

Patient Safety Tip of the Week

March 14, 2023 Runway Safety

March 12-18 is Patient Safety Awareness Week this year. So why are we discussing aviation near-misses this week? We have often used analogies from aviation (or other non-healthcare industries) for their lessons learned that may be applied to patient safety. And, sometimes, those other industries might learn from healthcare!

This past fall we gave a course “Why Accidents Happen” at Dartmouth’s Osher adult learning program. In that course we described multiple patient safety events in addition to many accidents or near-misses in other industries, citing the common themes that underly those events.

We discussed the 1977 Tenerife disaster, aviation’s deadliest accident, in which 583 people were killed when one airliner taking off crashed into another airliner on the same runway. We then discussed the 2017 Air Canada Flight that inadvertently lined up to land on a taxiway rather than the runway and overflow multiple planes that were in line on the taxiway at San Francisco International Airport (SFO), missing them by only feet (see our October 23, 2018 Patient Safety Tip of the Week “[Lessons From Yet Another Aviation Incident](#)”). That near-miss could have been aviation’s worst disaster ever.

Those 2 incidents were scary enough. Then came 2023. The first 2 months of 2023 have seen at least 6 “runway incursions” that were near-misses that could have had devastating results.

The one that first brought the issue to attention occurred at [JFK](#) on January 13, 2023. A Delta Airlines Boeing 737 was barreling down the runway in takeoff as an American Airlines Boeing 777 was crossing runway in a wrong location. An air traffic controller spotted the problem at the last minute, imploring the Delta pilot to abort takeoff. The Delta airliner, which had already been traveling at 100 mph, was able to stop its takeoff about 1000 feet short of the American airliner that was still on the runway. See the [flight radar illustration](#) of this event.

On February 4, 2023, at Austin-Bergstrom International Airport in Texas, a Southwest 708 began takeoff while a FedEx 767 was landing on the same runway. An air traffic controller cleared Southwest 708 to depart when the FedEx 767 was approximately 3 miles from the runway. The FedEx 767 flew directly over SW 708, then aborted landing

and turned sharply away from the runway and did a go-round. At recent congressional hearings, a [video simulation](#) (based on actual flight data) shows how close the two planes came in the Austin incident.

On January 23, 2023, a United Boeing 777 widebody jet crossed the runway at Honolulu Airport (HNL) as a Kamaka Air cargo plane was in the process of landing on that runway. The other aircraft was a Cessna 208B Grand Caravan (a smaller, single-engine standard passenger and cargo plane used at Hawaii's airports). At the closest point, the aircraft were separated by 1,170 feet.

On February 16, 2023, there was an incident where 2 planes almost collided on the runway at [Sarasota-Bradenton International Airport](#). This involved an American Airlines Boeing 737 and an Air Canada Rouge Airbus A321. While the former was cleared to land on runway 14, the latter was also cleared for takeoff from the same runway. The American Airlines crew self-initiated a go-around. No injuries or damage reported.

On February 27, 2023, there was a near-miss incident between a JetBlue commercial flight and a private jet at [Boston's Logan International Airport](#). According to a preliminary review, the pilot of a Learjet 60 took off without clearance while JetBlue Flight 206 was preparing to land on an intersecting runway. "JetBlue 206, go around" said the controller in Boston Logan's tower just in time to avert a crash. The two planes came within 565 feet (172 meters) of colliding, according to Flightradar24's preliminary review of its data.

On February 22, 2023, there was an incident at [Hollywood Burbank Airport](#) in California in which the crew of a Mesa Airlines flight was forced to discontinue a landing after air traffic controllers cleared another plane to take off ahead of it. An air traffic controller had cleared a SkyWest Airlines Embraer E175 to take off from Runway 33. At the same time, a Mesa Bombardier CRJ900 about 1.3 miles from the runway was preparing to land on that runway. The pilot of the Mesa flight discontinued the landing and ascended. The SkyWest aircraft continued with its departure, which prompted an automated alert to sound on the flight deck of the Mesa aircraft. The controller then instructed the crew of the Mesa flight to fly on a course away from the other aircraft.

Runway incursions may involve vehicles other than aircraft. On February 10, 2023, at Los Angeles International Airport there was a [collision between a plane and shuttle bus](#). The crash happened at a slow rate of speed as the jet — an empty American Airlines A321 jet — was being towed away from a gate. 5 people were injured.

And there have been several incidents where planes have bumped into each other while moving elsewhere at airports. On January 23, 2023, at JFK a JetBlue [plane struck the tail of another parked plane as it was pushing back from the gate](#). No injuries were reported. On February 3, 2023, two planes clipped wings at [Newark Liberty International Airport](#). A United Airlines Boeing 757 was parked at a gate and waiting for departure when its left wing was clipped by the right wing of a United 787, a much larger aircraft being towed to the next gate.

These near-misses and actual accidents demonstrate the typical **cascade of errors** and events superimposed on latent factors or enabling conditions that we see in accidents in almost any industry, including healthcare. Some of the common themes seen in these incidents include:

- Human error
- Communications breakdowns
- Lack of constraints
- Enabling factors
- Latent factors
- Weather
- Construction/maintenance issues
- Multitasking
- Unfamiliarity with new procedures
- Unanticipated circumstances or events
- Possible over-reliance on technology
- Root causes: pre-pandemic levels of air traffic, new pilots, time pressures

The 1977 **Tenerife accident** was aviation's deadliest event and illustrates many of these elements. Flights had been diverted to this small regional airport in the Canary Islands because of a bomb explosion at the original airport. The Tenerife airport was unaccustomed to handling this volume and planes of this size. It had only one major runway and one major taxiway, with 4 small taxiways connecting to the runway. There were so many planes that they had to line up on the entire taxiway. To take off, a plane would have to taxi down the main runway, turn around, and then take off.

Tower told the KLM jet to taxi to the end of the runway, turn around and get ready for takeoff. It also told the Pan Am jet to follow the KLM jet and exit on one of the short connecting taxiways. However, the Pan Am jet got confused about which connection to take. There were ground-level clouds near the Pan Am jet, which was now still on the runway, so the 2 planes could not see each other and the tower controller could not see them (the airport did not have ground radar).

A number of delays had added to time pressures on the KLM jet. The captain of the KLM plane was also KLM's Chief Flight Instructor and the poster child for KLM's ad campaign that stressed punctuality. Some simultaneous radio transmissions obscured information that the Pan Am plane was still on the runway. Despite the First Officer's warning that clearance had not yet been given, the KLM captain initiated takeoff. The KLM plane crashed into the Pan Am plane on the runway, killing 583 people.

Communication gaps were prominent in most of the other events, too. In the JFK near-miss, the American Airlines plane had taken a wrong turn, resulting in it crossing the runway on which the Delta plane was taking off. The air traffic controller (ATC) told the American pilot "go to runway 4 left and hold short of Kilo (Taxiway K)" but didn't say "turn right on Kilo" which could have clarified a little bit. The American pilot also

appears to not have repeated instructions back completely. Hearback is critical but sometimes words get garbled, particularly via radio.

In the Boston Logan near-miss, the air traffic controller had told the crew of the Learjet to “line up and wait” on Runway 9 as the JetBlue Embraer 190 approached the intersecting Runway 4 Right. The Learjet pilot read back the instructions clearly but began a takeoff roll instead. The pilot of the JetBlue aircraft took evasive action and initiated a climb-out as the Learjet crossed the intersection. So much for “**read back**”!

We all know that communication issues contribute to the vast majority of sentinel events in healthcare. “Read back” and “hear back” are not simple recitations of something said. One must be certain that the intent of the instructions or communication is clearly understood.

One thing we did not hear about in these recent near-misses is violation of the “**sterile cockpit**” rule. You will recall that the term “sterile cockpit” refers to the importance of focusing attention during critical periods such as takeoff and landing and avoiding all extraneous conversations. But erasure of cockpit voice recordings from the critical period also prevented verification of the sterile cockpit in at least the JFK incident. Our October 2, 2007 Patient Safety Tip of the Week “[Taking Off From the Wrong Runway](#)” discussed the 2006 accident where Comair Flight 5191 crashed in Lexington, Kentucky after taking off inadvertently from the wrong runway, which was too short for a commercial airliner (this runway was used by small general aviation planes). All passengers and all but one crew member died in the crash. There were multiple factors contributing to this accident, including violation of the sterile cockpit and distractions for the air traffic controller. Our May 26, 2009 Patient Safety Tip of the Week “[Learning from Tragedies. Part II](#)” also noted that violation of the sterile cockpit may have played a role in the fatal crash near Buffalo, NY.

There was another important facet related to the JFK near-miss. The American pilots were apparently unaware of the seriousness of the incident and continued their flight to London. The cockpit voice recording devices retain only two hours of recordings, and the flight from New York to London takes seven hours. So important data from the cockpit voice recorder was lost. You’ll recall that the same thing happened in the Air Canada near-miss in San Francisco in 2017 (see our October 23, 2018 Patient Safety Tip of the Week “[Lessons From Yet Another Aviation Incident](#)”). The healthcare analogy here is that you need to ensure all relevant information is secured as soon as you recognize a serious event has occurred. That may include sequestering any equipment that was involved.

Unanticipated events or conditions may also contribute. In the Austin-Bergstrom near-miss, the air traffic controller had cleared Southwest 708 to depart when the FedEx 767 was approximately 3 miles from the runway. But the SWA708 did not begin its departure roll until the FedEx aircraft was approximately .676 miles from the runway threshold. Freezing fog was causing low visibility at the time of the incident. Visibility was considered marginal and decreasing (estimated at about one-eighth of a mile). While it is

apparently normal for both flights to be cleared to use the same runway within that distance, it likely took the pilots longer to taxi and mentally prepare to transition from an on-the-ground vehicle to an airborne one because of that poor visibility.

The **complexity of airports** is also likely a major contributing factor. Some airports have **multiple runways and multiple taxiways crossing those runways**. Modern airports have tools designed to avert such accidents. The [Airport Surface Detection System \(ASDE-X\)](#) is a surveillance system using radar, surface radar, multilateration and satellite technology that allows air traffic controllers to track surface movement of aircraft and vehicles. It alerts air traffic controllers of potential runway conflicts by providing detailed coverage of movement on runways and taxiways. ASDE-X has now been implemented at 43 airports in the US, but many of the airports involved in the above near-misses did not yet have ASDE-X.

Modern airports also have other tools designed to avert such accidents. There are special **flashing lights which warn pilots against taxiing across a runway**. JFK is one of 20 airports in the United States equipped with the fully automated Federal Aviation Administration system that warns pilots “when it is unsafe to enter, cross, or takeoff from a runway”. Runway 31L, the runway the American pilot should have crossed, has red lights installed that automatically come on when it is in use. Runway 4L, the runway which the American pilot actually crossed, does not have these. Both runways, however, have yellow lights at the edges that typically signal when a runway is safe to cross. Immediate review of those lights after the near-miss showed they were functioning normally. But the American captain apparently did not have sufficient visibility to see those stop bar lights on the runway and a third pilot in the cockpit also could not see the lights.

That gets us back to what seems like a no-brainer – the **lack of constraints**. Why would you ever allow one plane to be crossing a runway on which another plane is landing? Yes, at least at the major airports there are the flashing yellow or red lights that warn a plane not to proceed across a runway. But that didn’t stop the American Airlines plane in the JFK incident. Should there not be some sort of physical barrier to prevent such crossing? The best fixes in any RCA are **forcing functions or constraints** that prevent someone from doing by accident something that will have dire consequences. In healthcare, we use special connectors that prevent oxygen lines from being hooked up to nitrogen lines, or connectors that prevent a feeding tube from being hooked up to an IV line. We also remove the vials of concentrated KCl from floor stock so it cannot be inadvertently administered in fatal dosage.

In our October 2, 2007 Patient Safety Tip of the Week “[Taking Off From the Wrong Runway](#)” we discussed a fatal aviation incident where a large plane inadvertently tried to take off on a short runway that was only used for small aircraft. We asked ourselves why there should not be a physical barrier that would prevent a large plane from entering that runway. Since “caution” lights did not seem to prevent the recent JFK near-miss, perhaps a physical barrier (like those at railway crossings) might be used to close off all crossings

on a runway on which a plane is landing. Of course, such a concept would have to anticipate unintended consequences (like a plane getting stuck between barriers!).

We'd also ask why there are ground-level criss-crossing of taxiways and runways at all? Why can't airports be designed with taxiways running beneath the runways? We are not engineers, but we've seen tunnels that allow road traffic beneath runways. So why couldn't they be built big enough to accommodate a large plane? Apparently, there are some airports, like Dulles International, that don't have runway crossings at all.

Limitation of runways seems to have played a role in some runway incursion cases. We described above how the paucity of runways and taxiways played a role in the 1977 deadly Tenerife disaster. Limitation of runways due to **construction or maintenance** seems to have played a role in other runway incursion cases. In the 2017 Air Canada near-miss at SFO (see our October 23, 2018 Patient Safety Tip of the Week "[Lessons From Yet Another Aviation Incident](#)") a runway had been closed for maintenance, likely contributing to the pilots incorrectly lining up with a taxiway rather than the runway. In the recent Honolulu near-miss, one runway was unavailable for landing and company notes for the UAL aircraft said they were not allowed to perform land and hold short operations (LAHSO) on the runway they finally landed on. That led to confusion in the UAL flight crossing the runway that the smaller plane was landing on.

Many of the most famous disasters in industry history have followed equipment or facilities maintenance activities, whether planned or routine. Well-known examples include Chernobyl, Three-Mile Island, the Bhopal chemical release, and a variety of airline incidents and oil/gas explosions. It is unknown how often maintenance activities contribute to medical incidents but, given the similarity of systems in medicine to those in other high-risk industries, it is likely that there are many cases in which maintenance errors contribute to adverse patient outcomes.

And then, we get to **root causes**. So, why so many near-misses now? In 2022, there were 1,732 recorded runway incursions, according to [statistics compiled by the FAA](#), and there have been 631 so far in 2023 (runway incursions are graded by type and severity but this list does not include a severity rating for each incident). Hassan Shahidi, president and CEO at Flight Safety Foundation, noted in an [interview](#) that **thousands of new pilots** have entered the workforce in the months since the pandemic and **travel demand has increased** post-pandemic. Those thoughts were echoed by [National Transportation Safety Board Chair Jennifer Homendy](#) who said "...we saw a lot of layoffs. We saw a lot of employees retire, we have new employees coming on that are being trained. We have drones coming online, air taxis, so it's a difficult time and it's really a transitional time for the aviation industry." [CNN's Pete Muntean](#), who not only covers aviation but is also a pilot and flight instructor, offered a similar opinion. We would also wonder whether the debacle of backed up, delayed, or cancelled flights over the recent holidays has increased pressure on airlines and air traffic controllers to get flights off on time.

Obviously, those two critical factors apply to **healthcare**. The COVID-19 pandemic has led to many healthcare workers retiring, creating **workforce shortages**, just as **pent-up demand** has led to more people seeking healthcare.

While there may well be an impact related to new pilots, there may also be a contribution from **new rules or procedures**. In the JFK near-miss the first officer was performing a series of tasks that involved processing takeoff data. But for the first time, under new procedures introduced just weeks before, she also had to make an announcement informing passengers and flight attendants of the impending takeoff (that announcement was previously made by the captain). It required the first officer to interrupt continuing tasks, be precise on timing and change intercom settings. Those recent changes may have been rolled out without adequate training. The Allied Pilots Association said the implementation involved an attempt to alter critical procedures through a 35-page bulletin and changes in a 65-page manual rather than through in person training.

We've learned so much from the aviation industry to improve patient safety. Most of those common themes listed as contributing factors to these recent aviation incidents also apply to healthcare incidents. So, we should learn from them. But maybe it's also time for the aviation industry to learn from healthcare!

See some of our previous columns that use aviation analogies for healthcare:

May 15, 2007	“Communication, Hearback and Other Lessons from Aviation”
August 7, 2007	“Role of Maintenance in Incidents”
August 28, 2007	“Lessons Learned from Transportation Accidents”
October 2, 2007	“Taking Off From the Wrong Runway”
May 19, 2009	“Learning from Tragedies”
May 26, 2009	“Learning from Tragedies. Part II”
January 2010	“Crew Resource Management Training Produces Sustained Results”
May 18, 2010	“Real Time Random Safety Audits”
April 5, 2011	“More Aviation Principles”
April 26, 2011	“Sleeping Air Traffic Controllers: What About Healthcare?”
May 8, 2012	“Importance of Non-Technical Skills in Healthcare”
March 5, 2013	“Underutilized Safety Tools: The Observational Audit”
April 16, 2013	“Distracted While Texting”
May 2013	“BBC Horizon 2013: How to Avoid Mistakes in Surgery”
August 20, 2013	“Lessons from Canadian Analysis of Medical Air Transport Cases”
December 17, 2013	“The Second Victim”
January 7, 2014	“Lessons from the Asiana Flight 214 Crash”
January 5, 2016	“Lessons from AirAsia Flight QZ8501 Crash”
October 23, 2018	“Lessons From Yet Another Aviation Incident”
July 19, 2022	“Sucked Out of the Plane at 17,000 Feet”

References:

JFK near-miss

<https://www.washingtonpost.com/transportation/2023/01/16/jfk-planes-close-call-runway/>

Flight radar animation of the JFK near-miss

<https://twitter.com/i/status/1614342894248394752>

Austin-Bergstrom International Airport near-miss

<https://www.statesman.com/story/news/local/2023/03/03/ntsb-preliminary-report-near-collision-fedex-southwest-airplane-austin-airport/69967765007/>

Animation of the Austin-Bergstrom International Airport near-miss

<https://www.c-span.org/video/?c5057634/acting-faa-administrator-pressed-miss-incident-austin-how-happen>

NTSB Preliminary Report on Honolulu near-miss

<https://data.nts.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/106632/pdf>

Sarasota-Bradenton International Airport near-miss

<https://www.heraldtribune.com/story/news/local/2023/03/07/sarasota-bradenton-airport-two-plane-near-miss-under-investigation-srq/69981193007/>

Boston Logan near-miss

<https://www.cnn.com/travel/article/boston-logan-airport-runway-close-call/index.html>

Hollywood Burbank near-miss

<https://www.washingtonpost.com/transportation/2023/02/24/burbank-hollywood-airport-ntsb-investigation/>

Plane/shuttle bus crash at LAX

<https://news.yahoo.com/five-people-injured-american-airlines-155812730.html>

Planes bump into one another at JFK

<https://www.cbsnews.com/newyork/news/2-jetblue-planes-bump-into-one-another-on-runway-at-jfk-airport/>

Two planes clip wings at Newark Liberty Airport

<https://www.cbsnews.com/newyork/news/2-planes-clip-wings-at-newark-liberty-international-airport/>

Animated story board on ASDE-X

https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/storyboard/detailedwebpages/asdex.html

FAA Runway Incursion Statistics FY2023 vs. FY2022

https://www.faa.gov/airports/runway_safety/statistics/year/?fy1=2023&fy2=2022

Interview with Hassan Shahidi

<https://www.cbsnews.com/news/runway-incursions-near-misses-airport-runways-whats-happening/>

Interview with Jennifer Homendy

<https://abcnews.go.com/Politics/national-transportation-safety-board-chair-norfolk-southerns-new/story?id=97791689>

Interview with Pete Muntean

<https://www.cnn.com/2023/03/11/politics/close-calls-airplanes-runways-what-matters/index.html>



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