# The Crash of Mercer Airlines Flight 901

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**Abstract**

The crash of Mercer Airlines flight 901 occurred on February 8th, 1976. Although the DC-6 was still in service some smaller airlines, its use had already been on the decline since the beginning of the jet age in the late 1950's. The crash was caused by the separation of a propeller blade on the #3 engine that while causing an imbalanced condition on the engine causing it to break free of its mounts, also penetrated the fuselage and the #2 engine cowling on the other side of the aircraft damaging its propeller control mechanism and causing an oil leak that was unknown to the crew. This failure happened at the takeoff phase which added to the workload of the flight crew, even though they got the aircraft in the air and returned to Burbank they had lost hydraulics and could not slow the aircraft down upon touchdown. They decided to proceed to Van Nuys airport six miles away and crashed one mile short of the runway.

## Introduction

On February 8, 1976, a Douglas DC-6 owned and operated by Mercer Airlines lost the #1 propeller blade on the #3 engine during takeoff (NTSB, 1976). This created an imbalanced condition and caused the engine to tear away from its mounts and separate from the aircraft (NTSB, 1976). When the propeller blade broke off of the hub it damaged both the fuselage and the #2 engine, although the damage was not apparent to the flight crew because they were currently dealing with the total loss and separation of the #3 (NTSB, 1976). The crew had successfully returned to Hollywood Burbank Airport but could not slow the aircraft down because of a loss of hydraulic pressure so they made the decision to take off again and attempt a landing at Van Nuys Airport 6 miles away because it had a longer runway (NTSB, 1976). The #2 engine that was damaged by debris from the failure of the #3 failed en route to the Van Nuys airport, the aircraft was no longer able to maintain altitude and caused the crew to attempt a landing at a golf course one mile from the airport (NTSB, 1976). Of the six passengers on board, 3 were killed, while the remaining experienced non-life threatening injuries (NTSB, 1976).

## Cause of the Crash

It was determined by the NTSB that the cascade event that caused the crash was the separation of the #1 blade on the #3 engine (1976). The propeller had recently been overhauled by a contractor for Mercer Airlines and it was discovered that there were some procedures that although required by the most recent edition of the propeller maintenance manual, were not performed (NTSB, 1976). These lapses were caused by both complacency and a lack of oversight by the airline. The Curtiss C632-S propellers are comprised of a hollow steel shell that is brazed together to form the airfoil section. This aircraft also had electric de-icing boots

installed on the leading edge and they extend from the base of the blade at the hub to approximately two thirds the length of the blade. The propeller that failed only had 85 flight hours on it since overhaul, which is significant because if the proper procedures had been followed the cracks would have been discovered by magnetic particle inspection (NTSB, 1976).

The NTSB determined that the most likely cause of the propeller blade failure were cracks in the brazing material of the steel shell that had developed into fatigue cracks (NTSB, 1976). These cracks occurred near the hub and were covered up by the spinner but would have been detectable if proper procedures would have been followed during the recent overhaul (NTSB, 1976). According to the overhaul manual for that propeller, the deicing boots are required to be removed for magnetic particle inspection, but due to the complacency of the maintenance personnel at the facility, it was not done (NTSB, 1976). The overhaul shop was also under scrutiny by the FAA, but because of the age of the components the business was dealing with, the inspectors were unfamiliar with the proper procedures and manuals so no discrepancies were reported (NTSB, 1976). This is a failure on the FAA's part because they sent unqualified inspectors to monitor an overhaul facility. The error was further compounded because Mercer had the proper manual supplement in its own document library but failed to provide surveillance over its contractors to ensure they had the latest information (NTSB, 1976).

If proper procedures would have been followed during the overhaul process then it is most likely that the cracks would have been discovered and this crash averted. Human factors played a large part in this disaster, although they were just beginning to enter into aviation with the use of Crew Resource Management, they should have also begun the implementation of Maintenance Resource management shortly thereafter but its usefulness was not recognized as quickly as CRM was at preventing accidents and loss of aircraft.

**Contributing Factors**

It was immediately apparent to the crew concerning the loss of the #3 engine, but was unknown to them at the time was that the propeller blade that had broken loose had severed the hydraulic systems of the aircraft and also damaged the #2 engine on the other side (NTSB, 1976). It damaged the control systems and junction box for the electrically controlled propeller, penetrated the front accessory case, and damaged the oil scavenge pump resulting in a loss of propeller control and a significant oil leak (NTSB, 1976). Once the propeller lost the electrical functions it was essentially locked in place and became fixed adding drag and preventing it from being able to be reversed (NTSB, 1976). The flight crew was dealing with a heavy workload already and failed to recognize this condition on the first landing attempt. The decision to get back into the air may have seemed prudent at the time but it was based on limited information. If the flight crew knew the condition of the #2 engine, they may have made the decision to overrun the runway instead of attempting to get to another airport. Once the #2 engine lost its oil supply because of the ruptured case it failed, the remaining two engines could not maintain the altitude and the aircraft finally succumbed to gravity on a golf course approximately one mile from the Van Nuys airport (NTSB, 1976).

The timing of the engine loss was also a factor in the crash; takeoff and landing are the most critical phases of flight and a major malfunction only adds to the workload, particularly on a piston powered transport category aircraft. The uniqueness of the aircraft requires a certain level of skill in both the pilots and flight engineer. The captain and co-pilot had approximately 6 years and three years respectively in the DC-6 aircraft and the flight engineer had less than a year’s experience in that type (NTSB, 1976). Although the flight crew was considered proficient by the investigators, they most likely did not have much simulator training in that type because

of the age and rarity of the aircraft since most airlines were entering the jet age and simulator manufacturers were concerned with building modern units for new aircraft (Page, n.d.). Engine out scenarios could only be trained on real aircraft and are limited to protect the aircraft and crew. Because of this, the flight crew could have become fixated on the engine that was already lost not realizing the damage to the second one.

**The Crash**

The aircraft impacted on a golf course approximately one mile away from its destination, collided with a building under construction and a residential trailer (NTSB, 1976). The Los Angeles Fire Department arrived about 3 minutes after the crash and laid down aqueous fire fighting foam because of a large fuel leak as a result of the crash (NTSB, 1976). The cockpit crew received fatal injuries but the remaining three passengers were able to free themselves from their seats and climb out of the aircraft (NTSB, 1976). During the rescue effort to extract the flight crew the fire department ignited the fuel with sparks from a carbide saw used to cut into the cockpit resulting in several fire fighters being injured when the fuel ignited (NTSB, 1976).

**Safety Initiatives**

The NTSB recommended that all metal propeller manuals be reviewed and changes made to the procedures to require the removal of the deicing equipment to facilitate the inspection of the surface of the blade (1976). The FAA also issued an airworthiness directive # 76-14-09 that required the inspection of all Curtis-Wright C632-S blades installed on any aircraft by having the deicing boot removed and to inspect for cracks (1976). It was also recommend that the FAA remind air carriers that when contracting out work they are required to ensure that facility is performing the maintenance in accordance with the manuals (NTSB, 1976).

Because of the fire, the Los Angeles Fire Department also made several changes to their personal equipment to increase the safety of the firefighters (Anderson 1978). They stopped using the rotary saw to gain entry into aircraft and they updated their clothing to include flame retardant pants and cuffed boots (Anderson 1978).

**Conclusion**

This crash was completely avoidable, if Mercer had performed proper surveillance of its contractors it would have been able to discover that the maintenance facility that was overhauling its propellers did not have the latest manual revisions or was following established procedures. The FAA also failed to conduct proper oversight by sending in inspectors that were unfamiliar with the requirements nor had the expertise to recognize that there were problems at the overhaul facility. There was complacency on the part of Mercer, the mechanics doing the blade overhaul, and that of the FAA. When this crash happened, the systems that are in place now to spot maintenance problems were just in their infancy and only beginning to be implemented. There have been many improvements in maintenance since then and at least the lessons learned from this crash helped to make aircraft safer through increased inspection procedures of the propellers.

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