a dubious hold-short read back from a pilot on an intersecting runway or taxiway. No one usually knows what they did or didn't do but things are certainly a lot safer because of it.

To enhance runway safety we can either continue what we have always done or change our tactics. Considering what they say about those who do the same things repeatedly while expecting different results, I think we should do something different. First, let's commit to investigating all events much more robustly, including the people involved whenever possible. Second, let's add Safety-II concepts to runway safety by closely examining the routine performances of our pilots, controllers, and vehicle operators. After all, they are the real runway safety experts out there and I think we can learn a lot from them.