

## Air and Space this Week

### Item of the Week

# COMMERCIAL AVIATION'S WORST DISASTER

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**KEY WORDS:** Tenerife Canary Pan Am 1736 KLM 4805 583  
Cockpit Resource Management

*Commercial aviation is no doubt an **extremely** safe way to get people and goods from one place to another. But rarely, accidents happen. We've had a lot of close calls lately, and from time to time, a serious crash occurs. When it does, the FAA, the National Transportation Safety Board, and other organizations investigate to identify the cause(s) and recommend changes to make air travel even safer.*

*Accidents happen almost always when there is a series of errors or problems that occur in sequence. Changing any one of them would have prevented the accident. An example is the deadliest air crash of all time, a runway collision between two fully-loaded and fully-fueled Boeing 747 aircraft, on the island of Tenerife, 46 years ago this week on March 27, 1977.*

### SETTING

Tenerife is one of the larger of the Canary Islands, lying in the Atlantic west of Morocco. They are an autonomous community of Spain, with local capitals on Tenerife and Gran Canaria. The name has nothing to do with Tweety Bird, rather it shares the same root as the constellation Canis Major; making these the "Dog" Islands. They are the tops of a number of volcanoes that developed over a hot spot in the Earth's mantle ([La Palma erupted](#) in 2021). Over two million people live here. The Islands are close to Africa geographically, but the way transportation routes lie, they are easy to reach from Africa, Europe, and the Americas. That, and their natural beauty, interesting history, and nice beaches make tourism an important industry.

The primary airport in the Canaries is at Las Palmas, on the island of Gran Canaria. Tenerife has a much smaller airport, Los Rodeos (now known as Tenerife Norte Airport), and there are small airports on some of the other islands.

I remember how impressed everyone was with the Boeing 747 entered commercial service. It was much larger than other commercial jets, and because of that it looked much slower than other jets when in its landing approach. It was used primarily for long flights, and thus acquired a cachet of glamor, since it was the plane used to get to distant glamorous locations, not the next state over.

## MULTIPLE PROBLEMS

Political unrest troubled the Canaries in the mid-late 1970s, and violence was used on occasion. On the morning of March 27, 1977, a terrorist bomb exploded at the Las Palmas Airport. Its purpose apparently was a demonstration of strength; it wasn't targeted at the public. But the danger it represented set off a chain of event that would result in tragedy. Break any one of the events in the chain and this would have been a relatively normal day.

The first link in the disaster chain was the reaction to the bomb. Authorities took the immediate and appropriate step of closing Las Palmas to all traffic. Some planes diverted to more distant locations, but many of them went to the nearest airport that could handle them, Los Rodeos on Tenerife.

The second link was the traffic problem on the ground caused by the sudden influx of diverted flights. Los Rodeos did have a runway long enough to handle (barely) the 747, but it was the only runway there. The airport had a relatively small apron in the gate area, and had only one taxiway, lying parallel to the runway. So many aircraft had landed that they filled the apron and were parked all along the taxiway, a situation that required any plane preparing to take off to get into position by back-taxiing down the runway and doing a 180° turn in place.

The third link is ground control. The overworked air traffic controllers were coping OK, but barely. They had the great disadvantage that there was no ground radar to help them understand exactly where each plane under the control was; they always relied on visual observation, but they never had this many planes to keep track of before. English is the official international language of aviation, but it didn't help the situation that English was a second language for the air traffic controllers and many of the flight crews. Radio technology circa mid-1970s didn't help the situation, either. Worse, many of the flight crews who found themselves at Los Rodeos had never been there before and were quite unfamiliar with the airport layout (simple as it was).

The fourth link in the accident chain was time. Planes already had to divert to Tenerife, which cost a lot of time. The traffic jam there cost more time. A number of flight crews were concerned about the delays, because there were hard limits to how many consecutive hours a crew could operate. They didn't want to get stuck by rules on Tenerife if they could avoid it; an overnight delay would cost a lot in hotel fees, if they could find rooms, and it would really mess up their carrier's schedule for days to come.

The fifth link was weather, which was good during the many landings caused by the shutdown of GCA Las Palmas. But Canary Island weather is almost as fickle as it is here in Colorado, and late in the afternoon, a thick fog rolled in, dropping visibility to the limit that would allow continued flight operations. The controllers in the tower could not see any aircraft at the take-off end of the runway.

There would be one more link in this cavalcade of disaster. More on it later.

Egad, what a mess!

## THE PRINCIPAL PLAYERS

The two aircraft that play leading roles in this story were both Boeing 747s: Pan Am Flight 1736 and KLM Flight 4805. Both had been scheduled to land at Las Palmas, but ended up at Los Rodeos. The Pan Am flight had come from the LAX via JFK, carrying a lot of American tourists bound for a cruise sailing out of Gran Canaria. The KLM flight was bringing a load of tourists from Amsterdam coming to enjoy a Canary Island holiday.

The long delay due to closure of Las Palmas and the resulting traffic at Los Rodeos was a pain for those on the Pan Am flight, but the crew kept everyone on board, ready to go when clear. There were 380 passengers and 16 crew aboard.

The crew of the KLM flight was under increasing time pressure; they had to get back to Amsterdam before the flight crew's hours were up. The KLM plane had to get its passengers to Las Palmas as soon as it reopened, and then make the flight to Amsterdam before the deadline. It would need to fuel at Las Palmas to make the last leg of its long day. The KLM pilot, Jacob Van Zantern wanted to save as much time as possible, so he decided to fuel at Los Rodeos while they were waiting. Parked aircraft blocked his way to the normal refueling spot, so a tanker truck came to him and went to work. Of course, it was not long after refueling started that Las Palmas re-opened. Fueling would take about 45 minutes.

The paved space at Los Rodeos was really crowded with planes, some of them really big ones, like the KLM and Pan Am 747s. The Pan Am was blocked in behind the fueling KLM and could not get around it, so they had to wait about 45 minutes, too.

## THE ACCIDENT

The KLM plane finally finished fueling and requested take-off permission. The Pan Am requested take off permission, too. The flight controller checked, found no flights immediately incoming (the landing rate had slowed dramatically after Las Palmas opened), so he cleared both planes to taxi down the main runway to the takeoff turn around point.

There were several paved paths connecting the runway to the taxiway paralleling it. The controller told the Pan Am aircraft to take the one halfway down the runway, and wait there for the KLM to take off, then re-enter the main runway and taxi to the end, turn around, and be ready to take off.

Then the fog came rolling in.

The controller could not see either aircraft, but he was in radio contact with both.

The co-pilot of the Pan Am was helping the pilot navigate the unfamiliar, fog-shrouded path. The cross-connect the controller intended for them to take came in at an angle that would require a very sharp 135° turn, followed by a similar difficult turn back to parallel the runway. The entrance of the cross-connect did not look like it could possibly be the right way so they continued down the runway, and reported to the tower that they were going to take the next

cross-connect, which offered easier turns. They had been talking with both tower and the KLM before, so they felt safe knowing that both tower and the KLM knew the situation.

The tower called the KLM and told them to make the turn around at the end of the runway and then to hold for take-off position, to give the Pan Am time to clear off the runway. The tower instructed the KLM to wait for "ATC Clearance," where the tower would give the KLM post take-off instructions, prior to take-off. Rather than hold after the turn-around, Captain Van Z. advanced the throttles. The First Officer reminded Van Z. that ATC clearance had not yet been received. Van Z. said, "Go ahead, ask" even after he started the take-off roll. The controller thought the KLM was sitting in take-off position, and read off their post-take-off ATC instructions. The instructions used the word "takeoff" but did not explicitly give permission to do so. The First Officer read back the ATC instructions to the controller and then said "We are now at takeoff." Captain Van Z. said "We're going." The controller could not see the KLM in the cloud, and said "OK," thinking that the FO meant KLM was now at (the) takeoff (position).

Alas, the sixth link in the chain of tragedy reared its ugly head.

The controller followed up their "OK" with "Stand by for take-off. I will call you." The Pan Am, monitoring the communications between KLM and the tower, reported that they were still on the runway, as a warning to both KLM and tower. Alas, the calls between tower and KLM and from the Pan Am occurred at exactly the same time. The KLM heard a garbled message, with only the words "take off" being fully audible. Raring to go, Captain Van Zantern (one of KLM's most experienced pilots and was at the time was KLM's chief flight instructor) rammed the throttles forward.

As the KLM began to really pick up speed, the tower told the Pan Am to call when they were clear of the runway, and the Pan Am responded that they would call when they were clear. The Flight Engineer was listening to the radio calls, and caught on that a mistake might be in the process of being made. He queried the pilot about the possibility that the Pan Am plane might still be on the runway, but was brusquely rebuffed. He was low on the seniority totem pole and Captain Van Z was high, and time was short, and that was that.

The flight crew of the Pan Am at first could see nothing as they groped through the fog to find the correct turn off. When the lights of the KLM appeared spookily through the mist, they were understandably a bit slow to catch on to the fact that the KLM was approaching. Their confusion was short-lived, and the pilot reacted by attempting to swerve the giant plane out of the way, firewalling the throttles. They succeeded to get their plane crosswise on the runway, and were moving to the side in a vain attempt to get clear.

The flight crew of the KLM didn't see the Pan Am right away, either. When they did, Captain Van Z. pulled back on the column hard. His engines were already at full speed, but his aircraft was only going about 200 MPH, not enough to get the heavy, heavy KLM off the ground quickly. His plane did its best as Van Z dragged its tail trying to go over the Pan Am. But it wasn't enough.

The KLM hit the Pan Am aft of its wing. The KLM was demolished, especially its undercarriage and fuel tanks. Its gutted wreck slammed back onto the runway before its full load of fuel burst into flames. Everyone aboard died immediately or in the ball of fire that resulted. The after two-thirds of the Pan Am were demolished, too, killing all aboard that part of the plane. But the Pan Am had gotten enough out of the way that the forward part of the fuselage was spared total annihilation. The cockpit crew and a few of the passengers in the front of the plane found themselves in a flaming, but largely intact, wreck. The only ways out were 10 meters or more above the ground. It was jump or die time. Sixty-one of the 393 people aboard survived. A total of 583 people lost their lives.

## **THE AFTERMATH**

The high cost in people, airplanes, and prestige resulted in a lot of finger-pointing in the aftermath of this disaster. It was clear from the start that a number of rare conditions prevailed: the sudden closure of Las Palmas, the crowding of planes at Los Rodeos, the lack of ground control radar, and the weather. Apart from ensuring that all airports should have ground control radar, there wasn't too much to learn from these links in the chain. It was just bad luck that the two key radio communications had been simultaneous.

It was very bad luck that the KLM had refueled on Tenerife. The delay allowed the weather to deteriorate, and the extra 45 metric tons of fuel made it much more difficult for the KLM to get off the runway quickly, and that extra fuel made the post-collision fire much more severe than it would otherwise might have been. His choice of refueling locations was also unfortunate in that it blocked the Pan Am from taking off earlier. Just a few feet of wing tip kept the Pan Am from being long gone before the KLM finished refueling.

There were some background noises on the Cockpit Voice Recorder that suggested that a soccer game was playing in the tower and that the controller(s) might have been distracted. That notion has largely been discounted. The controller is not totally off the hook; his query to the Pan Am about being off the runway was "Papa Alpha 1736" which was not really recognized by the KLM crew as being to "Clipper 1736," as per previous calls to it from the tower.

There was no mechanical fault in either aircraft, no overlooked maintenance, or other such causes in many air accidents. Therefore, the focus became "human factors."

Captain Van Zanten, while being the chief of flight training for KLM and a very experienced pilot, and been training others and had not personally flown in the twelve weeks preceding the accident. Further, the Cockpit Voice Recorder showed that his crew had clearly been intimidated by his position and experience when they only mildly mentioned the possibility that the runway wasn't clear.

KLM was reluctant to accept responsibility for the accident, citing the weather, the missed cross-connect by the Pan Am, and the overall chaotic situation. They later stepped up, accepted blame, and provided payment to victim families and for property damage at the limit cap imposed by the European Compensation Conventions.

Los Palmas on Gran Canarias remains the primary airport of the Canary Islands. A second airport, Tenerife South, was opened a year after the accident, and became the island's primary airport. Dos Rodeos downgraded to only inter-island and local flights, and renamed Tenerife North. It only recently started handling international flights again.

### ODDITY

Robina van Lanschot was a passenger aboard the KLM, heading home to her boyfriend on Tenerife. When the KLM flight deplaned during the delay, she took advantage of it being on her final destination anyway, and did not re-board. That left 234 passengers on the KLM, along with 14 crew.

### CONCLUSIONS

The various investigations confirmed the role that unusual events played in this accident (terrorist bombing, immediate airport closure, weather), however, a number of recommendations were made that were implemented and are still in effect today.

Installation and upgrading of ground control radar at airports capable of handling large commercial aircraft was expedited.

The words "take off" were eliminated from routine controller-aircraft communications, except for the explicit request and permission for an aircraft to actually take off. "Departure" became the correct word to use when requesting info or otherwise referring to an aircraft leaving the ground. English was already the language of air traffic control, but now greater emphasis was made to train everyone on standard phrases and avoiding slangy expressions like "OK". The use of rigorous call-back acknowledging of radioed requests was implemented, including the aircraft's call sign as part of the message both ways, in order to greatly clarify and confirm who was talking to whom.

Lastly, but importantly, this accident led to the realization of the importance of **cockpit resource management** and the implementation everywhere of training procedures improving communications, leadership, and decision-making, very much including more empowerment of crew in providing input to the pilot, especially in dangerous situations.

### REFERENCES

Smithsonian *Air & Space Magazine* video: <https://www.smithsonianmag.com/air-space-magazine/reviews-crash-in-canary-islands-180972227>

The Smithsonian Channel offers a series, "[Air Disasters](#)," in which each episode delves into an aviation crash/problem that required investigation and correction. The "Disaster at Tenerife" installment in this series is most instructive as to the chain of events that led to so many deaths. It was aired in the 10<sup>th</sup> season of the show, episode #3.

Simple Flying website: <https://simpleflying.com/tenerife-disaster>

National Transportation Safety Board Summary:

<https://www.nts.gov/safety/layouts/nts.recsearch/Recommendation.aspx?Rec=A-86-034>  
and Recommendation Letter: [https://www.nts.gov/safety/safety-recs/recletters/A86\\_30\\_43.pdf](https://www.nts.gov/safety/safety-recs/recletters/A86_30_43.pdf)

NTSB List of Deadliest Runway Accidents:

<http://www3.alpa.org/portals/alpa/runwaysafety/NTSBRunwaySafetyfactsheet.pdf>

Aviation-safety.net: <https://aviation-safety.net/database/record.php?id=19770327-0>

NOVA Episode 625, "The Deadliest Plane Crash," aired: 10/17/2006; Transcript of show [here](#);  
companion website: <https://www.pbs.org/wgbh/nova/planecrash>

Bureau of Transportation Human Factors: <https://rosap.ntl.bts.gov/view/dot/13937>

ALPA Action Report: <http://project-tenerife.com/engels/PDF/alpa.pdf>

Dutch Final Report (via FAA):

<https://www.faasafety.gov/files/gslac/courses/content/232/1081/finaldutchreport.pdf>

Wikipedia: [https://en.wikipedia.org/wiki/Tenerife\\_airport\\_disaster](https://en.wikipedia.org/wiki/Tenerife_airport_disaster)

Tenerife Information Centre: <https://www.tenerife-information-centre.com/tenerife-airport-disaster.html>

Information about the Canary Islands: [Wikipedia](#); [Map](#); [US News Travel](#);

La Palma Volcano erupted in 2021: <https://www.bbc.com/news/world-europe-58681233>

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