

China airlines flight 611 engineering essay

[Environment](#), [Air](#)



**ASSIGN
BUSTER**

China Airlines Flight 611, Boeing 747-200 aircraft, was flying from Taiwan Taoyuan International Airport Taoyuan Originally named as Chiang Kai Shek International Airport to Hong Kong International Airport in Hong Kong, a regularly scheduled flight on 25 May 2002. The aircraft was reported to be disintegrated in mid-air, and crashed into the Taiwan Strait just after 25 minutes after taking off, killing all 225 people aboard. The aircraft was popular around the world and was widely used for over 20 years. After which the accident happened, Taiwanese Authorities quickly launched one of the largest rescue mission of the country aviation history.

The incident of the crash occurred between 15: 37 and 15: 40, local time, the aircraft disappeared from radar screens, assuming that it has experienced and in-flight breakup at FL350 (approximately 35, 000 feet), in the Taiwan Strait, near the Penghu Islands. It was spotted by a military C-130 aircraft, approximately 23 nautical miles northeast of Makung. The aircraft consists of total 19 crew members and 206 passengers. All was found dead after the crashed and the first body was found at 18: 10. Some passengers were found floating on the surface of the ocean, while some remained strapped in their seats. Pieces of the aircraft were also found in the ocean and on Taiwan, as well as the city of Changhua. No signs of burns, explosives or gunshots were found on the wreckage by searchers, except that oil slicks were spotted.

Section 2 Event

The aircraft was popular around the world and was widely used for over 20 years. After which the accident happened, Taiwanese Authorities quickly launched one of the largest rescue mission of the country aviation history. More than a thousand people took part in it. Fishing boat, coast guard and

Taiwan military race out to the sea. The aircraft was found 55km away from the Taiwanese shore, north of the Penghu island where it disappeared.

Great amount of wreckage, including landing gear wheels, are found on the ocean. Wreckage of the plane was spread far and wide. Some items are found on land, and some were more than a 100km away in Central Taiwan. As the rescue team continues, Taiwan Aviation Safety Council begins its investigations into the crash of the 22 year-old plane.

It was reported that, there is typically one major accident happens every four years, for China Airlines, and this particular accident was so far the most difficult one. The search for survivors goes around the clock. There were 225 people on the airplane, however, none was found alive. Bodies were taken to the Penghu Island to be identified and examined. The National Transportation Safety Board (NTSB) then joins the investigation, and a team of investigators was dispatched to Taiwan. Investigators wants to know how one of the most successful and popular airplane simply fell off the sky.

25 days after the crash, of flight 611, two " Black Box" were found, in which, one contains the voice recording of voice conversation in the cockpit and the other, data from the flight computer.

However, either could give what happened. After trying to retrieve the conversation in the cockpit, there are no unusual sounds before the crash, only after which, the sound of the plane crashing apart was recorded and the recording stopped. Wreckage examinations were the only option left for investigations.

At a cruising altitude of 34, 900 feet, the aircraft experienced an in-flight break-up. After which, it approaches to its cruising altitude of 35, 000 feet. Before the breakup, the thrust of one of the aircraft's four engine began to subside. Concurrently, the engine was the only one recovered from the sea floor. It was likely due to the structural failure in the aft lower lobe section of the fuselage.

The final investigation report indicates that the accident was caused by improper repair and maintenance after a previous incident, happened in 1980. It is the result of metal fatigue of the aircraft's tail.

On the 7 February, 1980, China Airlines Flight 611 had a tailstrike accident while landing in Hong Kong. Part of the plane's tail was damaged in the incident. A temporary repair on the airplane was done the day after. A more permanent repair was conducted by a team from China Airlines from 23 May to 26 May, 1980. However, during the permanent repair of the tailstrike, it was not carried in accordance with the Boeing Structural Manual (SRM). The area of the damaged skin on the plane's tail was not trimmed or removed properly. In addition, the repair doubler plate that was supposed to cover in excess of 30% of the damaged area did not extend beyond the entire damaged area enough to restore the overall structural strength.

The cause of the metal fatigue had evidences of brown nicotine stain, caused by the smoke from the cigarettes of people, about seven years before the disaster (smoking was allowed in a pressurized plane at that time). The engineers detected brown nicotine stain all the way around the doubler plate during the inspection. It is concluded that due to the nicotine to had been

seeping out because of the pressure that built up when the airplane is in cruising altitude, then stained the part around the doubler plate of the tail. However, there is no proper maintenance done to the doubler plate, which then causes the plane to fall apart in mid air.

Section 3 Maintenance Error

The accident for the crash is due to improper structural repair. Day after the tail strike, China Airline did a temporary repair, engineers attached a large aluminum plate over the damaged area but a more permanent repair was to be carried out within four months. Engineers of China Airline placed doubler plates right over the scratched material, but the doubler plate that they used was not 30% larger than the affected area. In fact, it was barely or maybe not even larger than the scratched area in certain area.

According to the Boeing Repair Manual, many of the scratches on plane were too deep to be repaired. The entire damaged section should had been cut out and replaced by a new one. However, it was not done so, as evidence indicates that the repair was not done according to the Boeing repair Manual. After much investigations, it appears that the maintenance technician failed to replace the damaged pieces, which causes the scratches to remained. China Airline engineers told the investigator that the scratched area was too large to be cut down, so they sanded the scratches down instead.

Even though the repair was not done accordingly to the Boeing Repair Manual instructions, they made it seemed like it was. China Airline Engineers documented that they had repaired according to the Boeing standard, and

that made the damage impossible to detect as anyone reading the entry would assumed that the damaged area had been cut out as it should had been done so.

Thus, metal fatigue of the instrument caused a maintenance error of improper structural repair by the China Airline engineers was disastrous.

Section 4 Contributing Factors

4.1

The China Airlines Flight 611 accident was caused by improper use of information/ incorrect modified information/ improper work process.

The China Airlines Flight 611 suffered a tail strike while landing on runway on the 7th of February 1980, 22 years before the accident, at the time when the airplane was only six months old. On the day after the tail strike China Airlines did a temporary repair by attaching a large aluminium plate over the damaged area. A permanent repair was scheduled for the aircraft four months later. According to Boeing's Structural Repair Manual, a light scratch on the structure of the aircraft can simply be sanded down. But the tail strike that occurred left a deep scratch on the skin of the fuselage that cannot be repaired by sanding it down. The correct procedure was to cut out the damaged area and replace it with a doubler patch that is 30% larger than the original affected area. China Airlines told that the area was too large to be cut out. They did not follow the procedure and carried on sanding down the scratches and finally covering it with a doubler plate. Unfortunately the repair wasn't sufficient nor was the doubler plate large enough. This shows that the engineer tasked with this did not use the information given to him

by the Boeing's structural repair manual nor did he followed the work process/ procedure but instead modified the manufacturer's Structural repair manual incorrectly. With the doubler plate perfectly concealing the improper repair from ever being detected by anyone, the scratches were left to deteriorate into cracks and allowed to spread out for 22 years, until the pressure in the plane was too large for the structure of the plane to withstand that the plane tore apart in mid-air.

4.2

Another contributing factor includes the complacency of engineers.

According to Boeing's recommendations, the scratches on the skin of the fuselage were too deep to be repaired. The proper action was to cut out the damaged area and replace it with a doubler patch 30% larger than the removed area. The engineer in charge of the task was probably complacent and thought that it was okay to simply sand the scratched area and put a doubler plate on it. He probably thought that the scratch was nothing serious and the doubler plate was strong enough to support the skin and hence did the repairs following his own false judgments.

After the Aloha Airlines Flight 243 accident on April 28 1988, the Federal Aviation Administration laid out inspection procedures to be done on older planes. The inspection of China Airlines Flight 611 was carried out on 2001, a year before the accident. This would have been an opportunity for China Airlines to detect the improper repair that was done 21 years back when they found a brown stain on one of the 31 doublers found on the aircraft. This could have warned them of the catastrophic crack that lies behind the

doubler and forced them to take immediate action. The China Airlines overlooked this to be something minor and moved on to the second part of the Federal Aviation Administration's procedure which was a detailed inspection of the repaired areas scheduled to be done on the 2nd November 2002. Unfortunately the Boeing-747 never made it to the specified date.

4.3

Another contributing factor includes improper work process and procedure.

The repair done was on the damage caused by the tail strike four months later was not logged in truthfully. The way that the engineer logged the repair done to the damaged area made it seem like it was in accordance to the Boeing's recommendations and structural repair manual. This lead the improper repair to be oblivious to anyone as anyone who read the entry would have thought that the damaged area had been cut out as it should have been.

4.4

Amount of supervision

The repair job might have lacked supervision when it was done and logged. There was no one to witness and re-check the repair that was supposed to be done, how it was done and how it was logged in the entry. If there was someone watching over their actions then hiding such a big mistake would have been impossible. At the very least the engineer would have had to schedule for another proper repair to be done on the next scheduled check.

Section 5 Error Prevention Strategies

Aviation agencies around the world to inspect their plane more thoroughly for any hidden damages that might develop into a major structure failure. Operators should take the doubler plates off and do a visual inspection to the structure underneath.

Develop a tool that allows mechanics to easily detect hidden damages behind the doubler. Such tools are used today. Using ultrasound, sound wave travels through metals and it can reveal damage underneath the doubler. It is the same technology that allows doctor to see the foetus inside the mother's womb . The disadvantage is that it requires a lot of time.

Reinforce importance to perform structural repairs according to the Structure Repair Manual or other regulatory agency approved methods, without deviation, and perform damage assessment in accordance with the approved regulations, procedures, and best practices. For any structural damages beyond existing approved data, operators should seek assistance and consultation from the manufacturer(s) for appropriate repair procedures.

Categorize structural repair as a major repair

Describe defect type and location clearly

Step by step instructions and signature requirements

Detailed drawings of the damages, locations on the aircraft, doubler dimensions, material specifications, applicable Structure Repair Manual sections, and any special instructions

Review the record keeping system to ensure that all maintenance activities have been properly recorded. No longer accept any quick writes of the repair work was done properly if the repair does not have all the necessary documentation that show the repair was done properly in order to provide a clear view for inspector/auditors conducting records reviews.

Assess and implement safety related airworthiness requirements, which consists of the Repair Assessment Program(RAP) and Corrosion Prevention and Control Program, at the earliest practicable time and ensure they are completed in conformity with the approved maintenance documents. When implementing the programs, information such as, operational factors, safety aspects, and the uncertainty factors in workmanship and inspection should be fully documented.

Increase maintenance crew's awareness with regard to the irregular shape of the aircraft structure, as well as any potential signs that may indicate hidden structural damage.

7. Operators to maintain healthy relationship with the manufacturer's field service representative so as to actively seek assistance and consultation from manufacturers' field service representatives in maintenance and repair operations.

8. Consider the implementation of stand-alone power sources for flight recorders and adding of cabin pressure as one of the mandatory Flight Data Recorder parameter to improve effectiveness in investigations.