
**Runway excursion, United Air Lines, Inc., Boeing 727 QC, N7425U,
Chicago O'Hare International Airport, Illinois, March 21, 1968**

Micro-summary: This Boeing 727 QC abandoned its takeoff after rotation, resulting in a runway excursion.

Event Date: 1968-03-21 at 0351 CST

Investigative Body: National Transportation Safety Board (NTSB), USA

Investigative Body's Web Site: <http://www.nts.gov/>

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AIRCRAFT ACCIDENT REPORT

Adopted: December 31, 1968

UNITED AIR LINES, INC.
BOEING 727 QC, N7425U
CHICAGO O'HARE INTERNATIONAL
AIRPORT, ILLINOIS
MARCH 21, 1968

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
WASHINGTON D.C. 20591

UNITED AIR LINES, INC.
BOEING 727 QC, N7425U
CHICAGO O'HARE INTERNATIONAL
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SYNOPSIS

A United Air Lines, Inc., Boeing 727 QC, N7425U, operating as Cargo Flight 9963, crashed on takeoff from O'Hare International Airport, Chicago, Illinois, on March 21, 1968, at approximately 0353 c.s.t. The aircraft was destroyed by impact and ground fire. The three crewmembers, who were the only occupants of the aircraft, evacuated through the cockpit windows. The captain sustained injuries requiring hospitalization, while the first and second officers received only minor injuries.

Shortly after commencement of the takeoff roll on Runway 9R, the intermittent takeoff warning horn sounded, indicating an improper setting for takeoff of any one or a combination of the following items: flaps, speed brakes, stabilizer trim, or auxiliary power unit exhaust door. As the takeoff progressed, the crew attempted unsuccessfully to locate the condition which initiated the warning horn. The horn finally ceased just prior to reaching rotate speed.

Almost immediately after the captain rotated the aircraft, the stick shaker came on, indicating the aircraft was approaching

a stall. The captain lowered the nose slightly and added thrust, but the aircraft failed to climb or accelerate. The captain therefore elected to discontinue the takeoff and allowed the aircraft to settle back to the macadam shoulder off the right side of the runway. The aircraft then proceeded across the ground at an angle of approximately 4° with the runway until it came to rest at a point 1,100 feet beyond the east end of Runway 9R and 300 feet to the right of its centerline. During the latter part of the rollout, the aircraft struck a drainage ditch, causing damage which resulted in the fuel fed ground fire which consumed much of the aircraft.

Evidence in the wreckage established that the flaps were set at the 2° position. This setting is outside the takeoff range of 5° to 25° and thus constitutes a condition which would activate the warning horn.

The Safety Board determines that the probable cause of this accident was the failure of the crew to abort the takeoff after being warned of an unsafe takeoff condition.

1. INVESTIGATION

1.1 History of the Flight

United Air Lines, Inc., (UAL) Boeing 727 QC, ^{1/} N7425U, Cargo Flight 9963, crashed on takeoff, March 21, 1968. Flight 9963 was a regularly scheduled cargo flight originating at Newark Airport, New Jersey, and destined for San Francisco, California, with an en route stop at O'Hare International Airport in Chicago, Illinois. A crew change was effected at O'Hare, and the crew involved in the accident took charge of the aircraft.

The flight planning was carried out in a routine manner. Because the planned gross weight of the aircraft was near the maximum allowable for takeoff, and in view of the nearing-freezing temperatures, the first officer computed the maximum allowable takeoff weights for several runways, including 9L and 9R, for flap settings of 5° and 15°, with and without engine anti-ice. Although these computations indicated that the aircraft weight was within limits for a 15° flap takeoff, the captain elected to make a 5° flap takeoff since the weight was only slightly under the 5° flap gross weight and, in his view, the aircraft performed better at such weights with the lower flap setting.

Flight 9963 departed from the blocks at the UAL cargo area at approximately 0339 c.s.t., ^{2/} and was cleared to taxi to Runway 9R. The first officer stated that, as they began to taxi out,

^{1/} Quick change, cargo/passenger

^{2/} All times herein are central standard based on the 24-hour clock.

he lowered the flaps to 5°. He further stated that, shortly thereafter, he checked the controls by pushing the yoke full forward and rotating the wheel to the extreme right. He was able to detect outboard aileron movement because the aircraft was still in the well-lighted cargo area. He then rotated the control wheel to the full left position, and the captain looked out his left window and signaled that he also observed aileron movement. ^{3/}

While performing the pre-takeoff checklist during the taxi-out, the crew noted that the No. 1 engine anti-ice light did not illuminate with the anti-ice selector switch in the wing position, indicating that the No. 1 engine anti-ice valve was stuck open. When attempts to close the valve were initially unsuccessful, the captain decided to return to the ramp and procured a taxi clearance for that purpose. As the aircraft was being turned around, the anti-ice valve returned to its normal or closed position. The crew then tested the valve, which operated normally, and obtained clearance to resume their taxi toward the runway.

The pre-takeoff checklist was resumed where the crew had left off, starting with the item "altimeters," and the remainder of the taxi to the runway was routine. The captain asked for the final items as the aircraft taxied onto the runway following receipt of takeoff clearance at 0351. The takeoff was commenced in a rolling manner, rather than from a full stop, with the captain making the

^{3/} The aileron movement observed by the pilots at this point is only possible with the flaps at 5° or more. The outboard ailerons are locked when the flaps are in the 2° position, but are free with the flaps positioned at 5°.

takeoff and the first officer holding forward pressure on the yoke. The prescribed UAL procedure for a rolling takeoff is to advance the throttles to approximately 1.4 EPR ^{4/} and, when the aircraft is aligned on the runway and rolling, to advance the throttles to take-off EPR, which in this instance was a value of 1.98.

According to the crew, the takeoff roll was progressing normally until the intermittent takeoff warning horn was activated. This horn sounds when any of the following conditions exist as the No. 3 throttle is advanced to 65 percent, or greater, of takeoff thrust while the aircraft is on the ground:

- (1) Speed brake lever is not in the 0° detent.
- (2) Flap control lever is set outside the takeoff flap range of 5° to 25°.
- (3) Stabilizer trim setting is outside of the green band limits (1 to 9-1/2 units noseup).
- (4) AFU ^{5/} exhaust door is not closed.

The warning horn cannot be silenced except by correcting the condition causing its activation, or, as designed, when the nosegear oleo strut becomes extended.

The crew related that they immediately began to check the items that would cause the horn to be activated. The captain stated that he looked at the speed brake handle, which is on the left side of the center pedestal. He said he "grabbed the handle and tugged on it to be sure it was in the detent and it was." He

^{4/} Engine pressure ratio
^{5/} Auxiliary power unit

also stated that he "looked down at the trim indices on my side and saw it was in the green band." He then asked the first officer to check the flaps and received an answer that they were "o.k." He also remembered looking and seeing the green leading edge flap light illuminated. ^{6/} He further stated that "the flaps indicator, that is, the dials, are rather difficult to read at night, and they're jiggling around quite a bit." In addition, he noted that the location of the flap handle, as well as the lighting, makes it difficult to see.

The first officer gave the following account of his actions immediately subsequent to the activation of the warning horn:

"I called 'flaps' and felt the handle was in a detent which in the dark was well back from the zero position and I felt certain that it was the 5° detent. I observed that the needles of both flap indicators were at the 3 o'clock or 5° position though I did not read the number 5° on the indicator, and the green leading edge device light was on. I then called 'speed brake' and rammed my flat palm against the handle and could feel it full forward and in the detent. . . . I called trim and used my hand flashlight to definitely verify that it was in the aft portion of the green band and was certain the index was stationary."

^{6/} With the flap lever in the 2° position, this light will illuminate when two leading edge slats on each wing are extended. When the flap lever is in or beyond the 5° position, the light will illuminate when all leading edge flaps and slats are retracted.

The second officer stated that his first reaction to the horn was to look at the APU door light which was out. He also recalled that the flap gauges "looked normal."

The crew further related that the warning horn ceased at or shortly prior to reaching V_R .^{1/} The captain, believing that the condition which had caused the horn to sound was no longer a problem, rotated the aircraft. He stated that the aircraft rotated very easily and with "abnormally light pressure." Immediately thereafter, the stick shaker was activated, indicating that the aircraft was in a flight condition approaching a stall. The captain reacted by pushing the nose over and shoving the throttles forward. He stated that "at this point I was faced with the decision of trying to keep the airplane in the air and clear the freeway, which was not too far off, or put it back on the ground. Since it was not climbing or accelerating and the stick shaker was still going, I elected to do the latter." Accordingly, he closed the throttles as the aircraft settled back to the macadam shoulder off the right side of the runway.

The captain recalled that he used the wheel brakes and reverse thrust during the rollout, but could not remember if he used speed brakes. The crew related that, after proceeding over the ground in

^{1/} V_R (rotate speed) and V_1 (critical engine failure speed) were both calculated to be 143 knots for a 5° flap takeoff.

a fairly smooth manner, the aircraft struck a ditch and decelerated rapidly. As the aircraft skidded to an abrupt stop, the crew was tossed around violently inside the cockpit.

The crew recalled that the engine instruments were normal insofar as they were observed during the takeoff. In addition, the first officer stated that, when the stick shaker became activated, he "glanced again at the airspeed indicator and saw the needle pass through the V_2 ^{8/} bug by at least 5° of the dial." The V_2 bug had been set for 161 knots. The first officer was also of the view that, during the period following rotation, 15° aircraft noseup attitude was never exceeded.

The accident was viewed by a number of ground witnesses, most of whom were located in the vicinity of the cargo area, which is approximately 1,000 feet north of the east end of Runway 9R. Three witnesses described the takeoff roll, rotation, and lift-off as being smooth and normal. The eight witnesses who saw the aircraft in flight estimated that its maximum altitude above the runway was from 10 to 50 feet, and that the aircraft was in a normal noseup attitude, although it seemed to maintain an altitude rather than climb out. Some of the witnesses noted that the aircraft touched down in a noseup, left wing low attitude, and several of these described hearing a power reduction during touchdown. Three witnesses heard the engines go into reverse after touchdown, while others described the fire and separation of the tail section.

^{8/} Takeoff safety speed.

With respect to the landing lights during the takeoff regime, one witness "saw a light shining down ahead of the wheels," another (an air carrier pilot) noted that the "left wing landing light appeared to be approximately one-half or more retracted," while a third stated that "the lights appeared to be shining at a slight angle downward on straight ahead." A fourth witness felt that the lights "were on before rotation but were out just after rotation," ^{9/}

The aircraft came to rest approximately 1,100 feet beyond the east end of Runway 9R and 300 feet south of the runway centerline. ^{10/}

The accident occurred at nighttime at approximately 0353.

1.2 Injuries to Persons

The three crewmembers, who were the only occupants of the aircraft, were taken to a local hospital for first-aid treatment. The first and second officers were treated for minor cuts and bruises and released. The captain was hospitalized and treated for a back injury.

1.3 Damage to Aircraft

The aircraft was destroyed by impact with the drainage ditch and by the ensuing ground fire.

^{9/} The outboard landing lights are mounted on the outboard kreuger flaps. Thus, with a 5° or higher flap setting these lights are directed forward, whereas with a 2° flap setting they are directed downward.

^{10/} The geographic coordinates for O'Hare Field are 41° 59' N and 87° 54' W, and the field elevation is 667 feet m.s.l.

1.4 Other Damage

There were scrape marks on the runway and impressions on the adjacent macadam shoulder, as well as deep ruts in the muddy ground to the south of Runway 9R. One runway light was damaged when overrun by the right main landing gear tire.

1.5 Crew Information

An examination of company and Federal Aviation Administration (FAA) records of the flight personnel aboard Flight 9963 revealed that all crewmembers were properly qualified and certificated for the flight involved. Detailed information in this regard is set forth in Appendix A.

1.6 Aircraft Information

An examination of pertinent aircraft records indicated that the aircraft met airworthiness requirements and a check of maintenance log sheets for the period subsequent to January 1, 1968, indicated that all discrepancies listed thereon had received appropriate attention. Records also disclosed that maintenance checks, service checks, terminating pre-flight checks, and en route service checks were performed as required and the related forms executed in the proper manner. ^{11/} Statistical data concerning the aircraft, including the powerplants, are set forth in Appendix B.

The weight manifest form prepared for Flight 9963 listed a takeoff gross weight of 166,051 pounds and a center of gravity of

^{11/} In searching the records, particular attention was focused on items pertaining to flight control systems and related indicating systems.

16.0 percent MAC. ^{12/} Due to a change in cargo weight, the center of gravity was altered to 14.1 percent MAC. The change in MAC was given to the crew via company radio prior to departure; however, the weight change itself was not transmitted to the crew. Investigation also revealed that the cargo weight was overstated by 900 pounds. However, neither of the weight discrepancies had any effect on the center of gravity. The corrected takeoff gross weight, which was 165,695 pounds, and the center of gravity both were within limits.

The aircraft was serviced with 4,331 gallons of aviation kerosene at O'Hare, bringing the total fuel load to 43,800 pounds.

The captain of Flight 9963 on the Newark-Chicago segment stated that the aircraft flew normally in all respects except for takeoff. The first officer was flying the aircraft and noticed that it had a tendency to overrotate. It required a considerable amount of forward pressure on the yoke to hold a 10° noseup attitude. After retrimming the aircraft for this apparent tail-heavy condition, no further problem was encountered. This item was not entered in the aircraft flight log.

A check of other pilot personnel who had flown this aircraft during the several days prior to the accident revealed that the airplane had performed normally.

1.7 Meteorological Information

The surface weather observation at O'Hare for 0350 was as follows:

^{12/} Mean aerodynamic chord.

measured ceiling 1,000 feet broken, 1,700 feet overcast, visibility 7 miles, very light snow, temperature 34° F., dew point 30° F., wind 020° 12 knots, altimeter setting 30.05 inches.

The amended aviation terminal forecast issued at 0240, valid for the period 0240 to 1100, called for ceiling 500 feet broken, 1,800 feet overcast, visibility 5 miles, light snow, wind 010° 12 knots, briefly ceiling 800 feet overcast, visibility 1-1/2 miles, light snow.

Copies of the terminal forecasts were among the weather documents which were attached to the company flight plan, log, and dispatch release, which were signed by the captain. A self-help weather briefing display was available to the crew in the UAL Dispatch Office.

The general consensus among ground witnesses concerning weather was that a very light snow was falling, visibility was good, and a slight wind was blowing from the east.

1.8 Aids to Navigation

Not involved.

1.9 Communications

There were no reported problems with communications.

1.10 Aerodrome and Ground Facilities

Runway 9R is 10,000 feet long and 150 feet wide, with a cement surface. There is a macadam shoulder approximately 10 feet wide on each side of the runway, and a macadam blast pad at each end of the runway. High intensity runway lighting is available for this runway. There was no appreciable accumulation of moisture on the runway.

1.11 Flight Recorders

(a) Flight Data Recorder

The aircraft was equipped with a Fairchild flight data recorder, model 5424, S/N 7837, which was recovered from the wreckage. The flight recorder was damaged by impact and fire, but the recording medium was intact and readable. However, there were malfunctions in the airspeed and altitude parameters. Consequently, the only information obtainable was that derived from the vertical acceleration and magnetic heading parameters.

The magnetic heading trace on the flight recorder data graph remained within 4° of 090° (the runway heading) from commencement of the takeoff roll until breakup occurred. The vertical acceleration trace appeared normal until the approximate point in time when the aircraft was rotated, following which there were a series of rapid and substantial excursions of this trace, which reached extreme values of 2.0 positive g's and .5 negative g's.

(b) Cockpit Voice Recorder

The aircraft was equipped with a United Control Corporation model V-557 cockpit voice recorder, S/N 1014, which was recovered from the wreckage in satisfactory condition. The cockpit area microphone recorded the voices of the crew from engine startup until the crash. Voice identification information set forth in the transcript prepared from the recording was provided primarily by the first officer on Flight 9963.

The recording contains the sound of the intermittent warning horn for a period of 31 seconds during the takeoff roll. The horn ceased 2 seconds prior to the first officer calling out "rotate," and 4 seconds after that utterance, the stick shaker is heard.

A correlation of the flight data recorder and the cockpit voice recorder, based on a common time reference, indicates that the transmission from Flight 9963 acknowledging takeoff clearance commenced 39 seconds prior to the start of takeoff roll.

Attached hereto as Appendix C is that portion of the cockpit voice recorder transcript commencing with the issuance of takeoff clearance and terminating with the end of the recording.

1.12 Wreckage

During an examination of Runway 9R, an impression was found in the flexible (macadam) pavement of the right runway shoulder. The start of this impression was approximately 2,200 feet short of the east or far end of the runway. The impression was approximately 100 feet long and was angled approximately 4° to the right of the runway centerline. The measured width of the impression was approximately 5-7/8 inches, which closely corresponds to the measured width (5-3/4 inches) of a worndown area found on the drag link lower tip of the tail skid assembly. The lower skid was fractured on the left side, approximately 5 inches from the skid end, and the drag link lower tip had sustained a heavy, continuous scraping.

A second mark was found along side of the above described impression. This mark, best described as a scrape, started on the cement portion of the runway at a point just short of the 5-7/8-inch impression and continued off onto the flexible pavement. The No. 2 (center) engine thrust reverser fairing, which is located at the 6 o'clock position, was found scraped through. Material which was similar to the runway cement and the flexible pavement was found embedded within the scraped portion of the fairing.

The first contact of the right gear was made in the dirt adjacent to the runway, approximately 15 feet from the flexible pavement edge and approximately 2,050 feet short of the far end of the runway. The left main gear rolled off the runway approximately 1,940 feet short of the far end.

The left and right main gear wheel tracks were continuous until joined by the nosegear track at a point approximately 900 feet short of the end of the runway. From this point on, the three gear tracks were continuous until the aircraft crossed a drainage ditch, which was essentially perpendicular to the path of the aircraft.

The impact with the ditch, which is approximately 6 feet deep, sheared the landing gears and damaged the left wing and underside of the fuselage. After contacting the ditch, the aircraft skidded, shedding portions of the lower fuselage structure and belly cargo, the ventral stair, and portions of the right wing. Just before the

aircraft came to rest, the aft fuselage, No. 1 engine, and the stabilizer assembly separated from their respective attaching structures.

The aircraft came to rest approximately 640 feet beyond the ditch, on a magnetic heading of approximately 095°. The final wreckage site was approximately 1,100 feet east of the far end of Runway 9R and approximately 300 feet south of the runway centerline. Attached hereto is a chart depicting the impression in the flexible pavement, the tire tracks, and the distribution of the wreckage.

During the examination of the wreckage, particular emphasis was centered on those components (flaps, APU exhaust door, speed brakes, stabilizer trim) whose setting or position might have activated the takeoff warning horn. The evidence uncovered may be summarized as follows:

1. The APU exhaust door was recovered in its frame and found closed and latched.
2. The speed brake panels and actuators were found in the stowed and locked position. The speed brake handle was found out of the stowed position.
3. According to the most reliable evidence, the horizontal stabilizer trim setting was 8.5 units aircraft noseup, which would have been the approximate correct trim setting for a takeoff with a center of gravity of 14 percent MAC.

4. The flaps were set at the 2° position, as indicated by the following evidence:
- a. The flap control handle was fixed in the 2° position by the solidified plastic from the cockpit overhead panels, which had melted during the ground fire.
 - b. The flap control handle track guide was fitted to the handle and the mechanism aligned with the 2° detent.
 - c. Leading edge slat Nos. 2, 3, 6, and 7 were extended and locked, while Nos. 1, 4, 5, and 8 were retracted and locked. This combination occurs only at a selection of 2° flaps.
 - d. The main quadrant in the trailing edge flap followup system was in a position corresponding to less than 5° flaps.
 - e. The measured position of the trailing edge flap jack-screws placed the flaps at 2°.
 - f. The aileron lockout mechanism that is programmed by the actual flap position was recovered in the 2° flap position.

All four flap position transmitters operated properly when functionally tested. However, the pulling and breaking of cables to the transmitters bent and tore away mounting structure to the extent that no reliable position information existed.

The flap position switch, APU door switch, speed brake switch, and stabilizer position switch for the takeoff warning system were removed and examined. All switches were tested and functioned properly, with the exception of the APU door switch, which was too damaged to be tested.

There was no evidence to indicate that the flight control, hydraulic, autopilot, electrical, pneumatic, communication, navigation, fire protection, or air conditioning systems were malfunctioning prior to the accident; nor was there any evidence suggestive of any abnormalities or discrepancies within the powerplants, their component and accessories, or the fuel system, other than those attributed to damage caused by ground impact. The No. 2 engine thrust reverser was in the cruise (flight stowed) position, while the Nos. 1 and 3 engine thrust reversers were in the "in transit" position.

An examination of Runway 9R was conducted in order to ascertain if any parts might have become disengaged from the aircraft during its takeoff roll. The results of this search were negative.

1.13 Fire

The majority of the aircraft was destroyed by a fuel-fed ground fire resulting from the impact with the drainage ditch which severely damaged the wing structure, causing fuel spillage from the wing tanks. The fire was fought by the Chicago Fire Department which maintains a station at O'Hare Field.

1.14 Survival Aspects

The captain evacuated from the aircraft through the left cockpit window. He stated that he jumped, rather than use the rope, because the fire was illuminating the ground well enough to enable him to see where he would land. The first officer was the second crew-member out, jumping through the right cockpit window. He was followed out this window by the second officer. The three crewmembers then met near the nose and together proceeded away from the aircraft, which was rapidly becoming engulfed in flames.

Shoulder harnesses, although available, were not worn by the crewmembers.

1.15 Tests and Research

On March 29, 1968, tests were conducted at Denver, Colorado, utilizing a UAL B-727 flight simulator and three UAL B-727 qualified flightcrews. The three crews were notified to report for simulator training without knowledge of the program or of the facts regarding Flight 9963, although they were aware of the accident. Each crew was briefed separately and was unable to converse with the other crews who were about to take the tests or who had completed the tests.

The crews were told that no names would be taken and that the tests were being conducted to gather data in connection with the investigation of the accident involving Flight 9963. They were briefed that they would make five takeoffs and that, within its capabilities, the simulator would be programmed with the following information:

Airport elevation	667 feet
Runway heading	090°
Wind	020° 11 knots
Gross weight	166,595 pounds
Center of gravity	14 percent MAC
Temperature	34° F

Each crew was asked to utilize the normal operating procedures for each flight test conducted. All takeoffs were initiated by first stabilizing the engines at takeoff EPR and then releasing the wheel brakes simultaneously.

The first two tests were 5° flap takeoffs, the first for warmup purposes, while the second was used to collect data. The third test was also a 5° flap takeoff, but the intermittent warning horn was activated by an electrical switch 10 seconds after brake release. The horn could not be silenced by the crew. Crew Nos. 2 and 3 aborted their takeoffs 3.5 and 7 seconds respectively after commencement of the horn. The captain of crew No. 1 asked if he should continue the takeoff to satisfy the test. He was told "no" and he aborted the takeoff 17 seconds after the horn was activated.

The fourth test was a 2° flap takeoff utilizing 5° flap V_R and V_2 speeds. The captain of crew No. 1 knew the flaps were set at 2°, but the captains of crew Nos. 2 and 3 did not and assumed they were conducting a 5° flap takeoff. The warning horn was silenced for this test. All crews experienced activation of the stick shaker at V_{LOF} ,^{13/}
13/ Lift-off speed.

and their immediate reaction was to apply forward yoke which in turn deactivated the stick shaker and climbout was continued. Crew No. 3, on experiencing the stick shaker, also applied forward yoke to deactivate it. Following this, climbout attitude of 8° to 9° noseup attitude was established, and almost immediately the stick shaker was activated again. They reapplied forward yoke, again deactivating the stick shaker, and then continued the climbout without further stall warning.

The fifth and final test was also a 2° flap takeoff utilizing 5° flap V_R and V_2 speeds. The captain of crew No. 1 was told it would be a 5° flap takeoff, while the other two crews knew the flaps were, in fact, set at 2°. The warning horn again was silenced. All crews experienced the same stall warning as occurred in the fourth test. Crew No. 3 experienced the identical stall warning twice as described in the previous test.

1.16 Other Information

(a) Prior Incidents

A spot check of FAA Air Carrier En Route Inspection Reports revealed two similar occurrences of the intermittent takeoff warning horn being activated during takeoff of a B-727 aircraft. Both of these incidents occurred at Denver, Colorado.

On November 2, 1966, the crew of Frontier Air Lines Flight 771 aborted their takeoff because of activation of the warning horn. The horn sounded because the wing flaps were set at 2°.

On April 29, 1967, United Air Lines Flight 227 also experienced hearing a warning horn, aborted their takeoff, and found the flaps were set at 2°.

(b) Performance Data

According to the Boeing 727 Operations Manual, stick shaker speeds for a gross weight of 165,000 pounds are 169 KIAS ^{14/} for 2° of flaps and 143 KIAS for 5° of flaps. Stall speeds for a gross weight of 165,000 pounds are 152 KIAS for 2° of flaps and 128 KIAS for 5° of flaps. ^{15/}

^{14/} Knots indicated airspeed.

^{15/} The figures listed above are the upper limits of the stick shaker and stall speed ranges. In other words, the stick shaker will activate and the aircraft will stall at or below the above-listed speeds.

2. ANALYSIS AND CONCLUSIONS

2.1 Analysis

The investigation disclosed that the only causal factors involved in the accident were directly related to the chain of events initiated by the flaps being in the 2° instead of the 5° position. The evidence uncovered in the wreckage conclusively established that the flaps were in the 2° position. Furthermore, the events which occurred during the flight are consistent with such a setting. This setting is outside the flap takeoff range of 5° to 25° and therefore accounts for the activation of the takeoff warning horn during the takeoff roll. The 2° flap setting also explains why the stick shaker came on immediately after the nose was rotated and why the aircraft was relatively unresponsive to control and power inputs during the brief time it was airborne. Finally, the ground witness' statements that the landing lights were retracted or shining downward also support the conclusion that the flaps were at the 2° position during takeoff. With a 5° or higher flap setting, the outboard landing lights are directed forward, whereas with a 2° flap setting, those lights are directed downward.

Apart from the evidence regarding the flaps, there was no other indication of any condition or malfunction which could have accounted for the activation of the takeoff warning horn and the stick shaker or the sluggish flight characteristics of the aircraft. The evidence in the wreckage indicated that the other components connected to the

takeoff warning system (stabilizer trim, speed brakes, and APU exhaust door) were properly set for takeoff and therefore would not have caused the horn to sound. Moreover, there was no evidence of a malfunction or discrepancy in the powerplants or flight control system which might have explained the inability of the aircraft to climb or accelerate. In this instance, except for an adverse reflection on UAL flight preparation procedures, the several discrepancies in the computed gross weight were not significant, and the weight and balance of the aircraft were within limits. Finally, an analysis of the existing weather conditions discounted airframe icing as a causal factor.

In attempting to determine the latest point in time at which the flaps were still in the 5° position, a careful examination was made of the taxi-out portion of the flight. The first officer stated that he placed the flaps in the 5° position as the aircraft left the blocks and, while the aircraft was still in the well-lighted cargo area, that a check of the flight controls was made. He further stated that the pilots detected outboard aileron movement on both wings that could have occurred only with a flap position of 5° or more. The cockpit voice recorder indicates that, shortly thereafter, the flap setting was checked at 5° as the first and second officers proceeded with the pre-takeoff checklist. ^{16/} At this stage of the taxi-out, therefore, it appears that the flaps were in the proper position for takeoff.

It is difficult to ascertain exactly when or how the flaps came to be in the 2° position. There are, however, two possible explanations

^{16/} The portion of the cockpit voice recorder referred to above is not included in the transcription which is excerpted in Appendix C.

in this regard. The first involves the events immediately following the detection of a malfunction of the No. 1 engine anti-ice valve during the pre-takeoff checklist. As the flight proceeded to turn around and taxi back toward the cargo ramp, it is possible that the first officer, through force of habit, started to perform the taxi-in checklist. This checklist is not performed by the challenge-response method, but rather is accomplished separately by the first officer. This would account for the absence of any oral mention of the checklist on the cockpit voice recorder.

The first item on this checklist is "Flaps-up," which would call for moving the flap handle to the 0° position. However, when moving the flaps to the 0° position during flight, a pause is made at the 2° position to provide for operation of the leading edge devices. Accordingly, it is possible that the first officer instinctively paused at the 2° detent when raising the flaps, even though such a pause was not required since the aircraft was on the ground.

Continuing with this line of reasoning, before the first officer could continue the retraction of the flaps from 2° to 0°, he may have become absorbed in the attempts to correct the anti-ice valve malfunction. Indeed, the cockpit voice recorder reveals that the first officer actively participated in the crew's effort to alleviate that problem. When the anti-ice light went off, and that system tested normally, the crew resumed taxiing toward the runway and the pre-takeoff checklist was also resumed. However, the crew started

where they had left off with the item "altimeters," and in the process of completing the checklist did not check the preceding items, one of which was the flaps. ^{17/} Accordingly, the 2° flap position would have remained undetected. Although a control check was conducted just prior to takeoff, no mention was made of outboard aileron movement which would have indicated a 5° flap position. In any event, it is doubtful that such movement could have been detected because the aircraft was positioned in an unlit area at that time.

It should be emphasized that the aforedescribed chain of events is only a possible explanation based on a series of assumptions which in turn rest on circumstantial, rather than direct, evidence. The first officer, when questioned specifically on this matter, stated that he "most definitely did not reposition the flaps or touch the flap handle or any other item normally associated with the 'taxi-in.'" On the other hand, the entire theory as postulated above, rests on the proposition that he repositioned the flaps instinctively, without being consciously aware that he was doing so. Accordingly, it would be expected that he would not recall such an action.

The second possible explanation regarding the improper flap position is that, when the flaps were positioned to the 5° setting by the first officer as the aircraft left the blocks, the flap

^{17/} UAL policy with respect to the takeoff checklist is that "If following the completion of the Challenge-Respond, a delay of sufficient duration is incurred to cause repositioning of any controls, the Challenge-Respond must again be completed in its entirety." Thus, if the first officer in fact moved the flaps from the 5° position, it was incumbent on him to resume the pre-takeoff checklist starting with the first item.

handle was placed just short of the 5° detent rather than in the detent itself. At some later time during the taxi-out, the handle crept forward until reaching the 2° detent. In order to test the validity of this theory, a number of experiments were conducted during the investigation by placing the flap handle on a B-727 on the lip of the 5° detent and then taxiing the aircraft at normal taxi speeds. These tests demonstrated that the flap handle will slip toward and into the 2° detent, and not toward the closer 5° detent. Again, however, this theory is not based on direct evidence, but rather is offered only as a possible explanation of what happened.

On balance, the Board concludes that the available evidence does not allow a determination, with any reasonable degree of certainty, as to when and how the flaps came to be in the 2° position. The only conclusion that can be reached is that the flaps were in fact in the 2° position at the time the warning horn became activated during the takeoff roll.

A correlation of the flight and cockpit voice recorders, based on a common time reference, shows that the transmission from Flight 9963 acknowledging takeoff clearance commenced 39 seconds prior to the start of takeoff roll. In addition, the cockpit voice recorder transcript indicates that a period of 44 seconds elapsed between the beginning of that transmission and the activation of the takeoff warning horn. (See Appendix C.) Accordingly, the horn began sounding approximately 5 seconds after the commencement of the takeoff roll.

The approximate 5 second delay between the commencement of the takeoff roll and the activation of the warning horn is explained by the handling of the throttles prescribed by the UAL takeoff procedure. For a rolling takeoff, the throttles are advanced to the 1.4 EPR position as alignment is completed. When the aircraft is aligned on the runway and rolling, the throttles are advanced to takeoff EPR. The 65 percent takeoff thrust position, at which the warning horn is activated, is beyond the throttle position corresponding to a power setting of 1.4 EPR. Consequently, the horn would not have been activated until the throttles were advanced through the 65 percent position to takeoff thrust following the brief pause at the 1.4 EPR position.

As noted previously, evidence in the wreckage established not only that the flaps were in the 2° position, but also that this setting would have been accurately reflected in the cockpit both by the flap position indicator and by the position of the flap handle itself. Accordingly, it is difficult to understand why the crew was unable to detect the improper flap setting which caused the horn to sound continuously for 31 seconds. The statements of the crewmembers, however, shed some light on this matter. The first officer "felt that the (flap) handle was in a detent which in the dark was well back from the zero position and I felt certain was in the 5° detent." His determination was therefore based on "feel" rather than visual observation, apparently because of lack of lighting.

The captain also stated that the flap handle, by reason of its position as well as the lighting, is difficult to see at night. It should also be noted that the distance between the 2° and 5° detents is only about 1 inch.

With respect to the flap indicators, the first officer stated that, although he observed the needle to be in about the 3 o'clock or 5° position, he did not read the number 5° on the dial. In addition, the captain noted that the flap indicators are "rather difficult to read at night, and they're jiggling around quite a bit."

Both the captain and the first officer also appear to have relied to a certain extent on the fact that the green leading edge flap light was illuminated. Such reliance was not justified, however, because a green flap light indicates not that the flaps are within the takeoff range, but only that the leading edge devices agree with the position of the flap control lever. Thus, this light will be illuminated when the flaps are in the 2° or any other position, as long as they are in fact in the position called for by the lever.

Regardless of the reasons why the crew did not detect the improper flap setting, it is obvious that the takeoff roll is not a period during which a crew should be troubleshooting an unsafe takeoff condition. During this period, the aircraft is rapidly accelerating, leaving an ever-decreasing amount of time within which to discover the problem. Furthermore, any attempts to scan the cockpit in order to locate the warned-of condition, particularly at

night in a darkened environment, only serve to divert the crew from their other critical duties.

The only safe procedure, dictated by sound judgment, would be to abort the takeoff and correct the problem before attempting another takeoff. Indeed, any other action has the effect of defeating the purpose of the warning system, which is installed on the aircraft to indicate an unsafe takeoff configuration and should be treated as such. Had the crew in this case aborted the takeoff, rather than attempting to locate the unsafe condition while continuing the takeoff roll, they could have readily identified the problem and recommenced their departure safely after only a minor delay.

The UAL Flight Operations Manual, as constituted at the time of the accident, set forth in sufficient detail the reasons why the takeoff warning horn will sound, and also the means by which the horn can be silenced. However, this manual contained no specific instructions as to what action should be taken by the crew if the horn should become activated during the takeoff roll. A review of Boeing 727 Flight Operations Manuals used by other carriers revealed similar deficiencies.

With respect to instructions imparted during training, it appears that pilot personnel again were taught the conditions which would activate the warning horn, but that no explicit directives were given to abort the takeoff if the horn sounded before the aircraft reached V_1 speed. The crews apparently were permitted some degree

of discretion in attempting to correct the unsafe takeoff condition, rather than immediately aborting the takeoff. Indeed, reports were received from several airline crews during the investigation relating that they had been able to locate and correct the unsafe condition while continuing the takeoff roll.

The Board recognizes that the simulator tests conducted subsequent to the accident, as well as the two warning horn incidents which occurred in Denver, constitute examples of situations in which flightcrews aborted takeoffs upon activation of the warning horn. However, the value of the simulator tests as a reliable indication of the reactions of flightcrews in general is somewhat qualified by the fact that the test crews, although unaware of the details of the subject accident, were informed that the tests were part of the investigation, and therefore must have been "on guard" with respect to any takeoff emergencies. Similarly, the crews involved in the two operational incidents were no doubt acutely aware of their reactions to any abnormal occurrences in view of the presence in the cockpit of an FAA inspector. At any rate, the Board is unable to conclude that these examples provide sufficient assurance that all B-727 flightcrews will abort a takeoff when the warning horn is activated.

In view of the foregoing, the Board has recommended that specific instructions be issued to all Boeing 727 operators requiring that takeoffs be aborted if the intermittent warning horn sounds during the takeoff roll before the aircraft reaches V_1 speed. Letters embodying this recommendation have been transmitted to the Administrator of the FAA. These letters, plus the respective responses of the

Administrator, are discussed in detail in the Recommendations and Corrective Action section.

Continuing with the chronological analysis of Flight 9963, the explanation for the warning horn ceasing 2 seconds prior to the first officer calling V_R is contained in the captain's statement. He related that as the aircraft reached rotate speed, the nose "came right off the ground . . . with abnormally light pressure." This description closely corresponds to the observation of the preceding crew who noted that the aircraft had a tendency to overrotate. It therefore appears likely that, just prior to reaching rotate speed, the nose gear strut became sufficiently extended to actuate the switch that cuts out the ground operating mode of the warning horn.

In analyzing the actions of the captain during the brief period in which the plane was airborne, it must be remembered that he believed the flaps were set at 5° , whereas in fact they were in the 2° position. Accordingly, the rotate and lift-off speeds of the aircraft were in fact considerably higher than the planned speeds, with the consequence that the aircraft was rotated and lifted off prematurely. Furthermore, the stall warning speed range was at or below 169 KIAS (for 2° of flaps) rather than at or below 143 KIAS (for 5° of flaps), which accounts for the stick shaker becoming activated immediately after lift-off.

The captain reacted to the stick shaker by pushing the nose over and adding power, which is the normal method of averting a stall. At

this point, it should be noted that, when presented with a similar situation, the crews participating in the simulator tests subsequent to the accident, took the same remedial steps as the captain of Flight 9963. The difference, of course, is that the simulator flights were able to accelerate through the stick shaker speed range, while on Flight 9963 the stick continued to shake during the entire airborne period of the flight. It appears, however, that the aircraft must have closely approached the stick shaker speed of 169 knots in view of the first officer's observation that the airspeed indicator passed through the 161 knot mark by 5° of the dial.

In any event, the Board does not believe the captain acted unreasonably in deciding to discontinue the climbout. Even after adding power and pushing the nose over, the aircraft did not climb or accelerate through the stick shaker speed range, thereby presenting the captain with the risk of crashing into the freeway off the end of the runway if he chose to continue the flight. The Board also recognizes that, regardless of the results of the simulator tests, the captain of Flight 9963 was presented with a split-second decision under actual operational conditions which cannot be recreated in toto in a simulator.

The various markings on the runway and runway shoulder, when correlated to the damage on the underside of the aircraft, provide a clear picture of the manner in which the aircraft settled back to

the surface. While airborne, the aircraft was drifted to the right approximately 4° in relation to the runway centerline, apparently due to the crosswind from the left. Initial contact with the surface was made by the tail skid and the No. 2 engine thrust reverser fairing, which contacted the runway shoulder while the aircraft was in a nose-high attitude. ^{18/} As the aircraft continued to travel off the runway, the left main gear settled to the runway and, shortly thereafter, the right gear made contact a short distance from the runway edge in the adjacent muddy terrain. This indicates that, in addition to a nose-high attitude, the aircraft settled with the left wing slightly down, which corresponds to ground witness observations. The nosegear finally touched down approximately 1,300 feet beyond the point where the main gear contacted the surface. From that point, the aircraft rode on all three gears until it impacted with the drainage ditch.

In regard to the use of the available decelerative devices, the captain stated that he used the wheel brakes and reverse thrust, but he could not recall whether he used the speed brakes. Several witnesses supported his recollection concerning reverse thrust by their statements that the aircraft sounded as if it went into reverse after touchdown. The evidence derived from the wreckage was inconclusive on this point, indicating only that the No. 1 and No. 3 engine reversers were in the "in transit" or "unstowed" position.

^{18/} In order for these two parts of the aircraft to contact the surface, the aircraft deck angle had to be in excess of 13° .

Evidence did show, however, that the speed brake panels were stowed and thus were not utilized. Their primary effect while the aircraft is on the ground is to decrease lift, thereby increasing the effectiveness of the wheel brakes. However, in view of the fact that the aircraft was rolling out over muddy terrain, it is questionable whether the increased effectiveness of the brakes, provided by extension of the speed brakes, would have significantly reduced the impact forces with which the aircraft struck the ditch.

From the vantage point of hindsight, it is clear that had the captain been able to keep the aircraft aligned with the runway while airborne and during ground rollout, the degree of damage sustained by the aircraft would have been far less severe. The fact that the aircraft would have been rolling out over a paved surface, rather than muddy terrain, would have greatly increased the effectiveness of the wheel brakes. Furthermore, even assuming that the aircraft would nonetheless have overrun the end of the runway, the drainage ditch would have presented no problem since that portion of the ditch which traverses the area corresponding to the extension of Runway 9R is underground.

The Board is somewhat concerned with the failure of the crew of Flight 9963 to wear the shoulder harnesses which were installed on the aircraft. The Board recognizes that, although shoulder harnesses are required equipment on all transport aircraft certificated after January 1, 1958, ^{19/} neither the Federal Aviation Regulations nor

^{19/} See Part 121.321 of the Federal Aviation Regulations (14 CFR 121.321).

company policy requires flightcrews to wear them. Nevertheless, the Board believes that shoulder harnesses are a proven safety factor and should be worn during the critical periods of takeoff and landing. This view is borne out by the circumstances of the subject accident. The crewmembers most vivid recollection of the impact is one of being violently tossed around inside the cockpit. The wearing of shoulder harnesses would have held the upper parts of their bodies in a stationary position and would therefore have tended to reduce the severity of the injuries, which included lacerations and bruises on the chest, face, and arms, as well as back injuries. Flightcrews should be encouraged to wear shoulder harnesses, not only to enhance their own safety, but also to assure that they will be available to assist in the evacuation of passengers once the aircraft has come to rest.

In view of the foregoing, the Board recommends that the FAA and air carriers re-examine their positions regarding shoulder harnesses with a view toward requiring their use through appropriate revisions of pre-takeoff and before-landing checklists.

2.2 Conclusions

(a) Findings

1. The aircraft was airworthy, and its gross weight and center of gravity were within limits.
2. The flight crewmembers were properly certificated and qualified for the operation involved.

3. Weather was not a causal factor in the accident.
4. There was no indication of a mechanical failure or malfunction of the aircraft structure, systems, or powerplants.
5. Evidence conclusively established that the flaps were in the 2° position during takeoff, although it cannot be determined when and how the flaps came to be in this position.
6. The 2° flap position is outside the takeoff range and therefore activated the takeoff warning horn shortly after the commencement of the takeoff roll.
7. The flight crewmembers were unsuccessful in their attempts to ascertain the condition that activated the warning horn, which continued to sound until just prior to rotate speed.
8. The Operations Manual, as well as flight training, were deficient in that they did not impart to pilots specific instructions requiring them to abort takeoffs if the takeoff warning horn is activated prior to reaching V_1 speed.
9. Immediately after lift-off, the stick shaker was activated, indicating that the aircraft was approaching a stall.
10. The captain lowered the nose and added power, but the aircraft failed to climb or accelerate through the stick shaker speed range.

11. The captain's decision to discontinue the climbout was reasonable under the circumstances.
12. The aircraft settled back to the surface on the right shoulder of the runway in a nose-high attitude.
13. The aircraft was destroyed by the ground fire which resulted from the impact with a drainage ditch during ground rollout.

(b) Probable Cause

The Safety Board determines that the probable cause of this accident was the failure of the crew to abort the takeoff after being warned of an unsafe takeoff condition.

3. Recommendations and Corrective Action

As a result of this accident, the Safety Board, in a letter to the Administrator of the FAA dated May 14, 1968, recommended that the FAA review the crew training curriculum and the operating procedures relative to (1) aircraft takeoff handling characteristics with various flap settings, and (2) the operations from a systems standpoint of the intermittent warning horn in the takeoff regime and action expected of the crew when the horn is heard during the takeoff roll. Specifically, it was recommended that the Boeing 727 Operations Manual be revised to require that the takeoff be aborted should the intermittent warning horn sound during the takeoff roll and that the reason for the horn sounding be determined and corrected before another takeoff is attempted.

The Administrator, in his reply of June 6, 1968, stated that each air carrier pilot receives ground instruction, as well as being checked by FAA inspectors, relative to the operation of the takeoff warning system, including aborted takeoffs involving activation of that system. The Administrator further stated that each air carrier's manual contains instructions to the effect that, if a malfunction (e.g., activation of the warning horn) occurs prior to V_1 , the takeoff should be aborted. The Administrator therefore concluded that "successful completion of an approved B-727 training program adequately prepares a pilot for operation of that

aircraft, provided he adheres to the operating procedures taught in the training program and as outlined in the appropriate flight operations manual."

The Administrator also noted that, as a result of the accident, United Air Lines issued an operations alert bulletin re-emphasizing the operational aspects of the takeoff warning horn. ^{19/} The Administrator added that FAA field personnel had been requested to place particular emphasis on that same subject during training as well as pilot certification.

In its response of August 19, 1968, the Safety Board expressed the view that, while the emphasis on the takeoff warning system was gratifying, further action was required. The Board noted that the operations manuals of air carriers, although stating the reasons the horn would sound, contained no specific instructions on actions to be taken by the crew if the warning horn should sound during takeoff rolls. It was pointed out that UAL personnel were apparently not given explicit instructions to abort the takeoff if the horn sounds prior to reaching V_1 , but rather that the crews had some prerogative in attempting to correct the cause thereof rather than to abort the

^{19/} The referenced bulletin was a teletype message sent to UAL flight domiciles on May 2, 1968, prescribing the following procedures when the takeoff warning horn sounds:

"Normally, this warning should occur very early in the takeoff roll when the takeoff run should obviously be discontinued and the condition corrected prior to another attempt. Should the warning occur near V_1 when you are committed to fly, then a higher rotation speed is obviously desirable."

takeoff at once. The letter also cited the admission of other airline crews that, during takeoff rolls, they had been able to locate and correct the condition which caused the horn to sound.

The Safety Board's letter also expressed the belief that the procedure set forth in the UAL operations alert should be required of all Boeing 727 operators. It was therefore recommended "that specific instructions be issued to all Boeing 727 operators which require that takeoffs be aborted if the intermittent warning horn sounds during takeoff rolls before reaching V_1 ."

By letter dated September 10, 1968, the Acting Administrator responded, in pertinent part, as follows:

"We have requested our field offices to review the procedures prescribed in the air carrier's manuals to assure that takeoffs will be aborted whenever the takeoff warning horn sounds prior to reaching V_1 , unless there are other overriding factors. If such instructions are determined to be inadequate or nonexistent, the air carrier will be requested to update their Flight Operations Manuals or issue an alert bulletin." 20/

20/ Copies of the 4 letters discussed above are contained in the Public Docket of Recommendations, which is maintained in Safety Board's offices in Washington, D. C.

The Safety Board believes that the corrective measures described in the foregoing letter should, when effectuated, prevent the recurrence of similar accidents in the future.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOSEPH J. O'CONNELL, JR.
Chairman

/s/ OSCAR M. LAUREL
Member

/s/ JOHN H. REED
Member

/s/ LOUIS M. THAYER
Member

/s/ FRANCIS H. McADAMS
Member

APPENDIX A

Crew Information

Captain Victor S. Hudson, Jr.

Captain Hudson, age 40, was employed by United Air Lines on June 18, 1952, and was upgraded to captain on June 30, 1966.

Captain Hudson satisfactorily completed the following:

Proficiency - 1/12/68 (B-727) Initial

Line - 3/13/68 (B-727)

Pilot data from company records are as follows:

	<u>Approximate Hours</u>
a. Total pilot time	10,500
b. Total pilot time in B-727 (captain)	33
c. Total pilot time in B-727 (first officer)	1,000
d. Total pilot time last 90 days	60
e. Total pilot time last 30 days	60
f. Total pilot nighttime last 30 days	21
g. Certificate number and ratings held: Airline Transport Pilot No. 474665 with ratings DC-3/6/7, CV 240/340/440, B-727, airplane multi-engine land with commercial privileges single-engine land.	
h. Date of last physical examination for first class medical certificate - 1/15/68 with no limitations.	
	<u>Hours and Minutes</u>
i. Crew rest past 24 hours	11:20
j. Duty time last 24 hours	10:15
k. Flight time last 24 hours prior to this flight	4:46
l. Flight time this flight	0:16

First Officer Frederick D. Coleman

First Officer Coleman satisfactorily completed the following:

Proficiency - 12/6/67 (B-727)

Line - 1/10/68 (B-727)

Pilot data from company records are as follows:

	<u>Approximate Hours</u>
a. Total pilot time	1,280
b. Total pilot time in B-727	135
c. Total pilot time last 90 days	134
d. Total pilot time last 30 days	52
e. Total pilot nighttime last 30 days	27
f. Total flight engineer time in B-727	809
g. Certificate number and ratings held: Commercial Pilot No. 1583019 with airplane single and multi-engine land and instrument ratings.	
h. Date of last physical examination for first-class medical certificate - 7/26/67 with no limitations.	
	<u>Hours and Minutes</u>
i. Crew rest past 24 hours	11:20
j. Duty time last 24 hours	10:15
k. Flight time last 24 hours prior to this flight	4:46
l. Flight time this flight	0:16

Second Officer Donald N. Jackley

Second Officer Jackley, age 34, was employed by United Air Lines on March 6, 1967, and was originally qualified as flight engineer on May 30, 1967,

in DC-6 type equipment. Checkout as flight engineer in B-727 airplane was accomplished on December 11, 1967.

Second Officer Jackley satisfactorily completed the following:

Proficiency - 12/11/67 (B-727)

Line - 12/27/67 (B-727)

Flight Engineer data from company records are as follows:

	<u>Approximate Hours</u>
a. Total second officer time	303
b. Total second officer time in B-727	160
c. Total second officer time last 90 days	160
d. Total second officer time last 30 days	54
e. Certificate number and ratings held: Flight Engineer No. 1764-128 with ratings reciprocating engine powered and turbojet powered.	
f. Date of last physical examination for first-class medical certificate - 2/28/68 with no limitations.	
	<u>Hours and Minutes</u>
g. Crew rest past 24 hours	11:20
h. Duty time last 24 hours	10:15
i. Flight time last 24 hours prior to this flight	4:46
j. Flight time this flight	0:16

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APPENDIX B

Aircraft Information

a. Aircraft

Type - Boeing 727-220C; Identification - N7425U; Manufacturers Serial No. 19200; UAL Plane No. 7425

Date of Manufacture - June 19, 1967

Date of UAL Acceptance - June 19, 1967

Registered Owner - United Air Lines, Inc.

Total aircraft time 2208.04 hours

Time since #3 maintenance check 171.55 hours

Time since last service check 52.15 hours

Time since last terminating preflight check 17:11 hours

Time since last en route service 00:00 hours

b. Engines - Pratt & Whitney JT8D-1

<u>Position</u>	<u>Serial No.</u>	<u>Time Since Last Heavy Maintenance</u>	<u>Time Since Overhaul</u>
1	649018	2269 hours	5606 hours
2	653309	1700 hours	4345 hours
3	653421	172 hours	4831 hours

Note: All hours shown above are times as corrected by UAL OPBSP.

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APPENDIX C

COCKPIT VOICE RECORDER EXCERPTS

The following is a transcription of that portion of the cockpit voice recording commencing with the issuance of takeoff clearance and terminating with the end of the recording.

LEGEND

LC O'Hare Tower

RDO Aircraft radio channel

CAM Cockpit area microphone channel

-1 Captain's voice

-2 First officer's voice

-3 Second officer's voice

* Unintelligible word or phrase

Note 1 Words enclosed in parentheses are the best possible determination

Note 2 Times indicated are in minutes and seconds from beginning of
issuance of takeoff clearance.

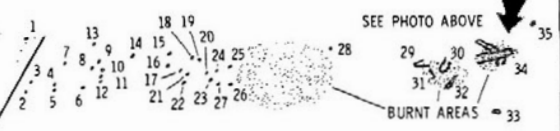
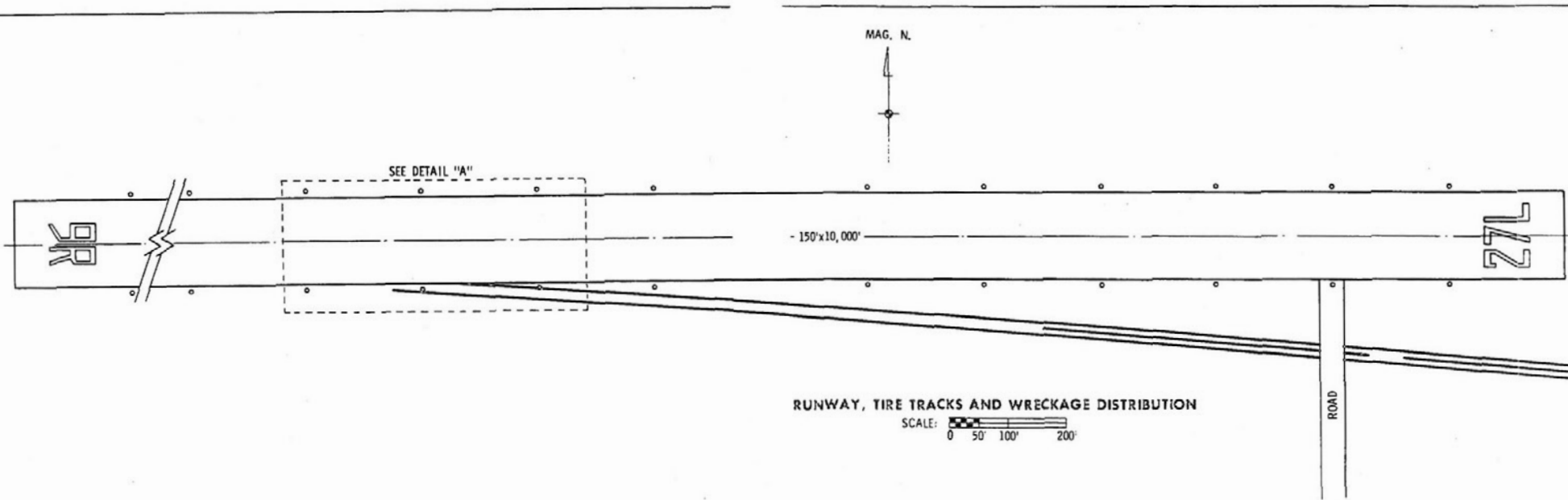
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CONTENT

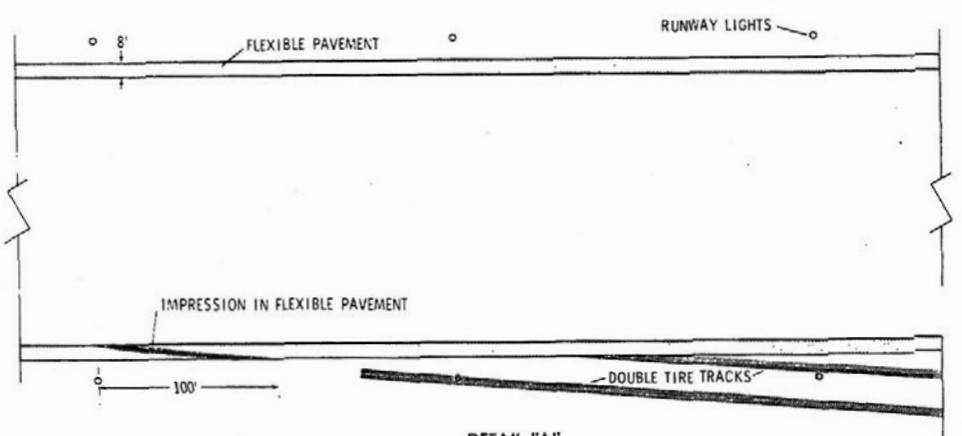
<u>TIME</u>	<u>SOURCE</u>	
0:00	LC	Seventy nine sixty three, turn left heading two seven zero, cleared for takeoff nine right
0:05	RDO-2	Left two seven zero the heading, cleared for takeoff nine right, United seventy nine sixty three, good night
0:15	CAM-1	Final items
0:16	CAM-3	Ignition
0:18	CAM-2	Flight
	CAM-3	Anti-skid
0:20.5	CAM-2	Armed - nose release
0:22	CAM-3	Oil cooler --- ground off, takeoff checklist complete
	CAM-?	*
0:46.5	CAM-?	Okay its ***
0:49	CAM	Sound of pulsating warning horn begins
0:51	CAM-2	Flaps, AFU, flaps, speed brake, forward in the detent, flaps five to fifteen degrees, trim up, it's in the green band (1:02.5)
	CAM-1	Oh, ... it
1:07.5	CAM-1	I have it
	CAM-?	(You going to get it?)
1:16.5	CAM-1	. It must be the trim
	CAM-2	No, it's in the green band now
	CAM-2	It can't be the trim

<u>TIME</u>	<u>SOURCE</u>	
1:20	CAM	Sound of pulsating warning horn ceases
1:22	CAM-2	Rotate
	CAM-3	APU's (okay)
	CAM-2	It's in the green band
1:26	CAM	Sound of stick shaker begins
1:34	CAM	Sound of breakup begins
1:45		End of recording

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RUNWAY, TIRE TRACKS AND WRECKAGE DISTRIBUTION
SCALE: 0 50' 100' 200'



DETAIL "A"
SCALE: 0 50' 100'

LEGEND

1. Sliding Fairing - Right Wing to Fuselage
2. Section of Wing Panel
3. Section of Left Wing L.E. Slat
4. Wing Inboard Flap Track Center Fairing
5. No. 3 Nose Cowling Ring
6. Right Main Landing Gear
7. R.H. Main Landing Gear Door
8. Air Conditioning Ram Air Duct
9. Heat Exchanger
10. Vane Axial Motor Driven Fan
11. Section of Fuselage Structure
12. Section of T.E. Flap Structure
13. Section of R.H. No. 6 L.E. Slat
14. L.H. Flap Inboard Actuator Fairing
15. Main Landing Gear Door Assembly
16. Tail Skid Yoke
17. L.H. Main Landing Gear Door Actuator Link
18. Air Stair Upper Support STRUT
19. Nose Landing Gear Door
20. Tail Skid
21. Section of Fuselage Keel Beam
22. Transmission - R.H. Flap
23. Section of Keel Beam
24. Tail Skid Compression Cartridge Housing
25. Section of Fuselage Lower Aft Cargo Floor Assembly
26. Lower Wing Skin Fuel Access Plate
27. Lower Cargo Door
28. Section of Fuselage Skin and Stringers
29. Horizontal Stabilizers
30. Section of Aft Fuselage With Vertical Fin and No. 2 Engine
31. No. 1 Engine
32. No. 3 Engine
33. Section of Nose Gear
34. Section of Fuselage
35. L.H. Main Landing Gear Assembly

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
Washington, D.C.

TIRE TRACKS & WRECKAGE DISTRIBUTION CHART
DCA 68-A-3, UNITED AIRLINES B-727QC, N7425U
CHICAGO-O'HARE INTERNATIONAL AIRPORT
CHICAGO, ILL.
MARCH 21, 1968

A.

IX

B.

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