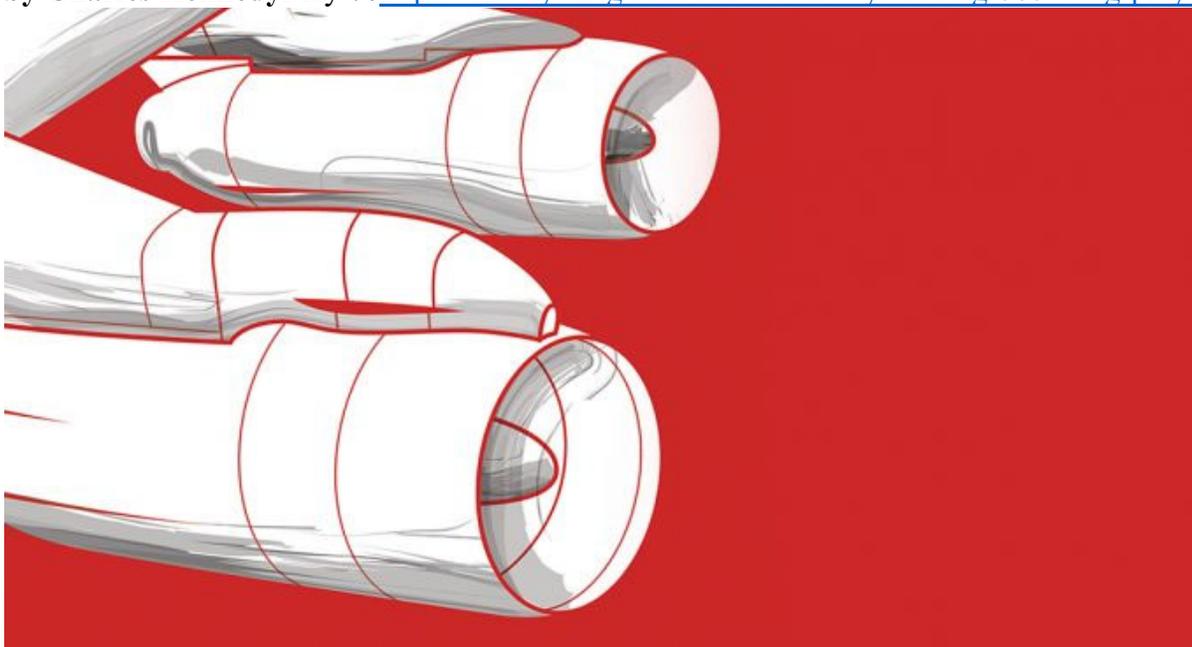


Airways Magazine



Boeing 707: A wing and a prayer

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The innate strength test of the Boeing 707 came when two flights suffered virtually identical mishaps in the same year: an engine explosion and a mid-air collision. In both cases, they were able to land safely.

By Charles Kennedy

The Boeing 707 was built to be incredibly tough. The manufacturer wasn't going to repeat the tragic metal fatigue experience faced by de Havilland in the early years of its Comet jetliner program, when at least three planes were lost with all those on board. In addition to being the beneficiary of the British pioneers' hard learned lessons, the 707 also had military-grade pedigree in its prototype. The 'Dash Eighty' was as much a proof-of-concept machine for the US Air Force (that was looking for a transport and an air-to-air tanker), as it was for the airlines.

Proof of the innate strength of the 707 came in 1965, when two flights operated by US carriers suffered virtually identical mishaps, although for different reasons—an engine explosion and a mid-air collision. In both cases, they were able to land safely.

Pan Am / Boeing 707-321B / N761PA

Clipper Friendship

Flight PA843: San Francisco–Honolulu

On the morning of June 28, 1965, four Airmen gathered in the Pan Am crew room at San Francisco International Airport (SFO). The two Pilots had similarly high levels of experience. Captain Charles Kimes had recorded a total flying time of 17,736 hours in his logbook, 2,606 of those on the 707. First Officer (FO) Frederick R. Miller had a total of 17,027 hours, including 2,817 on the 707. The Flight Engineer (FE) was Fitch Robertson, and Second Officer (SO) was Max Webb.

One hundred forty-three passengers boarded N761PA Clipper Friendship, a Boeing 707-321B that had rolled off the Renton production line on February 26, 1962, and had been delivered to Pan Am on June 13 that same year. Since then, it had racked up 12,789 hours, flying the era's most prestigious flights—SFO to Tokyo or through the Pacific Islands to Sydney, New York to London, or on long stretches down from New York to South America. Some missions involved a complete circumnavigation of the globe. Today's flight was probably the most straightforward in the entire network: PA843, a simple five hour hop across the Pacific Ocean to Honolulu.

Clipper 843 rolled off its stand at 14:09 Pacific Daylight Time, nine minutes behind schedule on a perfectly clear and sunny day: a balmy 75°F (24°C) with a 15kt breeze blowing from 310 degrees.

Takeoff on 28L was normal but, 39 seconds after liftoff and passing 800ft, there was a thump, accompanied by a sharp yaw to the right. Pieces of engine started falling out of the sky onto the ground.

“We've lost power on Engine Number Four,” announced FE Robertson. FO Miller hit a large red button to fire the extinguisher system inside the engine, and then looked over his shoulder, out of his side window, to see a sight few have survived to describe. The wing was engulfed in a plume of white-hot fire that curled upward. The engine and its mounting were spitting fragments of molten metal.

The nose of Clipper Friendship was yawing jerkily from side to side due to the disintegrating right wingtip, which altered the shape of the airfoil and thus the plane's very aerodynamic properties and center of gravity. The Boeing officials who looked at the flight later on agreed that this was around the time at which the plane should have crashed.

An explosion in the outboard reserve fuel tank dealt the final blow to a failing structure. The outer 29ft (9m) of the right wing separated, taking Engine Number Four with it.

The engine plunged to the ground into a San Bruno furniture shop, while the wing debris trail stretched nine miles. Incredibly, this aluminum shower falling across south San Francisco caused no injuries.

As the jet streaked upwards, trailing a billowing stream of oily black smoke, Captain Kimes' control was so tenuous that he considered ditching in the Pacific. SO Max Webb asked for permission to instruct the passengers to don life jackets. Kimes immediately agreed. The flight radioed a distress call to the tower, Kimes saying, with classic understatement: "We have problems with power here."

By then, the 707 had crossed the south San Francisco peninsula and passed over the coastline near Daly City. The disintegration of the wing had stopped. Kimes was able to strike a balance of rudder and aileron trim that achieved a degree of stability, but had to apply dynamic and considerable physical input to the controls for the rest of the flight. Kimes leveled the aircraft at 1,200ft and slowed to 200kt, to "preserve the integrity of the remaining wing," as he later put it.

Though the weight of the fuel tanks reduced the plane's performance and though Tank Number Four on the right wing was dangerously near the fire, the full tanks held one advantage. Ironically, Number Four tank's load was later determined to have acted as a heat sink, actually reducing the damage to the nearby structure despite the fire's intense heat, calculated as being as high as 1,165°F (630°C).

Despite the critical situation, it was decided not to ditch but to head north-northeast and attempt an emergency landing at Travis Air Force Base. The city of San Francisco was now wobbling past outside the passenger windows on the right side; to the left was the ocean.

Passenger Nancy Sweeten told Life magazine: "When the wing fell off, it felt as if the plane was falling out from beneath us. You could see fragments blowing out there, just hanging on. I was sure we were going to ditch in the Pacific Ocean." Another passenger agreed. "A piece of the wing came off and the man next to me put his hands up and said, 'That's it, we're through.'"

When Air Traffic Control (ATC) asked for a progress report, Captain Kimes broadcast a sentiment not very different from that of his passengers. "I don't know if I can keep it in the air or not."

May 2016



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The Cabin Crew were working to prepare for a water ditching. “We were given life jackets and pillows,” recalled Mary Jane Eaken, of Berks County, Pennsylvania, “and told to put our heads in our laps.”

Kimes made a cautious turn to the right, to head inland towards Travis, recrossing the coastline over the Golden Gate National Recreation Area, then passing the built-up area of San Rafael, the San Pablo Bay, and the business and residential areas of Vallejo.

At 14:25, Clipper 843 began approaching Travis but, when Miller dropped the landing gear lever into the down position, the gear did not extend. Kimes had to break off the approach to give FE Robertson time to crank the main gear down manually. He started with the left main gear, to temporarily ease the asymmetry caused by the uneven engine power and new wing shape, then followed with the right main gear, and finally the nose gear.

At 14:34, Kimes began a second approach. 843’s troubles still weren’t over. As the damaged jetliner descended over the scrubby landscape towards the runway, Kimes spotted a twister of turbulent air spinning dangerously close to the runway threshold. He carefully steered the barely-controllable jet out of harm’s way, then returned to the approach path in time to cross the threshold on speed and height, flare carefully over the tarmac, and settle Clipper 843 back onto terra firma.

As the gravely wounded bird came to a stop on the runway, the fuel tanks in the right wing were still shedding plenty of their remaining 82,000lb of fuel through leaks caused by flying debris, so the area around the right wing, and especially the still-smoldering stub, was foamed while the passengers were disembarked using the escape slides through the forward and rear main doors on the left side. The San Francisco Examiner called it the ‘Miracle Jet Landing’—with good reason.

Pan Am Ops, back across the bay at SFO, quickly mustered up another 707 and got it airborne for the short hop to Travis where it would pick up the passengers and fly them on to Honolulu without further delay. However—before the eyes of all 143 shaken-up passengers from Clipper 843—the 707 sent to save them suffered the indignity of collapsing onto its nose as the nose landing gear failed after

touchdown. In a shower of sparks and smoke, the second 707 slid to a halt, tail high, nose down—repairable but, for now, a wreck. With no other option, SFO sent yet another 707 to take the people of Clipper 843 on to their destination.

And what a mess they left behind when they finally departed—one 707 with a blackened stub where the wing and outer engine should have been, reminiscent of a bomber back from a mission; another sitting with its tail high, nose squatting down to the tarmac. Eight passengers, after seeing the second 707 become disabled before their eyes, had had enough, and stayed behind.

After some fairly minor patches, N761PA—with three engines, a wing, and two-thirds of a wing—was ferried up to Boeing's plant in Renton, Washington, where a whole new outer wing was grafted on in a major repair effort. N761PA returned to flight and served Pan Am for 11 more years, then flying a further eight years for Air Manila International in the Philippines.

The accident report gave the cause as the third stage turbine disc in Number Four engine disintegrating explosively: "This failure was caused by a transient loss of operating clearance between the third stage turbine disk and the third stage inner sealing ring. This loss of clearance resulted from a combination of improper turbine rotor positioning during engine assembly, the use of serviceable worn parts, and an operating clearance which was less than predicted in design analysis."

What is incredible is that, despite the devastating amount of damage, the aircraft was able to sustain flight and continue to a safe landing, delivering all 143 passengers and 10 crew without a scratch. And, to prove the point, the same miracle was played out again later the same year on the other side of the country.

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TWA / Boeing 707-131B / N748TW

Flight TW42: San Francisco–New York

On December 4, 1965, the skies were busy with air traffic flying in and out of the New York area, the busiest airspace in the country. One flight entering the area was Trans World Airlines (TWA) flight 042, which had departed SFO five hours earlier, at 09:05 PST, bound for New York's John F Kennedy International Airport (JFK). The aircraft was N748TW, a 707-131B that had rolled out off the line at Boeing's Renton facility on April 14, 1962 (50 years to the day after the sinking of the Titanic) and had racked up 12,965 hours of flight time.

In command was Captain Thomas H. Carroll, a TWA employee for 20 years. His total flying hours to date numbered 18,842, including 1,867 on the 707. FO Leo M. Smith had a total flying time of 12,248 hours, 2,607 of which in the 707. FE Ernest V. Hall was on his first trip on the 707 after completing the conversion course and being released by his instructor to the line. In the cabin, four crew members were serving the 54 passengers.

After about five hours in the air, TW42 was cleared to descend to 21,000ft (6,400m) and then down to 11,000ft (3,350m) where it leveled off just above the tops of the clouds.

At this point, another aircraft entered the story. Eastern Air Lines' N6218C was a Lockheed L.1049C-55-83 Super Constellation, operating flight EA853, flying from Boston (BOS) to Newark (EWR). It

had left BOS at 15:38 EST and had climbed to its cruising altitude of 10,000ft. The Boston ATC center handed it off to New York's at 16:10.

The skipper was Captain Charles J. White, an 11-year veteran of Eastern with 11,508 flight hours, 1,947 of those on the Constellation. His FO was Roger I. Holt Jr, who had a total of 8,090 hours in his logbook, 899 of which on the L.1049 (and 241 hours as FE). SO on the flight was Emile Greenway. They were accompanied by two Cabin Crew.

At 15:40, White Plains surface weather observation was 4,000ft (1,220m) scattered clouds, 8,000ft (2,440m) scattered clouds, 12 miles (19km) visibility, temperature 46°F (8°C).

On the flight deck of EA853, the First and Second Officers, who would survive, remembered flying south towards the VORTAC at Carmel, New York, a hamlet 60 miles north of New York City, at 10,000ft between 205 and 210kt, flicking in and out of 'fluffy' clouds, the tops of which were around 300ft above their altitude.

The FO spotted the red-and-white TWA jet and immediately thought it was at their altitude. "Look out!" he yelled, and hauled back on the controls simultaneously with Captain White. At that moment, a passenger was about to take a picture of the cloudscape surrounding them when the 707 appeared. He attempted to photograph the jet, terrifyingly close, but was prevented in doing so by the steep left turn and climb that wrenched the 707 out of his shot.

TW042 was being flown by Captain Carroll, who had the autopilot engaged in a heading mode that was tracking towards the Carmel VORTAC, with Altitude Hold engaged to maintain 11,000ft; despite the help from the autopilot, the Captain had his left hand on the control yoke. He spotted the blue-and-white Lockheed Constellation at a 10 o'clock position, rolled his 707 hard to the right and pulled up with help from his FO.

Five passengers on the left side of the 707 could see the Connie coming towards them. One told investigators, "It came at us from behind a white cloud."

When it became clear, in the TWA cockpit, that the evasive actions would not allow the two aircraft to pass clear of each other, both Pilots attempted to reverse the wheel to the left and push the nose down. Before the 707 could react, two sharp shocks were felt. In the passenger cabin, personal items, hats, and coats fell into the aisle from the open overhead hat racks in a general hubbub of panic and confusion. The two airliners had collided. The time was 16:19.

The 707 was gravely wounded, with 25 feet of its left wing gone, heavy damage to Number One engine (which held on and continued to produce power) as well as considerable secondary structural damage caused by the heavy impact forces and the mass of flying debris.

Captain Carroll struggled to regain control of the falling jetliner, while FO Smith radioed the ground. "Mayday, mayday, mayday, Trans World 42 declaring an emergency; we have collided with another airplane, descending out of 11,000." After losing several thousand feet, the aircraft became controllable, no doubt due to a combination of trim and control inputs that would have been very familiar to Captain Kimes.

The controller vectored the 707 across Connecticut and Long Island Sound towards JFK. The flight performed a wide circuit to manage speed and to give the tower time to observe through binoculars and check that the landing gear was down and locked.

TW042 landed safely on JFK's runway 31L at 16:39 local time.

The ordeal of EA853 was far greater. After the collision, the Super Constellation continued to climb briefly before shuddering into a left-turning dive, shedding parts and going out of control. With no response from the controls or trim tabs, the Pilots could only try to regain control by applying or reducing engine power.

They regained a modicum of control after descending beneath the clouds, although this was fleeting, as several zoom climbs took them back into the murky overcast. Finally, passing Danbury, Connecticut, they found a power setting that would maintain a controlled descent of 500ft per minute, with airspeeds fluctuating between 125 and 140kt. It was obvious that flying to an airport and making a normal landing would have been impossible; an off-field landing would have to be attempted. It took two and a half minutes for the crew to reestablish radio communications with the ground, but there was little of use to say, and nothing anyone on the ground could do to help—they were going to crash, there was no way out.

Beneath them were the woods that carpeted the hilly terrain on the Connecticut-New York state line; no obvious site for a crash landing was immediately apparent. As the ground loomed closer, a meadow on a hillside appeared and, by using asymmetric power, Captain White and his crew were able to get their dying bird to head for it. A final burst of full power raised the nose in a last-ditch attempt to lessen the severity of the crash landing. At 16:28, three minutes before TW042 touched down at JFK, EA853 hit a tree, 46ft above the ground. Some 250ft further on, the left wing hit another, bigger tree, and most of the wing separated. The Connie flopped to earth and slid on its belly up the 15° slope and came to a stop after 700ft. The general heading of the wreckage trail was 243°, only 10° askew from the pre-collision heading, four miles from the area where numerous parts from both aircraft were found.

Thanks to Captain White and his crew's incredible feat of airmanship, all aboard were able to escape through exit doors or breaks in the fuselage, with the exception of one passenger. White returned to the burning wreck in a futile effort to save that soul; alas, he lost his life in the rescue attempt, bringing the day's death toll to four, as two other passengers from EA853 died in hospital.

The Civil Aeronautics Board (later the FAA) issued its report a year later, on December 20, 1966. A number of factors had contributed to bringing the two aircraft together. The two flights had actually been assigned altitudes 1,000ft apart—Eastern on a level assignment of 10,000ft and TWA on an 11,000ft one.

Altimetry, as a specialist pursuit within aviation, is a staggeringly complex field. Both airlines ran test flights and introduced varying leaks or disconnections to the static systems which drive altimeter readings, and were able to create discrepancies of 65ft here (differences in barometric pressure on the two planes), or 50ft there (static source correction factor on the 707). Together, they conspired to reduce the vertical separation to less than the intended 1,000 feet.

However, the main enabling event was the Eastern Constellation's making a swooping climb due to an optical illusion created in part by an upsloping cloud deck. The maneuver was recreated by Eastern test pilots in a ship similar to N6218C. The three attempts that were most carefully measured resulted

in reasonably steep ‘evasive’ emergency climbs from 10,000ft to 11,000ft that were clocked at 10.8 seconds, 14.2 seconds and 10.2 seconds respectively. Alas, the reactionary evasive maneuver made by the TW042 crew then sealed the fate of the two flights.

The first character of this episode to be praised has to be Captain White, who masterminded the miraculous crash landing of his Super Constellation though he had no effective control surfaces and very little in the way of open space in which to put her down—and who gave his life in an attempt to save the last remaining passenger still inside the wreck of his ship.

Captain Kimes and Captain Carroll and their crews are worthy of being remembered for incredible feats of airmanship in bringing their badly damaged 707s in for safe landings. And let us not forget the Cabin Crews on all three aircraft, who, faced with the fear of the passengers, had the unenviable job of preparing them for the worst and evacuating them all safely.

But the real hero of the story is the Boeing 707, which proved, in 1965 (as before and since), that it could take almost anything that was thrown at it and remain flyable. Both of the machines in these stories were repaired and returned to service. In fact, their eventual ends were similar—both were scrapped at Davis-Monthon Air Force Base at Tucson, Arizona, to support the KC- 135E program: the TWA aircraft on July 7, 1982, as CZ #0035, and the Pan Am on November 22, 1985, as CZ #0149.

After the second incident, TWA’s maintenance control issued an update to the Minimum Equipment List (MEL), which stated what had to be working on an aircraft to make it safe and legal to dispatch:

“WIE [with immediate effect] 707 may now be dispatched for flight with left or right wing missing.”

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151

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