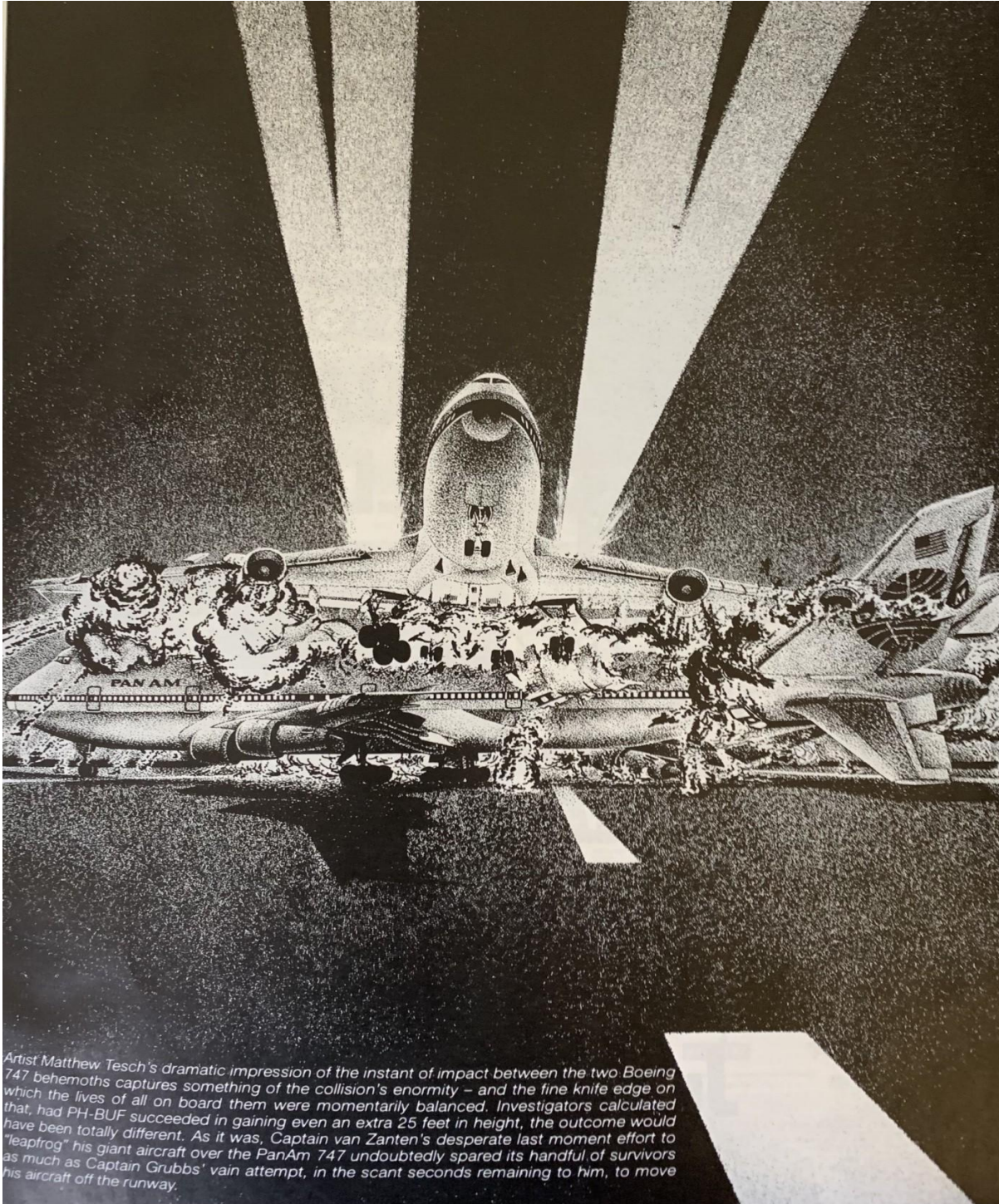


6 – JAMMED RUNWAY (Human-Environment)



[16]"Apocalypse on the Runway: Revisiting the Tenerife Airport Disaster", *Medium*, 2022. [Online]. Available: <https://admiralcloudberg.medium.com/apocalypse-on-the-runway-revisiting-the-tenerife-airport-disaster-1c8148cb8c1b>. [Accessed: 24- Jul- 2022].

Some events leave indelible marks and will forever be remembered.

The deadliest accident in aviation history happened on March 27th, 1977 in Spain. Two Boeing 747's – operating KLM 4805 and Pan Am 1736 flights - crashed into each other at the, what is now known as, Tenerife North Airport (TNA) in Tenerife. The collision led to the death of 583 people: all passengers of the KLM flight were killed as well as the majority of those of Pan Am flight. Only 61 passengers managed to survive.

How did they collide whilst in the airport? What exactly happened?

Neither flights were intended to stop at the Tenerife Airport, in principle, both flights were bound to the Grand Canaria Airport (GCA) in the Canary Islands. A bomb threat at the Grand Canaria Airport had caused numerous flights, including these two, to be diverted to the airport in Tenerife for safety reasons. The airport in Tenerife was rather small and could not accommodate efficiently all the flights destined to it plus the flights that were diverted from the Canary Islands. TNA only had one runway (for takeoff and landing) and one taxiway (paths to connect the runway with hangers, terminals, etc). Due to the situation at GCA, the Tenerife Airport became extremely congested to the point that airplanes had to park on the taxiway, meaning that other planes could no longer taxi on the taxiway. Eventually, once the situation at GCA had been stabilized, the Pan Am flight was ready to leave TNA but could not because the KLM flight, which was refueling, was obstructing the runway making it impossible for takeoff to occur. Important to note that the geographic location of TNA, which is only approximately 600 meter above sea level and this has a negative impact on the weather conditions of the airport. Because of its altitude, drifting high density clouds often cluster the airport causing poor visibility along runways and other sections of the airport, this was exactly the situation on that day. The control tower had ordered the KLM flight to taxi down the runway and perform a U-turn in order to then take off, however, before taking off the pilot needed clearance from the tower. Shortly after, the Pan Am flight was instructed to taxi down the same runway and take the third exit out of the runway, the poor visibility (less than 100m) in addition to the absence of visible markings highlighting the exits, caused confusion for the PanAm flight as they were not able to find the third exit and had remained on the runway at a height between the third and fourth exit. In the meanwhile, the KLM flight had completed the turn, lined up, and advanced its throttle (started to move) without ATC clearance. The first officer brought up the fact that clearance was not given and radioed the tower stating “ready for takeoff”, the tower responded with the route to be taken by the aircraft after takeoff however did not explicitly give ATC clearance. The first officer then read back the route and concluded with “we are now at takeoff”. The control tower (which could not see any aircraft on the runway due to visibility) responded with a very non-standardized statement “ok”. Here, a big misunderstanding occurred whereby the controller understood that the aircraft is ready for takeoff and still awaiting ATC clearance, in fact shortly after the controller said “stand by for takeoff, I will call you” but this crucial message was not heard by the cockpit of KLM because at the same time, the Pan Am flight had radioed the tower stating they were still “taxiing down the runway” causing a radio interference whereby none of the parties involved heard the last two statements. Due to this poor communication and lack of received information, the KLM flight proceeded to accelerate down the runway (still with very poor visibility) till it saw the Pan Am flight still on the runway, but by that time it was already too late and the two planes ended up colliding.

Overall, we have seen what the repercussions of human error/negligence are, and we also see how the environment plays a key role in such situations and how the environment can enhance mistakes and therefore increase the levels of danger and risk. In this accident there were a series of contributing factors and for clarity, these shall now be briefly listed below:

- Reduced visibility due to environment
- Radio interference
- Lack of clear communication
- Overcrowding of the airport

What could have been done?

Despite the accident was largely due to human factors on behalf of the KLM cockpit and the control tower, there are some recommendations which can help avoid such situations from reoccurring based on ISO 12100's 3 step method.

Step 1: Inherently safe design measures

In order to inherently reduce the risk there are some steps which could be followed. Before flights which are not destined to a particular airport are diverted, there should be an airport capacity analysis to ensure overcrowding of airport runways and taxiways does not occur, in the event that there is overcrowding it could be wise to consider diverting certain places to other adjacent airports instead. Additionally, all exits of a runway and taxiway should be cleared marked with reflective lines and light systems. Control towers should be equipped with Surface Movement Radar (SMR) to detect the location of aircrafts and other vehicles; that way in situations of poor visibility there is a supplement to human observation. Moreover, it must be demanded that aircrafts never take off without explicit clearance from the control tower. These are all precautionary measures that can vastly decrease the level of hazard attributed to such situations.

Step 2: Safeguarding and complementary measures

The use of standardized language in aviation can definitely help avoid situations of misunderstanding and miscommunication. Having standard phrases to describe specific events would certainly be beneficial and can further reinforce safety and accurate communication. Furthermore, it could also be demanded that a double confirmation must be given to pilots before initiating takeoff whereby the pilot must be given permission twice in order to avoid any potential miscommunication or to avoid that information is not received. Airports must also ensure that they have adequate radio communication with little to no interference to avoid the smooth exchange of information.

Step 3: Information for use

In situations where visibility is heavily reduced such as the case at hand, this should be communicated and airport takeoffs and landings should be halted until a clearer situation arises.

This may not always be possible depending on the circumstances but this sort of communication sometimes can prove necessary and critical to avoiding such situations from happening again.

From this tragic incident, there is a lot to be learnt and understood. The key takeaway here lies in understanding the role that humans and the environment play in the success or failure of a technical system and engineering practices. These two have adverse roles in the system and have the potential to dictate the outcome of certain events. Therefore, it is necessary to understand these as well as anticipate and predict any shortcomings as a result of these two aspects.

[15]"Tenerife airport disaster - Wikipedia", *En.wikipedia.org*, 2022. [Online]. Available: https://en.wikipedia.org/wiki/Tenerife_airport_disaster#Speculations. [Accessed: 24- Jul- 2022].

[16]"Apocalypse on the Runway: Revisiting the Tenerife Airport Disaster", *Medium*, 2022. [Online]. Available: <https://admiralcloudberg.medium.com/apocalypse-on-the-runway-revisiting-the-tenerife-airport-disaster-1c8148cb8c1b>. [Accessed: 24- Jul- 2022].

[17]S. Georgilidakis and S. Georgilidakis, "Tenerife Airport Disaster: 45 Years Ago Today - Mentour Pilot", *Mentour Pilot*, 2022. [Online]. Available: <https://mentourpilot.com/tenerife-airport-disaster-45-years-ago-today/>. [Accessed: 24- Jul- 2022].

[18]"NOVA | The Deadliest Plane Crash | The Final Eight Minutes | PBS", *Pbs.org*, 2022. [Online]. Available: <https://www.pbs.org/wgbh/nova/planecrash/minutes.html>. [Accessed: 24- Jul- 2022].