FS-1

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CIVIL AERONAUTICS BOARD

AIRCRAFT ACCIDENT REPORT

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AERONAVES DE MEXICO, XA-XAX, DOUGLAS DC-8,
NEW YORK INTERNATIONAL AIRPORT
NEW YORK, NEW YORK, JANUARY 19, 1961

SYNOPSIS

An Aeronaves de Mexico DC-8-21, Mexican Registration XA-XAX, crashed and burned following a balked takeoff from runway 7R, New York International Airport, New York, New York, January 19, 1961, about 2017. Four of the nine crew members were killed; all 97 passengers survived but some were injured.

This accident was apparently caused primarily by unnecessary balking of the takeoff by the check pilot who was not in either pilot seat. Contributing factors were marginal weather, snow on the runway, and anti-icing heater possibly not used.

Investigation

The Flight

Aeronaves de Mexico Flight No. 401 of January 19 was scheduled to depart New York International Airport, New York, N. Y., at 1830,[1/] nonstop to Mexico City, Mexico. There were 97 passengers and a crew of 9 aboard, including 5 cabin attendants. Captain Ricardo Gonzales Orduna was in command of the flight in the left seat. Eastern Air Lines' Captain William B. Poe occupied the jump seat in the capacity of check pilot, directly behind him. Other crew members were First Officer Antonio Ruiz Bravo, Second Officer Xavier Alvarez Bacha, Purser Gloria Sanchez Herrejon, Steward Alberto Reyes Campos, Stewardess Margarita Badillo, Stewardesses Laura Martin de Jorge, and Maria Autoniata Ponce de Leon.

Departure was delayed about one and one-half hours by the late arrival of the crew and about 40 of the passengers due to weather conditions.

The aircraft had arrived from Mexico City at 1515, that day, and snow had accumulated on it. Glycol was used to remove the snow from the aircraft including the pitot heads, and the process was continued until time to start the engines for taxiing out. The Second Officer and Captain Poe conducted a walkaround inspection of the aircraft. They had supervised the later portion of the refueling operations, increasing the fuel load by 2,000 pounds, because of anticipated headwinds. Captain Poe walked out on the taxiway to check the snow conditions locally and reported a depth of about one inch. He described the snowfall as "fairly hard," and the snow as "very fine and very dry."

1/ All times herein are eastern standard based on the 24-hour clock.

The crew boarded the aircraft at 1935. Final clearance and dispatch papers were received from Eastern Air Lines Operations after the de-icing had been finished. The engines were then started and the flight was cleared to runway 7R at 2004. Its gross weight at this time was 272,171 pounds, well under the permissible limit, and the location of the center of gravity was also well within permissible limits. While holding short of the taxiway, the flight received its IFR clearance at 2010. Two minutes later it was cleared to taxi to the westerly end of runway 7R, where it stopped and was then cleared for takeoff. The latest airport weather was given to the flight as: precipitation ceiling 300 feet; sky obscured; visibility one-quarter mile; light snow; fog; wind east-northeast 18; gusts to 24, altimeter 29.64. While the aircraft was being taxied to takeoff position it was given "runway 4R[2/] visual range less than 2,000 feet." At 2014:38 the flight reported: "Aeronaves 401 rolling." (The weather minimums for this flight were: ceiling 200 feet; visibility one-half mile.)

The first approximate 6,200 feet of takeoff roll was observed by control tower personnel, visually, until the aircraft was lost to view by obscuring snow, approximately 3,800 feet from the control tower. They stated that at that time the aircraft had not taken off or rotated. Another tower controller observed the aircraft by airport surface-detection ground radar from the start of its roll to the eastern end of runway 7R, where it disappeared from view. A few seconds later he observed a bright orange flash in the sky northeast of the airport. He could not tell if the aircraft left the runway. Emergency procedures were started immediately by the controllers and an unsuccessful attempt was made to contact the flight on the departure radio frequency.

Captain Poe was the only survivor of the four cockpit occupants. He stated as follows: The checklist was accomplished normally. The runway condition was good and everything apparently occurred in a routine manner through the 100-knot time check when the first officer called out "cien" (Spanish for 100). Upon reaching approximately 130 knots (the V_1 speed) the first officer called out V_1 and V_R rapid succession. The aircraft was then rotated quickly and somewhat excessively. Poe did not see the airspeed go over 130 knots and as rotation started he saw the airspeed start to drop back quite rapidly to about 110 knots. At this time the Aeronaves captain called or pointed to the airspeed indicator. Poe felt that the aircraft could not become airborne under these conditions and that the runway remaining was not long enough to put the nose back down to start the takeoff again from that speed. His only choice, so he stated, was to try to get the aircraft stopped on the runway. Poe unfastened his safety belt, stood to gauge progress down the runway, moved forward, shoved the throttles forward briefly, noted a normal and uniform response from the engine instruments (the EPR gauges were reading normally from 2.52 to 2.54), and then pulled the throttles full back. Captain Gonzales "immediately" pulled the reverse throttles back into reverse thrust and used wheel brakes. Poe extended the spoilers and then sat down on the jump seat without refastening his seat belt. He believes that the aircraft did not take off Whether it did or not will be discussed later in this report. Poe's actions would have taken about three seconds, as shown by later test.

2/ Runway 4R, not 7R, was referred to because 4R is equipped with a transmissometer.

The aircraft continued ahead the full length of the 10,000-foot runway, beyond it, through a blast fence,3/ catching on fire, through the airport boundary fence, and across Rockaway Boulevard where it struck an automobile, injuring the driver and sole occupant. After going through the blast fence, many parts were shed before the aircraft came to rest in flames 830 feet beyond the end of the runway. Emergency vehicles from the airport and of the New York Fire Department were quickly started for the scene. Although impeded somewhat by weather conditions, they reached it within about six minutes and extinguished the fire. Evacuation and rescue of the occupants had already been effected in a total time of about five minutes, although most persons were out of the wreckage and away from the fire site in half this time. Many of the survivors were taken to hospit , in privately owned vehicles. Destruction of the aircraft was extensive.

Weather

During the period from 1900 to 2100 there was a precipitation ceiling of 500 feet or less due to snow. Prevailing visibility remained at less than one mile and gradually dropped to one-quarter mile in snow and fog. Runway visual range decreased until it was reported as less than 2,000 feet at the time of the accident.

The snow consisted of small dry flakes and was blown and drifted by surface winds which averaged 15 to 22 knots with gusts up to 27 knots.

A check of snow on runway 7R between 1900 and 2000 was reported as follows by a representative of the snow committee.4/

First Quarter (of runway)	-	Mostly clear with some patches of compacted snow.
Second Quarter	-	Scattered patches of snow one to two inches deep.
Third Quarter	-	Snow patches two to three inches deep.
Last Quarter	-	Scattered snow finger drifts four to six inches deep.

Runway 7R remained open and available for use until closed by the airport management immediately after the accident and because thereof.

As has been stated, the weather information transmitted by the tower to Flight 401 as it taxied onto runway 7R at about 2012 was: precipitation ceiling 300 feet; sky obscured; visibility one-quarter mile; light snow and fog; wind east-northeast 18; gusts to 24; altimeter 29.64, runway 4R visual range less than 2,000 feet.

About one minute after the accident the Weather Bureau observed and reported: precipitation ceiling 300 feet; sky obscured; visibility one-quarter mile; snow,

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3/ This fence is of 10-foot sections of steel, each 10 feet high, designed to withstand and deflect the blast of jet engines. The sections are bolted sufficiently frangible to fail readily if struck by a landing aircraft, i e., from the opposite direction.

4/ The snow committee, composed of persons from various airlines using N.Y. International Airport, undertakes the measurement and reporting of snow conditions on runways for all operators.

fog, blowing snow, temperature 20°F, dewpoint 16°F; wind east-northeast 19; gusts to 24; altimeter 29.65; runway 4R visual range less than 2,000 feet.

A few minutes after the accident the pilot of another DC-8, which was preparing to take off after Flight 401, was cleared to taxi up runway 7R about 3,300 feet in order to return to his terminal (runway 7R was then closed). He reported visibility was approximately 1/2 to 3/4 of a mile and that he observed snow patche about one inch deep covering 1/3 of the runway. He did not see Flight 401 take of

Two tower controllers and some eyewitnesses saw Flight 401 during its takeoff roll at distances from 1/2 to 2/3 of a mile in blowing snow.

The crew of the last flight (also a jet) taking off from runway 7R before the accident, reported that at the time of their takeoff, 1947, visibility was 1/3 to 3/4 of a mile with ceilings of 300-400 feet, with an improving trend, and that snow was not sticking to their aircraft.

Eastern Air Lines Flight Manual prescribes six inches of snow depth as maximum for DC-8 takeoff. There is nothing in the record to indicate a depth of more than six inches anywhere on runway 7R, although it was probably close to that figu at the upwind end of the runway. At La Guardia Airport, only a few miles away and where weather conditions should not have differed appreciably, the U. S. Weather Bureau measures and reports snow conditions. Official observations there bear out a probable snow depth of up to six inches (discounting drifting and plowing) at Ne York International at the time of the accident.

Virtually continuous light dry snow had fallen and the temperature had remained at about 20°F during the several hours the aircraft was parked on the airpo between flights.

Witnesses

The takeoff roll was timed by one passenger, a highly qualified employee of a aircraft manufacturer. His experience caused him to estimate that rotation should start in 35 to 40 seconds. When 50 seconds passed and the aircraft was still on the runway he thought the roll was too long, tightened his seat belt, and leaned forward for protection. Not over one or two seconds later, he testified, the aircraft lifted off the runway with a "thump," stayed airborne no longer than a count of three, and was back on the runway with brakes and reverse thrust being applied. The "thump" was caused, he believes, by the normal rapid extension of the landing gear struts as the aircraft left the runway. He believes the rotation maneuver started with a fast pullup just after 52 or 53 seconds of takeoff roll, and, right after rotation and becoming airborne very briefly, the power was retarded and the aircraft touched down smoothly on all three gears and immediately went into revers thrust. He sensed pronounced braking action from wheel brakes. About this time t aircraft struck something, ran off the runway into rough terrain, during which he heard the rending of metal and felt a "tremendous" series of bounces up and down a sideways. This witness was in seat 2B in the first-class section.

Most of the passengers thought that the aircraft did leave the ground briefly This opinion, based on the apparent falling away of runway lights, was shared by two Aeronaves DC-8 pilots who were riding as passengers and one stewardess who was seated aft in the cabin. Some persons on the ground who watched the takeoff roll,

or parts of it, thought the aircraft did leave the runway rather abruptly. One well-qualified groundwitness saw the aircraft's lights rise for a short time coincident with reduction of engine power at about the 6,400-foot point on the runway. Others could not see clearly enough, or not at all, to say if the aircraft left the runway. (This runway is nearly two miles long and ground visibility was restricted due to blowing snow.)

Blowing and drifting snow obliterated tire tracks made during the takeoff roll before measurements could be made. This precluded any possibility of learning definitely the precise point at which the aircraft may have left the runway.

Systems

Investigation of several systems of the aircraft was greatly hampered by covering snow and cold weather. Fire destroyed most of the structure, including a majority of the systems components. An unknown amount of additional damage was caused by the firefighting and rescue operations. There was no evidence of fire in any system prior to the accident. No evidence could be found to indicate any system had been malfunctioning. As far as can be determined no circuit breakers were opened during the time the aircraft was on the ground at New York. The switch controlling the pitot and stall-warning anti-ice heaters was found in the "off" position. There was no evidence of impact to this switch or to the surrounding structure.

The flight recorder foil survived the crash and severe ground fire, although a heavy accumulation of mud, kerosene, and carbonized residue was found on the exposed portion of the foil which normally would have contained the pertinent intelligence. A mixture of hydrochloric and hydrofluoric acids cleaned the carbonaceous deposits off the foil but caused some etching of the traces.

Examination of the record for a period of at least four trips prior to the accident revealed that the recorder had malfunctioned on two occasions. This malfunction resulted in no lateral foil movement; however, the stylii for the four parameter traces were still tracing. Therefore, only a vertical stylii trace was made when the foil failed to advance. The last failure of the recorder occurred prior to the accident of the 19th of January and the recorder was inoperative at the time of the accident. Thus, the foil yielded no intelligence whatever relative to this balked takeoff.

Powerplants

All damage resulting from rotational interference is attributable to loads and distortions imposed by impact forces. In general, the rotor blades and vanes of engines Nos. 2 and 3 showed somewhat more severe rotational damage. Oil systems of all engines were normally clean and there were no signs found of inadequate lubrication. All main bearings except No. 6 of No. 1 engine were inspected and found free of any indication of operational distress. Because impact forces had solidly jammed the No. 1 engine in the No. 6 bearing area, and there were no other indications that would cast doubt on the pre-crash condition of this bearing, it was considered impractical to uncover it. The hot sections of all engines yielded no overtemperature indications.

There were no signs of fuel contamination in any of the five samples taken from fuel in use by each engine and from the refueling truck. All were laboratory-analyzed as "satisfactory." The fuel pumps and fuel controls of engines Nos. 2, 3, and 4 were still operable (those of No. 1 were not) and were test-run with satisfactory results. However, there was no reason to suspect any difficulty with the No. 1 fuel pump and fuel control.

In short, the investigation of these four powerplants yielded no indication of any powerplant distress and indicated that they had been producing power as selected.

Structures

The general cluster of wreckage came to rest about 100 feet beyond Rockaway Boulevard in marshy, frozen, and snow-covered terrain on a heading of about 105 degrees magnetic and slightly to the right of the extended centerline of runway 7R.

Tire marks of the normal intermittent anti-skid type were found beginning 7,535 feet down the 10,000-foot runway. They extended 2,235 feet farther down the runway and ended approximately 230 feet from the runway end.

All four engines separated from the aircraft. Nos. 1, 3, and 4 came to rest east of Rockaway Boulevard close to the main wreckage. The No. 2 engine came to rest on Rockaway Boulevard. The left main landing gear also separated from the aircraft and came to rest on Rockaway Boulevard adjacent to the No. 2 engine. Several other airplane component parts and many fuselage and wing fragments were strewn over the accident path from the blast fence to the main wreckage site.

Fire broke out early during the sequence of events after the airplane struck the blast fence. At approximately 150 feet east of this fence and extending about 300 feet in an easterly direction the ground was scorched. A scorched fragment of the wing leading edge was found approximately 400 feet east of the blast fence. The majority of the destruction of the wings and the fuselage was the result of the intense and prolonged fire which persisted after the accident.

The fuselage was almost completely destroyed by the prolonged fire following the accident. Only portions of the flight deck upper structure, the belly and lower side panels, and the extreme aft area were unmelted. The fuselage had remained reasonably intact throughout the accident sequence except for a partial separation of the flight deck section. The heat destruction following impact precluded any establishment as to the extent of this damage.

The wing center section and the wings, except for their bottom skins, were substantially consumed by fire but the outline was in its original configuration. The left wing from leading edge wing station 785 and rear spar wing station 693 to the tip, and the right wing from leading edge station 841 and rear spar station 7[illegible] to the tip, were unburned.

The wing flaps were destroyed by fire except for the No. 2 engine exhaust [illegible]ate, which was torn off. The wing spoilers, which were extended, were consumed by fire as was approximately 50 percent of the tail assembly.

The actuators from the burned wing flaps were in the 15-degree takeoff flap position. The remaining right outboard wing slot door was open, the remaining right wing spoiler linkage was seized in the 60-degree extended position, the control gust lock mechanism was in the "off" position and the horizontal stabilizer was set 1.25 degrees aircraft noseup.

The cockpit area, including the instruments, controls, and circuit breaker panels, was almost totally consumed by fire. However, the overhead panel, the glare shield panel, and a number of damaged flight instruments were recovered. The pitot heat selector was found seized in the "off" position, both wing landing light switches were on, and the windshield heat was on warmup, but other switches were freely moveable because of fire damage. Both static selectors and both KIFIS[5/] test switches were in the normal position.

The pitot heater ammeter was seized at the 1.1 ampere indication, and disassembly revealed that heat expansion of the hairspring had moved the hand from zero to that reading. No impact marks were found on the overhead panel, disassembly of the selector switch revealed no marks of overtravel, and there were no impact marks on the hard rubber pitot selector lever.

An extensive search of the wreckage area failed to locate the copper airspeed pitot heads, the pitot sumps, or any part of the airspeed system other than the indicating instruments, the one static port, and a few short sections of airspeed aluminum tubing.

Only a static port from the air data system was found. It was not contaminated other than with mud similar to that present at the accident scene, and no contamination in the short aluminum airspeed line sections was found.

The airspeed indicators were recovered with the captain's seized at 60 knots (at the stop) and the first officer's at 63 knots. A foam deposit was found within the captain's instrument emanating from an opening in a torn off line. The Nos. 1, 2, 3, and 4 engine pressure ratio instruments (EPRs) indicated 2.25, 2.55, 2.6 and 2.5, respectively. Their setting bugs were found at 2.55, 2.55, 2.5 and 2.2, respectively. The Nos. 1, 2, 3 and 4 exhaust temperature gauges indicated 340°C, 360°C, 300°C, and 300°C, respectively. The Nos. 1, 2, 3 and 4 tachometers indicated 10, 85, 1 and 15 percent, respectively.

The empennage flight control system forward of the leading edge of the horizontal stabilizer was destroyed. The empennage control systems were properly connected and substantially intact. Most of the fuel system, hydraulic system, and electrical system were destroyed.

In summary, there was found no evidence of failure, malfunctioning or fire prior to impact in any of the various parts and components mentioned above.

This aircraft was serial number 45432 and its total airframe time was 52° hours and 24 minutes at the time of the accident. Four hours and 19 minutes was accumulated the day of the accident on the trip from Mexico to New York.

5/ Kollsman Integrated Flight Instrument System.

The aircraft was delivered to Aeronaves de Mexico at Long Beach, California, October 28, 1960, and flown to the Eastern Air Lines maintenance facility at Miami Florida, the same day. Aeronaves de Mexico and Eastern Air Lines had previously worked out an agreement on the maintenance to be performed on XA-XAX. In general, Aeronaves de Mexico performed all trip checks and call items on the Mexican end of the route, using the same procedures and program as the Federal Aviation Agency approved Eastern Air Lines system. Eastern performed all routine maintenance and all major and turnaround inspections in the United States and complied with all of the Federal Aviation Agency Airworthiness Directives. Eastern integrated XA-XAX into its own DC-8 maintenance program.

The time since last phase check (No. 2) was 120 hours and 11 minutes and was completed on January 3, 1961, by Eastern Air Lines at Miami, Florida. The time since the last interphase check was 12 hours and 54 minutes and was completed January 17, 1961, in Mexico. The last trip check was completed at Idlewild International Airport, New York, on the day of the accident.

All writeups on the aircraft, except for a hard landing on November 11, 1960, were malfunctions of various pieces of equipment as might normally be expected in routine day-to-day operation. The appropriate hard landing inspection was complied with by Eastern Air Lines personnel.

The maintenance history of this aircraft appeared to be without any item which could be significantly related to this accident.

Human Factors

Medical examinations were made on the bodies of the four deceased crew members. Three had been on the flight deck and one had been in the lounge immediately aft of the flight deck. All four deaths were caused by multiple burns or generalized third and fourth degree burns. Tests for toxicity produced negative results on all four, and there was no significant level of carbon monoxide in any of the four.

As has been mentioned, EAL Captain Poe was the only flight deck survivor. He was thrown several feet clear of the wreckage, as was his seat. No other flight deck seats were found.

Twenty-eight of the cabin occupants, both passengers and attendants, were injured in diverse manners and varying degrees. As far as can be determined, these persons, as well as all other cabin occupants, did have their seat belts fastened, as directed.

Operating and Training Agreement Between Aeronaves and Eastern Air Lines

A joint training agreement between Aeronaves de Mexico, Eastern Air Lines, and the Douglas Aircraft Company, provided that Aeronaves flight crews receive DC-8 training, using Eastern Air Lines ground and simulator facilities and Douglas Company flight instructors for check-out in the DC-8 aircraft. Eastern Air Lines provided DC-8 ground school classes between October 3, 1960, and November 4, 1960, for five Aeronaves DC-8 captains and eight Aeronaves pilots, including the crew of Flight 401/19. Ground school training included the following: general information dispatch, performance, high-altitude weather, radio and radar, autopilot, anti-icing and de-icing, electrical, powerplant, fire protection, fuel, hydraulics, flight

controls, oxygen system, pressurization and air conditioning, instruments, and emergency procedures. All three flight crew members of Flight 401/19 graduated from the DC-8 ground school with high grades.

All three flight crew members received flight simulator training from Eastern Air Lines and completed their courses satisfactorily.

All three flight crew members were flight-trained in the DC-8 at Miami, Florida, by Douglas Aircraft Company flight instructors. Captain Gonzales was checked out as "captain" and both First Officers Bravo and Bacha were checked out as both "first and second officers," and qualified at the systems panel.

The cabin attendants received 25 to 30 hours of DC-8 training at New York, which included aircraft familiarization, DC-8 systems, jet-age terms, emergency equipment location and use, aviation physiology, emergency first-aid, emergency evacuation, demonstration and individual participation and use of emergency exit doors, windows, evacuation chute or slide, and a review of the training program. This was followed by a written examination which all attendants passed with high grades.

A cooperative service agreement between Aeronaves de Mexico and Eastern Air Lines was arranged so that Eastern would provide certain services for Aeronaves at the New York International Airport Eastern facility, and Aeronaves de Mexico would furnish Eastern certain services at the Aeronaves facility in Mexico City. This agreement provided for ground services at Idlewild (New York International) Airport and included such items as the handling of Aeronaves aircraft at the Eastern Terminal, provision for Aeronaves ticket counter space, turnaround service, including interior and exterior cleaning of the aircraft and aircraft servicing, cargo handling, preparation of weight and balance, flight plans, dispatch releases, flight traffic, and miscellaneous ramp services. Similar services were to be provided by Aeronaves for Eastern aircraft at Aeronaves facility in Mexico City. Eastern provided trip checks and departure checks and included such adjustments, repair, or replacements as necessary to correct unsatisfactory items reported in the airplane powerplant performance report. In connection with Flight 401/19, Eastern provided the required ramp services, including the de-icing, cargo and passenger, baggage handling, flight planning and dispatching, weather briefing and turnaround service and inspection. There were no uncorrected items in the aircraft flight log according to the Mexican captain who commanded the aircraft on its last prior flight and also according to the surviving EAL Captain Poe.

Eastern loaned Aeronaves qualified check pilots to assist in the early stages of Aeronaves jet operation between Mexico and New York. This assistance was for approximately two months so that EAL check pilots could accompany each Aeronaves DC-8 captain for at least three round trips and each Aeronaves first officer for a maximum of twelve round trips over the New York-Mexico City route. In accordance with agreement to assist Aeronaves in any proper and practical manner, EAL arranged to assign to Aeronaves four of its senior check pilots qualified on the DC-8. These check pilots on this assignment would specifically perform the following functions:

1. Observe and monitor the performance of Aeronaves flight personnel.

2. Coach and familiarize Aeronaves flight personnel with standard procedures for the DC-8, and particularly to familiarize Aeronaves flight crews with air traffic control procedures in the New York area.

3. To assist Aeronaves flight crews in any other possible way which, in the knowledge and experience of our check pilots, would contribute to the safe, efficient conduct of the Aeronaves operation.

EAL Captain W. B. Poe was aboard Aeronaves Flight 401/19, in accordance with the above.

The Eastern Air Lines Flight Manual, utilized by Aeronaves de Mexico, contains the following:

> "...The Check Pilot or Instructor shall take over the controls at any time during the flight when in his opinion the Captain or Pilot will not be able to maintain control or recover within safe limits from any maneuver. This 'taking over' of controls shall include any take-off or landing when it appears the aircraft may be subjected to damage..."

Takeoff Performance

The Douglas Aircraft Co., Inc., manufacturers of the subject aircraft, has furnished the Board with certain takeoff data. All of it is predicated on the following conditions, which are those prevailing, or assumed, at the time and place of the accident.

Aircraft nose 300 feet from southwest end of runway 7R at start of takeoff rol

Takeoff gross weight	270,671
Flaps set	15 degrees
Engine anti-ice	On
EPR 6/ (Brakes released after takeoff power is set and blowaway jets off five seconds after brake release)	2.52 - 96% thrust 4 engines
Wind	18 knots, east-northeast
Temperature	20 degrees F.
Runway	7R Idlewild
MAC	26 percent
Runway gradient	Zero

Because there are no known data applicable to snow-covered runways, the follow ing is based on a dry, concrete runway.

(A) Normal Takeoff Profile

	Airspeed (Knots)	Distance (Feet)	Time (Sec.)	Thrust (EPR)	Attitude (Degrees)	Altitude (Feet)
100 K Ck	100.0	2000	21.3	2.52	-1	0
V1	130.8	3270	29.6	2.52	-1	0
VR	143.0	3994	33.6	2.52	-1	0
Liftoff	154.6	4801	37.0	2.52	+9 to +11	0
V2	160.56	5950	42.18	2.52	+9 to +11	35
35 Ft alt	160.56	5950	42.18	2.52	+9 to +11	35

(Distance in feet is in relation to western end of runway 7R)

6/ According to testimony of Captain Poe.

(B) Profile for an Abort (Balk) at V1

	Airspeed (Knots)	Distance (Feet)	Time (Sec.)	Thrust (EPR)	Attitude (Degrees)	Altitude (Feet)
100 K Ck	100.0	2000	21.3	2.52	-1	0
V1	130.8	3270	29.6	2.52	-1	0
Brakes	130.8#	3720	33.26	Forward Idle		

1. Accelerate Stop Distance (Brakes Only)

6350		Forward Idle	-1	0

2. Accelerate Stop Distance (Brakes plus #2 and #3 engines in reverse thrust takeoff power and #1 and #4 engines in forward idle thrust)

5965	2.52 #2 and #3	-1	0

3. Accelerate Stop Distance (Brakes plus all four engines in reverse thrust takeoff power)

5660	2.52	-1	0

(C) Abort (Balk) at VR (No rotation started)

100 K Ck	100.0	2000	21.3	2.52	-1	0
V1	130.8	3270	29.6	2.52	-1	0
VR	143.0	3994	33.6	2.52	-1	0
Brakes	143.0#			Forward Idle	-1	0

1. Accelerate Stop Distance (Brakes Only)

8185	Forward Idle	-1	0

2. Accelerate Stop Distance (Brakes plus #2 and #3 engines in reverse thrust takeoff power and #1 and #4 engines in forward idle thrust)

7710	2.52 #2 and #3	-1	0

3. Accelerate Stop Distance (Brakes plus all four engines in reverse thrust takeoff power)

7445	2.52	-1	0

(D) Accelerate to Time of 50 Seconds and 52 Seconds without Rotation

100 K Ck	100.0	2000	21.3	2.52	-1	0
V1	130.8	3270	29.6	2.52	-1	0
VR	143.0	3994	33.6	2.52	-1	0
50 Sec Run	200.01	7470	50.0	2.52	-1	0
52 Sec Run	208	8170	52.0	2.52	-1	0

Note: Estimated distance to stop aircraft after reaching 208 and 8170 feet on runway is 5,300 feet additional if brakes are used and all four engines are in reverse thrust at takeoff power.

(E) V_{MU} (the minimum speed at which this aircraft could have left the runway) was 127.8 knots.

With respect to the runway lighting, investigation has disclosed that the runway lighting nad been changed and that there had been one or more notices to airmen (NOTAMS) on the subject. These changes in lighting were on the last half of the runway. At the time Poe pulled the throttles the aircraft was still on that portion of the runway which was lighted, as originally prescribed, and he does not ascribe any irregularity in lighting on the far end as a factor in discontinuing the takeoff.

Analysis

The methods employed for measuring visibility and snow depth leave much to be desired. As now provided they are not properly representative of pertinent runway conditions. The transmissometer cannot measure runway visual range values below 2,000 feet and the prevailing visibility, reported at 1/4 mile at the time of the accident was observed at a point well removed horizontally and vertically from runway 7R. The procedures used for measuring snow depth are not precise as to the permissible length of time in advance of a takeoff that runway measurements of snow depth can be made, the points along the runway at which measurements should be made and the means for establishing density. However, the weather and runway conditions though marginal, are not considered to have been prohibitive or critical.

Much of the aircraft was destroyed by impact and fire and could not be examined. However, the facts disclosed by those parts which were examinable, plus the circumstances, make extremely unlikely the possibility of failure or mechanica malfunctioning of any part of the aircraft or of fire prior to impact.

When Captain Gonzales called or pointed to the airspeed indicator, Captain Poe felt that the 130 knots which the indicator was then showing was insufficient for takeoff and, after gauging progress, quickly pulled the power. But what remains unknown is Captain Gonzales' motive in pointing toward or calling attention to the airspeed indicator. He may have been calling to Poe's attention an indication whic was too low (as Poe apparently believed), or he may have been conveying the idea that the airspeed indicator was not to be trusted and should be ignored. Whether th latter is the case or not, after Poe pulled the throttles the aircraft was committe to a balked takeoff, irrespective of what was in store at the end of the runway.

There is no way of positively establishing the dependability of this airspeed indicator. The maintenance records indicate that it should have been functioning properly. As has been mentioned, the switch controlling the heat to the pitot tube was found "off." Whether it was not "on" during takeoff or was knocked to "off" at impact cannot be established, although the latter is unlikely as has been explained If it was not "on" during takeoff, an erroneous airspeed indication may have result This subject will be discussed later in this analysis.

Examination of the engines substantiated that they were capable of developing full power and that they had not been damaged prior to impact. As has been pointed out, one of Poe's observations during the brief period when he was weighing a balk was that of the four EPR gauges, and he stated that they were reading normally. These gauges could read erroneously if their probe ends were iced up. These ends are electrically heated and can be turned off only by means of the circuit breakers (which was not done as far as can be ascertained during the period that the aircraft was on the ground between flights at New York International Airport). Thus, there is no reason to suspect that there may have been an erroneous power indicatio by the EPR gauges.

According to Poe, V_1 and V_R were called in rapid succession by the first officer. However, the aircraft could not have accelerated from the 129 knot V_1 speed previously calculated by the flight crew to the calculated 143 knot V_R speed without an appreciable time interval. The captain's airspeed was at the time indicating 130 knots, also according to Poe, and shortly thereafter quickly reduced to 110 knots during rotation at which time Captain Gonzales pointed to or mentioned his airspeed. All three of these conditions were obviously abnormal.

Poe also felt that the aircraft did not become airborne and was not accelerating properly after rotation, although he felt that the rotation was abrupt and excessive. He therefore reduced engine power without cross-checking with the first officer's airspeed. The stewardess in the aft cabin could not have noticed the runway lights becoming farther away unless the aircraft was airborne, as rotation only would have lowered the tail and caused the lights to become closer. Also, the aircraft's lights were seen to rise for a short time coincident with reduction of engine power at about the 6,400-foot point on the runway. The landing lights are located in the trailing edges of the wings and the navigation lights are at the tips, both of which would lower slightly during rotation since they are somewhat aft of the main landing gear and would not rise except after the aircraft became airborne. The two DC-8 pilots and the well-qualified passenger, all of whom were seated well forward, believed the aircraft to have been airborne, as do two lay ground-witnesses. Additionally, the lifting sensation described by passengers in the aft part of the cabin (which should have lowered if rotation only had occurred), the stopping of runway roughness, the smooth feeling of flight, the thump normally coincident with extension of the landing gear oleo struts on becoming airborne quickly, a touchdown bump, and the preponderance of other witness' evidence, establish the aircraft being airborne for a few seconds.

According to the Douglas Aircraft Company performance data the aircraft, under existing conditions but on a snow-free runway, would normally have been rotated after a 3,994-foot roll in 33.6 seconds at 143 knots and become airborne at 4,801 feet in 37 seconds at 154.6 knots. But the evidence of five persons on the ground indicates that the aircraft was not airborne by the time it had rolled 6,200 feet down the runway.

According to the same performance data the aircraft, in 50 seconds, should have traveled 7,040 feet along the runway and reached a speed of 200 knots. But it did not travel 7,040 feet in that time. At 50 seconds (by calculation, Table D), with uniform acceleration, it should have passed the 6,200-foot point at an airspeed of 163.8 knots. It became airborne two or three seconds later, touched down, and caused intermittent skid marks beyond the 7,040-foot point (at 7,535 feet). Actually the takeoff roll started about 300 feet from the threshold where a normal turn from the taxiway would place the aircraft. It is, therefore, obvious that the aircraft was not accelerating properly.

The aircraft could not have become airborne at less than 137.8 knots. It must have been appreciably greater than that figure because an abrupt and excessive rotation, as apparently did occur, is not possible at that minimum takeoff speed due to the relatively slower elevator effect at that speed.

The tested three-second average time required for Poe to unfasten his seat belt, stand up, estimate progress, move the throttles ahead slightly, then close them, when applied to a DC-8 simulator rotated at a 163-knot airspeed, resulted in a simulated 150-foot climb.

This altitude could not have been possible as the aircraft could not have touched down again in a maximum 1,335-foot distance, and indicates that the airspeed at becoming airborne must have been considerably less than 163 knots.

Thus, the takeoff speed could not be less than 137.8 knots and not as much as 163 knots. A uniform acceleration to 130 knots, then a constant speed to the end of the 50-second period, would require 16 seconds at 130 knots (which no captain is likely to allow). This indicates that acceleration was probably normal to the 100-knot point, but not normal thereafter. The probability exists that after the 100-knot point the speed continued to increase, but more slowly, to the 143-knot airspeed at liftoff, since this was the airspeed that the first officer should and probably did call as V_R. From this it is clear that either the captain's airspeed indication was erroneous or Poe was mistaken in stating that it read 130 knots.

On the basis of the following evidence, it is concluded that the captain's airspeed indicator was giving an erroneous low reading at the time takeoff was aborted. The first officer, observing his airspeed indicator, had called out V_R (143 knots). Immediately thereafter, Captain Gonzales had pointed to his airspeed indicator and Captain Poe in checking the airspeed on the captain's instrument had read 130 knots and advanced, then closed the throttles.

At the time of the accident the sustained wind velocity was 19 knots with gusts to 24 knots. Such gusts might account for a slight change but not a 13-knot increase (130 to 143) or 20-knot decrease (130 to 110) in the airspeed indications. It is evident, therefore, that the captain's airspeed must have been indicating erroneously for some other reason.

The possibility of Glycol entering the airspeed systems through the pitot heads during anti-icing and de-icing of the aircraft was explored. However, because both pitot sumps were drained after use of Glycol, the possibility of Glycol having affected the airspeed systems appears to be most unlikely.

It cannot be definitely shown, due to impact and fire damage, that no mechanical malfunction of the captain's airspeed system occurred. However a review of the aircraft's records revealed no uncorrected airspeed items and indicated a satisfactory leak test of the airspeed systems on January 4, 1961, with no malfunctioning noted thereafter. In addition, the left airspeed indicator was evidently slow by at least 13 knots up to the rotation point. Similar leaks simultaneously affecting both systems are extremely unlikely.

As has been stated, it cannot be definitely substantiated that the pitot heat selector was not moved by impact to the "off" position, where it was found. This is so because the copper pitot heads and the transducer heating elements were not found despite extensive effort by investigators and considerable expense for earthmoving equipment.

The pitot heat selector furnishes current for the heating elements in the captain's and first officer's pitot heads and for the stall-warning transducer. Current is supplied to all three when the selector is in any one of the four positions except "off." The ammeter indicates current drawn by whichever one of these three elements is selected. The proper amperage is 1.75 to 2.75 for each airspeed pitot, and 1.25 to 2.75 for the stall-warning transducer. The ammeter indicated 1.1 amperes when found (probably moved to that figure from zero by fire, as has been mentioned). Neither the knob of the pitot heat selector nor the assembly in the

immediate vicinity bore any marks of impact, although there was marked fire damage. Moreover, there were no marks of overtravel within the selector switch, and it is unlikely that impact would move the selector knob due to the internal spring followup design of the switch. This strongly indicates that the selector was not moved by impact.

Thus, it appears that the left airspeed indicator was slow to the 130-knot point and then suddenly changed. Since leaks are unlikely, the cause could only have been of a type that was changeable with increased airspeed. The probable cause for such an erroneous reading could not be determined. However, the possibility exists that failure to apply pitot heat during snow conditions may have played a part in the erroneous indication.

As has been shown, there was no decay in engine power and consequently the slow acceleration must have been due to snow on the runway. The amount of this lessening of acceleration is not subject to precise and specific quantitative analysis. If there had been no impairment of acceleration, the aircraft would normally have been only 3,994 feet down the runway rather than 6,200 or more feet at time for rotation.

It has been established that the aircraft was capable of continuing the takeoff if power had not been reduced by Poe. Eastern's Operations Manual, utilized by Aeronaves, authorizes the check pilot to take over control at his discretion, as has been mentioned under Investigation. Whether or not Gonzales would have continued the takeoff if Poe had not reduced power will never be known.

In an effort to determine whether or not continuation of such a takeoff as that involved in the accident (with one or both airspeed indicators malfunctioning) is safer than discontinuing the takeoff, arrangements were made with two air carriers for tests in their DC-8 flight simulators. These tests indicated that (1) such a takeoff by a qualified DC-8 captain could be completed with a reasonable degree of safety, and (2) captains normally do cross-check with the first officer's airspeed under such conditions.

Any small amount of snow which may have remained on the aircraft after desnowing or any small amount which may have accrued while taxiing did not palpably, have any significant effect on the aircraft's takeoff capability. Therefore, snow on the structure is not considered to be a factor in this abnormal takeoff.

Aeronaves de Mexico utilizes Eastern's checklists and, since the accident, Eastern has changed its cockpit checklist to eliminate turning off the pitot heat selector once it is turned on prior to engine starting. At the time of the accident the procedure was to turn it "off" and "on" again before takeoff.

The DC-8-21 aircraft has the capability of being rotated to its physical limits (until the bottom of the empennage almost touches the runway) and continuing to accelerate until becoming airborne. Once it becomes airborne, even though rotation has continued to the maximum physical limits, airspeed continues to increase, assuming there are no malfunctions or failures. It is not possible in a DC-8-21 to "get on the back side of the power curve," i.e., to enter the region of operation wherein the power required is greater than the power available, while the aircraft is on the ground. If the angle of attack is not further increased following liftoff, the aircraft would continue to accelerate. Flight tests have proven that maximum rotation at the minimum speed will result in a positive rate of climb and

the shortest runway distance to liftoff. Once airborne the takeoff performance characteristics will be much the same as if rotation had been made at the predetermined flight manual V_R, taking into consideration, of course, the differences in elapsed time, distance, and airspeed.

A question has been raised as to the possibility of decreasing the speed of the aircraft from 130 to 110 knots very quickly - say within five seconds - during or immediately after rotation, as Poe believed. To achieve such a decrease in airspeed the deceleration would have to be 8.44 feet/sec.^{2} (0.26g) which, at the takeoff gross weight of 270,000 pounds, would require a drag force of 70,500 pounds. Thrust available from the four engines, at between 110 and 130 knots, is approximately 59,000 pounds. Assuming conservatively that 59,000 pounds of thrust is in balance with the drag (no acceleration), an additional 11,000 pounds of drag would be needed upon retarding power to idle to produce a 0.26-g deceleration. Actually, with the throttles in "idle," the engines are still producing some forward thrust. To determine the effect of the increased drag on the aircraft, due to the rotated attitude, a series of calculations were made. Assuming that the aircraft's speed was stabilized at about 130 knots (thrust = drag), and then rotated, the time necessary to decelerate to 110 knots is:

6.9°	rotation =	45.7 seconds
8°	rotation =	34 seconds
12°	rotation =	18 seconds

These times are obviously too long to be considered in this case. In addition, the assumption that the aircraft was stabilized at 130 knots is false because the engines were apparently operating properly and producing the proper amount of thrust for continued acceleration. Thus, it can be seen that it is not possible for the aircraft to have decelerated from 130 knots to 110 knots in five seconds.

Conclusion

The Board concludes that the aircraft did become airborne. Investigation of the accident has pointed out that Captain Poe erroneously believed that if the speed of rotation were appreciably below the calculated V_R speed, a longer takeoff run would result.

The Board concludes that the takeoff was discontinued as a result of the action of the check pilot, who was not seated in a pilot seat, in reaching forward without warning and pulling the throttles back. This action caused power to be decreased on all four engines.

Probable Cause

The Board determines that the probable cause of this accident was the unnecessary discontinuing of the takeoff by the check pilot, who was not in either pilot seat.

Contributing Factors

The contributing factors in this accident were the marginally poor weather, snow on the runway, and the possibility of the pitot head heat not having been on.

BY THE CIVIL AERONAUTICS BOARD.

/s/ ALAN S. BOYD
Chairman

/s/ ROBERT T. MURPHY
Vice Chairman

/s/ CHAN GURNEY
Member

/s/ G. JOSEPH MINETTI
Member

/s/ WHITNEY GILLILLAND
Member

SUPPLEMENTAL DATA

Investigation

The Civil Aeronautics Board was notified of this accident immediately after occurrence, and an investigation was immediately initiated in accordance with the provisions of Title VII of the Federal Aviation Act of 1958.

The Carrier

Aeronaves de Mexico operated under United States Civil Aeronautics Board foreign air carrier permit issued pursuant to order E-11730, dated August 16, 1957 It specified that Aeronaves de Mexico shall conform to the airworthiness and airman competency requirements of the Government of Mexico for Mexican international service.

A concurrent foreign air carrier operations specification, No. 2032, was issued by the United States Civil Aeronautics Administration, dated December 6, 1957. It certified that Aeronaves de Mexico was properly and adequately equipped and able to conduct a reasonable safe operation as a foreign air carrier, in the scheduled air transport of persons, property and mail, within the United States.

Flight Personnel

Captain Ricardo Gonzalez Orduna, age 46, a Mexican National, held a currently effective airline transport certificate No. 98 (Mexican). He was checked out as a DC-8 captain by the Douglas Aircraft Company on November 30, 1960, at Miami, Florid He was rated in the Boeing 247, C-39, DC-3, DC-4, L-49, Britannia, and the DC-8. His total pilot time was 15,210:34 hours, of which 94 hours were in DC-8's. His total night time in DC-8 aircraft was 46:47 hours, and his total instrument time in the last three years was 182 hours. The date of his last Class "A" medical examination was July 27, 1960.

First Officer Antonio Ruiz Bravo, age 32, a Mexican National, held a currently effective airline transport certificate No. 390 (Mexican). He was checked out as First Officer and Second Officer by Douglas Aircraft Company on November 27, 1960, at Miami, Florida. He was rated as Captain in the DC-3 and First Officer and Second Officer in the DC-8. His total pilot time was 8,260:56 hours, of which 125:37 were in DC-8's. His total night time in DC-8 aircraft was 54:06 hours, and his total instrument time in the last three years was 160:00. The date of his last Class "A" medical examination was November 19, 1960.

Second Officer Xavier Alvarez Bacha, age 32, a Mexican National, held a currently effective airline transport certificate No. 553 (Mexican). He was checked out as First Officer and Second Officer by Douglas Aircraft Company on November 26, 1960, at Miami, Florida. He was rated as Captain in the DC-3 and First Officer and Second Officer in the DC-8. His total pilot time was 8,143:05 hours, of which 123:34 were in DC-8's. His total night time in DC-8 aircraft was 53:48 hours, and his total instrument time in the last three years was 176:00. The date of his last Class "A" medical examination was September 25, 1960.

Captain William B. Poe, age 53, a United States National, was a designated Eastern Air Lines DC-8 check pilot, and held a valid airline transport pilot certificate with ratings: M-202, 404, Constellation, L-188, DC-3, DC-4, DC-6, DC-7, and DC-8 aircraft. He had a total of 19,495:00 flying hours, of which 285:00 were in the DC-8. His total night time was 4,800:00 hours, with a total instrument time of 2,124:00. His last FAA first-class medical examination was taken November 4, 1960 (limitation: reading glasses).