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NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

**UNITED AIRLINES FLIGHT 2885,
N8053U, McDONNELL DOUGLAS DC-8-54F
DETROIT, MICHIGAN
JANUARY 11, 1983**

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16. Abstract On January 11, 1983, United Airlines Flight 2885, a McDonnell Douglas DC-8-54F, N8053U, was being operated as a regularly scheduled cargo flight from Cleveland, Ohio, to Los Angeles, California, with an en route stop at Detroit, Michigan. United 2885 departed Cleveland at 0115 and arrived at the Detroit Metropolitan Wayne County Airport at 0152, where cargo for Detroit was unloaded, the airplane was refueled, and cargo for Los Angeles was loaded. At 0249:58, United 2885 called for clearance onto runway 21R and was cleared for takeoff at 0250:03. Visual meteorological conditions prevailed at the time, and the company had filed and been cleared for a standard IFR flight plan.

According to witnesses, the takeoff roll was normal, and the airplane rotated to takeoff attitude one-half to two-thirds of the way down runway 21R. After liftoff, the airplane's pitch attitude steepened abnormally, and it climbed to about 1,000 feet above ground level. The airplane then rolled to the right and descended rapidly to the ground. An explosion and fireball occurred at impact The airplane was destroyed by impact and by the postimpact fire. The flightcrew, consisting of the captain, the first officer, and the second officer, were killed.

The National Transportation Safety Board determines that the probable cause of the accident was the flightcrew's failure to follow procedural checklist requirements and to detect and correct a mistrimmed stabilizer before the airplane became uncontrollable. Contributing to the accident was the captain's allowing the second officer, who was not qualified to act as a pilot, to occupy the seat of the first officer and to conduct the takeoff.

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SYNOPSIS

On January 11, 1983, United Airlines Flight 2885, a McDonnell Douglas DC-8-54F, N8053U, was being operated as a regularly scheduled cargo flight from Cleveland, Ohio, to Los Angeles, California, with an en route stop at Detroit, Michigan. United 2385 departed Cleveland at 0115 and arrived at the Detroit Metropolitan Wayne County Airport at 0152, where cargo for Detroit was unloaded, the airplane was refueled, and cargo for Los Angeles was loaded. At 0249:58, United 2885 called for clearance onto runway 21R and was cleared for takeoff at 0250:03. Visual meteorological conditions prevailed at the time, and the company had filed and been cleared for a standard IFR flight plan.

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1. FACTUAL INFORMATION

1.1 History of the Flight

On January 10, 1983, a McDonnell Douglas DC-8-54F, N8053U, was being operated by United Airlines, Inc., (UAL), as a regularly scheduled domestic cargo flight under 14 CFR 121. The flight departed O'Hare International Airport, Chicago, Illinois, as United Airlines Flight 2894 (United 2894) on schedule at 2215 central standard time, destined for Cleveland, Ohio. The en route portion of the flight was uneventful, and United 2984 arrived at Cleveland at 0009 1/ eastern standard time. At Cleveland, the

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1/ All times are eastern standard time based on the 24-hour clock unless otherwise noted.

flight number was changed to United Airlines might 2885 (United 2885) for the regularly scheduled cargo flight from Cleveland to Los Angeles, California, with an intermediate *stop* at Detroit, Michigan. United 2885 departed Cleveland at 0115, arrived at the Detroit Metropolitan Wayne County Airport at 0152, and taxied to the UAL freight terminal on the northwest side of the airport. *Cargo* for Detroit was unloaded, the airplane was refueled, and cargo for Los Angeles was loaded. Jncluded in the cargo was a shipment of Special Form Americium 241 in the form of solid metal pellets. UAL freight handling personnel reported that the turnaround went smoothly; however, one cargo "igloo" was inadvertently not loaded on the airplane (see 1.6.1 Weight and Balance). The freight handling personnel also indicated that they observed the second officer inspecting the exterior of the airplane after the refueling was completed.,

The flightcrew of United 2885 called Detroit Clearance Delivery at 0231:26 for air treffic control clearance to Los Angeles, stating that they had received Automatic Terminal Information Service (ATIS) message Foxtrot. United 2885 had filed a standard IFR flight plan and was cleared as filed. According to the cockpit voice recorder (CVR), the flightcrew completed the before engine start checklist, started the engines, and then called for taxi instructions at 0245:58. During the taxi, the flightcrew accomplished the before takeoff checklist, and at 0248:42, the second officer called "trim" and the first officer responded "set." 2/ According to the CVR, beginning at 0249:16, the captain, the first officer, and the second officer discussed the idea of the first officer switching seats with the second officer. According to the CVR, the fiit officer and the second officer Sad completed switching *seats* about 0249:40, 24 seconds later. (See appendix E.) United 2885 called for clearance onto runway 21R at 0249:58 and was cleared for takeoff at 0250:03. The before takeoff checklist was completed, and the second officer, now seated in the right pilot seat, called for the "flight recorder," and the first officer, now' seated at the engineer's panel, responded lights out," indicating that the flight data recorder was turned on. The CVR indicated that the throttles were advanced for takeoff at 0251:05 and that power stabilized 7 seconds later. The CVR also showed that "eighty knots" and "Vee One" were called by the captain and that the airplane broke ground about 0251:41.

Twenty-five persons were interviewed and it was determined that 16 had actually seen or heard the airplane. (See figure 1.) Most of the witnesses indicated that the takeoff appeared normal to rotation and that the airplane rotated approximately one-half to two-thirds of the way down the runway near the intersection of runway 21R and runway 9-27 to a normal or fairly nose-high attitude. Several witnesses reported normal engine noise and one reported that the noise of the engines was at a lower pitch than normal. One witness reported hearing a strange engine sound, which he described as sounding like an F-15 going into afterburner. Most witnesses indicated that the aircraft broke ground witheut dragging the tail skid, that the angle of ascent was abnormally steep, and that tine airplane climbed rapidly.

According to the witnesses, approximately 5 seconds after the takeoff and as the airplane was climbing, flames could be seen behind the engines on both wings. Witnesses described the flames variously as coming from one, two, or three of the engines; as coming in two short bursts and then ceasing; as looking like "sparks;" and as looking like a "fireworks show which lit up the sky." According to most witnesses, the airplane continued to climb with wings level to about 1,000 feet. The airplane then rolled to the right in a gradual right turn until it was in a wings vertical position (right wing down, left wing up). One witness, who was located 1 mile east of the takeoff point, thought the angle of ascent was normal *and* that the airplane banked *to* the right *about* 30° from the

2/ The checklist response is "3 set" which refers to aileron, rudder, and elevator trim settings.

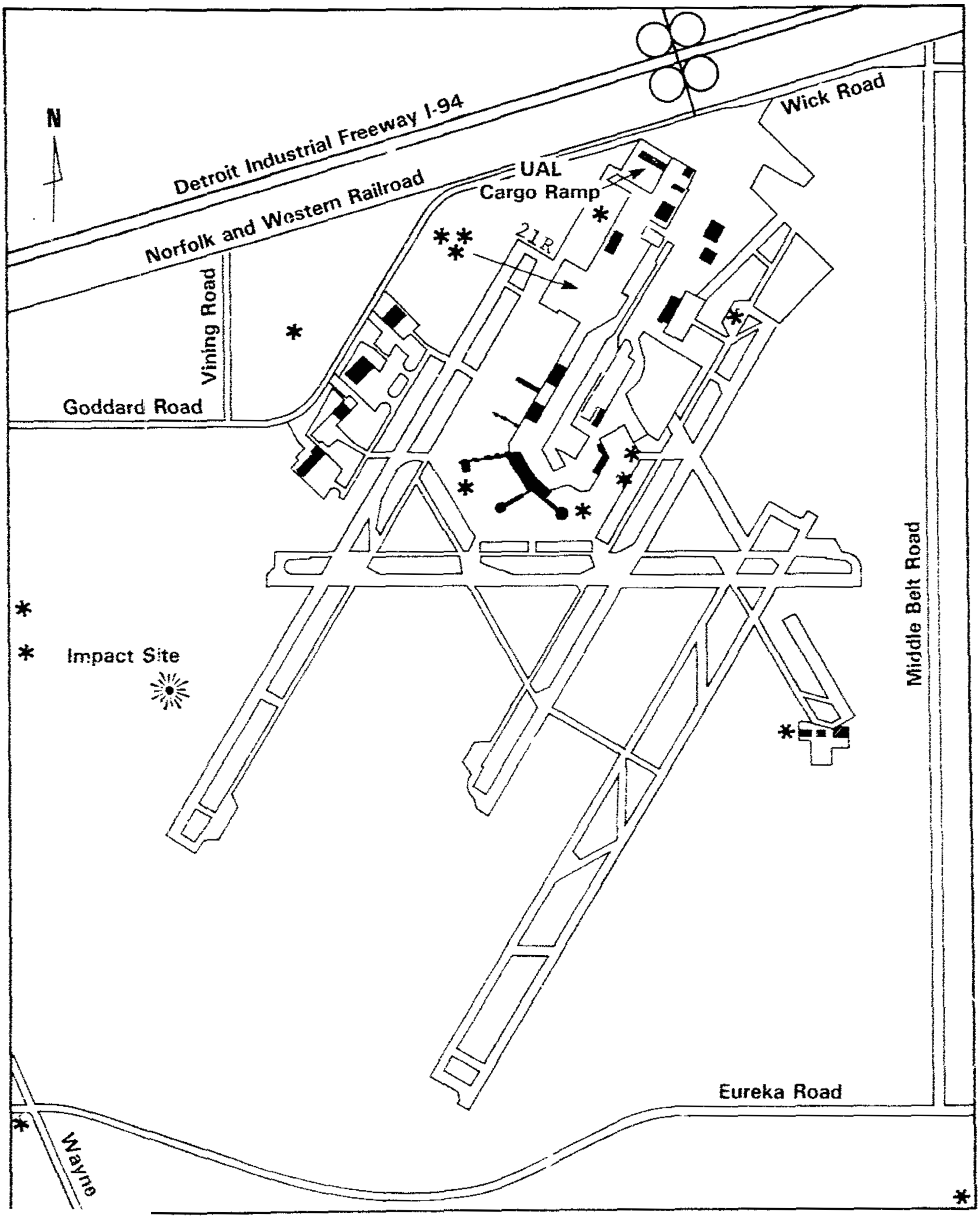


Figure 1.--Detroit Metropolitan Wayne County Airport runway/terminal layout, accident site, and witness locations.

horizontal and never increased above that angle. Another witness, who was located 1,000 feet beyond the end of runway 21R, stated that the airplane started a sharp right turn at 300 to 500 feet. Most witnesses could not recall the attitude of the airplane from the time it reached the wings vertical position until it crashed, and simply said that the airplane "dropped from the sky" at that point. Two witnesses who had head-on views reported that the airplane came back to a wings horizontal (nose slightly down) attitude from the wings vertical attitude just before the crash. When queried about whether they could have been looking at the airplane in an inverted horizontal position at this point, these two witnesses said they were not positive. They could not recall the position of any of the airplane's external lights when it was in the horizontal position. All of the witnesses stated they saw an explosion which was followed by a fireball and intense ground fire.

The accident occurred about 0252:11 during hours of darkness at 42° 13' N latitude and 083° 22' W longitude.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Other	Total
Fatal	3	0	0	3
Serious	0	0	0	0
Minor/None	0	0	0	0
Total	3	0	0	3

13 Damage to Airplane

The airplane was destroyed by impact forces and postcrash fire.

14 Other Damage

There was impact damage to a farmfield. In addition, about 1 acre of the field was contaminated by debris and fuel

1.5 Personnel Information

The crewmembers were properly certified and qualified for their respective assigned positions for the flight (see appendix B). There were no flight attendants on board the airplane.

The captain resided in Seattle, Washington, On January 9, 1983, he "deadheaded" to Chicago on UAL Flight 150 and arrived at 1910 c.s.t. He spent the night at his son's home and was in bed by 2200 c.s.t. The following morning the captain took his son to work and conducted personal business That evening, the captain and his son went to a basketball game involving the captain's daughter. The captain arrived at O'Hare International Airport about 2100 c.s.t. His son reported that his father was in good spirits

The first officer resided in Henderson, Nevada. He did not travel as scheduled on January 10, 1983, but "deadheaded" from Las Vegas, Nevada, on UAL Flight 218 at 1340 P.s.t and arrived in Chicago at 1900 c.s.t, about 3 hours 15 minutes before takeoff. The first officer reportedly had retired about 2100 P.s.t. on January 9, 1983.

The second officer resided in Westlake Village, California On January 10, 1983, he "deadheaded" as scheduled from Los Angeles on UAL Flight 118 and checked into the layover hotel at 0645 c.s.t. on January 10, 1983. He was observed at UAL's O'Hare Dispatch office around 2100 c.s.t., and the dispatchers stated that he appeared alert and rested.

The second officer entered DC-8 first officer upgrade training in June 1979. Simulator training began July 1, 1979, and continued through August 6, 1979, during which he received 41 hours as pilot at the controls. Instructor comments on his training records included: "scan very weak; procedural knowledge poor; tendency to overcontrol on takeoffs and landings; heading, altitude, and airspeed control poor." On July 7, 1979, the instructor commented, "Takeoff - pulled up into stick shaker and over-controlled. . . ." On August 6, 1979, instructor comments included, "Inconsistent bank in steep turns weak scan, stall series need(s) more work (Unsure of recovery speeds and getting secondary stall). . .Still basic flaws in scan pattern (inadvertent 45° - 50° bank)." On August 8, 1979, after the second officer had completed 19 simulator training periods, his training was terminated, as it was considered doubtful that he could successfully complete the DC-8 first officer upgrading course.

The second officer reverted to his former duties on the DC-8 and performed satisfactorily. He was precluded from bidding for any first officer vacancies for 6 months, because of his inability to complete the first officer upgrade course. He was also restricted to bidding B-737 or B-727 equipment. On February 27, 1980, he entered first officer training in the B-737. He successfully completed this upgrade training in March 1980; however, his training records indicated that extended training time was required because of ". . .inconsistency in maneuvers due to getting behind in planning and attitude instrument flying." As a result of his initial line check, he was scheduled for additional trips with a flight manager safety pilot. On May 3, 1980, he was released to line flying but was placed in an accelerated check program. En route proficiency checks on July 8 and 15, 1980, were satisfactory, and check pilot comments concerning his improvement and anticipated progress were included, e.g., ". . .been on the B-737 for three months, but is developing into a very smooth pilot." Following an unacceptable approach, go around, and hard landing, the check airman commented, "From this point on en route (check) . . .showed rapid improvement." Similarly, on February 10, 1981, the check airman commented, "Flying technique has improved greatly." On March 18, 1981, the check airman again commented on slow scan, excessive control inputs, and power changes and assigned him to a training captain in April During this period, a flight proficiency program was established for him which included special scan training at Denver and special en route proficiency, with line checks through September 1981. On April 29, 1981, he failed to pass an en route check and was removed from line flying. The check airman cited "2-dot" deviations on the ILS localizer and glide slope (the captain completed approach) and a tight base with a high sink rate during a visual approach. He summarized, ". . .attitude could not be better and he is a hard worker, however, he has not made normal progress in his first full (year) as first officer. His command ability is below (average) and has exhibited poor operational judgement both IFR and VFR."

The second officer entered special B-737 training on May 8, 1981, but after 6:15 hours of simulator time, he received an unsatisfactory proficiency check. The instructor commented that, "repeated a back course ILS and holding patterns for satisfactory performance, but after two repeats, engine failure on takeoff still was unsatisfactory. . . .was late retracting the gear, and his directional control was weak because of over and under control with the rudder." As a result of an informal meeting with UAL training staff, the B-737 Fleet Manager in San Francisco confirmed in writing that, "In view of the continuing problems in reaching the desired level of pilot proficiency, you have voluntarily agreed, in writing, to forego bidding any future pilot vacancies on United Airlines and remain in second officer status for the balance of your flying career." On May 17, 1981, he was assigned to a DC-8 second officer requalification class and his performance at these duties was satisfactory.

1.6 Aircraft Information

The airplane, a McDonnell Douglas DC-8-54F, N8053U, was owned and operated by United Airlines, Inc. (See appendix C.) The DC-8-54F is a freighter airplane, used solely for cargo. The passenger area is divided into 14 compartments or "pits" numbered consecutively front to back. Pit No. 1 is forward of the cargo door, pit No. 2 is opposite the cargo door and normally is not used, pits Nos. 3 through 13 extend toward the rear of the cabin, and pit No. 14 is not used for cargo.

1.6.1 Weight and Balance

The captain received a dispatch release for United 2894/10 (Chicago-Cleveland) and United 2885/11 (Cleveland-Detroit-Los Angeles) at Chicago, with no maintenance deferred items. The flight proceeded without incident to Detroit, where a revised flight plan to Los Angeles was issued. The revised release increased the fuel load for the Detroit-Los Angeles leg from 54,700 to 56,500 pounds because of anticipated additional cargo and its effect on performance.

Tne airplane was refueled with 931 gallons of Jet-A kerosene, 108 gallons more than requested, which is within refueling standards that are based on total airplane fuel load. Consequently, the fuel aboard was about 731 pounds more than planned prior to taxi. The planned taxi burn was 400 pounds.

Further, a discrepancy in the loading computations resulted from a misunderstanding between the UAL loading supervisor and the loading transporter operator at the UAL freight terminal in Detroit. The supervisor advised the operator to get the "igloo" from line No. 3 3/ as the last load for the airplane. The operator misinterpreted the supervisor's instructions. At the time the instructions were given, the operator was transporting an "igloo" for pit No. 3 of the airplane and believed that to be the igloo to which the supervisor was referring. The "igloo" on line No. 3 was never loaded. It contained 3,502 pounds of mail ahich was to have been placed in pit No. 1 (forward-most position in the cabin area). As a result, the crew departed with an erroneous weight and balance. The following computations reflect the difference between the planned and actual loading:

	Planned	Actual
Operating Empty Weight	130,978 pounds	130,978 pounds
Weight Cargo	59,458 "	55,956 "
Fuel	56,500 "	57,230 "
Ramp Weight	246,936 "	244,164 "
Taxi Fuel	-400 "	-400 "
Takeoff Gross Weight	246,536 "	243,754 "
Center of Gravity	29.8%	32.5%

3/ The freight handing area at the Detroit Metropolitan Airport has an assembly array of rollers divided into "lines" on which cargo pallets or "igloos" can be built-up and staged for efficient loading.

Although the structural gross weight limit for the **DC-8-54F** is 318,000 pounds for taxi and **315,000** pounds for takeoff, the controlling weight limitation in this instance was the maximum landing weight at Los Angeles, which was **240,000** pounds Accordingly, based on a fuel burnoff of 46,700, the maximum allowable takeoff gross weight for United 2885 was **286,700.** The allowable center of gravity limits were **16.8** and **34.1** percent MAC.

The second officer prepared the takeoff data card based on the company provided weight and balance data and the current ATIS information. Since the airplane's takeoff **gross** weight was in error, the takeoff data used by the flightcrew were inaccurate. The data card for Flight 2885 was not recovered, but the following is a comparison of planned data and the actual takeoff data which was based on the postaccident determination of weight and center of gravity of the airplane. 4/

	Planned	Actual
Flaps	15°	15°
Center of Gravity	29.8%	32.5%
Stabilizer Setting	**1.9** ANU	**0.2** ANU
V_1 5/	120.5 knots	120 knots
V_R 5/	136	135
V_2 5/	150	**149.5**
Engine Pressure Ratio	1.76 (1.87) 6/	1.76 (1.87)

1.7 Meteorological Information

Based upon the 0100 and 0400 surface weather maps prepared by the National Weather Service, the Detroit area was under the influence of a deep low-pressure system centered over upper Michigan at 0100 and over scuthern Canada north of Lake Huron at 0400. Conditions in the Detroit area were characterized by overcast stratiform clouds and moderate southwesterly winds.

The weather at the time of the accident was as follows:

> Time--0254; type--local; ceiling--measured 1,900 feet overcast; visibility-- 10 miles; temperature--38°F; dewpoint--33°F; wind 220° 10 knots, altimeter--29.56 inHg; remarks--aircraft mishap.

The flightcrew had received ATIS message Foxtrot which was broadcast on 124.55 MHz, beginning at 2345:49:

> Detroit Metro Information Foxtrot, zero four three seven zulu special weather, ceiling measured two thousand eight hundred broke!? eight thousand overcast, visibility one zero, temperature four zero, dew point three three, winds two three zero at one zero, altimeter two niner five seven, ILS approaches to runways two one in use, landing and departing runways two one, advise you have Foxtrot

4/ Based on information received from **Douglas** Aircraft Company, May **12,** 1983.

5/ V1 - Critical engine failure speed, Vr - rotation speed, V2 - takeoff safety speed.

6/ UAL company procedure provides a maximum allowable ***EPR*** setting as well *as* a "normal de-rated" thrust setting (based on fuel and mainteaance considerations) either of which the captain may select on each takeoff.

The current applicable directive for providing ATIS in selected terminal areas is FAA Handbook 7210.3F, dated October 1, 1981, Paragraph 1230, Automatic Terminal Information Service. This directive requires that a new ATIS be made upon receipt of any new official weather report regardless of content change acd reported vaiues. The Detroit terminal facility receives hourly local surface weather observations provided by the National Weather Service.

1.8 Aids to Navigation

Not applicable.

1.9 Communications

There were no known communications difficulties.

1.10 Aerodrome Information

Detroit Metropolitan Wayne Coucty Airport, elevation 639 feet mean sea level (m.s.l.), is located in Romulus, Michigan, 6 miles southwest of Detroit. The airport is certified in accordance with 14 CFR 139, Subpart D.

The landing area consists of four runways--3L/21R, 3C/21C, 3R/21L, and 9/27. Runway 22R is 10,501 feet long, 200 feet wide, and has a grooved, concrete surface. The runway has medium intensity approach lights with runway alignment indicator lights, high intensity runway edge lights, and centerline lights.

The Detroit Metropolitan Airport is serviced by a Terminal Radar Approach Facility (TRACON) and a Air Traffic Control (ATC) Tower. The TRXCON is equipped with an airport surveillance radar. The control tower is equipped with two bright radar indicator tower equipment (BRITE) scopes which allow viewing of radar information under high ambient lighting conditions. The local controller in the tower at the time of United 2885's takeoff stated that at about 0251:48, he noted a target on his BRITE scope over the runway 21R area, indicating 1,200 feet. The Cleveland Air Route Traffic Control Center radar also acquired a target over Detroit runway 21R, indicating 1,100 feet, ai about 0251:48. The airport has an operational Low Level Wind Shear Alert System (LLWSAS); there were no alerts issued before or after the accident.

1.11 Flight Recorders

The airplane was equipped with a Fairchild model 5424 flight data recorder (FDR), Serial No. 6099, and a Sundstrand model V-557 cockpit voice recorder (CVR), Serial No. 2641. The FDR and CVR were located in the tail of the airplane and were not damaged. Both were removed and taken to the Safety Board's Washington, D.C., laboratory for examination and read out.

Examination of the FDR's foil recording medium disclosed that all parameter and binary traces were being recorded apparently in a normal manner prior to the time of United 2885's takeoff. However, examination of the parameter traces for United 2885's takeoff indicated that movement of the foil medium bad slowed to a near stop for about 55-60 seconds beginning approximately 23 seconds after the recorder was turned on. The aircraft was on a magnetic heading of 305° during this 23-second period with changes of ±0.5°. The foil began to move at normal speed again approximately 15 seconds prior to ground impact with no other indications of foil slowdown. The maximum altitude reached was measured to be 1,650 feet m.s.l. or 1,010 feet above the takeoff runway elevation.

Eleven previous flights were recorded on this foil prior to the accident flight, and **all** were examined for evidence of similar slow down of foil movement with negative results.

The recorder, including the foil medium and its magazine, were taken to the manufacturer's facilities in Commerce, California, for further examination on April 6, **1983.** A new foil recording medium was installed in the magazine, which was then connected to an electrical power source but was not connected to any parameter input since the examination was concerned only with timing. The recorder began operating immediately, and the foil could be seen to advance continuously at the proper speed. The recorder was turned upside down for about **1** minute and then upright again for about **1** minute before the foil magazine was removed. When the recorder was first inverted, the binary traces shifted and approximated the appearance of those on the accident foil. The binary trace shift, *an* unusual occurrence, was 0.001 inch, the same as the shift seen in the accident foil traces. During the examinetion, the recorder failed to begin operation twice when electrical power was applied. However, in each case, the timing control and foil began moving after the timing control was tapped.

The FDR readout for United **2885's** landing *at* Detroit indicated that the airplane had maintained a constant rate of descent from about 3,000 feet above ground level (AGL) to touchdown, that the airplane heading on final approach was 220° *to* 214°, and that the final approach speed was about 146 knots.

A transcript of the CVR tape was made which began when United **2885** requested air traffic control clearance at **0231:26** and ended with the sound of impact at **0252:11.4.** The timing on the transcript (see appendix E) was as accurate as could be read on a digital clock.

The CVR transcript showed that the takeoff roll started at 0251:05 and that the airplane broke ground at **0251:41.** The **sound** of a stickshaker 7/ started at **0251:41.2.** There was a second stickshaker sound at **0251:51,** and the captain yelled, "Push forward, push forward" at **025153.**

A CVR sound spectrum analysis was performed to determine as much information relative to the performance of the airplane **as** possible. The signals from the cockpit area microphone (CAM) and radio channels were examined aurelly and electronically. The times of changes in engine RPM, stickshaker occurrences, and sounds similar to engine surges were established within the limitations *of* the equipment **as** follows:

- o Engine acceleration began at 0251:05.2.

- o Engines stabilized at 0251:12.6 at 103 percent RPM, N1, which corresponded to an exhaust pressure ratio (EPR) of **1.81.** All four engines were running about the same RPM. However, slight differences in engine RPM resulted in smearing of the frequency trace, which made exact determination of engine RPM difficult.

- o Fcllowing the initial appiication of thrust, the engine RPM remained essentially stable, about **103** percent, N1, until the end of the second stickshaker sound at 0252:01.2. At this time, the spectrum printout became indistinct. Sounds similar to engine surges could be heard beginning at 0252:06.6 and continuing for approximately 1 second.

7/ An aural warning to notify flightcrew that the airplane is approaching stall.

- The stickshaker could be identified during the following intervals:

  a. **0251:41.2** until **0251:42.8**

  b. **0251:51.0** until **0252:01.2**

  c. **0252:09.2** until **0252:10.4** - It remained off until impact at **0252:11.4.**

1.12 Wreckage and Impact Information

The accident site was a freshly plowed farmfield within the airport boundary. The center of the impact area was located about 1,200 feet west (right) of the centerline and about 8,800 feet from the approach end of runway 21R The wreckage pattern was roughly fan shaped, between 180-300 feet wide and 350 feet deep, from east to west (See appendix D.) Five ground craters, indicating the impact of the airplane5 four engines and nose, were found at the eastern edge of the wreckage site. The impact marks indicated that the airplane struck the ground about 70° - 80° nose down with about 200° right roll. Most of the wreckage was damaged by ground fire.

The largest piece of intact structure was a portion of the aft fuselage with the empennage assembly attached. All cargo tie down fittings (bear traps) had been sheared off in the forward direction. The rear cabin doors (left and right) were found intact, attached, and open. The aft fuselage pressure bulkhead was intact with no evidence of structural or fire damage.

The right and left main landing gear and the nose gear retract mechanisms were damaged indicating that the landing gear was down and locked upon impact. Flap actuators from both the left and right flaps were recovered and were measured and compared with another DC-8F- The actuator piston rod extensions were consistent with 15° trailing edge flap extension. The leading edge slats were destroyed by impact and fire. The flight control tab and geared trim tab were in place and intact on the right elevator and damaged on the left elevator.

The external surface of the aft fuselage skin had marks that indicated the position of the horizontal stablizer's leading edge at impact. The distance from the reference rivet on the Ieft side of the fuselage (forward of the stabilizer) to the center of the impression left by the stabilizer's leading edge was 12.5 inches down. The stabilizer jackscrews, chains, and sprockets on both the left and right sides were intact, continuous, and well lubricated. The power control unit was intact with no evidence of hydraulic fluid leakage. Measurements were taken on the jackscrews in accordance with the United Airlines DC-8 Maintenance Manual. The exposed threads were measured from the drive nut5 upper stop to the upper end of the threads: left jackscrew -- 8-3/4 to 9 threads; right jackscrew -- 9 threads. These measurements corresponded to 7 1/2 units of nose-up horizontal stabilizer trim. 8/ The aft fuselage section was rolled over to examine the lower fuselage structure and the tail skid area. The lower fuselage was undamaged and the blue paint on the tail skid was unmarked.

The rudder and rudder trim tab were intact and attached to the separated section of vertical stabilizer. One spoiler actuator and a portion of another were the only components of the spoiler system that were identified; however, the position of the spoilers at impact could not be determined.

8/ Airplane stabilizer trim is expressed in units as aircraft nose up (ANU) and aircraft nose down (AND).

Several components were removed from the aft fuselage and empennage area and were examined and functionally checked under Safety Board supervision at the United Airlines Maintenance Facility in San Francisco, California. Functional checks were made on the power control unit which was disassembled for inspection. The power control unit hydraulic pump/motor was connected to a hydraulic test stand. Hydraulic pressure was then increased to 3,000 psi and the following noted:

- o No external leakage was observed.
- o Manual operation of the control arms simultaneously forward and aft resulted in rotation of the upper and lower sprockets at the proper rate in both the clockwise and counterclockwise directions. There was no evidence of brake slippage.
- o Operation of the control arms opposite to each other (one forward, one aft) resulted in no rotation of the sprockets.
- o Manual operation of the control arms individually in both directions resulted in no rotation of the sprockets.
- o Internal leakage was checked with the unit pressurized to 300 psi and was found to be within tolerances.
- o All test results were withii specified limits.

The power control unit was removed from the hydraulic test stand and delivered to the UAL electrical shop where electrical power was applied to the motor resulting in the sprockets being driven smoothly at the proper rate and in both directions. Brake operation was normal.

The power control unit was partially disassembled to facilitate examination of the sprocket shear rivets and shaft bearing. The six shear rivets, three upper and three lower, were intact, and the shaft bearing was in good condition. Manual rotation of the gearbox input spline resulted in rotation of the driver sprockets. The gearbox manufacturer's original inspection seal was attached to the gearbox housing.

Jackscrew examinations revealed that they were in good condition with no visual damage noted to the drive sprockets, and the measurements taken on site were verified.

Four component parts of the rudder system were examined and/or functionally checked -- the rudder power actuator, the rudder system shutoff valve, the rudder system pressure reducer, and the rudder trim tab actuator- All components were found to be satisfactory.

Five of the six wing flap actuators were disassembled and inspected. Impact and fire damage precluded functional testing. The elevator position transmitter w— found to oe satisfactory. The right aileron control unit, the right aileron tab lockout cylinder, the right manual reversion unit, and the left aileron control unit were functionally checked and performed satisfactorily. The right spoiler actuator was also functionally checked and performed satisfactorily. Fire and heat damage precluded functional testing of the left spoiler actuator.

The airplane's battery was tested and all cells read at least 1.2 volts, and the battery maintained 24 volts when subjected to a 5-ampere load. The flight data recorder bracket connectors and wiring were examined visually and a continuity check did not reveal any open circuits.

The four Pratt & Whitney JT3D-3B engines were documented at the accident site and removed to the Eastern Air Lines hangar at Detroit Metropolitan Airport for further investigation. All engines incurred severe damage, and internal components displayed rotational damage indicating that they were operating at impact. The No. 2 engine was shipped to the United Airlines Maintenance Facility in San Francisco for a teardown disassembly inspection under Safety Board supervision. The inspection did not reveal any preimpact discrepancies.

1.13 Medical and Pathological Information

All three flightcrew members sustained fatal injuries as a result of the accident. The pathological examinations disclosed no abnormal conditions, and the toxicological tests were negative for alcohol and drugs.

1.14 Fire

The airplane exploded on impact and was subjected to an intense postaccident ground fire.

1.15 Survival Aspects

The accident was not survivable because impact forces exceeded human tolerances.

The Detroit Metropolitan Airport Fire Department responded to a direct crash alarm at 0252. A fireman on duty in the fire station watchtower saw the impact explosion and fire and immediately initiated an alarm switch which was audible in the fire station equipment room and sleeping quarters.

The first fire truck was en route to the scene within 1 minute 18 seconds of the alarm. Seven pieces of equipment, manned by the total complement of the fire station, nine men, responded to the alarm. The vehicles responding were four fire trucks, one pumper, one mini-pumper, and an ambulance. The vehicles proceeded down runway 21R, turned onto a gravel road, and diverted into the plowed field to go directly to the accident site. Three fire trucks became mired in mud and were unable to reach the burning airplane. One fire truck, with 4,000 gallons of water and 515 gallons of AFFF, 9/ had taken a slightly different route and was able to reach the site. The pumpers and the ambulance remained on the gravel access road and did not reach the site.

Three to four minutes elapsed from the time the fire department was notified to the time response personnel arrived on scene. The initial large fire was knocked down and the primary fire of burning fuel was controlled at 0259. There were about 8,000 gallons of Jet-A fuel on board. Some of the cargo -- paper catalogues -- continued to burn in small isolated fires. These small fires did not hamper the firefighters' search for survivors.

9/ AFFF—Aqueous film forming foam.

In addition to the seven airport units, **six** units and **20** men from mutual **aid** departments responded to the accident. Several. mutual aid firemen joined in the firefighting effort. About 0405, the on-scene commander was notified that there **was** Americium **241,** a hazardous material, on board the airplane. He pulled all the firemen from their duties to prevent radiation exposure, since there was no possibility that any crewmember had survived the impact and there were no passengers. When the amount of radioactive material and dose rate information became known **20** minutes later, **he** ordered the firefighting and rescue efforts *to* resume. Since the accident occurred on the airport property, there were no security problems.

The total amount of firefighting materials expended in extinguishing the **fiies** was:

> 650 gallons of **AFFF,** 12,000 gallons of water, 300 pounds of dry chemical, 60 pounds of metal **X,** 34 pounds of Halon, and **40** pounds of CO_2.

1.16 Tests and Research

1.16.1 Human Performances

Twelve United Airlines flight crewmembers who had flown with United 2885's crew in the 6-month period prior to the accident were interviewed. These crewmembers included three captains, five first officers, and four second officers.

According to these crewmembers, the captain bad been an above average, skillful pilot who normally made smooth landings using trim in the flare. He was described as being comfortable in his position, with a friendly, easy-going manner. One of *&e crewmembers interviewed stated that the captain had once suggested a seat swap, and another crewmember stated that the captain was generous in permitting second officers to fly the airplane. The crewmembers stated that the captain was a confident person who expected active participation from each crewmember. There were a number of observations that the captain had a happy home life.

The first officer was described as *an* average pilot. According to the crewmembers interviewed, he was not consistent in airplane control, flying smoothly on one flight and flying roughly on the next flight. He was also described as a somewhat mechanical pilot. The crewmembers stated that the first officer sometimes performed checks out of sequence and was not consistent in resetting the trim after landing. A few of the crewmembers noted that the first officer had been preoccupied with a number of outside business interests that accounted ***for*** much of his time. He had once volunteered *to* e different *captain on a previous **flight,** "If you went the* flight engineer to fly, *I* can **work** the panel."

The crewmembers interviewed described the second officer as a competent, professional, conscientious flight engineer. He was also described as being a quiet, conservative, person who seemed satisfied as a second officer. Most of the interviewed crewmembers were not aware of any other flying activities by the second officer besides those related to his employment with United Airlines.

The **12** United **Airlines** flight crewmembers who were interviewed were questioned about seat swapping, deadheading, and trim setting, and the safety of passenger flight versus freighter flight operations.

Most of the crewmembers interviewed stated that seat swapping was occurring less than it had in the past, but that they were aware of limited seat swapping in freighter or ferry flight operations. A reason given for the decrease in seat swapping was that second officers no longer received pilot training at United Airlines

Four of the crewmembers interviewed said that they always deadheaded according to the published schedule. Seven said that they generally deadheaded according to the published schedule, and that when they did deviate from the schedule, it was on the Los Angeles–Baltimore trip that has about a 28–how layover. Some crewmembers said that they would get a good nights sleep at home and then deadhead later than the published schedule and still have time for a good nap prior to the start of the flight sequence. All of the crewmembers who were interviewed lived near their base domicile and did not commute long distances.

Most of the crewmembers who responded to questions regarding trim setting believed that at night a penlight was necessary to see the cockpit reading. Three crewmembers stated they had developed the habit of confirming the setting by feeling the position of the trim indicator. Also, three crewmembers said that they would doublecheck the paper work if it called for 4 or more units of trim.

All of the crewmembers who commented on the safety of passenger versus cargo flight operations agreed that the operations were equally safe except for two factors. They reported a greater fatigue factor in cargo operations since most flights are at night. The other factor was the nonuniformity of the cargo flight manifest between stations

1.16.2 Landing at Detroit

Based on the airplane's zero fuel weight at Cleveland (165,681 pounds) and the fuel remaining prior to refueling at Detroit (52,400 pounds), the airplane landing weight at Detroit was approximately 218,081 pounds with a cg of 28 percent MAC. The Vref for a full flap landing was 138 knots. Hands–off elevator setting for 138 knots is about 4.0 units ANU.

1.16.3 Simulator Tests

Simulator testing was accomplished in two phases. The first phase took place shortly after the accident using a DC–8-61 simulator at the UAL Training Center in Denver, Colorado, to reconstruct flight conditions and circumstances which might have been involved in the accident flight. A simultaneous attempt by both simulator pilots to trim the stabilizer in opposing directions resulted in nonmovement of the stabilizer.

In the second phase, UAL training personnel modified the DC–8–61 simulator to DC–8–54F characteristics, and on June 10, 1983, a series of takeoffs and landings were performed. The takeoffs simulated the accident takeoff and the landings simulated the landing at Detroit. The conditions and results of both phases were similar. All of the simulator tests were flown by pilots, and the takeoff and landing simulations of June 10, 1983, were performed by a DC–8 simulator test pilot and a current DC–8 line pilot. Simulator conditions were:

Gross weight:	243,400 pcunds 10/
Center of gravity:	32.5 percent MAC
Winds:	220°/10 knots
Stabilizer trim:	7.5 units ANU

Eleven takeoffs were performed with the modified simulator; the last 10 of the takeoffs were recorded. After three takeoffs were performed to familiarize the cockpit crew with the simulator characteristics, five takeoffs were made with stabilizer trim settings of 7.5 and 10.0 ANU. Three takeoffs were then made coordinating CVR-derived timing, transmissions, and aural cockpit signals. On these three takeoffs, pilot technique was (1) to push the control yoke forward at 80 KIAS for the elevator check, (2) to neutralize the yoke, (3) to exert enough forward pressure to hold the nose down to prevent the airplane from lifting off prematurely, (4) to rotate with positive movement of the yoke aft at Vr, (5) to push the yoke forward to establish a 10° nose-high climb attitude since rotation was faster than normal due to the stabilizer trim setting, and (6) to push full forward on the yoke to prevent the abnormal nose-high attitude and to attempt recovery. Stabilizer trim was not changed. The stickshaker activated on all takeoffs, and in some instances, the time of onset was identical to stickshaker onset derived from the CVR of United 2885. As the simulated airplane gained airspeed after liftoff, it was impossible to hold the proper climbout attitude with full forward control wheel input. The nose of the airplane rose from 30° to 40° noseup, with accompanying stickshaker, and simulated a stalled condition.

The following results were compiled from pilot comments, the recorded data from rhe simulator tests, the CVR, and Douglas' performance calculations.

- o With a stabilizer trim setting of 7.5 AND, the airplane had an uncommanded rotation at approximately 114 knots unless forward control column pressure was applied.

- o With a stabilizer trim setting of 10 ANU, the airplane had an uncommanded rotation at around 100 knots, if forward control column pressure was not applied. A tail strike would occur during rotation.

- o In all cases, the airplane continued to rotate to stickshaker following rotation even with full nosedown elevator deflection.

- o Pitch rate following rotation could be slowed momentariiy in all cases when nosedown elevator was applied.

- o With a stabilizer trim setting of 7.5 ANU, the airplane pitched up to stickshaker in approximately 8 seconds after rotation when the nose was held on the ground until V_R and the airplane was allowed to rotate with a zero control column force at rotation. Stickshaker onset was at approximately 25° to 30° ANU.

- o The takeoffs that were performed with positive control column input at V_R most closely matched United 2885's CVR timing of stickshaker onset.

10/ Actual gross weight was about 243,764. The difference is not significant and has negligible effect on characteristics.

- The table below displays the timing of selected events as recorded on the CVR and the average times of simulator runs 7, 8, 11, 12, and 13, all of which used the following control inputs: the nose wheel was held on the runway until V_R, a normal elevator pull force was applied at V_R while using a stabilizer trim setting of 7.5 ANU.

Event	Elapsed Time (seconds) CVR	Simulator (average)
Sound of power	0	0
80 knots	20.3	20
V_1	31.0	28.6
V_R	32.8	32.8
First stickshaker	36.0	37.8
Second stickshaker	45.8	41.4

- The airplane, under the actual takeoff conditions, would not have sufficient pitch control authority solely from elevator input to maintain an angle of attack below stickshaker with the stabilizer trim setting of 7.5 units ANU, or with a stabilizer trim setting of plus 4.7 ANU more than the correct setting-

- The airplane elevator **does** have sufficient pitch control authority at 7.5 ANU stabilizer trim setting to rotate to an attitude at which a tail strike will occur before attaining minimum takeoff speed.

Landings were made with the simulator configured to match parameters of the landing at Detroit immediately before the accident: gross weight -- 218,000 pounds; center of gravity -- 28 percent MAC; and winds -- 220° at 10 knots The technique used for landings was normal -- trim the stabilizer to produce zero control column force during the final approach, but with emphasis on making a smooth touchdown by using trim in the flare. Stabilizer settings on final approach approximated 4.0 ANU as forecast by Douglas. The final stabilizer trim settings as recorded for the lsndings were: 4.9, 6.23, 5.7, 7.8, 5.8 and 7.95. The highest stabilizer trim setting, 7.95, was accomplished when the approach and landing was made by a pilot who was currently flying the DC-8 on the line and not by the simulator test pilot

1.17 Other Information

1.17.1 Pitch Control and Horizontal Stabilizer Trim

The United Airlines DC-8 Flight Manuel and the McDonnell Douglas DC-8 Flight Study Guide both state:

> Pitch control is provided by elevators hinged to the horizontal stabilizer aft spar.. The elevators, which are interconnected to operate in unison, are actuated manually by the inboard aerodynamic, control tabs. The outboard tabs are gear driven by relative movement between the elevator and the stabilizer and assist the control tabs in displacing the elevator. Initial control column movement displaces the control tab on each elevator.

After the control tabs reach full travel, further movement of the control column moves the elevators directly. An elevator position indicator (EPI) provides positive indication of the elevator position. The EPI is used while making a control check prior to takeoff to verify elevator movement.

Pitch trim is accomplished by varying the position of the horizontal stabilizer. The horizontal stabilizer is hinged at its rear spar and its position is adjusted by a pair of screwjacks attached to its front spar. Rotating nuts on the jacks are driven by roller chains from a central gear box which may be powered by either a hydraulic or an electric motor. The jacks have nonreversible threads without dependence on friction brakes or locking devices.

The gear box contains a differential planetary gear train. Both motors have brakes spring-loaded to the ON position. Actuation of either motor releases the brakes on that motor with the .brake on the other motor remaining locked to provide for the differential gears.

The hydraulic motor provides the primary power for stabilizer adjustment. The DC-8-54F has a 13 horsepower motor and a trim rate of 1/2 unit per second. There is no trim-in-aotion aural warning.

The hydraulic motor is controlled by two hydraulic slide valves interconnected such that both valves must be opened for the motor to run. Both valves are spring-loaded to the OFF position. The valves are connected by two independent cable systems to two side-by-side "suitcase" handles on the cockpit control pedestal. The two handles must be operated by a single control- Dual controls are used so that in case of the failure of one of the valves or of its hydraulic or cable system, the other valve closes and prevents stabilizer runaway.

The hydraulic motor may also be operated by dual switches on the control wheels. These switches control a pair of electric servo motors through independent electric circuits. The servo motors act on the cables connected to the "suitcase" handles and these handles will move when the wheel trim switches are used. Both switches must be operated simultaneously for the system to operate.

The electric motor is used for autopilot controlled trim and alternate trim. The trim rate using the electric motor is approximately 1/20 unit per second. The electric motor is controlled by two levers on the control pedestal. Each lever actuates a switch which is spring-loaded to the OFF position. One switch controls the motor current while the other switch controls the brake current, both acting through independent electric circuits. Thus, both levers must be operated in order for the motor to run. Again dual controls are used to prevent stabilizer runaway due to a single failure.

1.17% company Procedures

The UAL DC-8 Flight Handbook includes normal, irregular, and emergency procedures as well as bulletins for the operating crews. The following is found in the general section of the normal procedures: ". . .it is recommended and would be considered good judgment if an exterior inspection is accomplished when time permits."

Normal procedures are indicated by phase of operation (e.g. cockpit preparation, before start, taxi out) and the flight crewmember responsible for accomplishing the operation. The Exterior Inspection - Second Officer section contains the following:

> Recommended sequence is to start at the left forward fuselage and walk around the airplane in a clockwise direction. During the inspection, observe the generai condition of the airplane, check all surfaces, fuselage, empennage, wings, flight controls, windows, antennas, engines and cowlings, looking for proper position, damage, fluid leakage and security of access panels. Check that the crew, passenger and cargo doors that are not in use are closed and door handles recessed.

'%e Preliminary Cockpit Preparation - Second Officer section contains the following: "Flaps, Stabilizer, Elevator Position Indicator.. .Observe Positions." However, such action is not required at en route stops. The Cockpit Preparation - Captain section includes the following:

*LONGITUDINAL TRIM — TEST

Simultaneously move LONG TRIM handles in opposite directions and hold in full travel position, while observing that the LONG TRIM indicator does not move and/or the HYD SYS PRESS does not decrease.

Test both sets of control wheel LONG TRIM switches for proper operation.

ALTERNATE LONGITUDINAL TRIM — TEST

Move ALT LONG TRIM switches to NOSE UP and NOSE DOWN positions and observe proper movement of LONG TRIM indicator.

NOTE

Do not move the ALT LONG TRIM switches in opposite directions simultaneously.

*HORIZONTAL STABILIZER TRIM — SET
*RUDDER TRIM — SET
*AILERON TRIM — SET

[The asterisk indicates those items which must be accomplished even on en route stops, with no change of crew.]

The Taxi Out procedures prescribe, in part, that the following checks be Performed by the identified crewmember: [C= captain, F/O= first officer, S/O= second officer]

C, F/O, S/O FLIGHT CONTROLS	TEST
C, F/O YAW DAMPER (-61/71)	ON
C YAW DAMPER (-61/71) Must be off for DC-8F.	CHECK
C HORIZONTAL STABILIZER TRIM Recheck setting for final weight manifest information.	CHECK

The Before Takeoff Checklist prescribes the following challenges and responses:

CHALLENGE (S/O)	RESPONSE (C, F/O, S/O)
ANTI-SKID	ARMED
GUST LOCK	OFF
FLAPS	INDICATED, DETENT
CONTROLS	CHECKED, PWR ON, LTS OFF
TRIM	3 SET
EPR/N1 BUGS	SET
V SPEEDS	SET

The UAL Takeoff procedures assign specific functions to be performed by the appropriate crewmember, in part, as follows:

C, F/O THROTTLES Smoothly advance throttles and assure that all engines are spooling up evenly before applying final takeoff thrust. On DC-8-61/8F set takeoff EPR less 0.03.	TAKEOFF THRUST
S/O EPR, EGT, N1, N2, FUEL FLOW All indications normal.	CHECK
C BRAKES	OFF
S/O GROUND COOLING AND BLOWAWAY JET SHUTOFF BUTTON (-61/8F) Push button in after takeoff EPR set. approximately 5 seconds after start of takeoff roll. Note that button stays in and light is off.	IN

C, F/O FINAL THRUST Between 40-80 knots, after blowaway jet off, set thrust to value shown on takeoff data card.	SET
C, F/O ELEVATOR At approximateiy 80 knots, pilot flying check the elevator by applying positive forward control column pressure and note the appropriate airplane response.	CHECK
C, F/O AIRSPEEDS The pilot not flying call out V1, Vr, and V2 as those speeds are reached.	CALL OUT
C, F/O GEAR (ON ORDER) Either pilot call positive rate and other pilot confirm. Pilot flying call for gem up and pilot not flying retract gear.	UP

The Taxi In standard operating procedures require the first officer to retrim the stabilizer to 2° ANU.

1.17.3 Hazardous Materials

About 0800, the Special Form Americium 241 (Am 241) radioactive materials (RAM) package was found. The outer, cardboard layer of the package was almost completely burned, and the inner metal Department of Transportation type A container was scorched 3ut intact. No release of radioactive materials occurred.

The shipment of Am 241 originated in Tonawanda, New York, and was en route to a manufacturing firm in Korea, via Los Angeles, California. Enclosed within the innermost plastic jars of the container was a total of 10,000 multilayered and electroplated "foils" containing Am 241 and other metals, which were bonded to a metalic holder resembling a small pellet. Each of these pellets was to become a component of a smoke detector. The Special Form Certificate filed with the Department of Transportation describes the source and attests to the nondispersible nature of the Am 241 while in this composition -- under extreme conditions of heat, stress, or other ambient factors, the foils will not decompose into smaller particles subject to inhalation, ingestion, or surface contamination.

The outer container of this shipment was subject to the requirements of 49 CFR 178.205 for type 12B fiberboard boxes There was no retrievable section of this container with which to verify compliance. The packaging of the RAM shipment was determined by the quantity of Am 241 as measured in curies The maximum amount of Am 241 which may be transported in a type A package is 20 curies, according to 49 CFR 173.389. This package contained 0.015 curies, less than 1/1,000 of the allowable quantity.

The Transport Index (TI) for this shipment was 0.2. ' The TI is determined by measuring the radiation dose rate (in millirems per hour) at a distance of 3 feet from the external surface of the package. The maximum allowable TI for the air transport of a

Class II radioactive shipment is 1.0 millirem per hour, or 500 percent of this package. The labels, placards, and shipping documents accompanying this package were in compliance with current regulations.

1.17.3.1 Hazardous Materials Notification

About 45 minutes after the accident, an airport operations employee went to the UAL cargo building to transport a UAL freight supervisor to the crash site. He overheard other UAL employees discussing the RAM shipment aboard United 2885 and notified the CFR station by radio about 0405 to alert the emergency response commander. Firefighting and rescue operations were suspended until 0425, when the onscene personnel were advised of the type of RAM and the dose rate.

UAL freight personnel were aware of the RAM cargo within minutes of the crash from information on waybills and dangerous goods documents. They contacted UAL's Systems Operation Control Department (OPBOB) in Chicago and were advised that OPBOB would notify authorities concerning the RAM package. Discussions among UAL's senior management resulted in a call to the regional office of the U.S. Department of Energy (USDOE) to notify them of the RAM cargo. This occurred at approximately 0450, or 2 hours after the accident.

The USDOE notified the Michigan State Police (MSP) which is the state agency designated to receive radiological incident reports during non-duty hours. By prior arrangement, MSP notified the Radiological Health Services Division, Michigan Department of Public Health. Two health physicists, equipped with radiation monitoring devices, were dispatched to the scene and arrived about 0620.

UAL's notification flow-chart for a Hazardous Materials Incident (UAL Operations Manual, Chapter 45-11) directs the air freight employee to notify OPBOB immediately (as was done in this accident) and implies that OPBOP will make the other necessary calls. The instructions, however, require the local employee to immediately contact local emergency groups and then notify corporate officials. The phone numbers of local emergency officials and the Radiological Health Services Division (which was eventually notified and discovered the RAM) were available to UAL's Detroit Air Freight employees, but were not used.

Detroit Metropolitan Wayne County Airport is certified and inspected by the Federal Aviation Administration (FAA) according to the provisions of 14 CFR 139. In order to receive and maintain its certificate of operations, the airport must comply with the Emergency Plan requirements that the certificate holder prepare instructions for the response to a radiological incident, show that principal tenants of the airport have participated in the development of the plan, and that all agencies specified in the plan can be notified during an accident (139.55(e)). However, a simulated drill of the emergency plan is not recommended or required. The radiological incident emergency plan for the Detroit Airport was approved by an FAA Certification Inspector on November 18, 1980.

The plan states that the FAA tower is required to notify the Airport Operations office, the Airport Fire Chief, and Airpo.t Security of an in-flight radiological emergency on any aircraft landing at the airport. The Airport Operations Officer is required to notify the Radiological Officer who, in this case, was the Airport Fire Chief; the airline (carrier) or tenant is also required to notify the Airport Police office of a RAM incident and of the type, amount, and location of the material.

49 CFR 175 contains regulations specifying the actions to be taken by air carriers in the event of a release, or suspected release of radioactive materials. Chapter 45-11 of UAL's Operations Manual establishes employee procedures for handling hazardous materials and, along with 49 CFR 175, is available at all UAL Air Freight facilities. The manual provides specific guidance and notification procedures in the event of damage, spills, or aircraft accidents involving hazardous materia's These procedures require the Air Freight facility to maintain a current list of local emergency responders, to provide the notification sequence to emergency response and corporate officials, to list special instructions in the event of a radiologicel incident, and to name other agencies which must be contacted under various circumstances

Federal reporting and notification requirements for an air carrier, contained in 49 CFR 175.45 and 175.700, state the conditions when the carrier must notify the nearest FAA Civil Aviation Security Official "at the earliest practicable moment." Circumstances include: "Fire, breakage, or spillage, or radioactive contarnination involving shipment of radioactive materials," or "A situation exists of such a nature that, in the judgment of the carrier, it should be reported to the Department even though it does not meet the criteria, or a continuing danger to life exists at the scene of the incident." Paragraph 175.45(a)(7) states that if the air carrier reports the incident to the FAA, it is exempt from notifying the National Response Center (NRC), and the carrier's only telephonic responsibility is to the FAA.

1.18 New Investigative Techniques

None.

2. ANALYSIS

2.1 General

The airplane was certificated, equipped, and maintained in accordance with Federal regulations and approved procedures. There was no evidence of preaccident failure or malfunction of the airplane structures, systems, or powerplants. The flightcrew was properly certificated and qualified for this scheduled domestic cargo flight at their assigned positions. They held current medical certificates Weather was not a factor in this accident. The hazardous materials shipment aboard the airplane met current packaging requirements, was not breached, and there was no spillage of radioactive materials. The FDR did not function on the accident flight and useful data were not recorded. The Safety Board reaffirms Safety Recommendations A-82-64 through -67, issued July 13, 1982, that would require installation of suitable digital flight recorder systems on air carrier aircraft.

2.2 Human Performance

Based on information obtained during interviews with 12 United Airlines flight crewmembers, who were familiar with the crew of United 2885, the Safety Board attempted to determine why the first officer and second officer switched seats.

The crewmembers interviewed described the captain as a confident, good natured pilot, comfortable and at ease in the airplane and "generous" in allowing second officers to fly. According to these crewmembers, the captain practiced an "open crew concept" and as such expected participation and involvement from each crewmember.

Believing that second officers most likely desire to fly, the captain might have inadvertently influenced the second officer's decision to fly even though he might not have had a great desire to fly. Additionally, the first officer..might have suggested the seat switch since one of the crewmembers interviewed reported that the first officer had offered to switch seats on a previous flight and to work the panel if the captain wanted the second officer to fly.

Although the second officer had attempted to qualify as a first officer, none of the crewmembers interviewed had ever heard the second officer express a desire to fly. It appears that the second officer was surprised when on taxi out the captain said, "Are you guys trading?" and the first officer replied, "Do it." The captain then repeated, "Are you guys "Jading?" and the first officer said, "Ready - you ready." The second officer replied, "go for it." The first officer then said, "ready to trade" to which the second officer replied, "oh we're going to trade now?" After the swap occurred and the takeoff roll was started, the second officer was still concerned about the last second officer checklist item (transponder on) and called for it twice during the takeoff roll.

Although the Safety Board could not determine precisely why the first officer and second officer switched seats, the Safety Board concludes that the f i t officer and second officer switched seats with the approval of the captain-

Apart. from the violation of both FAA and UAL regulations, the more significant aspect of the seat swapping is that neither crewmember was qualified for the duties of the position he occupied on takeoff. Despite the fact that virtually all of the takeoff checklist had been completed before the swap, the cockpit conversation contained several reassurances, cautions, and reminders by various crewmembers indicating possible tentativeness or uncertainty on the part of the first officer and the second officer. In this regard, the most critical mismatch of duties versus qualifications existed in the second officer occupying a pilot position, rather than the first officer acting as a flight engineer.

The second officer had failed to meet the performance standards required of a UAL first officer in the DC-8 and the B-737. Despite many additional simulator hours, special scan training, and several "special check" flights, he continued to receive comments indicating overcontrol, poor command judgment, and an inability to monitor several factors at once. The check captain's comments indicated that the second officer,' after nearly a year of B-737 line flying as first officer (May 1980 to April 1981), displayed poor judgment and failed to fly stabilized approaches both on instruments and visually. The instrument approach had 2-dot deviations in localizer and glide slope, and the visual approach involved a tight turn with a high sink rate. Even when the "unstabilized approach" was called out on the ILS, the second officer did not initiate a go-around, ... prescribed in company procedures. On May 14, 1981, the second officer agreed in writing to revert to second officer status and complete his airline career in that capacity. This was the culmination of approximately 3 1/2 years of efforts to upgrade to a first officer.

The second officer's demonstrated inability to cope with the many changing parameters of flight during a landing suggests that he would similarly be unable to deal with the situation he faced during the accident takeoff. He might not have been capable of assessing the gravity of the rapidly deteriorating flight conditions on takeoff and might not have been capable of initiating corrective action for the unwanted and unexpected trim. This takeoff was at night and, with the reduced visual cues, required skills such as rapid scan and division of attention -- skills at which the second officer was considered to be deficient. There is no evidence to suggest that the captain was aware of the serious deficiency in the 'second officer's flying skills, especially in light of his performance as a second officer. Had the captain been aware of the second officer's limited skills, he probably would have either not allowed the swap or would have closely supervised the takeoff and the cockpit procedures and configuration.

The seat swapping might have been suggested by either the first officer or the captain as a result of their being fatigued. At the time of departure, the first officer had been active a minimum of approximately 14 hours, and the captain had been active for 19 hours. The Safety Board concludes that the captain and first officer did nat adhere to established crew rest procedures and that they night have been fatigued.

The Safety Board is concerned about the flightcrew's disregard of federal and company rules and regulations. The Board does not believe, nor do the interviews with United Airlines flightcrew members indicate, that seat swapping is a prevalent practice on that airline. A senior captain should allow seat swapping only as outlined in company procedures and with knowledge of the involved crewmembers' flying capabilities. The flightcrew members did not perform their checklist responsibilities in a professional manner. Adherence to crew rest requirements is a matter of personal discipline. This accident clearly illustrates the importance of compliance with established rules, regulations, and checklists. The Safety Board believes that compliance with written directives in today's sophiscated transportation system is mandatory and basic to safe, efficient operations.

2.3 Airplane Configuration

The most critical element of the accident sequence was the excessive noseup horizontal stabilizer position. Physical evidence in the form of postimpact, stabilizer jackscrew positions and stabilizer leading edge witness marks on the aft fuselage skin clearly showed that the stabilizer trim was set at 7.5 units ANU at impact.

Ground impact and the ensuing postcrash fire destroyed the wings and forward fuselage structure which precluded establishing continuity in all channels of the mechanical flight control systems between the cockpit and the flight control surfaces. Functional testing of the hydraulic and mechanical actuator components of the flight controls for the pitch, roll, and yaw channels did not reveal any malfunctions or abnormalities. The Safety Board considered various failure modes that might have resulted in the misset trim.

One failure mode considered was a dual failure in the hydraulic or electrical stabilizer trim system forward of the power control unit which resulted in a "runaway" trim in the airplane noseup direction. The power control unit hydraulic pump/motor drives the stabilizer trim at a rate of 1/2 unit per second. The time intervals on the CVR tapes indicated that from the start of takeoff roll to impact enough time elapsed #at a runaway stabilizer trim would have been driven full travel (10 units) during the accident flight rather than only 7.5 units. The probability of a dual failure having occurred and the runaway conditinn having gone unnoticed in the cockpit is considered extremely remote since the suitcase handles are located adjacent to the captain's right leg. Service history of the DC-8 airplane does not indicate any problem with runaway stabilizer trim. The electrical portion of the stabilizer trim drives the unit at a much slower rate (1 7 to 1/20 units per second). Using the above time interval, a Failure of the electric trim would hsve resulted in a setting of about 4.5 units at impact. The Safety Board, therefore, believes that a dual failure did not occur on this accident flight.

The Safety Board considered the possibility of a mechanical failure in the stabilizer power control unit or jackscrew assemblies which prevented the stabilizer from being positioned to the takeoff setting and that this condition went unnoticed by the flightcrew during performance of the preflight and takeoff checklists. The power control unit, jackscrews, chains, and sprockets were continuous and in good condition prior to removal from the airplane onsite. Subsequent functional testing of the power control unit, electrically and hydraulically, was satisfactory. Partial disassembly of the power control unit revealed that the gearbox was in good condition with no sheared rivets in the sprocket drive train or evidence of excessive shaft bearing wear. The operation of the power control unit and condition of the jackscrews, sprockets, and chains discounts the possibility of this type failure.

Another possible failure considered was a mechanical failure in the stabilizer position indicator on the cockpit pedestal which resulted in a false reading of stabilizer trim to the flightcrew. Since the suitcase handles move full travel when the trim switch is activated, the flightcrew's attention would normally be directed to the position indicator which is located next to the suitcase handles. If the flightcrew followed procedures, the stabilizer trim would have been set after landing and then the fii setting made before takeoff. Any discrepancy would have been noted then. The Safety Board, therefore, discounts this type failure.

The Safety Board considered the possibility of tho first officer or the second officer inadvertently having engaged the autopilot when they switched seats. Autopilot stabilizer trim power is powered by the electric motor that trims randomly at a rate of 1/20th unit per second. Since the autopilot switch is a three-position switch on the center pedestal and has to be moved forward, then sideways to the right at mid-point, and forward again to engage, it would have been necessary that the switch be inadvertently moved through two distinct motions. The Safety Board believes it is highly improbable that this happened, since any sideways movement of a person exiting the seat would be to the left and any person entering the seat would normally step over the pedestsl. On the other hand, if the first officer had inadvertently engaged the autopilot switch when he boarded the airplane before 0230, the electric motor would have run for 21 minutes (1260 seconds) and the trim would have been driven to the limits. However, the flightcrew should have noted an engaged autopilot when they performed the before-takeoff flight control check at 0248+. Finally, the seat swap between the first and second officer was made at about 0249:16 and liftoff was about 0251:38, or 42 seconds later. The trim rate would have moved the stabilizer about 7 units, to about 8.9 units ANU. The electric trim motor was checked and did operate at the proper rate. Consequently, the Safety Board does not believe that the autopilot was inadvertently engaged by the first officer or the second officer during the seat swap.

Another possibility considered that could account for the misset trim was that the flightcrew neglected *to* reset the stabilizer trim after the landing at Detroit and the subsequent takeoff was attempted with the stabilizer trim at the final landing flare position. Both the captain and the first officer, who made the landing, were known to continue trimming noseup stabilizer as a means of smoothly flaring the airplane during the landing. About 4.0 units ANU would have neutralized the aerodynamic control force for the landing, and additional units ANU could have provided flare. Simulator flight testing indicates *that* a final stabilizer trim setting of 7.5 units ANU is feasible and in fact was achieved when a line DC-8 pilot made the landings using this technique. However, the presence of landing trim before takeoff presupposes the following missed opportunities for correction: (1) the prescribed first officer's standard operating procedure to retrim after landing to 2 units ANU; (2) the second officer's walkaround and preliminary cockpit preparation (not required on en route stop); (3) the captain's cockpit preparation; (4) the captain/first officer's setting of trim after start; (5) the captain's recheck setting versus final weight on taxi out; and (6) the first officer's check of trim on before-takeoff checklist.

The fiist officer's inconsistency in retrimming after landing, the short duration of taxi after the landing, the short duration of the turnaround, and the cold, dark 'night might have contributed to these oversights. The crew's activities in the cockpit prior to the takeoff, in particular the first officer and second officer's exchanging positions, was not a normal procedure and could have contributed to the oversight. Other crew factors such as fatigue and lack of flight qualifications for the positions occupied on takeoff could also have contributed to the oversight. The Safety Board concludes that the flightcrew inadvertently overlooked setting the stabilizer trim at takeoff and that the 7.5 units ANU trim setting used in the previous landing was not removed after landing or detected while preparing for takeoff.

Contributing somewhat to the noseup tendency of the airplane was the further eft center of gravity resulting from the inadvertent omission of the cargo "igloo" for pit No. 1. The missing pallet would have been positioned in the forward most pit and its omission, along with the extra 731 pounds of fuel, shifted the center of gravity aft ana changed the recommended stabilizer setting from 1.9 ANU to 0.2 ANU. While the omitted "igloo" was not causal to the accident, since the airplane would have been easily controlled with a proper trim setting, it did contribute to the noseup tendency of the airplane.

2.4 Airplane Performance

Acceleration, rotation, and liftoff.--Engine acceleration started at 0251:12.6, and the engines stabilized in 7 seconds at a setting equal to 1.81 EPR, which was .05 EPR higher than planned. Airplane acceleration was normal and the 80-knot check was made at the expected acceleration point. When the second officer pushed the control column full forward for the 80-knot check, he did not voice any concern over the handling characteristics of the airplane. Of course, with his limited flying skills and knowledge, the second officer might not have recognized any deviations or discrepancies.

The airplane was overrotated at liftoff. Witnesses' statements and the flightcrew's remarks on the CVR clearly indicated an unusually nose-high attitude at liftoff. This was due to the misset stabilizer trim and abetted by the aft center of gravity. Apparently, none of the crewmembers immediately recognized the precariousness of the situation, since there were no comments from any crewmember other than those referring to the attitude of the airplane.

The simulations of the takeoff conducted after the accident demonstrated that immediately after liftoff when nosedown elevator forces were applied, the rate of rotation slowed, giving the impression that it would be possible to arrest the rotation solely with forward control input. Recovery of the airplane at rotation was possible if immediate nosedown trim was applied along with full forward elevator input. However, once the airplane left the ground and started to accelerate, recovery was improbable.

Initial climb and attempted recovery.--The captain expressed apprehension approximately 10 seconds after rotation, but only 3 seconds before stickshaker activation. His delayed reaction time might have been a result of hi not recognizing the hazardous situation or of his expectation that the second officer would correct the airplane's attitude. It could not be established if comments recorded by the CVR concerning trim were intended as commands to initiate an action or merely announcements reinforcing action already in progress. The simulator flights revealed that after liftoff, the airspeed increased until the nose reached about 15° ANU, the airspeed would stop increasing and then rapidly decrease as a 30° to 40° noseup attitude was reached. The airplane.then entered a stall, and recovery was not possible. The FDR, the tower BRITE scope, and the Air Route Traffic Control Radar indicated the maximum height achieved was about 1,000 feet above ground level.

Out of control descent.--After the airplane climbed to about 1,000 'feet, it rolled to the right and made an uncontrollable descent to impact. After the captain commented about going inverted, there were other exchanges between the captain and first officer suggestive of differing recovery ideas but impact occurred 8 seconds later. Recovery during this period was impossible. Analysis of the CVR tape indicated engine surges during this time period which would account for witnesses seeing flames near the engines.

The inability of the captain to recover the airplane at any time 'might have been complicated by some action of the second officer, such as freezing on the control column, holding noseup trim, or both. If the second officer's trim command was opposite the captain's input, there would have been no movement of the stabilizer.

2.5 Automatic Terminal Information Service

On the first call, the communicating pilot informed clearance delivery that United 2885 was in receipt of Automatic Terminal Information Service (ATIS) Foxtrot. ATIS Foxtrot was recorded at 2345:49 and was not updated to information Golf until 0249:45. Surface weather reports were received at 0047 and 0147. Although no appreciable content change was reflected in the reported weather, the ATIS should have been updated subsequent to receipt of the new surface weather reports as required by FAA Handbook 7210.3F, dated October 1, 1981.

Because the meteorological conditions existing at Detroit at the time of the accident were not representative of the type of meteorological conditions which reasonably can be categorized as hazardous to flight, the failure of tower personnel to update the ATIS is not considered to be an accident causal or contributing factor. However, the failure of air traffic control personnel to comply with existing directives to update the ATIS constitutes an operational deficiency. This deficiency could present a significant hazard to the safety of terminal flight operations if conditions such as convective activity are present in the area and are not included in the ATIS report. Such lax application of established procedures for updating ATIS is not consistent with the Safety Board's position which advocates that pilots always be provided with timely information on which to base their operational decisions.

26 Hazardous Materials Notification

At least five federal, company, or local regulations or agreements were in effect at the time of the accident that outlined hazardous materials airport notification procedures. None were followed, and it was only happenstance that the airport operations employee overheard a discussion concerning the RAM shipment and notified the onscene commander. Airport operators are required by the FAA to insure coordination among participants in airport emergency plans. However, there is no requirement to periodically exercise the plans, at any level. The Safety Board believes that some form of periodic exercise of airport emergency plans should be required. A major Safety Board study on airport safety, including emergency plan exercises, is in the final stages of preparation. The Safety Board will use the information developed in this study as well as the circumstances of this accident to make recommendations regarding the need for a requirement for emergency plan exercises and their form and scope.

Air carriers have an exemption from a requirement to immediately notify the National Response Center (NRC) in the event of a RAM release or threat of release. The exemption applies when the air carrier notifies an FAA security officer. The Safety Board believes that NRC notification procedures of carriers of RAM materials should be uniform in all modes of transportation and that this exemption is not appropriate.

3. CONCLUSIONS

3.1 Findings

1. The airplane was certificated, equipped, and maintained in accordance with Federal regulations and approved procedures.

2. There was no evidence of preaccident failure or malfunction of the airplane powerplants, systems, or structures

3. The flightcrew was properly certificated and medically qualified for the flight at their assigned positions

4. The flight data recorder did not function and information tnat would have been useful to the investigation was not recorded.

5. Weather was not a factor in this accident.

6. The hazardous materials shipment aboard the airplane met current packaging requirements, the container was not breached, and there was no spillage of radioactive materials.

7. The horizontal stabilizer trim was at 7.5 units ANU at impact.

8. Functional testing of the selected hydraulic and mechanical components of the flight control system which survived the accident did not reveal any discrepancies The power control unit, sprockets, chains, and jackscrew assemblies of the horizontal stabilizer trim system. were in good condition, the trim system was continuous, and operated normally when tested.

9. The three landing gear were down and locked at impact. The trailing edge flap setting was 15° with no assymetry.

10. The first officer and second officer swapped duty stations about 65 seconds before takeoff with the approval of the captain

11. The airplane was loaded with a more aft center of gravity than indicated in the dispatch papers

12. The captain and first officer did not have the prescribed crew rest prior to the trip sequence and might have been fatigued.

13. The second officer, who attempted to make this nighttime, visual takeoff, had failed to qualify as a DC-8 first officer. Although the second officer had qualified as a first officer on the B-737, he required special training and surveillance and subsequently iost the qualification after a year on the line.

14. The second officer was permanently removed from all pilot duties by mutual written agreement with the company.

15. The fiihtcrew inadvertently overlooked setting the stabilizer trim for takeoff, and the setting of 7.5 units ANU was the previous landing trim setting.

16. Had any one of six distinct procedural requirements involving all three crewmembers been followed, the stabilizer landing trim should have been set within acceptable limits at takeoff.

17. After takeoff, the captain and the second officer were unable to arrest the pitchup and control the rirplane.

18. The airplane climbed to about 1,000 feet above ground level.

19. The engines surged during the climb causing visible flames to emit from the engines

20. Detroit Metropolitan Airport tower personnel did not update the Automatic Terminal Information Service information in accordance with current Federal Aviation Administration directives. This failure was not causal to the accident.

21. At least five federal, company, or local regulations or agreements outlining hazardous materials notification procedures were in effect at the time of the accident. None were followed.

22. Airport operations ere required to insure participant coordination in airport emergency plans, but there is *no* requirement to periodically exercise the plans.

23. Air carriers have an exemption from the requirement to notify the National Response Center in the event of a radioactive material or hazardous materials incident Carriers in other modes do not have an exemption.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the flightcrew's failure to follow procedural checklist requirements and to detect and correct a mistrimmed stabilizer before the airplane became uncontrollable. Contributing to the accident was the captain's allowing the second officer, who was not qualified to act as a pilot, to occupy the seat of the first officer and to conduct the takeoff.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ PATRICIA A. GOLDMAN
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ G. H. PATRICK BURSLEY
Member

/s/ DONALD D. ENGEN
Member

October 31, 1983

4. APPENDICES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was notified of the accident about 0315 on January 11, 1983, and immediately dispatched an investigative team to the scene from its Washington, D.C., headquarters. The team arrived in Detroit about 0930. Investigative groups were formed for operations, weather, air traffic control witnesses, human factors, structures, systems, powerplants, maintenance records, flight data recorder, cockpit voice recorder, hazardous materials, and airplane performance.

Parties to the investigation were the Federal Aviation Administration, United Airlines, Inc., McDonnell Douglas Corporation, United Technologies Corporation, the Air Line Pilots Association, and the International Association of Machinists and Aerospace Workers

2. Public Hearing

A public hearing was not held, and depositions were not taken.

APPENDIX B

PERSONNEL INFORMATION

Captain William S. Todd

Captain Todd, age 55, was born March 22, 1927, and was employed by United Airlines on April 4, 1955. He held airline transport pilot certificate No. 1246927 for airplane multiengine land, with ratings in the CV-240, CV-340, CV-440, B-707, B-720, B-727, and DC-8, and commercial privileges for airplane single-engine land. He had about 16,102 total flying hours, 2,711 of which were in the DC-8. His last proficiency check was completed September 13, 1982. His FAA first class medical certificate was issued July 28, 1982, with the limitation that the holder shall wear correcting lenses for near vision. He also held flight engineer certificate No. 1313573 for the DC-6 which was issued July 6, 1955.

Captain Todd flew the DC-8 as a first officer from August 1964 to January 1968. He flew as captain on Boeing 727 and 720 airplanes from 1968 to 1981. Following routine upgrade training for the DC-8, he failed the initial oral portion of 'tis examination on October 28, 1981. He was given 6 hours of additional training on all aircraft systems including hydraulics and pneumatic warning systems, and firefighting, and he subsequently passed the oral and flight examinations. he received a DC-8 rating on November 1, 1981, and has flown the airplane continuously since.

Captain Todd was on vacation from December 18, 1982, until January 4, 1983. He flew a trip sequence on January 5 and 6 which included 5:29 flying hours. At the time of the accident, he had been on duty about 4 hours 50 minutes and had flown 1 hour 31 minutes.

First Officer James G. Day

First Officer Day, age 51, was born January 31, 1931, and was employed by United Airlines on March 21, 1966. He held airline transport pilot certificate No. 1656056 for airplane multiengine land, with a Lear Jet rating, and commercial privileges for airplane multiengine land limited to centerline thrust. He had about 9,360 total flying hours, 6,493 of which were io the DC-8. His last proficiency check was completed on January 11, 1982, and he received proficiency training June 15, 1982. His FAA first class medical certificate was issued January 27, 1982, with the limitation that the holder shall wear correcting lenses for near vision. He also held flight engineer certificate No. 1698473 with a turbojet power rating, and a flight instructor certificate which was issued in 1966, but had since expired.

First Officer Day flew as second officer in the E727 from July 1966 until November 1968, when he was upgraded to first officer in the B-727. In April 1971, he shifted to second officer in the DC-8, and was upgraded to first officer in January 1977. He entered training for an airline transport pilot certificate and a type rating in the Learjet in June 1977. After accumulating 15 flying hours in the airplane, he failed the initial flight check, but he successfully completed the reexamination flight check on June 17, 1977.

First Officer Day was not on duty in January until the trip sequence on *the 5th* and 6th, during which he accumulated 5:29 flying hours. At the time of the accident, the first officer's dutv hours were *the* same as the captain's.

Second Officer Robert E. Lee

Second Officer Lee, age 50, was born on June 24, 1932, and was employed by United Airlines on December 23, 1967. He held commercial pilot certificate No. 1590538 with ratings for airplane single and muftiengine land instrument, and rotorcraft-helicopter. He also held flight engineer certificate No. 1807177 with a turbojet rating. He had about 8,827 total flying hours, 4,468 of which were in the DC-8. His last proficiency check was completed on May 24, 1982. His FAA first class medical certificate was issued on June 18, 1982, with no limitations.

Second Officer Lee sewed as second officer on B-727, B-720, and DC-8 aircraft through June 1979, when he entered training to upgrade to DC-8 first officer. Training was terminated on August 8, 1979, and he reverted to DC-8 second officer. Second Officer Lee successfully completed B-737 first officer training in May, 1960, however he was removed from line flying after failing an en route check on April 29, 1981. He agreed to forego bidding on pilot vacancies on United Airlines and to remain in Second officer status. He hac? performed as e DC-8 second officer since May 17, 1981.

APPENDIX C

AIRCRAFT INFORMATION

The McDonnell Douglas DC-8-54F was purchased by United Airlines on November 7, 1968, from McDonnell Douglas and has been operate? continuously by United Airlines since that date. As of January 11,1983, at departure from Detroit Metro Airport in Michigan, the aircraft total time was 31,902 hours

Examination of the records included: review of applicable Airworthiness Directives, McDonnell Douglas Service Bulletins, aircraft and engine permanent records, engine life limit parts status, aircraft maintenance checks, inspections, overhaul, a 200-hour review of current aircraft maintenance records as per the Aircraft Maintenance Information Systems (AMIS), work deferment records and nonroutine maintenance records. The review of the airplane's flight logs and maintenance records showed that all applicable Airworthiness Directives had been complied with, and that all checks and inspections were completed within their specified time limits The recora review showed that the airplane had been maintained in accordance with company procedures and FAA rules and regulations and disclosed no discrepancies that could have affected adversely the performance of the airplane or any of its components

The airplane was powered by Pratt and Whitney JT3D-3B engines rated at 18,000 lbs of thrust at 84°F.

Statistical Data

Aircraft

Date of Certification	Ncvember 7,1968
Fuselage Number	406
Serial Number	46010
Registration Number	N8053U
Airframe Total Time	31,902 hours
Time Since Overhaul	10,329 hours
Aircraft Cycles	13,474

Engines

	Eng. #1	Eng. #2	Eng. 83	Eng. #4
Serial number	645305	645554	645541	642297
Date manufactured	11/13/66	2/18/68	9/9/66	12/1/66
Date installed	11/28/82	12/20/81	10/12/82	8/19/81
Total time (hours)	36,532	32,810	42,809	36,858
Total cycles	13,896	13,298	17,180	13,662

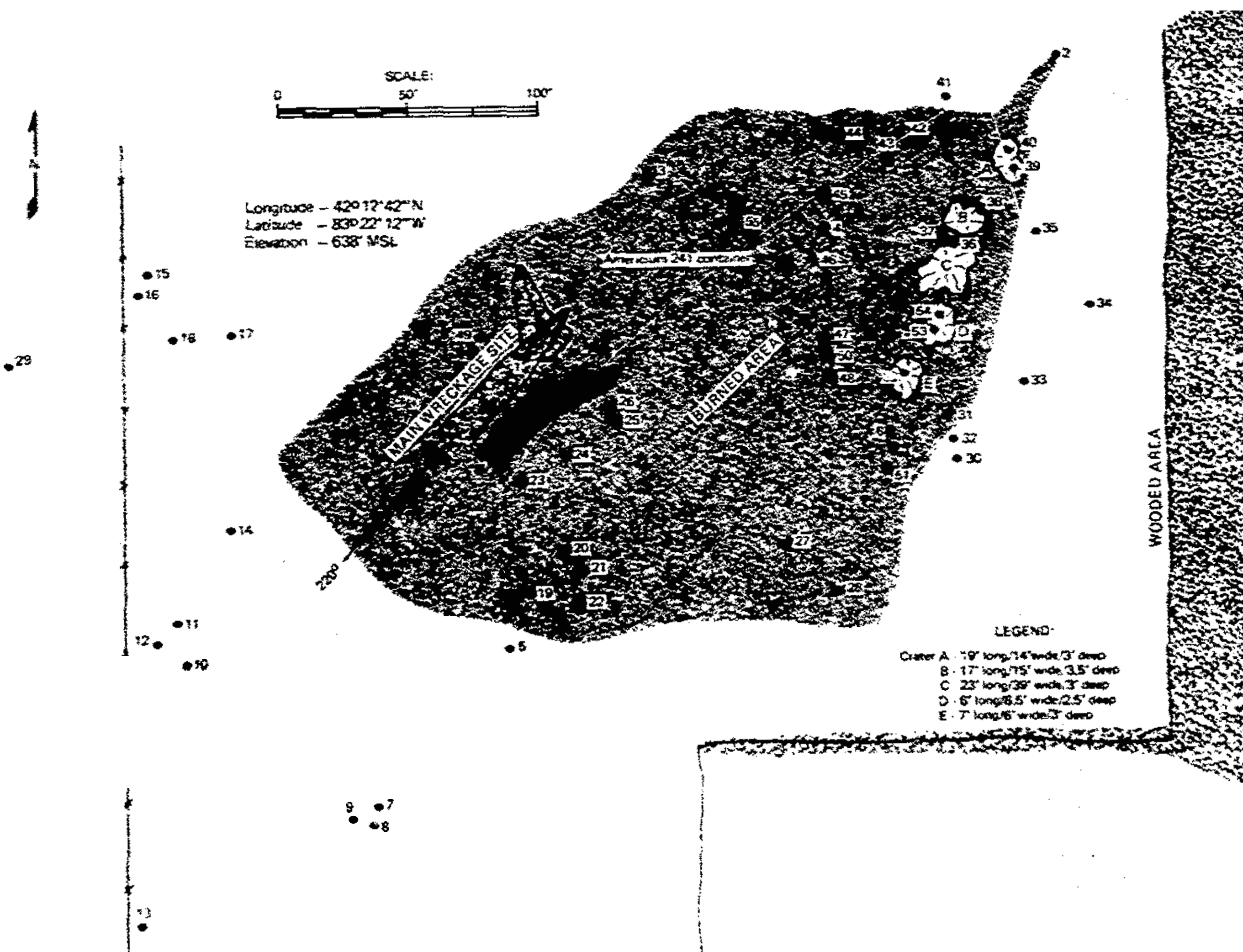
Flight Controls

Flight controls were overhauled and maintained at different times during the life of the aircraft in accordance with United Airlines' approved maintenance programs.

During the last "C" check (December 21, 1981), both ailerons and empennage flight controls were inspected. The aileron reversion mechanisms were replaced on both wings, but no components were replaced in the empennage. Cockpit elevator control columns, left and right, were checked per AD Note 73-7-9.

APPENDIX D

WRECKAGE DISTRIBUTION



WRECKAGE DISTRIBUTION OF PARTS

1. 70' section of aft fuselage and empennage assembly.
2. Pieces of red and clear glass (wingtip lighting).
3. No. 1 engine
4. No. 2 engine
5. No. 3 engine.
6. No. 4 engine
7. Inboard section of right wing including main landing gear/flight spoiler panels/inboard and outboard flaps.
8. 12' section of right fuselage including floor/blanked windows and circumferentials.
9. Cargo net ring and portion of galley structure.
10. 12' section of lower fuselage structure including cargo pit opening.
11. Electronic compartment door and adjacent structure
12. Cargo compartment door.
13. Engine first stage fan hub.
14. Fuselage keel beam structure–upper.
15. 24' section of lower wing skin.
16. Lower osc flating beacon/adjacent structure.
17. Left main landing gear door
18. Right main landing gear door
19. Portion of forward air conditioning compartment.
20. Partial right service door frame including data plate (mfg 10/5/68, T.C. 4A25: Model DC-8F 54); lower fuselage skin and static port area.
21. Nose landing gear.
22. Portion of engine thrust reverser
23. Section of fuselage center keel beam including aileron/spoiler cable hydraulic package
24. Spoiler hydraulic reservoir and plumbing.
25. Wing rear spar section.
26. Left main landing gear.
27. Right inboard aileron and 7' section of wing rear spar.
28. Forward main entry door and fire extinguisher.
29. Inboard section of lower wing skin.
30. 26' section of upper right wing skin.
31. Right outboard aileron section.
32. Left, center, and right windshields
33. Right outboard aileron section.
34. Two pieces of upper wing leading edge.
35. 4' section of upper wing skin and fuel probe.
36. Portion of main cargo door with actuator.
37. [illegible]
38. Fuel fill adapter, left wing parts, overwing fuel fill port.
39. Wing leading edge structure inboard of No. 1 engine
40. Wing components including fuel selector valves.
41. Section of left wing tip skin—crushed, deformed.
42. 18' outboard section of left horizontal stabilizer.
43. 16' outboard section of left elevator.
44. Left outboard aileron.
45. 30' outboard section of left wing less flaps
46. Left wing structure including rear spar section and main landing gear trunnion.
47. Portion of upper wing skin.
48. 24' section of upper wing skin.
49. Engine fan components and heat exchanger
50. Overwing exit door.
51. Portion of right wing tip.
52. Right wing leading edge structure, engine pylon fitting and aileron torque tube cams in Crater "E."
53. 3' section of main cargo door sill and lock.
54. Portion of center wing structure including upper wing to fuselage attachment fitting.
56. Left inboard aileron and left wing flaps.

APPENDIX E

COCKPIT VOICE RECORDER TRANSCRIPT

TRANSCRIPT OF A SUNDSTRAND Y-557 COCKPIT VOICE RECORDER WIVED FROM THE UNITED AIRLINES DC-8 WHICH WAS INVOLVED IN AN ACCIDENT AT DETROIT, MICHIGAN, ON JANUARY 11, 1983

LEGEND

CAM	Cockpit area microphone voice or sound source
RDO	Radio transmission from accident aircraft
-1	Voice identified as Captain
-2	Voice identified as First Officer
-3	Voice identified as Flight Engineer
-?	Voice unidentified
CC	Crewman on ground (Intercom)
CD	Clearance Delivery
GND	Detroit Ground
TWR	Detroit Tower
N314WN	Other aircraft
*	Unintelligible word
#	Nonpertinent word
( )	Questianble text
(( ))	Editorial insertion
---	Pause
Note:	All times expressed in eastern standard time.

INTRA-COCKPIT

TIME & SOURCE	CONTENT
0241:49 CAM-?	* *
0241:50 CAM-2	We've got a manifest?
0241:53 CAM-3	(Yeah)
CAM-2	Windshield heat
CAM-1	On

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
0231:26 RDO-2	United twenty eight eighty five heavy to Los Angeles with Foxtrot
0231:35 CD	United, ah, twenty eighty eight five heavy, Metro Clearance Delivery cleared to Los Angeles via Detroit Metro four, departure as filed, squawk four one two five, departure frequency one two four decimal zero five
0231:50 RDO-2	As filed, Detroit Metro four fourty one twenty five and one twenty four oh five
0231:58 CD	United twenty eight eighty five heavy readback correct, yood night
0232:00 RDO-2	Good night

INTRA-COCKPIT	
TIME & SOURCE	CONTENT
CAM-2	Cabin signs
CAM-1	They're on
0241:56 CAM-2	Parking brake
CAM-1	Set
CAM-2	Hydraulics
0241:59 CAM-3	Check
0242:01 CAM-2	* pumps
CAM-3	On
CAM-?	* *
0242:05 CAM-?	Yeah
CAM-3	No big deal
0242:16 CAM-1	What is it you need to know?
0242:18 CAM-1	What is it you need to know?
CAM-2	Oh I * * *
0242:23 CAM-2	Hydraulic pumps selector

AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT

APPENDIX E

INTRA-COCKPIT

TIME & SOURCE	CONTENT
CAM-1	Pumps are on, hut,?
CAM-2	Oil quanity
0242:24 CAM-2	Fuel
CAM-3	Fifty nine
CAM-1	Oh they're all fifty nine that's showing on the totalizer?
0242:33 CAM-2	Fifty nine and ah SAI
CAM-1	It's on
CAM-?	PTC
0242:43 CAM-1	(What'll that be?)
CAM-1	(Clear this with him)
CAM-1	Start 'em then

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
0242:38 CC	Hello cockpit
RDO-1	Hello earth
CC	Are you ready to start engines?
RDO-1	Yeah
CC	Okay, you're clear on all four engines
RDO-1	Alright

INTRA-COCKPIT

TIME & SOURCE	CONTENT
CAM-1	You start 'em, I think I'm more tired
0242:54 CAM-3	(I don't know)
CAM-2	You ready to go?
0242:59 CAM-3	Okay hit 'em
CAM-?	* * N one
0243:05 CAM-?	* * none huh
0243:06 CAM-?	Ya sure?
0243:15 CAM-3	[illegible] pressure, fifteen
CAM-?	(Got air)
CAM-?	Nothing *
0243:29 CAM-3	We're not doing any good here are we?
CAM-3	Need more air if we're going to do it
CAM-?	Huh?
CAM-3	Tell him to crank up his air down there

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT

INTRA-COCKPIT

TIME & SOURCE	CONTENT
CAM-3	It still is down
CAM-2	Yeah
CAM-2	Now we got the switches on
CAM-2	(Ten) seconds from the start
0244:04 CAM-2	Thirty five
CAM-3	Closed
CAM-2	Four
0244:11 CAM-3	I don't know what to think now, once you turn the fuel on this, the air starts going down, you know
CAM-1	Yup
CAM-?	(Really)
CAM-3	You can get a hot start ((overlays indication below))

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
0243:36 RDO-1	I need a little more air
0243:39 CC	Okay, I think I know what's wrong
0243:42 CC	How's that?
RDO-1	Better

INTRA-COCKPIT

TIME & SOURCE	CONTENT
CAM-2	I didn't have any indication of fuel or anything up here
CAM-1	You'd get an explosion
CAM-3	You can get a hot start pretty quick that way
0244:23 CAM-3	[illegible] pressure, fifteen
CAM-2	I didn't have N one
CAM-1	(Fuel flow)
CAM-2	I didn't have nothing
CAM-3	Jim
CAM-3	Did you get weather?
CAM-3	Thirty five
CAM-2	# # I don't know
CAh-1	The weather is clear and twenty, sixty three degrees
0244:44 CAM-?	My god in the middle of the night
0244:50 CAM-3	[illegible] pressure, fifteen
CAM-?	Yeah
0245:03 CAM-3	There's thirty five

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT

APPENDIX m

INTRA-COCKPIT TIME & SOURCE	INTRA-COCKPIT CONTENT	AIR-GROUND COMMUNICATIONS TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
CAM	((Sound similar to buss transfer))		
CAM-1	((Sound of belch)) My god		
0245:13 CAM-2	Are ycu all right		
CAM-1	No		
0245:16 CAM-2	I think you getting mange, you have been eating that # protein		
CAM-3	Oil pressure fifteen, power coming on		
CAM-2	Oh, oh, something gave out		
CAM-2	(Not going)		
0245:32 CAM-3	Thirty five		
CAM-3	Call for disconnect		
		RDO-1	Disconnect
		CC	Okay disconnecting
0245:43 CAM-1	Holy # that baby's dark		
CAM-1	Now it isn't dark		
0245:48 CAM-?	You guys are taking my job away		

INTRA-COCKPIT

TIME & SOURCE	CONTENT
0246:35 CAM-1	Gotta unlock the controls (power on)
0247:12 CAM-?	That's funny
0247:13 CAM-?	Mike installation change
CAM-1	Salute
0247:35 CAM-3	(Ihere's an old light) on over there
0247:49 CAM-2	Clear right
0247:56 CAM-1	You guys go ahead and do it anytime you want
CAM-3	Okay, no changes
0248:02 CAM-3	You got ah, compass indicators

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
0245:58 HDO-2	United twenty eight eighty five taxi out of cargo
CD	United twenty eight eighty five contact ground point eight
ROO-2	Okay
ROO-2	United twenty eight eighty five with ya
GND	United twenty eight eighty five Metro ground taxi to runway two one right
RDO-2	Two one right

INTRA-COCKPIT

TIME & SOURCE	CONTENT
CAM-1	Align
CAM-2	Align
CAM-3	Flight nav instruments
CAM-2	Check here
CAM-3	Anti-ice
CAM-2	Off
0248:09 CAM-3	Pitot heat
CAM-2	Captains
0248:12 CAM-3	Spoilers
CAM-2	Checked lights out
0248:15 CAM-3	Normal pressures, anti-skid
CAM-2	On
0248:18 CAM-3	Gust lock
CAM-2	Off
CAM-3	Flaps
CAM-2	Say again

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-3	Flaps		
CAM-2	* indicating *		
CAM-3	Controls		
CAM-2	Right		
CAM-3	Drop		
CAM-2	Neutral		
CAM-3	(Drop)		
CAM-2	Left		
CAM-2	Neutral		
CAM-3	Drop		
0248:33 CAM-2	Forward (aft)		
0248:37 CAM-1	Right		
CAM-.3	Drop		
CAM-1	Left		
CAM-3	Drop drop drop		
0248:42 CAM-3	Power on, light out, trim		
CAM-2	Set		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-3	EPR bugs		
CAM-2	Twenty one, thirty seven, forty nine, forty four left and right		
0248:52 CAM-3	Vee speeds		
CAM-1	Twenty one, thirty seven, forty four left		
CAM-1	Forty nine left		
CAM-2	Okay		
0249:05 CAM-3	Ah -- yaw dampers		
CAM-2	Yaw dampers off		
0249:07 CAM-3	Fuel levers		
CAM-2	Detent		
CAM-3	lank selectors		
CAM-3	Mains		
CAM-3	Boost pumps		
CAM-3	On		
CAM-3	Down to the line		
0249:16 CAM-1	Are you guys trading?		

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-2	Do it		
CAM-1	Are you guys trading?		
CAM-2	Ready		
CAM-2	You ready?		
CAM-3	Go for it		
0249:23 CAM-2	Ready to trade		
CAM-3	Oh we're going to trade now?		
CAM-2	We're on tower frequency		
CAM-1	Okay		
0249:40 CAM-1	(You) got the gear and all that #		
CAM-1	(* * get the gear)		
CAM-?	Yeah		
CAM-1	These # things, I hate them		
CAM	((Sound of laughter))		
CAM-?	Switch over		
0249:48 CAM-3	It's already on it		

INTRA-COCK=		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-?	Tower frequency		
0249:49 CAM-3	Yeah I am on both, hm I'm on both of them		
		0249:58.1 ROO-1	United twenty eight eight five heavy, ready to go
		0250:02.8 TWR	United twenty eight eighty five heavy Metro tower turn-right heading two seven zero, runw-y two one right cleared for takeoff
		0250:09 ROO-7	Two seventy cleared for takeaff two one right
0250:16.8 CAM-1	That's two seventy six out, and it's all set up?		
CAM-3	Okay		
0250:22.5 CAM-1	Now let's have the finale		
CAM-3	Ignition		
0250:29.5 CAM-2	Do you want all boost pumps on or off		
CAM-3	On		

INTRA-COCKPIT

TIME & SOURCE	CONTENT
CAM-3	Ah ihey go all the way on
CAM-?	(Warning lights)
CAM-3	Off
CAM-3	Taking the runway
0250:38.6 CAM-3	Transponder
0250.40.9 CAM-1	That is on
0250:42.4 CAM-3	Flight recorder
CAM-2	Lights out
0250:45.8 CAM-3	(Ah set)
CAM-2	On

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
0250:31 TWR	Whiskey November did you get delayed at Pla or Butler
0250:36 N314WN	Yes sir Whiskey November ah we're just going over our clearance here, he're taxiing out now
0250:40 TWR	Okay 'hank you
0250:45 N314WN	Ah can't seem to find the Metro four departure

INTRA-COCKPIT

TIME & SOURCE	CONTENT
0250:47.7 CAM-3	That's it
0250:52.7 CAM-3	(Seatbelt, no smoking)
CAM-1	Full aown, yeah we'll get that on the roll
CAM-?	Transponder on?
CAM-?	Yeah we have the (transponder) on
CAM-?	Okay
CAM-'!	*
0251:01.1 CAM-?	(We get) everything yet?
0251:01.7 CAM-1	Okay fellows
0251:05.2 CAM	((Sound of power increases))

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
0250:49.0 TWR	Okay, maintain, ah, three thousand and departure control frequency one two four point zero five and, ah, he read you most the rest of it
0250:50:58 N314WN	Okay

INTRA-COCKPIT

TIME & SOURCE	CONTENT
0251:12.4 CAM-1	You got it
0251:12.6 CAM	((Sound of power stabilizes))
0251:20	((Clicks)) 1-1/2
0251:21.5 CAM-1	Looks good
0251:23.5 CAM	((Series of clicks)) 4
0251:25.5 CAM-2	Eighty knots

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
0251:10 N314WN	And, ah, Mhiskey November, we're gonna need nine thousand, ah, want us to take care of that now or later
0251:19 TWR	Requesting what altitude
0251:20 N314WN	Niner thousand or ten make it ten thousand
0251:23 TWR	One zero thousand (unintelligible) we'll take care of that now maintain five thousand, ah, Whiskey November expect further clearance to nine thousand ten minutes afted departure

INTRA-COCKPIT TIME & SOURCE	CONTENT	AIR-GROUND COMMUNICATIONS TIME & SOURCE	CONTENT
0251:27.3 CAM-1	Eighty knots		
CAM-1	(That's working *)		
		0251:35 N314WN	Whiskey November thank you five and then nine, ah, ten --- ten after
0251:36.2 CAM-1	Vee one		
0251:38.0 CAM-1	(Okay/rotate)		
0251:41.2 CAM	((Sound similar to soft stickshaker))		
0251:41.7 CAM-1	Now that's rotation!		
0251:46.9 CAM-1	Here we go		
CAM-3	Take (my/your) time		
0251:48.1 CAM-2	(Appollo ten)/(a fellow can't trim in ah)	0251:48.1 TWR	United twenty eight eighty five heavy contact departure
CAM-1	(Wait a minute here)		
CAM-1	(#)		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	**CONTENT**	**TIME & SOURCE**	**CONTENT**
0251:51.0 CAM	((Sound of stickshaker.))		
0251:52.7 CAP-1	No! No!		
CAM-1	Push forward, push forward!		
0251:55.8 CAM-1	Oh my!		
CAM-2	Trim!		
CAM-1	God		
0252:00.3 CAM-?	Oh, #		
CAM	((Sound of stickshaker ceases))		
CAM-?	*		
0252:03.4 CAM-1	It's going over		
CAM-?	(Yeah)		
0252:04.7 CAM-2	No back around		
		0252:07 TWR	United twenty eight eighty five heavy contact departure

INTRA-COCKPIT

TIME & SOURCE	CONTENT
0252:08.0 CAM-2	Back around the other way * *
0252:09.2 CAM-1	Oh
CAM	((Sound similar to stickshaker continues to impact))
CAM-1	Oh
0252:10.8 CAM-1	Running out of air
0252:11.4 CAM	End of tape

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT

APPENDIX F
UNITED AIRLINES POLICIES

The UAL Flight Operations Manual section on Policies - General states in Paragraph 1; "Conduct United Airlines flight operations activities in compliance with Federal Aviation Regulations and Company policies and procedures stated in this manual. However, NO REGULATION OR POLICY IS A SUBSTITUTE FOR THE EXERCISE OF GOOD JUDGMENT."

Paragraph 5 presents the Safety Policy which includes the following:

The Company's six point loss control policy is as follows:

A. Safety shall be considered by management and employees to be an integral and vital part of the successful performance of any job.

B. Safety is a paramount part of good operating practice and, therefore, a management function which will be given priority at all times.

C. Direct responsibility for the safety of an operation will rest with the supervisor of that operation. The Captain of a flight is the supervisor of that operation. See Paragraph 14.

D. Each individual employee is personally responsible to perform his duties giving primary concern to his own safety as well as that of his fellow employees, our customers and the property and equipment entrusted to his care.

E. Supervisory efficiency and ability will be judged by accident prevention performance as well as by other standards.

F. Management at all levels shall provide means for prompt corrective action in the elimination of unsafe acts, conditions, equipment or mechanical hazards.

Paragraph 14 previously referred to describes the captain's responsibilities:

14. The Captain is responsible for the following:

A. Command of the airplane. The pilot in command of an airplane is directly responsible for, and is the final authority as to, the operation of that airplane.

B. Safety of the crew, passengers, cargo and equipment, and overall safe conduct of the flight consistent with good judgment.

C. Compliance with Federal Aviation and Company Regulations.

D. Supervision of crew members during flight ani of flight officers during the period of flight preparation and termination of a particular assigned flight.

E. Reading all POSBD's (electronic messages of immediate operational impact) applicable to his airplane and operation, and reviewing them with his crew. The Captain's signature on the Dispatch Release Message (DRM) indicates he is familiar with the appropriate POSBD's

F. Training and development of crewmembers in techniques, methods, and day to day activities in accordance with UA policy and standard operating procedures.

G. Counseling of crewmembers as necessary.

H. Discussions of crew activities with crewmembers at time of assignment and periodically during such assignment.

14.1 The Captain's command of the airplane begins with the signal to start the airplane engines or the start of the push-back procedure, whichever comes first, and terminates when the airplane is accepted by qualified flight or ground personnel. In areas involving dispatch releases, gate parking and departure ptocedures, including pushback, engine starting, etc., there is obviously a shared responsibility between the Captain and other appropriate personnel.

Subsequent paragraphs address the responsibilities of the crew:

Responsibility of First-Officer

15. The First Officer is second in command. Should the Captain become incapacitated, the First Officer will assume the command and the responsibilities of the Captain. He will, therefore, learn the duties and responsibilities of the Captain, in addition to performing his own regular assignments.

Responsibility of Crew

16. Except as otherwise specifically directed by the Captain, all crew members noting a departure from prescribed procedures and safe practices should immediately advise the Captain so that he is aware of and understands the particular situation and may take appropriate action.

The Enroute section of the UAL Flight Operations Manual contains the following:

GENERAL COCKPIT POLICIES AND PROCEDURES

Flight Crew Stations and Look-Out

I. COCKPIT ORGANIZATION makes routine duties of as many activities as possible. it includes reviewing knowledge of navigation fixes, routings and frequencies before the; are needed. Cockpit discipline includes elimination of unnecessary conversation by crewmembers, assigned or observing.

2. **THE** CAPTAIN and First Officer will remain at the controls of the airplane during taxiing. Both pilots will have the rudder pedals and seats properly adjusted to assume control of the airplane at any time. During all takeoffs and landings, and in flight training during critical maneuvers, it will be normal procedure for the pilot not flying to be in the "ready" position at the flight controls but not actually touching them.

2.1 **FLIGHT** OFFICERS will man their stations at all times during flight operations (FAR 121.543); allowances are made for essential inspections and to insure personal alertness and comfort.

Manipulation of Controls

6. Only the authorized Captain and First Officer are permitted to operate the flight controls during flights operated under FAR 121, excepting that with the permission and at the discretion of the Captain in command a Supervisory Pilot currently qualified as a Captain on the equipment may occupy either pilot seat at any time. In addition, the Captain in command may permit occupancy of the right hand pilot position during cruising operations and manipulation of the flight controls by:

   A. A Fright Officer qualified as Captain or First Officer on the airplane.

   B. Pilot personnel of another air carrier properly qualified on the airplane and authorized Observer Member of Crew (OMC) by Senior Vice President - Flight Operations.

   NOTE: This does not preclude trainees from manipulating the controls during training flights which operate under FAR 91.

Flight Officers Changing Seats

7. First Officers (or pilots acting as First Officers) who are type rated in the equipment and have completed the enroute operating experience (shotgun) requirements for Captain, at the discretion of the Captain-in-Command, may occupy the left seat while enroute and for takeoffs and landings. While the First Officer is occupying the left seat, the Captain-in-Command will occupy the right seat.

8. Unassigned.

9. The Captain-in-Command will make all of his takeoffs and landings from the left seat.

Paragraph 27.5 of the UAL Operations Specifications - Explanations states, "When the Captain is not thoroughly acquainted with the capabilities of a First Officer assigned to him in regular schedule, it is recommended that the Captain make all takeoffs and landings until good crew coordination is established."