

= 1955 MacArthur Airport United Airlines crash =

On April 4 , 1955 , a United Airlines Douglas DC @-@ 6 named Mainliner Idaho crashed shortly after taking off from Long Island MacArthur Airport , in Ronkonkoma , Islip , New York , United States .

The flight was operated for the purpose of maintaining the currency of the instrument rating of two of the airline 's pilots . Shortly after takeoff and only seconds after climbing through 150 feet (46 m) , the plane began banking to the right . It continued to roll through 90 degrees ; the nose then dropped suddenly and moments later it struck the ground . All three members of the flight crew were killed upon impact .

A subsequent investigation found a simulated engine failure procedure was being conducted , which involved a member of the crew pulling back the throttle lever for engine No. 4 prior to taking off . Investigators found that if the throttle lever was pulled back too far , it would cause the propeller to reverse ? a feature designed to slow the aircraft upon landing . Once the landing gear was raised , the crew would have to raise a metal flag in the cockpit to bring the propeller blades back into the correct position , since a safety device prevented electric power from operating the rotating mechanism at the roots of the blades unless the aircraft was on the ground or the flag was manually raised . The Civil Aeronautics Board (CAB) concluded one of the flight crew applied full power to No. 4 engine , thinking this would bring the aircraft out of the increasing bank . Because the blades were reversed and the flag was not raised , that increased the reverse thrust from No. 4 engine , causing the DC @-@ 6 to spiral out of control . Since the plane was so close to the ground , the suddenness of the bank and dive meant the flight crew had no chance to recover the aircraft before impact .

In the aftermath of the accident , the Civil Aeronautics Administration (CAA) issued an Airworthiness Directive ordering all DC @-@ 6 and DC @-@ 6B aircraft to be fitted with a manual device which could prevent the inadvertent reversal of the propeller blades . United Airlines also stated they had begun installing reverse thrust indicator lights in the cockpits of their DC @-@ 6 aircraft , which would warn pilots when a propeller had reversed .

= = History = =

On April 4 , 1955 , a United Airlines check captain , Stanley C. Hoyt , age 45 , was carrying out instrument rating checks on two of the airline 's pilots . Hoyt had been employed by United Airlines since 1937 , and had 9 @, @ 763 flying hours experience , 549 of which were in a DC @-@ 6 . He was training the two pilots , Henry M. Dozier , age 40 , and Vernis H. Webb , age 35 , so they would be able to retain an instrument rating qualification , allowing them to fly under instrument flight rules . The aircraft was a Douglas DC @-@ 6 , registration N37512 , serial number 43001 . The airframe had flown 22 @, @ 068 flying hours , and had undergone an inspection 105 hours before the accident . The aircraft was powered by four Pratt & Whitney R2800 @-@ CB16 engines , fitted with Hamilton Standard 43E60 @-@ 317 propellers .

The weather on the day of the accident was clear , although there was a strong wind of about 20 knots (37 km / h) hitting the airfield from the southwest , with occasional gusts of wind as fast as 30 knots (56 km / h) . The aircraft made several circuits , taking off and landing again , before eyewitnesses observed the aircraft standing at the end of the runway and then taking off at about 15 : 50 Eastern Standard Time . Loaded with around 61 @, @ 000 pounds (28 @, @ 000 kg) , the aircraft was far below its maximum permissible weight and the center of gravity was within the prescribed limits for the model of aircraft .

Between 1 @, @ 500 feet (460 m) and 1 @, @ 800 feet (550 m) down the runway , the aircraft reached take @-@ off speed , lifted off the ground , and began climbing normally as the crew retracted the landing gear . Upon climbing through 50 feet (15 m) , the aircraft began banking to the right . The climbing bank continued to increase at a rate which alarmed witnesses , and soon after the aircraft rolled through 90 ° (at which point the wings were vertical to the ground) . At a height of around 150 feet (46 m) , with all four engines producing take @-@ off thrust , the nose

began to fall . Moments later the right wing and nose impacted the ground , causing the fuselage to cartwheel over , before the aircraft came to rest , with the correct side up . It was immediately engulfed in flames . All three members of the flight crew were instantly killed . Although emergency services at Long Island MacArthur promptly responded to the crash , the aircraft was destroyed by the post @-@ crash fire .

= = Investigation = =

= = = Wreckage examination = = =

The Civil Aeronautics Board (CAB) , charged with investigating the accident , examined the wreckage at Long Island MacArthur Airport . Reports from witnesses of the crash indicated the aircraft appeared to have made a normal takeoff and began climbing normally . But , moments later it began banking sharply to the right . Investigators examined the four charred engines and concluded all were producing power at the point of impact . They could not conclusively determine the amount of power being produced , but stated there was no evidence found in the wreckage that suggested the engines might have suffered an operational failure .

They were also able to determine all of the flight control surfaces , including the elevators , ailerons and rudder , were functioning properly at the point of the crash , and there were no faults in the flight control system . The flaps were extended to between 15 ° and 20 ° , the standard setting for take @-@ off . The propeller blades of No. 4 engine ? on the far right side of the aircraft ? were reversed ? minus 8 ° , while the blades of Nos. 1 , 2 and 3 engines were at 34 ° positive pitch (also standard for take @-@ off) .

= = = Reversed thrust = = =

The propellers of a DC @-@ 6 are designed to provide reverse thrust after the aircraft touches down . The pilot then retards the throttle levers to a point below idle speed and that directs the electric mechanisms in the propeller hub to rotate the blades to a position in which they will provide reverse thrust . Should the pilot need to perform a go @-@ around , he moves the thrust levers forward to a positive position again and that will produce forward thrust , enabling the pilot to execute a go @-@ around maneuver .

The Douglas Aircraft Company designed a system that would prevent the accidental reversal of propeller blades in @-@ flight . During development of the DC @-@ 6 , the company installed a system that cut electrical power to the mechanisms which rotated the blades while the airplane was in the air . When there was enough weight on the landing gear (which would only be the case when the aircraft was on the ground) , a switch which supplied electrical power to the mechanisms was closed ? meaning that when the aircraft touched down the blades could be reversed and thus the airplane could be slowed . When the switch was closed , a red flag would swing into view in the cockpit of the aircraft , warning the crew that the blades could be reversed . Should the switch fail to close upon landing , the flag could be raised manually and electrical power to the mechanisms would be restored . When the aircraft took off , electrical power would be cut to the mechanisms so that the propeller blades could not be inadvertently reversed , and the red flag swung out of sight . Reverse thrust warning lamps , which would have warned the crew if the propellers were reversed , were not fitted on Mainliner Idaho .

= = = Flight tests = = =

The CAB carried out flight tests using a DC @-@ 6 . They found that if the propellers were reversed prior to take @-@ off they would not , if the flag was not raised , be rotated automatically again in the air to produce forward thrust if full power was applied . Tests performed by United Airlines showed that , if the propellers of just one engine were reversed and full power was applied to all four

engines , then the aircraft would spiral into a dive . If METO (maximum except take @-@ off) power was applied to Nos. 1 , 2 and 3 engines , and full reverse thrust was applied to engine No. 4 , then the aircraft would become uncontrollable .

If full left aileron was applied , the aircraft could be recovered for a short period of time , but a violent turn to the right would continue , and the competing forces would cause the aircraft to stall , and violently roll and pitch down . Flight tests , investigators said , accurately reproduced what happened to Mainliner Idaho during the accident sequence . The tests performed by United and by the investigators showed that if , after the aircraft became airborne , full power was applied to an engine whose propellers were reversed , the propellers would produce not positive thrust , but increased reverse thrust . One aviation author wrote of the crash ,

" The flight tests showed conclusively that , at take @-@ off configuration , a DC @-@ 6 becomes uncontrollable with an outboard engine at full power with its propeller in reverse pitch . Control is lost so quickly that there is little the crew can do at low altitude . In the case of this accident , it was doubtful if there would have been time for forward thrust to be restored before control was lost . "

= = = Conclusions = = =

While the wreckage was being examined , investigators found that all four engines were producing thrust at the time of impact . There were only two ways that the propeller could be reversed during the take @-@ off sequence . Investigators ruled out electrical malfunction since , after detailed examination of the engine hub , there was no evidence found of this happening . Therefore , it was concluded that the only way the propeller could have been reversed was through an unintentional crew action . Although there was no formal evidence that a simulated engine failure was being performed , statements submitted by witnesses suggested that it was likely this was the case . United Airlines procedure calls for No. 4 engine to be shut down in a simulated engine failure ? the same engine which was found at the crash site with its propellers reversed .

The investigation concluded the accident sequence began when the check pilot , while the aircraft was on the ground , retarded the throttle lever for No. 4 engine past the idle position , and therefore reversed the propellers of that engine . Once the airplane took off and started banking to the right , it would have been a natural reaction for one of the flight crew to increase power to No. 4 engine , thinking that by doing so the engine would start producing positive thrust and the aircraft could be recovered . However , since the metal flag was not raised , there was no electrical power to the rotating mechanisms ? and increasing power to No. 4 engine would only have created more reverse thrust .

The final accident report concluded there wasn 't sufficient time for the crew to react , since the dive began suddenly while the plane was so close to the ground . " Control will be lost so quickly that there is little , if anything , that the pilot can do if it occurs at low altitude , " the report stated . " He must recognize what is occurring , analyze it , and take action to unreverse in a very limited amount of time . It is doubtful that unreversing could have been accomplished in this instance before control was lost . "

On October 4 , 1955 , the CAB released the final accident report , which concluded the reversal of the propellers and subsequent increase in power of the No. 4 engine had caused the accident .

" The Board determines that the probable cause of this accident was unintentional movement of No. 4 throttle into the reverse range just before breaking ground , with the other three engines operating at high power output , which resulted in the aircraft very quickly becoming uncontrollable once airborne . "

= = Aftermath = =

= = = Technological advances = = =

Following the accident , the Civil Aeronautics Administration (CAA) issued an Airworthiness

Directive ordering all DC @-@ 6 and DC @-@ 6B aircraft to be fitted with a sequence gate latch , known as a Martin bar . The device is a metal bar which a crew would manually swing in front of the thrust levers over the idle line , physically preventing the thrust levers from being retarded into the reverse position . According to the CAB report , a United Airlines engineer told investigators the Martin bar should make propeller reversal " a more reliable and safer device [than the system fitted to Mainliner Idaho] ... with its numerous switches , relays , and automatic operation . "

United Airlines issued a statement saying it had begun installing the device on its fleet of DC @-@ 6 and DC @-@ 6B aircraft one week before the accident , having used it successfully in service on their fleet of Douglas DC @-@ 7 aircraft . A Martin bar had not yet been fitted on Mainliner Idaho . United Airlines also said a program had begun to install reverse thrust indicator lights on all their DC @-@ 6 and DC @-@ 6B aircraft . The signals , fitted in the cockpit of the aircraft , would have warned the flight crew that the thrust lever had been pulled back too far , and the propellers had been reversed .

= = = Similar accidents = = =

Since the crash , there have been several other accidents involving reverse thrust . A Douglas DC @-@ 8 operating United Airlines Flight 859 crashed in 1961 when the first officer attempted to reverse all four engines during the landing roll . The left engines remained in forward thrust , while the right engines went into reverse , causing the aircraft to veer rapidly to the right and collide with airport construction vehicles , killing 17 of the 122 people aboard and 1 person on the ground . Japan Airlines Flight 350 , a DC @-@ 8 , crashed in 1982 short of the runway in Tokyo , after the mentally ill captain attempted suicide during the final approach phase of the flight , by putting the inboard engines into reverse thrust . Of the 174 people aboard , 24 died . In 1991 , Lauda Air Flight 004 , operated by a Boeing 767 , crashed after the left engine thrust reverser deployed in @-@ flight for reasons that could not be determined . The crash of a TAM Airlines Fokker 100 in 1996 was attributed to the deployment of the thrust reverser on No. 2 engine . The aircraft rolled to the right and crashed in a populated area of São Paulo , Brazil .