02/08/76 Mercer Airlines, Inc.

Official Accident Report Index Page

Report Number	NTSB-AAR-76-17
Report Title	Mercer Airlines, Inc., Douglas DC-6/YC-112A, N901MA, Near Van Nuys Airport, Van Nuys, California, February 8, 1976
Report Date	August 18, 1976
Organization Name	National Transportation Safety Board Bureau of Aviation Safety Washington, D.C. 20594
WUN	1823-A
Sponsor Name	NATIONAL TRANSPORTATION SAFETY BOARD Washington, D. C. 20594
Report Type	Aircraft Accident Report February 8, 1976
Distribution Status	This report is available to the public through the National Technical Information Services, Springfield, Virginia 22151
Report Class	UNCLASSIFIED
Pg Class	UNCLASSIFIED
Pages	41
Keywords	Propeller blade; fatigue crack; overhaul facility; magnetic inspection; carbide saw; ferrous metal identifier.

Abstract

At 1044 P.s.t. February 8, 1976, Mercer Airlines Flight 901 crashed while attempting an emergency landing on runway 34L at the Van Nuys Airport, Van Nuys, California. The No. 3 engine had separated from the aircraft during takeoff from runway 15 at the Hollywood-Burbank Airport, Burbank, California; the No. 2 engine failed while en route from Burbank to Van Nuys. The aircraft crashed on a golf course about 1 mile short of the threshold of runway 34L at Van Nuys.

Of the six persons on board the aircraft, three flightcrew members were killed; two flight attendants and a nonrevenue company employee were injured slightly. One person on the ground was injured slightly. During a postaccident fire, ten firemen were burned; three, seriously. The aircraft was destroyed.

The National Transportation Safety Board determines that the probable cause of this accident was the degraded performance of the sircraft after two engines failed. The dual failure was precipitated by the in-flight failure of the No. 1 blade of the No. 3 propeller assembly. The failure of the propeller blade resulted from a fatigue crack which originated in the leading edge under the deicer boot. The crack had not been detected during an improperly performed overhaul.

As a result of its investigation of this accident, the Safety Board issued three recommendations to the Federal Aviation Administration.

Facts of the Accident

Accident NTSB ID	76-17
Airline	Mercer Airlines, Inc.
Model aircraft	DC-6/YC-112A, N901MA
Year shipped	1946
Aircraft manufacturer	Douglas
Engine type	R1800
Engine manuafacturer	Pratt & Whitney
Date	02/08/76
Time	1044
Location	Near Van Nuys Airport, Van Nuys, CA
Country	USA
Fatalities	3
Injuries	3 slight plus 1 on ground slight; 10 firemen burned, 3 seriously
Fire during flight?	Y in engine
Fire on the ground?	Y
Probable cause	The degraded performance of the aircraft after two engines failed. The dual failure was precipitated by the in-flight failure of the No. 1 blade of the No. 3 propeller assembly. The failure of the propeller blade resulted from a fatigue crack which originated in the leading edge under the deicer boot. The crack had not been detected during an improperly performed overhaul.
Weather conditions	Rain
Total crew size	5
Cockpit crew size	3
Cabin crew size	2
Passengers	1
Report ID	NTISUB/B/104-76/017

Pages	41
Day or night?	Day
Flight number	901
Flight origin	Burbank, CA
Flight destination	Ontario, CA
Description	The No. 3 engine separated from the aircraft during takeoff; the No. 2 engine failed while en route. The aircraft crashed on a golf course 1 mile short of the Van Nuys runway.

SYNOPSIS

At 1044 P.s.t. February 8, 1976, Mercer Airlines Flight 901 crashed while attempting an emergency landing on runway 34L at the Van Nuys Airport, Van Nuys, California. The No. 3 engine had separated from the aircraft during takeoff from runway 15 at the Hollywood-Burbank Airport, Burbank, California; the No. 2 engine failed while en route from Burbank to Van Nuys. The aircraft crashed on a golf course about 1 mile short of the threshold of runway 34L at Van Nuys.

Of the six persons on board the aircraft, three flightcrew members were killed; two flight attendants and a nonrevenue company employee were injured slightly. One person on the ground was injured slightly. During a postaccident fire, ten firemen were burned; three, seriously. The aircraft was destroyed.

The National Transportation Safety Board determines that the probable cause of this accident was the degraded performance of the aircraft after two engines failed. The dual failure was precipitated by the in-flight failure of the No. 1 blade of the No. 3 propeller assembly. The failure of the propeller blade resulted from a fatigue crack which originated in the leading edge under the deicer boot. The crack had not been detected during an improperly performed overhaul.

1.INVESTIGATION

1.1 History of the Flight

On February 8, 1976, Mercer Airlines Flight 901, a Douglas DC-6/YC-112A, (N901MA), was being ferried from Burbank, California, to Ontario, California. There were three flightcrew members, two cabin crewmembers, and one nonrevenue company employee on board the aircraft.

The cockpit voice recorder (CVR) transcript indicated that while the aircraft was taxiing at the Hollywood-Burbank Airport, the crew discussed a problem with the fuel pressure and the boost pump on the No. 3 engine. The hydraulically operated windshield wipers had been turned on because of rain. Also, there was a comment recorded

on CVR, "That one inverter sounds awful."

At 1035:00, [1] Flight 901 was cleared by the Hollywood-Burbank Tower to make a rolling takeoff on runway 15. During acceleration, the flight engineer stated, "Look at that warning light on No. 3." There was no verbal response-from any other crewmember. The aircraft was accelerated normally to V_1 and V_2, was rotated, and was lifted off without difficulty. Shortly after the captain called for gear and flaps up, a loud noise was heard and the flight engineer announced that they had lost the No. 3 engine. Ground witnesses saw a flash of fire, black smoke, flying objects from the No. 3 engine, and the No. 3 engine separate from the aircraft. The first officer informed the captain that the engine had separated. The aircraft continued to climb and began a right turn.

At 1036:09, the crew of Flight 901 advised the Hollywood-Burbank Tower that they were returning to the airport and were declaring an emergency. They then requested and received clearance for a landing on runway 07.

At 1036:21, the local controller advised the flight that there was "trash" across the intersection of runways 07/25 and 15/23. The crew requested that crash equipment stand by, and the tower again advised them of debris across the intersection. The crew then inquired as to whether they could land on runway 07 or divert to the Van Nuys Airport. The local controller advised that there would be no problem with landing on runway 07 but that they might strike some of the debris on the intersection. During this period the reading of the emergency checklist was heard in the background. The captain elected to continue the approach and engine power was reduced to METO. [2] Immediately after the power was reduced, the crew saw that the No. 2 propeller reverse light was illuminated. Though incomplete, the emergency checklist was discontinued at that time.

The captain called for gear down and full flaps. As the approach continued, the first officer called out the airspeeds and, after reporting 115 kn, he said, "You got it made."

Ground witnesses reported that, as the aircraft circled the Hollywood-Burbank Airport, only the nose gear was extended. As the aircraft approached runway 07 for the emergency landing, witnesses reported that the main gear was also extended. The witnesses did not see the position of the flaps.

The aircraft touched down near the end of runway 07; the captain called for flap retraction and "gate." [3] The engine sounds increased, and the first officer advised the captain that the propellers were not going into reverse and to use the brakes. As the engine sound decreased, the captain replied that nothing was happening. The first officer said, "Get your air--get your air." The captain replied, "I'm doing it!" Maximum power was then applied; the aircraft again took off, and cleared the blast fence at the end of the runway by approximately 30 feet. The captain called for gear and flaps up. The first officer advised that the flaps were up as he positioned the gear handle to "up." Ground witnesses saw the aircraft begin a slow, climbing turn to the right.

At 1039:35, the crew advised the Hollywood-Burbank Tower that they had no brakes and that they were proceeding to the Van Nuys Airport, 6 nmi to the west. The crew then saw that the No. 2 oil pressure was low and that there was no BMEP [4] indication. Attempts to feather the No. 2 propeller were not successful, and the No. 2 engine stopped with the propeller blades at a positive, low pitch angle.

Ground witnesses reported that as the aircraft was proceeding toward Van Nuys Airport, the main gear was extended. The crew requested the Hollywood-Burbank Tower to inform the Van Nuys Tower that the flight would need to land on runway 34 and to have the emergency equipment stand by. This request was relayed to Van Nuys by the Burbank coordinator over the land line between the two towers. The flight contacted the Van Nuys Tower and was cleared by the local controller to enter traffic on the east side of the airport for a landing on runway 16, which was the active runway. The crew again requested runway 34 with the added information, "... that's about all we're going to make."

At 1043:22, the Van Nuys local controller cleared the flight to land on runway 34L, and the crew reported they had no brakes. As the aircraft approached the airport from the southeast, it was losing altitude and airspeed. The crew realized that they could not reach the airport and the captain commented that the windshield wipers were inoperative. The flight engineer explained that the windshield wipers did not work because the hydraulic system was inoperative. The throttles were retarded and a forced landing was attempted on the Woodley Municipal Golf Course, about 1-mile south of the Van Nuys Airport.

The aircraft touched down on it's main landing gear and bounced three times. The nose of the aircraft struck a 24-inch-high concrete foundation of a partially constructed building. The aircraft came to rest against a house trailer parked nearby. A fire erupted about 20 minutes after the crash while firemen were engaged in rescue activities.

The accident occurred during daylight hours at 1044:25 on February 8, 1976. The geographic coordinates of the accident site are 34°11' N latitude and 118°29' W longitude.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	3	0	0
Nonfatal	2	1	11
None	0	0	

1.3 Damage to Aircraft

The aircraft was destroyed.

1.4 Other Damage

A partially constructed building and a house trailer at the golf course were destroyed. Fairways, greens, a tee, and a power line were damaged.

1.5 Crew Information

The crew of Flight 901 was certificated and trained in accordance with current FAA regulations. (See Appendix B.)

1.6 Aircraft Information

1.6.1 Aircraft

The aircraft was certificated in accordance with existing regulations. All maintenance checks and airworthiness directives had been performed as required. The most recent heavy maintenance check was accomplished by Mercer Airlines on December 13, 1975; total aircraft time was 10,226 hours. Total time of the aircraft at the time of the accident was 10,280.4 hours. (See Appendix C.)

At takeoff, the aircraft's gross weight was 64,579 lbs., including 9,600 lbs. of 100/130 octane aviation fuel. The center of gravity (c.g.) forward limit (landing gear extended) was 14 percent MAC, and the rear forward limit (landing gear extended) was 35 percent MAC. The weight and c.g. for the flight were within prescribed limits.

1.6.2 Propellers

The propellers installed on N901MA were Curtiss-Wright electric propellers, Type C632-S. Propeller No. 3, serial No. 153465, had been overhauled in September 1975, and had been installed on N901MA in November 1975; it had accumulated 85 hours since installation.

The documents from the propeller overhaul facility indicated that the No. 3 propeller had been inspected magnetically (Magnaflux), but the specific parts inspected were not listed. Interviews with the overhaul facility's management personnel and the magnetic inspection facility's personnel established that the blades had been magnetically inspected, but that the rubber deicing boots, which cover about 45 inches of the inboard portion of the 75-inch blades' leading edge, had not been removed from the blades during the inspection. Personnel from both facilities stated that the rubber boots usually were not removed from the blades if the heating elements checked out electrically and if the rubber material had not been damaged or frayed.

Publication 5-3B3-550, dated March 1, 1962, is Curtiss-Wright's most recent overhaul manual for C332-S propellers. Part 3B3 of the manual pertains to the overhaul of the blades in general. Chapter 63.2, dated September 1, 1957, together with Model Difference Sheet 63.2-4MDS, dated November 1, 1964, describe the method to be used when magnetically inspecting the steel blades on the propeller. The instruction required that all steel blades be inspected over the entire external surface. The propeller overhaul facility did not have a copy of Chapter 63.2 or 63.2-4MDS in its library.

Mercer Airlines had the most recent propeller manual in its library; however, they had not determined which manuals or procedures were being used by the overhaul facility.

14 CFR 121.367 and 14 CFR 145.2 specify that the certificate holder (operator) shall have a program to insure that all maintenance, preventive maintenance, and alterations are performed in accordance with his (the operator's) manual.

14 CFR 121.363 places the responsibility for the airworthiness of an aircraft and its components on the certificate holder. It provides for the certificate holder to make arrangements with others to perform the required maintenance operations; however, it specifies that these arrangements do not relieve the certificate holder of the responsibility for assuring that the aircraft is airworthy.

The overhaul facility was under the surveillance of the maintanance inspectors of the Federal Aviation Administration's (FAA) Santa Monica General Aviation District Office. The Safety Board found no evidence that the FAA had noted or had informed the management of the overhaul facility that the overhaul facility did not possess the most current overhaul manual.

1.7 Meteorological Information

Meteorological observations at both the Hollywood-Burbank and Van Nuys Airports are made by FAA control tower personnel who have been certificated by the National Weather Service.

At 1002, the Burbank weather observation for February 8, 1976, was: "1,000 feet scattered, estimated 7,000 feet overcast, visibility--4 miles, light rain and fog, temperature--56°F, wind--°at 4 kn. altimeter setting--29.97 in."

The Van Nuys weather observation was: "600 feet scattered, 1,000 feet scattered, estimated 8,000 feet overcast, visibility--10 miles, light rainshowers, temperature--55°F."

At 1045, an observation for Van Nuys was: "Special, 1,200 feet scattered, 10,000 feet overcast, visibility--10 miles, rainshowers, wind--130° at 4 kn, altimeter setting--29.93 in."

The accident occurred during daylight hours, under overcast skies, and in rainshowers.

1.8 Aids to Navigation

Not applicable.

1.9 Communications

Air-to-ground communications and land-line communications between the Hollywood-Burbank Tower and the Van Nuys Tower were normal.

1.10 Aerodrome and Ground Facilities

Hollywood-Burbank Airport, elevation 775 feet m.s.l., has two runways -- 15/33 and 07/25. Runway 15/33 is 6,088 feet long and 150 feet wide, and has an asphalt surface. Runway 07/25 is 6,555 feet long and 150 feet wide and has an asphalt surface.

Van Nuys Airport, elevation 800 feet m.s.l., has two parallel runways -- 16/34. 16R/34L is 8,000 feet long and 150 feet wide and has an asphalt-concrete surface. 16L/34R is 4,000 feet long and 75 feet wide, and has an asphalt surface.

Instrument approach aids were available at both airports; however, they were not involved in this accident.

1.11 Flight Recorders

N901MA was not equipped with a flight data recorder, nor was it required. It was equipped with a United Data Control cockpit voice recorder, model 557Z, serial No. 1035. The recorder was not damaged by impact or ground fire. The tape was good quality and contained a record of the entire flight beginning with the pre-engine start checklists. (See Appendix D.)

1.12 Wreckage

1.12.1 Components Separated in Flight

The No. 3 engine, engine cowling, propeller, two pieces of lower fuselage skin, two pieces of the right (inboard) side cowling of the No. 2 engine, and the No. 2 propeller alternator separated from the aircraft during the initial takeoff from the Hollywood-Burbank Airport. Debris from the No. 3 engine was scattered across the intersection of runways 15/33 and 07/25.

The No. 1 blade of the No. 3 propeller was found on the runway. This blade had a chordwise fracture 43 inches from its tip. A 10-by 1.5-inch section was missing from the trailing edge of the blade. The remainder of the trailing edge was curled forward over the thrust face. A spanwise crease, about 24 inches long, extended outward from the fracture. There was a 9-inch cut through both faces of the blade and midway along the crease. At the leading edge, adjacent to the fracture, the blade was curled, torn, and kinked. Red paint, which covered the tip of the blade, was rubbed and scraped in a random pattern. Red paint was also found on the two pieces of the right (inboard) side cowling from the No. 2 engine which were recovered near the runway intersection.

These two pieces of cowling had been penetrated from the outside. Directly in line with this rupture in the cowling, the front accessory case of the engine had been penetrated and a large hole was punctured in the casing. Fragments of the case material were found inside the engine case. The No. 2 propeller electrical junction box was flattened and bent inward through the hole. The terminal blocks were broken and several of the terminals disconnected. The drive gears for the oil scavenge pump, which are located at the bottom of the accessory case, were disengaged.

1.12.2 Main Wreckage

The aircraft came to rest on a magnetic heading of 232°, about 50 feet from the western edge of the Woodley Municipal Golf Course and 1,200 feet south of Victory Boulevard in Van Nuys, California. The crash site is about 1-mile south of the threshold of runway 34L at the Van Nuys Airport. The elevation of the wreckage site was about 715 feet m.s.l.

The air aircraft had touched down on a magnetic heading of 278° and continued on that heading for about 1,710 feet until it struck the foundation of a partially constructed building. The aircraft rotated 46° to the left and slid about 140 feet; it came to rest against a house trailer.

A ground track, made by the outboard tire of the left main landing gear, began about 1,850 feet from the house trailer; the track was the first indication of ground contact. The main landing gear struts separated from the aircraft when it struck the concrete foundation. The wings, empennage, and fuselage, aft of fuselage station 261, remained essentially intact. The flaps were retracted.

The fuselage was torn or broken across the entire width of the aircraft at station 261. The forward portion of the fuselage was bent downward. The cockpit and forward portion of the passenger cabin were destroyed by impact.

The lower skin of the fuselage and the floor of the forward baggage compartment was torn and folded inward. The edges of the separation were jagged and the surfaces of the separation had deposits of a substance that appeared to be red paint.

Both horizontal stabilizers were streaked with oil; the left side of the fuselage was streaked with hydraulic fluid.

The left side fuselage tunnel, which is in the general area of the fuselage ice plate and below the cabin floor, had been punctured. The following lines are routed through this area: Nose gear actuation system, engine manifold pressure, emergency airbrake, and almost all of the cockpit electrical wiring. The hydraulic pressure for the wheel brakes and nose wheel steering are taken from the nose gear actuation line.

Many of the lines and much of the electrical wiring in the left side fuselage tunnel had been cut by the propeller blade. However, impact and fire damage prevented the identification of the lines and electrical wires that had been cut.

The emergency locator transmitter (ELT) was intact in its mounting and the antenna was connected. The ELT control switch was in the "Arm" position; however, the ELT did not activate. When tested by impact loads imposed from all directions, the unit did not activate; however, when tested in the manufacturer's test rig, the unit activated.

1.13 Medical and Pathological Information

The cockpit crewmembers sustained fatal traumatic injuries when the aircraft hit the concrete foundation. Pathological examination showed no evidence of preexisting of incapacitating diseases. The CVR confirmed the pathological findings that all flightcrew members were functioning during the emergency. The toxicological analyses were negative.

The two flight attendants sustained multiple contusions and abrasions to their heads and legs. The nonrevenue passenger sustained a slight contusion to the back of his head.

Three firemen sustained serious injuries consisting of second degree burns and damage to their air passages; seven firemen received minor burns. The occupant of the house trailer received abrasions when he evacuated the trailer.

1.14 Fire

There was no fire as a result of impact. The Los Angeles City Fire Department (LACFD) responded to the accident scene with 18 units. The first units arrived about 3 minutes after the accident. The fuel lines in the left wing's leading edge had ruptured and fuel had leaked under the forward section of the wreckage. Firemen and survivors described the fuel fumes outside the aircraft as "very strong;" however, when they entered the aircraft in an attempt to rescue the flightcrew members, they did not smell fuel.

In order to reach the flightcrew members, a decision was made to separate the cockpit from the fuselage by using a carbide saw. Before the cut was made, the area around the nose and wings of the aircraft was blanketed with aqueous film-forming foam. In addition to the foam, firemen, who held charged handlines, and the crash unit, which had a turret and ground nozzles, were positioned around the nose of the aircraft. The aircraft's skin was sawed from the right forward door to the top of the fuselage. The cut was located approximately 3 inches behind the cockpit/fuselage production splice. No sparks were generated during this activity. A ladder was then placed against the left side of the fuselage, aft of the cockpit, and a second cut which angled on the left side of the fuselage toward the production splice was started. Shortly thereafter, a large continuous stream of sparks was generated and fell to the ground. Immediately, a fire erupted and engulfed the firemen who were on or near the nose of the aircraft. The fire was extinguished in seconds by the firemen that had been prepositioned. The fire began about 20 minutes after the accident.

1.15 Survival Aspects

A California Highway Patrol helicopter landed within seconds of the crash, and its crew attempted to get into the cockpit. A person at the scene went to the rear exit and assisted the cabin occupants away from the aircraft. Several other organizations dispatched helicopters and ambulances to the scene, and the equipment stood by to assist in the evacuation. Helicopters were used to airlift seriously injured firemen to the hospital.

The senior flight attendant was seated in the aisle seat, row 13, right side. Her legs were pinned under her seat and her weight was being supported by her seatbelt. Her situation was further complicated because the seats in row 12 had fallen toward her. The second flight attendant was seated in the aisle seat, row 14, right side. Her legs also were pinned under the seat when it tilted forward and caused her weight to be suspended on the seatbelt. She experienced some difficulty freeing herself because her weight was on the belt and because the seatbelt fabric was difficult to pull through the buckle. After she freed herself, she assisted the senior flight attendant. Both went to the left rear door, opened it without difficulty, and exited.

The nonrevenue passenger was not trapped nor did he have any difficulty releasing his seatbelt. He climbed over his seatback to reach the rear exit because the aisle was blocked by debris and loose seats.

Six rows of seats were torn from their fittings during the crash. The cabin, forward of row 7, was damaged extensively. The evacuation slide had fallen from the attach fittings on the door. It was not used in the evacuation.

1.16 Test and Research

1.16.1 Metallurgical Tests

Safety Board metallurgists examined the No. 1 blade of the No. 3 propeller. Microscopic examination of the chordwise fracture disclosed fatigue markings emanating from the leading edge of the blade. Most of the fractures at the leading edge had been destroyed by mechanical damage following blade separation. In order to determine the precise origin of the fracture, a crack in the existing fracture plane was opened. Detailed examinations of the exposed fracture region disclosed that the fatigue began along the inside radius of the steel blade shell in an area which contained brazing material. Fractographic and metallographic examination showed that the fatigue probably began in the steel blade as a result of prior cracks in the brazing material which intersected mismatches in the steel formed during the manufacture of the blade shell. Material properties of the steel blade met engineering drawing requirements.

1.16.2 Analysis of Red Paint Smears

On March 5, 1976, the No. 1 blade of the No. 3 propeller, a section of metal from along the separation in the baggage floor, and sections of the right side cowling of the No. 2 engine were taken to the Federal Bureau of Investigation (FBI) laboratories for examination of the paint on the propeller and the red smears on the other pieces. The FBI report concluded that the paint particles from the metal from the baggage compartment floor could have originated from the propeller blade. The smears on the No. 2 engine cowling were of insufficient quantity to determine type or source.

2. ANALYSIS AND CONCLUSIONS

2.1 Analysis

The flightcrew members were qualified and properly certificated for the intended flight. The aircraft was properly equipped for the intended flight and the weight and c.g. were within the prescribed limits.

2.1.1 The Accident

The accident sequence was initiated when the No. 1 blade of the No. 3 propeller separated at a point 43 inches from the propeller tip. Metallurgical examination showed that the failure of the No. 1 blade resulted from fatigue cracks that had origins along the inside radius of the steel blade shell. These fatigue cracks initiated from other cracks in the brazing material that intersected mismatches formed during the manufacture of the blade shell.

The fatigue crack should have been detected during the last blade inspection. The crack probably remained undetected during the magnetic particle inspection because the overhaul facility did not remove the rubberized deicing boot along the lower portion of the blade. The crack was not visible when the propeller was installed on the engine.

The loss of one blade of the propeller caused an imbalance that instantly tore the No. 3 engine from the aircraft. The failed blade penetrated the lower fuselage near station 261 and traversed the width of the aircraft's fuselage. This was evidenced by the strip of lower fuselage skin found on the Hollywood-Burbank Airport and the red paint smears on the surfaces of the cut in the forward baggage compartment floors. The paint type matched that on the tips of all propeller blades; however, the No. 1 blade had the only scratch and scrape marks in the painted surface that would result from cutting through the fuselage.

As the blade traversed the fuselage, it severed most of the hydraulic and pneumatic lines and much of the electric wiring in the left fuselage tunnel. Although the damage inflicted during the impact and postaccident fire precluded identification of the lines and wires that were severed, the nose gear actuation line (hydraulic), engine manifold pressure line (pneumatic), emergency airbrake (pneumatic), and the propeller control (electric) were among those damaged when the blade passed through the fuselage. This damage caused the loss of propeller control, including reversing, and the loss of hydraulic and emergency airbrakes.

The propeller blade exited the left side of the fuselage and penetrated the right inboard side of the No. 2 engine. As the blade penetrated the No. 2 engine's front accessory case, it caused the No. 2 propeller's alternator to separate and the drive gears of the oil scavenge pump to disengage. When the front accessory case was penetrated engine oil was lost in about 4 minutes. The lack of oil prevented lubrication of the engine components, and the engine failed shortly after the crew abandoned the attempted emergency landing at the Hollywood-Burbank Airport.

The separation of the No. 2 propeller junction box caused the propeller to remain fixed in pitch, regardless of any action the crew could take. This fixed pitch resulted in an additional drag component on the aircraft when the No. 2 engine failed and stopped rotating.

Considering the situation, the captain's decision to remain in the traffic pattern at Hollywood-Burbank Airport and to land as soon as possible was prudent.

However, after landing with neither hydraulic nor emergency brakes available and with the aircraft being

accelerated by forward thrust when reverse power was applied, and considering the runway length and the obstacles at the departure end of the runway, the captain had to decide instantly whether: (1) To apply maximum available power to the three operating engines and takeoff, or (2) to keep the aircraft on the ground and attempt to avoid the obstacles and buildings at the end of the runway through the use of differential engine power. In retrospect, the latter alternative may have been more prudent in view of the impending failure of the No. 2 engine.

In this respect, after the No. 3 engine failed, had the crew monitored the engine and hydraulic instruments more closely during the 3 minutes the aircraft was circling to make the emergency landing, they would have known that the oil in the No. 2 engine had been lost and that a severe hydraulic system problem existed. The hydraulic system problem would have been indicated by the loss of hydraulic fluid quantity and system pressure. Had the captain been aware of these conditions before he attempted to land, he may have elected to stay on the ground rather than again becoming airborne with an impending second engine failure.

Although the crew selected landing gear up after the second takeoff, the landing gear remained extended. As long as the No. 2 engine continued to operate, there was sufficient power for the aircraft to accelerate and climb. However, when the No. 2 engine failed, the drag that was created by (1) the flat plate area of the No. 3 nacelle, (2) the flat blade angle of the No. 2 propeller blades, and (3) the extended landing gear was more than the two remaining operating engines could overcome. Faced with insufficient power to maintain altitude and airspeed, the crew had no alternative but to attempt a landing on the golf course. In addition, since the hydraulically operated windshield wipers were inoperative, rain restricted the forward visibility and the crew probably did not see the building before they reduced the throttles on engines Nos. 1 and 4.

The postcrash fire was ignited by sparks that were generated when the blade of the carbide saw contacted a steel bolt and steel nut which connected the cockpit to the cabin structure at the manufacturing splice. The sparks fell to the ground and ignited the fuel that had leaked from the aircraft.

Although firemen had covered the area around the nose of the aircraft with foam, the effectiveness of the foam was deteriorated by the movement of the firemen through the mixture, by the action of the wind and rain, or by a combination of these elements. The disturbance of the foam allowed the highly volatile fumes of the spilled aviation gasoline to escape from under the layer of foam and to be ignited.

The areas where the fuselage could be safely cut with a saw were not marked and the firemen did not know where they could saw without hazard. Since steel bolts are commonly used to connect the sections of the fuselage at manufacturing splices, rescue personnel should be aware of areas where saws can be used without encountering ferrous fasteners.

2.1.2 Inadequate Overhaul Procedures

The FAA certificated overhaul facility contracted by the carrier to perform the required maintenance on the Curtiss-Wright electric propellers did not have a current or complete overhaul manual. Although the Federal Air Regulations permit a carrier to contract for maintenance work, they do not relieve the carrier of the responsibility for the airworthiness of his aircraft. The regulations make it incumbent upon the carrier to insure that a contractor is using current manuals, equipment, and procedures when performing maintenance work for the carrier.

The carrier, in this instance, did have the current manuals in its library; however, they had not inspected and assured the adequacy of their contractor's library or procedures. The overhaul facility was under surveillance of FAA inspectors. The lack of proper manuals and the use of improper procedures in overhauling the propeller was not detected by these inspectors.

The Safety Board believes that a review of applicable maintenance manuals and procedures for older aircraft and

their subsystems must be more rigorously pursued by FAA approved repair stations and certificate holders, particularly when maintenance personnel do not have the opportunity to stay familiar with equipment or procedures.

2.2 Conclusions

(a) Findings

1. The aircraft was not airworthy at takeoff because of a fatigue crack in the No. 1 blade of the No. 3 propeller.
2. The fatigue crack was underneath the deicer boot and was not detected because the overhaul facility that inspected the propeller did not remove the deicer boot before performing a magnetic particle inspection.
3. The propeller inspection was not conducted in accordance with the propeller manufacturer's published criteria. The inspection facility did not have the manufacturer's current inspection publications.
4. Neither the carrier nor the FAA detected the lack of current inspection publications in the repair facility.
5. The No. 1 blade of the No. 3 propeller failed just after takeoff and the loss of the blade caused an imbalance that caused separation, almost instantly, of the No. 3 engine from the aircraft.
6. The No. 1 blade of the No. 3 engine penetrated the lower fuselage of the aircraft and penetrated the lower inboard side of the No. 2 engine.
7. As the blade passed through the fuselage, it severed pneumatic, hydraulic, and emergency airbrake lines as well as the electrical wiring for propeller controls and some engine instruments.
8. The flightcrew was not aware of the cause of this damage or that the No. 2 engine had been damaged.
9. The pilot attempted an emergency landing at Hollywood-Burbank Airport.
10. The pilot took off again after he found that he could not reverse the propellers and he had neither normal nor emergency airbrakes, and could not stop in the runway.
11. The pilot elected to divert to Van Nuys Airport where a longer clear runway was available.
12. The No. 2 engine failed en route to Van Nuys from damage caused by the propeller blade from the No. 3 engine.
13. The pilots could not feather the No. 2 propeller and the propeller stayed at a fixed-blade angle which created an additional drag component on the aircraft.

14. During the diversion to Van Nuys, the landing gears remained extended due to a loss of hydraulic system pressure and fluid through the severed hydraulic lines made by the propeller blade from the No. 3 engine. The crew did not know that the gear was extended and created additional unexpected drag on the aircraft.
15. The drag created by the flat-plate area of the No. 3 engine nacelle, the windmilling No. 2 propeller, and the extended landing gear was more than the power from two operating engines could overcome.
16. The pilot attempted to land on a golf course about 1 mile short of runway 34L at the Van Nuys Airport when they determined that they could not stay airborne.
17. The aircraft was destroyed and the flightcrew killed by impact.
18. A fire occurred about 20 minutes after the accident when a carbide saw blade struck a steel bolt in the aircraft structure igniting fuel during an attempt to remove the flightcrew from the wreckage.

(b) Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the degraded performance of the aircraft after two engines failed. The dual failure was precipitated by the in-flight failure of the No. 1 blade of the No. 3 propeller assembly. The failure of the propeller blade resulted from a fatigue crack which originated in the leading edge under the deicer boot. The crack had not been detected during an improperly performed-overhaul.

3.RECOMMENDATIONS

As a result of this accident, the National Transportation Safety Board recommended on June 3, 1976, that the Federal Aviation Administration:

Review the overhaul manuals for all metal propeller blades that are sheath equipped and insure that the manuals require that the surfaces of these blades beneath the sheaths be inspected either by removal of the sheath or by an alternate method which will detect cracks underneath the sheath. (Class 1--Urgent Followup.) (A-76-77)

Remind 14 CFR 121 certificate holders of their responsibility for insuring the adequacy of maintenance of their aircraft and components, even if the maintenance is contracted to outside repair stations. (Class 1--Urgent Followup.) (A-76-78).

Review FAA surveillance procedures for certificated repair stations to insure that they are adequate and that all repair stations maintain and use complete and current maintenance manuals. (Class II--Priority Followup.) (A-76-79.)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

WEBSTER B. TODD, JR.
Chairman

KAY BAILEY
Vice Chairman

FRANCIS H. McADAMS
Member

PHILIP A. HOGUE
Member

WILLIAM R. HALEY, Member, did not participate in the adoption of this report.

August 18, 1976.

APPENDIX A INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was notified of the accident at 1430 e.s.t., February 8, 1976.

Working groups were established for operations/air traffic control, witnesses, human factors, powerplants/structures/maintenance records, systems, and cockpit voice recorder.

Parties to the investigation were: Mercer Airlines, Inc.; Federal Aviation Administration; Pratt and Whitney Aircraft Division-United Technologies Corporation; and Curtiss-Wright Corporation.

The Los Angeles County Coroner's Office, Los Angeles Police Department, and the Los Angeles City Fire Department assisted the Safety Board during the investigation.

2. Hearing

No hearing was held.

Appendix B Crew Information

Captain James R. Seccombe

Captain James R. Seccombe, 38, was employed by Mercer Airlines on October 1, 1967. He held ATP Certificate No. 1430499 issued on November 5, 1958, and was type rated on the DC-6 on April 23, 1970. He was assigned and qualified as a captain on April 24, 1970. He completed his last proficiency check on October 27, 1975, and his last line check on November 28, 1975. Captain Seccombe's most recent first-class medical certificate was issued on August 4, 1975, with the limitation that. "Holder shall wear correcting glasses while exercising the privileges of his airman certificate."

Captain Seccombe had flown 20.8 hours during February and 45.1, 104.8, and 136.3 flight-hours in the last 30, 60,

and 90 days, respectively. He had a total of approximately 10,558 flight-hours.

First Officer Jack R. Finger

First Officer Jack R. Finger, 55, was employed by Mercer Airlines on February 9, 1969. He held ATP Certificate No. 260308 issued on September 15, 1961, and was assigned and qualified as a second-in-command on the DC-6 on August 6, 1973. He completed his last proficiency check on October 25, 1975. First Officer Finger's most recent first-class medical certificate was issued on December 9, 1975, with the limitation that "Holder shall wear correcting glasses for near and far vision while exercising the privileges of his airman certificate.

First Officer Finger had flown 3.0 hours during February and 18.9, 59.8, and 67.8 flight-hours in the last 30, 60, and 90 days, respectively. He had a total of approximately 6,600 flight-hours.

Flight Engineer Arthur M. Bankers

Flight Engineer Arthur M. Bankers, 53, was employed by Mercer Airlines on June 30, 1975. He held Flight Engineer Certificate No. 1344191, issued on June 22, 1956, and was assigned and qualified as a DC-6 Flight Engineer on June 30, 1975. He completed his last flight check on November 6, 1975. Flight Engineer Bankers most recent second-class medical certificate was issued on June 23, 1975, with the limitation that "Holder shall wear correcting glasses while exercising the privileges of his airman certificate."

Flight Engineer Bankers had flown 9.1 hours during February and 42.9, 65.9, and 91.4 flight-hours in the last 30, 60, and 90 days, respectively. He had a total of approximately 9,680 flight-hours.

Appendix C Aircraft Information

N901MA, a Douglas DC-6/YC-112A, serial No. 36326, was manufactured on February 11, 1946, under Army Air Corps Serial No. 45-873. It was manufactured under a military contract as a prototype aircraft for the U.S. Army Air Corps. It was later given to the Civil Aeronautics Administration, which used it exclusively as a ground trainer at the Aeronautical Canter, Oklahoma City, Oklahoma. It was subsequently sold at auction as surplus property to Conners Airlines, Inc., of Miami, Florida.

Up to this time the aircraft had never been registered under civil certification. Conners Airlines modified the aircraft and it was certificated in the transport category by the addition of Note 9 to the Federal Aviation Agency Aircraft Specification No. A-781. The aircraft was certificated on August 20, 1956. It was operated by Conners Airlines and later by several other operators under U.S., Ecuadorian, Spanish, and Canadian registrations until it was acquired by Mercer Airlines in 1967.

N901MA was powered by four Pratt and Whitney R2800 engines. Each engine was equipped with Curtiss-Wright electric propellers, type C632-S.

Engine and propeller data were as follows:

Engine Fosition	Engine Type	Serial No.	Time Since Overhaul (Hrs.)	Date Installed
1	R2800 -83AMS	P-51683	191.8	06-24-75
2	R2800 -83AM3	P-27257	1,807.4	10-08-74
3	R2800 -83AM3	P-52263	478.4	07-10-74
4	R2800 -CA18/CA15	P-27995	1,109.3	07-12-74

[1]Engine modified from R2800 - 83AMU-AD on August 9, 1974.

[2]TSO prorated from 2,340 hours to 1,063 on January 26, 1970, total TSO without prorating -- 3,084.4.

Propeller Position	Hub Design	Serial No.	Time Since Overhaul (Hrs.)	Date Installed
1	C632-S	153729	828	06-24-75
2	C632-S-256	156178	154.6	08-08-75
3	C632-S	153465	85	11-18-75
4	C632-S	153709	507	06-25-75

Appendix D Partial Transript of Cockpit Voice Recorder

TAKEN FROM THE

MERCER AIRLINES DOUGLAS DC-6, N901MA

VAN NUYS, CALIFORNIA

— — FEBRUARY 8, 1976

FROM 1834:35 TO 1844:37 G.M.T.

(1034:55-1044:37 P.s.t.)

LEGEND

CAM	Cockpit area microphone voice or sound source
RDO	Radio transmission from Mercer Airways DC-6
-1	Voice identified as Captain
-2	Voice identified as First Officer
-3	Voice identified as Flight Engineer
-4	Cabin Attendant
-?	Voice unidentified
UNK	Unknown
*	Unintelligible word
#	Nonpertinent word
%	Break in continuity
()	Questionable text
(())	Editorial insertion
---	Pause
LP	Light airplane call sign unknown
BG	Burbank ground control
BT	Burbank Tower
VNT	Van Nuys Tower

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTEI
		1834:55	
		BT	Niner zer
		RDO-2	Niner zer
		1835:00	
		BT	Can you on final f
		RDO-2	Okay, no
1835:16			
CAM-1	All right, hold items		((Extrane
CAM-3	Mixtures rich, cowls in track, (transponder forty-seven four four) barometeric checked		
1835:32			
CAM-3	Look at that warning light on number three		
1835:40			
CAM-2	V-one		
1835:45			
CAM-2	V-two		
1835:48			
CAM-1	Gear up		
CAM-2	Gear up		
1035:54			
CAM-1	Flaps up		
1835:55			
CAM	((Sound of explosion))		

CAM-1	Uh oh		
CAM-1	What was that?		
CAM-3	Number three engine		
CAM-1	Huh?		
CAM-2	Number two engine, number three rather, number three. Feather number three		
CAM-3	We just lost the oil pressure		
		1836:03	
		BT	PSA four four five
		PSA-451	Four fifty
		1836:09	
		RDO-2	Niner zer zero one may we r an emerg we lost a
		BT	Sir, you'r around, c
1836:12			
CAM-1	I want seven		
CAM-1	I want --- I want seven, Jack		
CAM-1	How does it look?		
CAM-2	We lost the engine, the engine's off, it's gone		
CAM-1	Beautiful		
CAM-1	Are we still flying?		
CAM-2	Yeah, let's go land		

CAM-2	I got --- I'll put the gear down when you call for it		
		1836:21	
		RDO-2	Nine oh c
		BT	Nine oh c of trash a
1836:38			
CAM-1	Where are the flaps?		
CAM-2	The flaps are up		
CAM-2	I'll hold the flaps up until you get around there		
CAM-1	All right		
CAM-?	All right ** ((sounds like emergency checklist being read in the background))		
CAM-1	Better pull the #		
		1836:51	
		RDO-2	Niner zer please
		1836:55	
		BT	Yes sir, i there's de debris on
		1836:59	
		RDO-2	Roger, u section, r
1837:00			
CAM-2	You got debris on the intersection		
CAM-1	What?		

CAM-2	The engine is off now, it's laying there on the # runway. It's in the intersection		
CAM-1	I guess that makes us go to Van Nuys		
		1837:08	
		PSA-451	Would y
		BT	Yessir I t now, plea
		PSA-451	Roger
		RDO-2	Niner zer can land to have t
1837:14			
CAM-2	Well, I don't know		
		1837:21	
		BT	Uh, nine landing o might, uh section b
		1837:29	
		RDO-2	Okay, nir
1837:30			
CAM-1	Pull back to meto power, I don't want to blow this # up		
CAM-1	Of course we're already on the edge. We're still flying. # it		
1837:39			
CAM-1	Put that on --- whoop		
CAM-3	Number two --- prop		
CAM-1	What's that?		

CAM-1	What's the problem?
CAM-3	Number two is in --- shows in reverse
1837:47	
CAM-1	It does?
CAM-3	It's got a reverse light
CAM-2	But we're flying
CAM-2	We're flying so # it
CAM-1	How does it look, Jack, I can't see
CAM-2	Pretty good, bring it around. Bring it right on around. Can you see the runway?
CAM-1	No
CAM-2	See the runway?
CAM-1	I got it
CAM-2	All right
CAM-3	Look at that number three fuel tank
CAM-2	Do you want the gear?
1838:05	
CAM-1	Right now
CAM-2	Okay, gear coming down
CAM-1	Listen we're going to reverse the outboards only. Hope the # gear comes down all right
CAM-2	There it is
CAM-1	Flaps twenty. Make them --- yeah, just twenty, right now, okay?
1838:26	
CAM-1	All right give me, uh, flaps full

CAM-2	Flaps full
CAM-1	Manifold, uh, two five, all right?
CAM-1	Speeds, Jack
CAM-2	One forty-five, one forty-five. Slow down quite a bit
1838:41	
CAM-1	Manifold two five
CAM-2	Not too high * * ((simultaneous with "manifold two five" above))
CAM-3	I can't read --- I can't read manifold pressure
CAM-1	All right
CAM-2	One forty five
1838:47	
CAM-1	Hey, the manifold's gone all the way across the # board
CAM-3	Yeah, you're right
CAM-2	Yeah I know
CAM-1	Speeds Jack
CAM-2	* okay
1838:53	
CAM-2	One twenty, one twenty
1838:56	
CAM-2	One fifteen, you're all right
CAM-2	Got it made. One fifteen, one ten
1839:00	
CAM-2	You're on the ground

1839:04	
CAM-1	Flaps up. Gate
CAM	((Sound of engines))
1839:06	
CAM-2	(Run aways) you're not --- pull them out of there. You're going to have to use brakes --- she won't go into reverse
CAM-3	* ((simultaneous with above)) brakes
1839:14	
CAM-1	Nothings happened!
CAM-2	Get your air --- get your air ((simultaneous with "nothings happend" above))
1839:15	
CAM-1	I'm doing it!
1839:17	
CAM-2	Okay, get the # out of here!
1839:18	
CAM-1	Move! Move! Move!
CAM	((Sound of power coming in))
CAM-3	Let's get the # out of here!
CAM-1	All right! Flaps thirty! Flaps twenty!
1839:20	
CAM	((Sound of takeoff warning horn))
1839:20	
CAM-2	Flaps are up! Flaps are up!
1839:32	

CAM-1	Gear up!		
1839:33			
CAM-2	Gear up!		
		1839:34	
		RDO-2	Nine zero no brakes
1839:35			
CAM-1	Max power! Come on! Get it in there!		
CAM-3	That's as much as we can get		
1839:42			
CAM-1	We got no # anything!		
CAM-3	Nope		
1839:44			
CAM-1	I want Van Nuys Airport		
CAM-1	Is the gear up?		
CAM-3	The gear is up		
CAM-1	Get the flaps up		
CAM-3	We don't have any. We have nothing		
		1839:47	
		RDO-2	Niner zer Van Nuy Van Nuy
		1839:51	
		BT	Roger, u
1839:59			
CAM-1	Aw, #		

CAM-3	Well, we've got (a good pair of engines)		
		1840:14	
		RDO-2	Niner zer latest Va
1840:15			
CAM-1	No reverse		
1840:17			
CAM-3	No nothing. Electrical went out (on the runway)		
		1840:20	
		BT	Wait --- a you in a r Airport fi VFR and here in ju
		1840:27	
		RDO-2	Okay wo coming a there, ple
		1840:32	
		BT	Right -- v
		RDO-2	All right,
1840:35			
CAM-3	Got no # oil pressure on number two engine		
CAM-1	What?		
CAM-3	No oil pressure on number two		
1840:41			
CAM-1	No BMEP either		
CAM-1	We're going to lose that #!		

CAM-2	You want to try one five? we can get it ---		
CAM-1	I don't know how we'll make it, Jack		
1840:54			
CAM-1	I want three four in --- ah where the # am I? I want three four. No, no, no, no! Three four at Van Nuys!		
		1841:03	
		RDO-2	Niner zer at Van N
		1841:06	
		BT	All right, six zero a
		1841:11	
		RDO-2	Roger, ze
1841:16			
CAM-1	Where is everything?		
CAM-3	You've still got max RPM on this thing		
1841:22			
CAM-1	Pull it back! Little bit, pull it back some		
CAM-3	Number four is clear, number two prop is (beginning to decay)		
CAM-1	What?		
CAM-3	Number two prop *ast; *ast;		
CAM-1	Are we losing RPM?		
CAM-3	Yeah		
1841:36			
CAM-1	We're losing power on it, too		

CAM-3	Yeah		
CAM-1	Give me max power. Where in the # are we?		
CAM-2	We're not too far away		
CAM-1	All right		
CAM-2	Keep it in the air --- keep it in the air		
CAM-3	Did it stop rotating out there?		
Yeah			
		1841:45	
		BT	Their fre niner poi
		1841:47	
		RDO-2	One one
1841:49			
CAM-1	Speeds up. You better feather it		
CAM-1	It's not feathering, #!		
		1841:52	
		BT	They knc
			((Extrane
		1842:04	
		RDO-2	Mercer n we're en hanging i
		1842:16	
		VNT	Mercer n side of th report do degrees a zero

1842:17			
CAM-1	Retract them! Retract them!		
CAM-1	How much power?		
		1842:25	
		RDO-2	We're no we're goi
		VNT	(Cessna r
		VNT	Cessna se stop this
1842:39			
CAM-3	You got max power		
CAM-2	You got a hundred and twenty knots		
CAM-2	We may end bellying this thing on that runway there		
		1842:43	
		VNT	Cessna C a possibl
		CCC	Charlie C --- what's
		1842:51	
		VNT	Ah it's a l going to engine pr sight yet. close eno around
1842:56			
CAM-1	I don't want to change frequencies, Jack, Just get us on the # ground at Van Ruyu		
		1843:10	

		RDO-2	This is ni the frequ emergenc are just b
		RDO-2	Niner zer airport fr and we'll four, lanc about all
		1843:22	
		VNT	Runway on runwa
		1843:29	
		RDO-2	Roger an present ti time, nin
		VNT	Cessna C have to g traffic ag
1843:37		1843:37	
CAM-2	Don't get any lower -- don't get any lower Jim	CCC	Charlie C
		VNT	(Cheroke full stop
		VNT	(Cheroke
		VNT	Cessna
1843:45			
CAM-1	We got no windshield wipers, Jack		
CAM-2	Yeah, I know		
CAM-3	That's because the hydraulic nyntom is out		
CAM-2	Bring it on around --- bring it on around		
CAM-?	* * we're instruments		

1843:59			
CAM-1	I'm losing speed		
CAM-2	Okay, I don't know, I would say go ahead and set the # thing on the golf course		
CAM-3	Me, too		
CAM-?	I don't know whether we can make that or not		
1844:10			
CAM-1	Jack, I'm too far for that!		
1844:16			
CAM-2	I'd just pull the # thing off right here --- the runway's too far, we're crashing here on the field ---		
CAM	((Sound of warning horn))		
		1844:20	
		RDO-2	We're cra crashing setting he
1844:23			
CAM-2	Keep the wing up! Keep the wing up! Set her down		
		1844:26	
		C21	Van Nuy six zero
1844:27			
CAM	((Horn stops))		
1844:28			
CAM	((Initial sound of impact))		
CAM-1	Gear		

1844:36	
CAM	((Sound of second impact))
CAM-?	* *
1844:37	
CAM	((Sound of third impact))
	End of Tape

[1] All times are Pacific standard time based on the 24-hour clock.

[2] Maximum except takeoff.

[3] Throttle position to place the propellers in reverse pitch.

[4] Brake mean effective pressure--an engine operating indication.

[5] The type of carbide saw used to cut the fuselage had been tested and used by the LACFD for many years. It reportedly did not create sparks unless it contacted ferrous metal during cutting operations.