Aircraft Accident Report, Near Collision of Delta Air Lines, Inc. Boeing 727-200, N467DA, and Flying Tiger, Inc. Boeing 747-F, N804FT, O'Hare International Airport, Chicago, Illinois, February 15, 1979

Micro-summary: **This Boeing 727 entered a runway being used by a landing Boeing 747.**

Event Date: **1979-02-15 at 0911 CST**

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

Investigative Body's Web Site: **http://www.ntsb.gov/**

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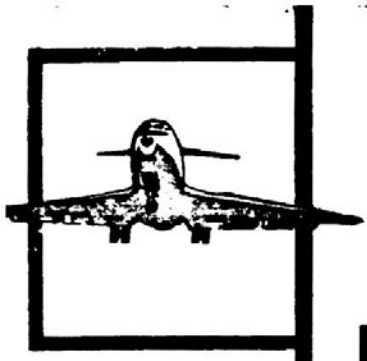

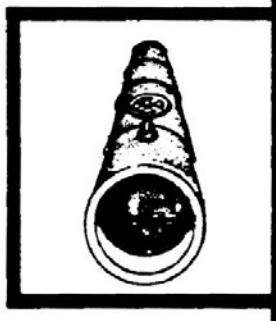

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

NEAR COLLISION OF
DELTA AIR LINES, INC.
BOEING 727-200, N467DA,
AND FLYING TIGER, INC.
BOEING 747-F, N804FT
O'HARE INTERNATIONAL AIRPORT
CHICAGO, ILLINOIS
FEBRUARY 15, 1979

NTSB-AAR-79-11

UNITED STATES GOVERNMENT

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Adopted: August 2, 1979

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SYNOPSIS

About 0911 c.s.t. on February 15, 1979, a near collision occurred on the ground at O'Hare International Airport, Chicago, Illinois, involving Delta Air Lines Flight 349, a scheduled passenger flight, and Flying Tiger Flight 74, a scheduled cargo flight. When cleared by various taxiways to runway 4R for departure, Delta Flight 349 was instructed initially by the air traffic outbound ground controller to stop before crossing runway 9R, an active landing runway. Clearance to cross this runway was issued subsequently by the ground controller as Flight 349 approached runway 9R. About this time, Flying Tiger Flight 74 was completing an instrument landing system approach to runway 9R and had been cleared to land by the air traffic local controller. Shortly after touchdown, the captain of Flying Tiger Flight 74 saw the Delta aircraft entering the runway directly in front of him, and to avoid collision, he veered his aircraft off the runway. The cargo plane, a Boeing 747, was damaged substantially. The Boeing 727 was not damaged, and there were no injuries to the occupants of either aircraft.

The National Transportation Safety Board determines that the probable cause of this accident was the O'Hare outbound ground controller's issuance of a taxi clearance across runway 9R, which permitted Delta Flight 349 to move into a collision path with Flying Tiger Flight 74 and, further, the failure of the pilots of Delta Flight 349 to maintain a continuous vigil for landing traffic before entering an active runway. The improper clearance was the result of the ground controller's failure to see the displayed radar target of the landing aircraft.

Contributing to the accident were the approach controller's failure to effect required spacing criteria between Flying Tiger Flight 74 and the preceding arrival aircraft and the local controller's failure to issue a missed approach clearance when he noted the less-than-required separation.

1. FACTUAL INFORMATION

1.1 History of the Flight

On February 15, 1979, Delta Air Lines, Inc., Flight 349, a B-727-200, N467DA, was a scheduled passenger flight from O'Hare International Airport (ORD), Chicago, Illinois, to Orlando International Airport, Orlando, Florida. There were eight crewmembers and a cockpit jumpseat rider aboard the aircraft. After 106 passengers were boarded, Delta Flight 349 (DL 349) received taxi clearance at 0906, 1/ from the ORD air traffic control tower's outbound ground controller. The controller's clearance, in part, was to taxi to runway 4 right (4R), ". . .use the outer, the stub, the east-west, the fourteen right parallel, to hold short of niner right. . . ." 2/ At 0910:00 while approaching runway 9R on the 14R parallel taxiway, DL 349 was cleared by the outbound ground controller to ". . .keep it moving, sir, and cross runway niner right and the tower is one two zero point seven five on the other side." DL 349 had been on 121.75 MHz, the outbound ground control frequency. During a postaccident interview, the outbound ground controller stated he checked his local radar display and observed landing traffic about 3 1/2 mi from the approach end of runway 09R. He said that he assumed that this radar target was the next aircraft in the landing sequence.

Runway 14R parallel taxiway between the east-west taxiway and runway 9R is a curved high-speed turnoff. It intersects runway 9R at an angle of about 120 degrees to the approach end at runway 9R. DL 349 had progressed to a point near the center of runway 9R when Flying Tiger Flight 74 (FT 74) passed on runway 9R immediately in front of their aircraft. Flight 349 stopped momentarily on the runway and then taxied to a point about 50 yards from runway 4R where the second officer left his aircraft by the aft airstair to make a visual inspection for possible damage. He found no damage and after reporting his observations, the captain decided to return to the ramp to have company maintenance personnel make a thorough inspection of the aircraft.

Both pilots stated later that after being cleared to cross runway 9R, they looked toward the approach end of runway 9R to view the landing area. Both stated that they saw no traffic and the captain continued to taxi. The captain recalled that because of the crossing angle it was necessary for him to lean forward to see the runway 9R landing area. He could not see the approach end of that runway, and he recalled that a fog bank was lying in the vicinity of the west end of the runway. He estimated that visibility to the west was about 1/2 mi. The first officer also recalled that he could not see the entire length of the runway.

Expecting to stop before crossing runway 9R, the captain taxied slowly as the aircraft approached the landing runway. The first officer recalled that DL 349 was about 150 ft from the north edge of runway 9R when the ground controller cleared DL 349 to cross the runway. At about 0910:29, the first officer first sighted FT 74 in his peripheral vision as the B-747 approached from his right side.

1/ All times used in this report are central standard time based on the 24-hour clock.

2/ See Appendix C, Figure 1, ORD Airport Diagram

He then looked directly at FT 74 and saw the aircraft on a ground collision course. The captain stated that his first sighting of the B-747 was immediately after the first officer shouted a warning as the B-747 passed in front of them.

Both pilots were concerned that because of the proximity of the aircraft, the left outboard engine nacelle of the B-747 would hit their aircraft. Both pilots believed that the left outboard wing of the B-747 passed over the nose section directly in front of the cockpit. The relative height of the B-747 wing to the top of the B-727 fuselage would have permitted the wing outboard of the engine to clear DL 349. Neither the flight engineer nor the jumpseat rider were aware of FT 74 until it had passed. Several passengers aboard DL 349 had seen FT 74 when it was airborne and ready to touch down. Other passengers observed FT 74 on the ground and coming toward them as their aircraft moved onto the landing runway.

Flight 74, a B-747-F aircraft, N804FT, a scheduled cargo flight, was on an instrument flight rules (IFR) clearance from Seattle-Tacoma International Airport, Washington, to John F. Kennedy International Airport (JFK), New York, with a scheduled stop at ORD. There were three flightcrew members and three nonrevenue passengers aboard. After arriving in the ORD terminal area, the flightcrew was advised to expect landing delays. Subsequently, the approach controller issued radar vectors to FT 74 for an approach to runway 9L; however, the captain declined to accept the clearance because of aircraft weight runway restrictions. He also declined a holding clearance and instead requested a further en route clearance to JFK. FT 74 was climbing through about 22,000 ft when ATC offered to make ORD runway 9R available if FT 74 would accept an immediate approach. The captain agreed to this offer and the flight was issued radar directives for an instrument landing system (ILS) approach to runway 9R. While on the approach, FT 74 was sequenced behind United Air Lines Flight 225 (UA 225) and ahead of Trans World Airlines Flight 291 (TW 291). The local controller advised UA 225, as he had preceding landing aircraft, that the runway 09R RVR was 3,000 ft in the landing area and 6,000 ft in the rollout area. Upon intercepting the localizer, FT 74 was directed to change to a local control frequency of 120.75 MHz. On this frequency, FT 74 was advised four times by the ORD parallel monitor 9R controller beginning at 0906:05 to reduce to final approach airspeed. One minute later, the flight acknowledged the advisory. At 0907:35, the monitor controller advised the local controller that he could issue FT 74 a missed approach clearance, if necessary. The FT 74 captain stated later that he was unable to reduce airspeed further at that time because he was maintaining his minimum approach speed.

At 0908:25, FT 74 reported to the local controller that the flight was passing the outer marker. FT 74 then was advised to continue and was further advised that it was number two to land. Immediately before 0909:35, UA 225 landed on runway 9R while FT 74 was about 2 miles from the runway threshold. As UA 225 landed, the local controller noted that the runway 09R RVR values had not changed and he also recalled seeing the programmed radar target of FT 74 on his radar display. At 0909:45, the local controller requested FT 74 to report visual contact with the approach lights, and 10 seconds later the controller cleared the flight to land after UA 225 turned onto a high-speed taxiway and cleared the runway. At 0910:05, FT 74 reported the lights in sight. At 0910:30, 25 seconds later, FT 74 transmitted on the local control frequency "Hey, Delta stop."

The following aircraft, TW 291, reported passing the outer marker at 0910:55. The outer marker is 4.7 nmi from runway 9R.

The captain of FT 74 stated later that he first sighted the approach lights from an altitude 300 ft above ground level. He said that atmospheric conditions were similar to a "white-out", and he remained on instruments for descent guidance. At 0910:01, the first officer advised the captain that the aircraft was 100 ft above decision height and the runway was straight ahead. The captain recalled that as the flight approached the runway, forward visibility was about 2 mi and he could see the entire length of runway 9R. Earlier, he had decided not to use landing lights. The aircraft landed about 2,400 ft down the runway where the ground spoilers extended and auto brakes took effect. The captain applied reverse thrust to three engines; the No. 4 engine thrust reverser was inoperative. About this time, the first officer called the captain's attention to DL 349 moving slowly onto the runway. As the B-727 moved further toward the runway center the captain of FT 74 steered his aircraft toward the right. The B-747 left the hard runway surface at about a 16-degree angle. From 2 to 3 ft of snow covered the ground adjacent to the runway and during deceleration the B-747 was substantially damaged. The flightcrew and passengers evacuated by means of the flightdeck slide chute after the B-747 stopped.

FT 74 left the runway surface at the east edge of the intersection of 14R parallel taxiway and runway 9R. The distance from the approach end of the landing runway was 4,100 ft. The aircraft continued for 1,325 ft, stopping about 100 ft south of the runway and 150 ft west of the north-south taxiway leading to runway 4R.

1.2 Injuries to Persons

There were no injuries to occupants of either aircraft.

1.3 Damage to Aircraft

The Boeing 727-200 was not damaged; however, the Boeing 747-F was substantially damaged.

1.4 Other Damage

One runway directional sign was damaged.

1.5 Personnel Information

All flightcrew members and controller personnel were certificated properly. (See Appendix B.)

1.6 Aircraft Information

Both aircraft were certificated, equipped, and maintained in accordance with Federal Aviation Administration (FAA) requirements. (See Appendix C.)

The height between the B-747 wingtip undersurface and the ground varies from 19 ft 2 in. to 16 ft 8 in., depending upon the aircraft's gross weight. At a point adjacent to the outboard engine, the height between the wing undersurface and the ground varies from 17 ft 8 in. to 16 ft 0 in., also depending upon weight. The B-747 fuselage is predominately a silver-gray color.

The height between the top of the B-727 fuselage and the ground is about 14 ft.

1.7 Meteorological Information

A low-pressure center was south of Chicago with a mild warm front extending eastward and a cold front lying to the southwest. O'Hare Airport was in an east-northeasterly air flow. The National Weather Service's (NWS) surface weather observations for ORD were, in part:

> 0905: Measured ceiling 300 ft overcast clouds; visibility—1/2 mi; weather—light freezing drizzle, fog and haze; temperature—23°F; dewpoint—23°F; wind from 080° at 10 kns; altimeter—29.87 inHg. Remarks—runway 14R visual range 4,000 ft variable to 4,500 ft.
>
> 0953: Measured ceiling 300 ft overcast clouds; visibility—1/2 mi; weather—light freezing drizzle, fog and haze; temperature—24°F; dewpoint 23°F; wind from 060° at 12 kns; altimeter—29.87 inHg. Remarks—runway 14R visual range 5,500 ft variable to more than 6,000 ft.

1.8 Aids to Navigation

The localizer and glide slope of the ILS for runway 9R was ground checked and certified by the FAA as operational within established parameters following the accident. ATC radar information is provided by an automated radar terminal system (ARTS III). 3/

1.9 Communications

DL 349 communicated with ORD outbound ground control on 121.75 MHz. FT 74 communicated with ORD local control position No. 1 on 120.75 MHz. Neither flightcrew could hear the clearances issued to the other aircraft, nor could they communicate with each other on their respective assigned frequencies. Both the local and the outbound ground controllers were wearing headsets in the tower cab, and they were not in direct communication with each other.

1.10 Aerodrome Information

O'Hare International Airport is located 16 statute miles northwest of Chicago, Illinois.

3/ An automated system of terminal air traffic control which provides flight data processing capability. The radar controller's operating position will display alphanumeric data associated with the secondary radar target.

Runway 9R, an asphalt, grooved surface, is 10,141 ft long and 150 ft wide. Approach lighting consists of MALS/R with no touchdown or REIL lighting. High-intensity runway lights are installed. There are four high-speed exits on the left side; the first exit, which is about 3,900 feet from the approach threshold, is also part of the 14R parallel taxiway.

There are two runway visual range (RVR) transmissometers along runway 9R located 1,335 ft from the threshold and 1,055 ft from the approach end of runway 27L for rollout readings. The transmissometer projectors and receivers are positioned on towers about 250 ft apart. A known intensity of light is emitted from the projector and is measured by the receiver. Any obscuring matter reduces the light intensity arriving at the receiver. The resultant intensity measurement is then converted to an RVR visibility value by the signal data converter. These values are displayed by readout equipment in the associated ATC facility and updated approximately once every minute for controller issuance to pilots. Due to variable conditions, the reported RVR values may deviate from the true observed visual range because of the slant range consideration. ATC towers report RVR when the prevailing visibility is 1 1/2 mi or less and/or the RVR is 6,000 ft or less. 4/

Runway 9R is a Category I ILS runway. Published decision height for a straight-in full ILS approach for all aircraft categories is 200 ft. Minimum visibility is 2,400 ft. The outer marker, identified "Deana," is located 4.7 nmi from the approach end of runway 9R. The middle marker is located 0.5 nmi from the approach end. The threshold crossing height is 64 ft; touchdown zone elevation is 664 ft. Simultaneous approaches with runway 9L are authorized. Radar procedures are required to fly the 9R published ILS approach. The distance from the tower cab to the runway 9R glide slope intersection point is about 4,600 ft.

The distance from the approach end of runway 9R to the intersection of runway 32L/14R is 3,541 ft. The distance from the approach end of runway 9R to the intersection of 14R parallel taxiway is about 3,900 ft. The approximate distance on the 14R parallel taxiway between the east-west taxiway and runway 9R is 450 ft. Designated as a high-speed turnoff for runway 27, this portion of the taxiway is curved. The north and south portions of the 14R parallel taxiway are offset at the intersection with runway 9R. The taxiway heading is about 120 degrees at the runway juncture.

1.11 Flight Recorders

FT 74 was equipped with a Sundstrand Data Control (SDC) 573-A digital flight data recorder (DFDR), serial No. 2156, and a Hamilton Standard flight data acquisition unit. The DFDR was not damaged and, with the tape installed in the unit, it was transcribed by the Safety Board's flight data recorder readout station. The printout began at an altitude of 3,299 ft m.s.l. This figure was calculated from the recorded pressure altitude assuming an altimeter setting of 29.87 inHg. All recorded parameters were taken for the last 3 min 15 sec of flight.

FT 74 was equipped with a Sundstrand V557B cockpit voice recorder (CVR), serial No. 7136. This particular tape system pauses and reverses direction

4/ Airman's Information Manual, FAA, January 1979.

each 15 min. The direction reversal came following the 20-ft callout, and the times following this callout are uncertain. However, the CVR is not believed to be inaccurate by more than 1 sec, which is within accepted tolerance.

DL 349 was equipped with a Lockheed LAS 109-D flight data recorder (FDR), serial No. 714. The readout covered the period from the point where electrical power was applied to the flight recorder after push-back from the passenger boarding area and continued through all taxi maneuvers until the aircraft returned to the passenger terminal, where FDR electrical power was terminated. DL 349 also was equipped with a Fairchild A-100 CVR, serial No. 921.

1.12 Wreckage and Impact Information

The structural damage to the Boeing 747-F was limited to the forward lower fuselage area (FS-240 to FS-800), the areas immediately forward and aft of the wings, and to the inboard engine installations. The fuselage aft of the wing fuselage fairings, including the complete empennage assembly, was not damaged. Snow was found in the electronic equipment bay and in both the left and right nose wheel well crawl spaces. Lower surfaces of the wing interspar skin along the entire spar showed no evidence of damage, and spar damage was not evident in the wing gear wheel well areas.

The leading edge devices of both wings were extended and intact, as well as the outboard trailing edge flap sections. The left inboard landing flap section was badly damaged but the tracks, carriages, jackscrews, and actuators remained attached. A 5- to 10-ft section of the right fore, mid, and aft inboard trailing edge flap had separated and the sections were found back along the aircraft's ground track.

The No. 1 engine support struts were undamaged and the engine was intact. The external cowling had no damage and the NI compressor rotated freely. Reverse thrust had been applied.

The forward portion of the No. 2 engine support strut was crushed and bent inboard and aft. Engine separation had occurred through the strut front and mid spars. The engine had separated from the aircraft and came to rest about 80 ft aft of the aircraft, in line with the No. 2 engine strut. The NI compressor and engine cowling were packed with snow. The external cowling and inlet nose cowling damage was extensive. Reverse thrust had been applied.

The No. 3 engine support strut exhibited a separation through the front spar between the forward and aft engine mounts, permitting the engine to droop downward. The engine inlet was packed with snow. Fifty percent of the NI spinner was damaged. Reverse thrust had been applied.

The No. 4 engine support strut was undamaged and the engine was secure. The NI core was completely packed with snow. The first stage fan appeared to be undamaged. The reverser system had been previously rendered inoperative, and a placard so stating was installed in the cockpit.

The nose gear drag braces and linkage separated, allowing the nose gear to rotate into the fuselage near FS-400. The box structure was bent but major

structural damage was not evident.

The right and left wing gear had separated from the aircraft and were located back along the ground track. Examination of the gear assemblies and wheel wells indicated that the right wing gear had separated through its forward design shear points and rotated aft about the alignment bearing while the left wing gear separated in a similar manner, except the design shear points remained attached in the wheel well and the attachment flange exhibited an overload failure. The body gears remained attached and sunk 3 to 4 ft into the frozen ground. All tires on the body and wing wheels were inflated and appeared in good condition.

There was no evidence of a loss of fuel system integrity during examination of the wings/fuselage area. The main cargo compartment floor was displaced upward at FS-400, and the cargo pallets and restraints in this area were displaced. The remainder of the compartment floor and restraints were undamaged and the cargo was secure. There was no damage evident in the cockpit and upper deck area. The cockpit seats and four passenger seats were secure.

1.13 Medical and Pathological Information

There was no evidence of any psychological conditions which would have precluded the flightcrew and controller personnel from performing their duties.

1.14 Fire

Not applicable.

1.15 Survival Aspects

Not applicable.

1.16 Tests and Research

Applicable times, distances, altitudes, ground tracks, and other related information were derived from ARTS III computer data, the DFDR (FT 74), the FDR (DL 349), the CVR's of both aircraft, and the air traffic control (ATC) communication transcripts. It was determined from correlated recorder data that FT 74 passed in front of DL 349 at 0910:31.

A visibility study was conducted to establish a base line from which to examine the ability of DL 349's flightcrew to visually acquire FT 74. The visual angles from DL 349 to FT 74 were calculated for the last 13 sec at 1-sec increments up to the point of passage (see Appendix D.) The study was limited to the 13-sec period before the flights passed because of the runway visual range limitation of 3,000 ft. The angles then were plotted on B-727-200 binocular photographs.

The binocular photographs were taken from the cockpit of a Boeing 727-200 by the FAA's National Aviation Facilities Experimental Center (NAFEC), Atlantic City, New Jersey. The binocular camera uses two lenses that are 2.5 in. apart, which is equal to the average distance between the human eye. The camera

BOEING 727–200 QD326
AIRCRAFT POSITION: LEVEL
FIRST OFFICER NORMAL REFERENCE POINT
CAMERA POSITION:
27.22" AFT OF INSTRUMENT PANEL LOWER EDGE
20" LEFT BUTT LINE
45" ABOVE DECK

● REPRESENTS LOCATION OF BOEING 747

NAFEC PHOTO AJB DECEMBER 1978

NUMBERS DENOTE TIME AND POSITION OF B-747

AS REFERENCED APPENDIX D

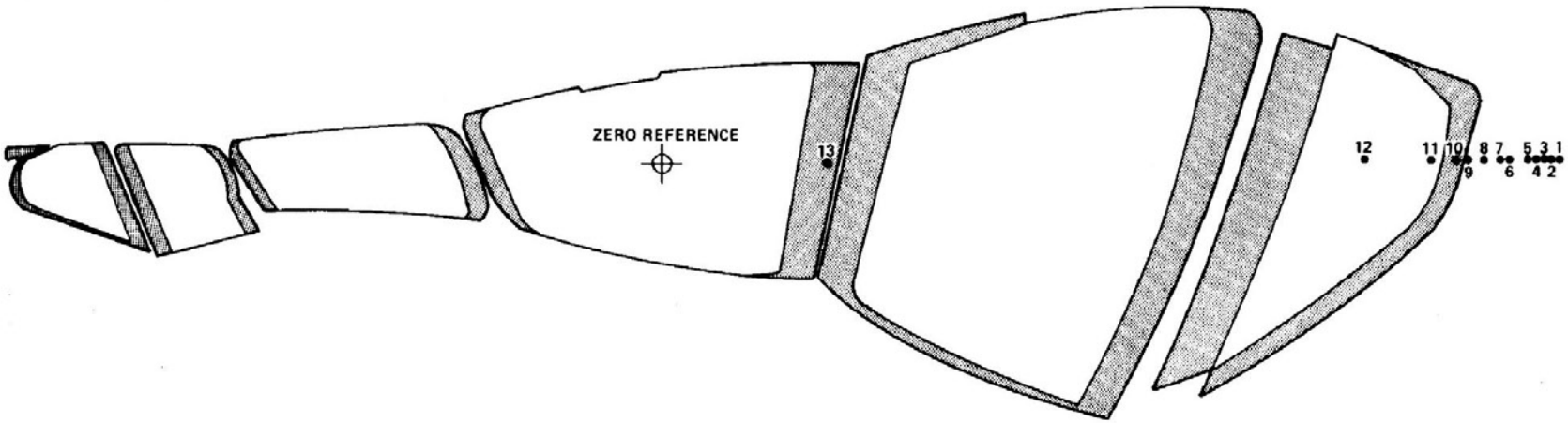

FIGURE 1

BOEING 727–200 QD326
AIRCRAFT POSITION: LEVEL
CAPTAIN'S NORMAL EYE REFERENCE POINT
CAMERA POSITION:
27.22" AFT OF INSTRUMENT PANEL LOWER EDGE
20" LEFT BUTT LINE
46" ABOVE DECK

● REPRESENTS LOCATION OF BOEING 747

NAFEC PHOTO AJB DECEMBER 1978

NUMBERS DENOTE TIME AND POSITION OF B-747
AS REFERENCED APPENDIX D

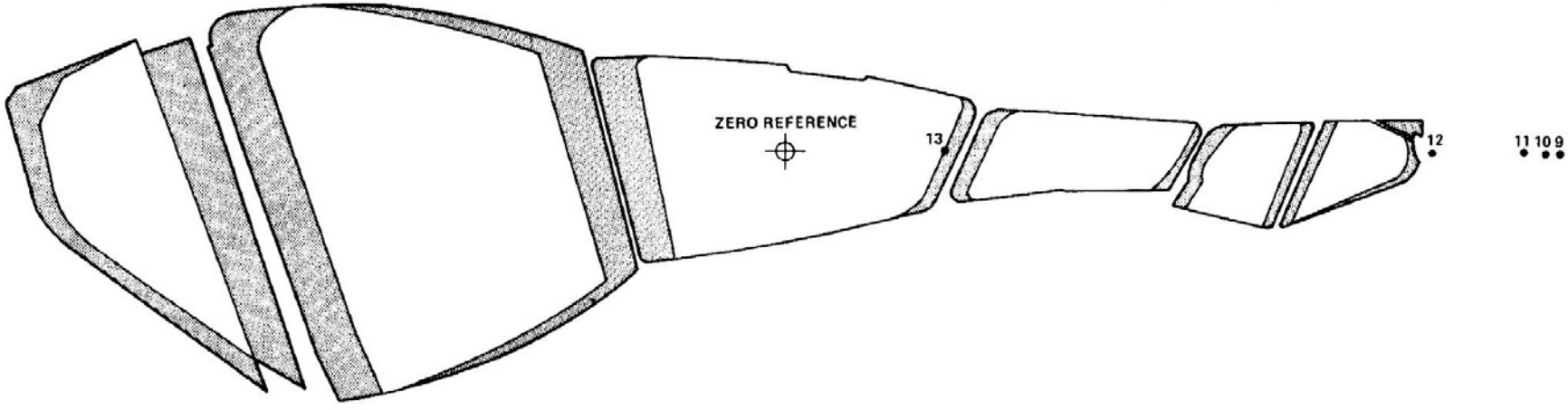

FIGURE 2

was mounted on each pilot's seat with the lenses fixed at the reference position. The camera is equipped with a continuous strip of film which superimposes a grid of horizontal and vertical lines in 5-degree increments on the picture, and when exposed presents a panoramic photograph of the window configuration from inside the cockpit. The photos show the outline of the cockpit windows as seen by a crewmember when he looks to the extreme left or right. The shaded areas indicate those portions of the windows exposed to monocular vision.

The reference eye positions were based on Boeing data. In the photographs, eye reference vertically locates the horizon in the window with the aircraft on the ground. The pitch and roll angles of the viewing aircraft were assumed to be zero because the aircraft remained on the ground. The maximum vertical displacement was only 1 degree and given the scale of figures 1 and 2 would be almost negligible. Therefore, all targets were plotted on the horizontal only, taking heading and position information into account.

The perspective look angles were developed from the position and orientation time history data displayed in Appendix D. The positions of the viewing aircraft and target point were placed in a common two-dimensional coordinate system and the viewing aircraft orientation heading angles. The target point was then referenced to the aircraft's coordinate system from which the look angles defining the line of sight were calculated. The look angles were then superimposed on each of the photographs about the zero reference to determine if the line of sight falls within the vision envelope or intercepts obscuring aircraft structure. The results are shown in figures 1 and 2 which define the Boeing 727 vision envelope based on the pilot's/first officer's normal eye position.

The vision envelopes as shown in figures 1 and 2 should be used only as a point of reference and should not be considered to represent the absolute limits of the crew's visibility. This is due primarily to the fact that figures 1 and 2 represent a vision envelope as defined by a single position, when in fact any movement of the pilot's head, eyes, and torso would significantly enlarge the envelope size and shape.

1.17 Additional Information

1.17.1 O'Hare Tower Controller Positions and Duties

The ORD tower facility is a Level IV, Limited Radar Approach Control Tower. Tower personnel are responsible for terminal ATC in the airspace immediately surrounding ORD (approximately 5 mi). Within this defined airspace, limited radar service is provided by tower personnel.

Six tower cab control positions, an inbound ground controller trainee, and one supervisory position were operational at the time of the accident. Eleven controller personnel were on duty. The local controller, the inbound ground controller, and the outbound ground controller are positioned approximately side by side in the tower cab. The local controller is responsible for handling all arriving and departing traffic and has the responsibility for the use of all runways on the airfield. The ground controllers are responsible for the handling of aircraft and vehicle ground movements.

The local controller has a Bright Radar Indicator Tower Equipment (BRITE) 5/ display at his position, and the ground controllers share BRITE and airport surface detection equipment (ASDE) displays combined in one unit. Either display can be selected by a switching feature. The local controller's BRITE display is also available to the ground controllers. At the time of the accident, ASDE was selected on the ground control panel and the outbound ground controller was using the local controller's BRITE display for reference. When he checked the display for landing traffic, he observed a radar target at "an estimated distance of three and one-half mi" behind UA 225; however, he did not identify the target.

The approach controller and the monitor controller positions are in the terminal radar control center (TRACON), which is located in a lower section of the tower building.

The approach controller is responsible for providing terminal radar service for arriving IFR/VFR aircraft. He provides this service by using airport surveillance radar and air/ground communications to establish the appropriate approach sequence. When a heavy aircraft is following another heavy aircraft while conducting an instrument approach, the approach controller is required to provide 4 mi radar separation between the two aircraft.

The parallel monitor controller is responsible for the coordination of simultaneous ILS approaches and any related matters pertaining to landing and departing aircraft. The monitor controller has the capability to communicate directly with aircraft. In this case, he had issued speed reduction requests to FT 74 on the local control frequency.

1.17.2 Air Traffic Control Facilities and Procedures

The ORD approach control facility is ARTS III-equipped and provides controllers with the capability to identify and track discretely coded and nondiscretely coded beacon targets by means of automatic or manual acquisition. The ARTS III computer displays data blocks for beacon-equipped arrivals sequenced along the ILS final approach course to a point 2 mi from the approach end of runway 9R. The computer is programmed to drop the data blocks at this point. Mode C altitude information is retained until arriving aircraft descend to 800 ft on the approach course at which time, for the purpose of reducing ground clutter, the altitude information is dropped. The target return is displayed then by an asterisk symbol. In the event of a missed approach, all relevant data is auto-dropped and placed on the coast/suspend computer list until the radar target enters the auto-acquire area.

The ASDE is high-resolution radar designed to detect principal features on the airport surface including aircraft and vehicular traffic. The plan position indicator 6/ and the BRITE are units of the ASDE. The ASDE will display targets

5/ Electronic equipment allowing viewing of radar indicators under bright sunlight or high ambient light conditions. They are designed for operation with airport surveillance radars.

6/ A type of radar separation presentation in which the sweep moves radially from the center of the tube face, and the sweep line rotates in synchronism with the antenna.

consistently for aircraft operating at altitudes of 50 ft a.g.l. or less, and the ASDE may display targets as high as 100 ft a.g.l. Maximum range for the O'Hare ASDE is between 2 1/4 and 2 1/2 mi. The viewable distance on the radar scope beyond the approach end of runway 9R is about 1 1/4 mi. The BRITE equipment used in the tower cab is a televised presentation of the same ARTS III alphanumeric display provided to the approach control facility. The ORD tower has BRITE 2 Plan Position Indicators and BRITE 4 video displays. A postaccident ground check of the ASDE performed by FAA personnel indicated the equipment was operational.

Paragraph 971 of FAA Handbook 7110.65A specifies that the ground controller must obtain approval from the local controller before authorizing an aircraft or vehicle to use any portion of an active runway. An exception to this requirement is allowable if alternate procedures are developed and contained in a facility directive that permits the ground controller to clear aircraft or vehicles across an active runway without individual coordination in each instance. No coordination was required between the ground controller and the local controller based on Chicago-O'Hare Tower Order 7110.7B, dated November 13, 1978, which contains the following procedural directives:

Ground Control shall not authorize an aircraft or vehicle to cross an active runway without coordination with the Local Control position unless the following procedures are adhered to.

a. The Ground controller shall visually scan the runway(s) and utilize the BRITE and/or ASDE as appropriate to ensure that crossing aircraft/vehicle will not conflict with arrival and/or departure traffic.

b. When the reported visibility is less than 1 1/2 mi, individual coordination is required unless the ASDE is operating, or the Ground controller can visually observe the point of crossing and a sufficient amount of runway to ensure that no conflict with arrival and/or departure traffic will occur.

Paragraph 1420 of Handbook 7110.65A requires radar separation of 4 mi for a heavy aircraft, such as B-747's and DC-10's, behind another heavy aircraft, and 5 miles for a small/large aircraft, such as a B-727, behind a heavy aircraft. The separation is required for the avoidance of wake vortex turbulence. FT 74, a B-747, was preceded by UA 225, a DC-10, and followed by TW 291, a B-727.

Paragraph 1120 of Handbook 7110.65A requires separation of an arriving aircraft from another aircraft using the same runway by ensuring that the arriving aircraft does not cross the landing threshold until the other aircraft has landed and taxied off the runway.

There were no delays to air traffic in the ORD terminal area at the time of the accident.

1.18 New Investigative Techniques

None.

2. ANALYSIS

After declining an approach to runway 9L, FT 74 had accepted a new clearance and the flight was sequenced by radar vectors behind UA 225 for an ILS approach to runway 9R. In his effort to accommodate traffic, the evidence indicated that the ORD approach controller spaced FT 74 by the provisions of Paragraph 1120, FAA Handbook 7110.65A, which requires separation of aircraft using the same runway by ensuring that an arriving aircraft does not cross the landing threshold until the preceding aircraft has taxied off the runway. However, the approach controller did not comply with the radar separation minimum criterion of 4 mi listed in paragraph 1420 of the same procedural handbook because UA 225 was only 2 mi ahead of FT 74.

According to ARTS III radar tracking data, UA 225 was crossing the runway threshold at 0909:17 as FT 74 was about 2 mi in trail. As UA 225 turned onto a high-speed taxiway and cleared the runway, the local controller immediately issued FT 74 a landing clearance. If the approach and local controllers, backed by the monitor controller, had sequenced FT 74 at a 4-mi landing interval, the ground controller would have had adequate spacing to clear DL 349 across the active landing runway after UA 225 passed the runway 14R and runway 9R intersection.

Chicago-O'Hare Tower Order 7110.7B authorized the ground controller to clear traffic across an active runway without coordinating with the local controller. The effectiveness of the directive is contingent on the proficiency of the ground controller to observe the activities of the local controller, to perceive the traffic flow, scan the runways, and monitor the ASDE and the BRITE display. The ORD order authorizes him to make an independent judgment as to whether it is safe and expedient to clear an aircraft or vehicle across an active runway. The ground controller had demonstrated his ability to move ground traffic safely in accordance with the ORD Tower Order many times during his 2 years at ORD.

The outbound ground controller did not effect coordination with the local controller before issuing the clearance to DL 349 to cross the active landing runway. Although he was not required to do so, the local controller should have advised the ground controller of the considerably reduced horizontal spacing between UA 225 and FT 74. If he had been so advised, the ground controller would have had sufficient information to preclude an improper judgment regarding the actual spacing between the aircraft arriving on the ILS approach course. This accident illustrates that there was a deficiency in the local order in that it did not provide for the probability of human error. On March 22, 1979, Chicago-O'Hare Tower Order 7110.7C was issued which prescribed improved coordination between ground and local controllers when aircraft cross active runways.

The ground controller stated that he checked the BRITE display for landing traffic before he cleared DL 349 to cross runway 9R. He observed a radar target at "an estimated distance of three and one-half mi" behind UA 225 but he did not read the associated alphanumeric data tag. In as much as there was no target at a distance of 3.5 mi, the radar target that he saw was TW 291, which actually was about 5.25 mi from the runway threshold. The ARTS III computer at ORD is programmed to display data tags for transponder-equipped arrivals to a point 2 mi from the approach end of runway 9R. At this point the data tag is automatically dropped and the basic radar target is emphasized with an asterisk

overlay as the target continues toward the runway threshold. The local controller confirmed his observation of the programmed asterisked target of FT 74 while he simultaneously monitored the progress of UA 225 on landing rollout. His observation of the asterisked radar target when UA 225 was on the runway placed the separation of the two heavy aircraft at less than the required 4 mi. Further, his observation confirms that the radar target of FT 74 was displayed and should have been observed by the ground controller.

At 0910:00, when the outbound ground controller issued the clearance for DL 349 to continue across runway 9R, DL 349 was turned onto the 14R parallel taxiway. Simultaneously, FT 74 was on a collision course from a point 335 ft a.g.l. and about 8,000 ft from the intersection of the parallel taxiway and the landing runway. Under the ORD ARTS III program, FT 74 would have been represented on the tower BRITE display as an asterisked target.

The Safety Board believes that when the ground controller looked at the radar, he anticipated that he would observe the arrival flight positioned behind UA 225 to be 4 mi in trail. When the ground controller scanned the BRITE display he failed to see the asterisked target associated with FT 74. Since he did not expect the next arrival flight to be sequenced so closely, he accepted a more conspicuously displayed target, with data tag, as the next arrival. This target represented TW 291, which was about 5.25 nmi behind FT 74. Based on what he perceived to be a safe interval between landing traffic, the ground controller cleared DL 349 to cross runway 9R. The Safety Board concludes that the clearance was the result of the ground controller's incorrect radar target identification.

At the time of the accident, visibility at ORD was variable, dependent upon the position of the observer and the direction of the observation. The 0905 NWS surface weather observation stated that visibility was 1/2 mi, with fog and haze, and also stated that runway 14R visual range was 4,000 ft variable to 4,500 ft. Several minutes before the accident, the local controller had advised landing aircraft that runway visual range for runway 9R was 3,000 ft in the touchdown zone and 6,000 ft in the rollout area. He also observed the RVR on runway 9R as 3,000 ft when UA 225 landed although he did not report, as required, the RVR reading to FT 74. He stated that he first saw the majority of landing aircraft as they touched down at the glide slope intersection point. The runway 9R transmissometer was located closer to the approach end of the runway than the glide slope intersection point and it was at this point that the 3,000-ft RVR value was taken. The Safety Board recognizes that the visibility along a RVR baseline is not always representative of the visibility outside the sampling volume 7/, and we believe such variable visibility conditions existed on the airport at the time of the accident.

It is noteworthy that the DL 349 captain recalled that a fog bank was off the end of runway 9R. The captain of FT 74 confirmed the fog's presence when he described a "white-out" area as he descended below the overcast. As outside visual reference was limited, he continued the descent to the runway by cockpit ILS instrument reference. Regardless of the different visibility distances observed

7/ Analysis of Visibility Observation Methods, Hockreiter, 1969, U.S. Department of Commerce.

at various airport locations, the Safety Board concludes that the runway 09R RVR accurately reflected the 3,000 ft visual range which was available to the DL 349 pilots in the direction of the landing B-747.

The cockpit visibility study determined that the visual angle in the horizontal plane, with the pilots' eyes in the normal reference position, permitted the captain to see objects within a 115° arc to the right from a point directly in front of him and permitted the first officer to see within a similar 137° arc to the right. The visual envelope would have been increased if either pilot had leaned forward or to his right.

After acknowledging the controller's crossing clearances, both the Delta captain and first officer looked toward the approach end of runway 9R as their aircraft completed the turn onto 14R parallel taxiway, a point which is 250 ft from the north edge of runway 9R. The first officer had an unobstructed view toward the runway threshold; however, his visual range ended at a point about 950 ft from the threshold. The captain could have seen the same distance only if he had leaned from his normal eye position, which he said that he did. The B-747 was beyond their visual range. At 0910:19, FT 74, while 55 ft above the runway, was about 2,800 ft from DL 349 and within visual range. As FT 74 descended over the runway, the aircraft may have been obscured initially to ground observers by the fog bank at the end of runway 9R. Further, the predominant silver-gray fuselage colors of the B-747 would have been inconspicuous against the dull colors of the overcast. The aircraft's landing lights were not illuminated and thus lessened easy recognition of the aircraft's position. At this time, DL 349 was 80 ft from the runway and the aircraft had turned to a magnetic heading of 118°. At that position, if the first officer had moved his head forward and to the right, which would have enlarged his vision envelope, it would have been within his capability to see the approaching aircraft and warn the captain to stop the aircraft. However, from the normal eye reference position, the first officer could not have seen FT 74 until about 4 seconds before the near collision. Although the response time was minimal, it probably was sufficient to have stopped the aircraft and permitted FT 74 to pass safely on the runway. The Delta captain could not have seen the B-747 from his position on the left side of his aircraft. DL 349, at this time, began a turn back to the right, reaching a heading of 128° as the B-727 entered the runway at 0910:26. Meanwhile, FT 74 had landed at 0910:24 and was within 1,100 ft of DL 349. The B-747 had now entered the normal vision envelope of the Delta first officer. The first officer could have seen FT 74 if he had looked in the direction of the runway 9R landing area. At this point, the DL 349 captain still could not see FT 74 which was well outside his vision envelope.

When the aircraft were about 850 ft apart, FT 74 started to head off the runway and the FT 74 first officer shouted a radio warning for DL 349 to stop. Because the two aircraft had been assigned different ATC communications frequencies, neither flightcrew heard the ATC clearances issued to the other flight and DL 349 could not hear the warning transmitted by the FT 74 first officer. It was not until the B-747 was within 150 ft that the DL 349 captain could have seen the other aircraft.

The Safety Board notes that 14 CFR 91.3 holds the pilot in command of an aircraft to be directly responsible for, and the final authority as to, the operation of that aircraft. Further, the Airman's Information Manual (AIM) 8/ states that ATC clearances and instructions pertaining to taxiing are predicated on known traffic and known airport conditions, and that although an ATC clearance is issued for taxiing purposes when operating in accordance with the FAR's, it is the responsibility of the pilot to avoid collision with other aircraft. In this accident, the captain of DL 349 failed to clear his right of way, and because he could not adequately scan for landing aircraft, he should have told his first officer to look for traffic before entering on the active runway. If he had done so, the accident would have been prevented.

3. CONCLUSIONS

3.1 Findings

1. The ORD outbound ground controller did not effect coordination with the local controller before clearing DL 349 across the active landing runway, nor was he required to do so.

2. An ORD tower directive, ORD Tower Order 7110.7B, authorized the ground controller to clear aircraft or vehicles across an active runway based on his independent judgment and without local controller coordination.

3. To comply with the order, the ground controller must use the ASDE and the BRITE displays and observe the landing runway before issuing a taxi clearance to cross an active runway.

4. The approach controller did not provide the required separation between UA 225 and FT 74. The monitor controller was unable to increase the spacing.

5. The outbound ground controller probably anticipated that the next arrival, sequenced behind UA 225, would be about 4 mi in trail.

6. Based upon what he perceived to be a safe interval between landing traffic, the ground controller cleared DL 349 across runway 9R and into the path of FT 74.

7. The ground controller had failed to see the displayed radar target of FT 74 on the BRITE display.

8. At the time of the controller's crossing clearance, FT 74 was not in visual range of the controller nor was it within the ASDE surveillance range.

8/ AIM, Paragraph 241(b), January 1979.

9. The DL 349 flightcrew looked for landing aircraft on runway 9R as their aircraft turned on the 14R parallel taxiway. They did not maintain a traffic lookout as they continued taxiing.

10. Visibility from DL 349 toward the landing area of runway 9R was 3,000 ft.

11. DL 349 entered runway 9R at a magnetic heading of 128° from a high-speed turnoff approximately 4,000 ft from the runway threshold.

12. From a normal reference eye position, the captain of DL 349 could not have seen the FT 74 until 1 to 2 sec before the B-747 passed in front of his aircraft.

13. From the normal eye reference position, the first officer of DL 349 could have seen FT 74 about 4 sec before the near-collision.

14. Passengers of DL 349 saw FT 74 while it was in the air and on the runway coming toward them.

15. Because the communication radios of each aircraft were tuned to different frequencies, the ground controller's transmissions to DL 349 were not heard by the FT 74 crew and the FT 74's transmission for DL 349 to stop crossing runway 9R was not heard by the DL 349 crew.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the O'Hare outbound ground controller's issuance of a taxi clearance across runway 9R, which permitted Delta Flight 349 to move into a collision path with Flying Tiger Flight 74 and, further, the failure of the pilots of Delta Flight 349 to maintain a continuous vigil for landing traffic before entering an active runway. The improper clearance was the result of the ground controller's failure to see the displayed radar target of the landing aircraft.

Contributing to the accident were the approach controller's failure to effect required spacing criteria between Flying Tiger Flight 74 and the preceding arrival aircraft and the local controller's failure to issue a missed approach clearance when he noted the less-than-required separation.

4. SAFETY RECOMMENDATIONS

As a result of this accident and other runway incursion incident/accidents which occurred at La Guardia Airport, New York, and Memphis Airport, Memphis, Tennessee, the National Transportation Safety Board recommended on June 8, 1979, that the Federal Aviation Administration(See Appendix H):

"Conduct a directed safety study, on a priority basis, to examine the runway incursion problem and to formulate recommended remedial action to reduce the likelihood of such hazardous conflicts. (Class II, Priority Action) (A-79-42)

"Alert all controller/pilot personnel that runway incursion mishaps represent a serious safety problem which requires their immediate attention. Special emphasis should be placed on the need for both groups to maintain greater visual surveillance in those taxi operations involving any runway crossing. (Class II, Priority Action) (A-79-43)"

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ PATRICIA A. GOLDMAN
Member

/s/ G.H. PATRICK BURSLEY
Member

ELWOOD T. DRIVER, Vice Chairman, did not participate. FRANCIS H. McADAMS, Member, filed the following dissenting statement.

I disagree with the majority of the Board wherein they conclude inter alia that the probable cause of the accident was ". . .the failure of the pilots of Delta Flight 349 to maintain a continuous vigil for landing traffic before entering an active runway."

The facts are as follows: Delta was cleared to cross the runway at 0910:00 by the outbound ground controller and told to "keep it moving." At this time Delta was approximately 472 feet from the runway. Shortly after receiving clearance to cross, both Delta crewmembers looked toward the approach end of the runway and observed no traffic. The approach to the runway, as well as approximately 950 feet of the approach end of runway 9R, was obscured by a fog bank; consequently, it was not possible for the Delta crew to observe any approaching traffic until it was at least 950 feet from the runway threshold. The Delta aircraft continued to taxi onto the runway, and when the nose had intruded to about 75 feet onto the runway the Flying Tiger aircraft was observed by the Delta first officer at about 0910:29. The near-miss occurred at 0910:31. Even according to the majority, the first time that the Delta first officer could have seen Flying Tiger from his normal cockpit position was at 0910:27, or 4 seconds before the near-collision. Delta was almost to the midpoint of the runway at this time.

The local controller stated that due to the existing visibility conditions he first observed landing aircraft as they touched down at the glide slope intersection point, 1,200 feet from the threshold. Flying Tiger passed this point at 0910:20, and

the nose of the Delta aircraft had already intruded onto the runway. In this connection, it is significant that the Flying Tiger crew did not see Delta until 0910:27, or 4 seconds before the accident—about the same time that Delta observed Flying Tiger.

Based on these facts, a majority of the Board has concluded that, despite an ATC clearance to cross the active runway in severely limited visibility conditions, the Delta crew could have avoided the accident if a continuous vigil for landing traffic had been maintained.

The Board has completely missed the point of this accident, since even if Delta had visually checked the runway at 0910:18 when Flying Tiger was 900 feet down the runway, Delta could not have seen Flying Tiger because of the restricted visibility and Delta would have entered on the runway as previously cleared. In other words, ATC vectored two aircraft on a collision course on the runway, and the attempt to blame Delta for being on the runway is highly unreasonable under the circumstances. The Board states:

> From the normal eye reference position, the first officer could not have seen FT 74 until about 4 seconds before the near collision. Although the response time was minimal, it probably was sufficient to have stopped the aircraft and permitted FY 74 to pass safely onto the runway.

At this time Delta was almost to the midpoint of the runway, and a potentially dangerous situation now existed. Even if Delta had stopped, an accident or near-collision would have already occurred; Flying Tiger would have had to swerve to the right to avoid a collision in any event. Under these circumstances I find, contrary to the majority, that stopping the aircraft would not have avoided an accident or incident.

A pilot receiving positive clearance to cross an active runway should visually clear the runway for landing traffic if he can physically see it. On the other hand, in this case the ground controller should have been aware of the restricted meteorological conditions and not have issued the clearance.

According to the majority's reasoning, Delta should not have crossed the runway until it was possible to visually clear the runway and approach. Unfortunately, it was not possible to visually clear the runway until there was a substantial improvement in the visibility conditions. Under these circumstances, Delta had the right to rely upon and accept the radar-vectored instrument taxi clearance to cross the runway, just as Flying Tiger had the right to rely upon its landing clearance.

However, of far more significance than the foregoing is the fact that once Delta had turned to a heading of 118 degrees to cross runway 9R it would have been physically impossible for Delta to have seen Flying Tiger, even if there had been no restrictions to visibility. Flying Tiger was not within the visual envelope of Delta until 0910:25; at 0910:25 the Delta aircraft had intruded onto runway 9. At all times prior to 0910:25, Flying Tiger was behind the right shoulder of the Delta first officer at about the 4:30 o'clock position.

The facts appear to be clear. At 0910:19, Delta was on a magnetic heading of 118 degrees, and the nose of the aircraft was near the north edge of runway 9. At this time Flying Tiger was 55 feet in the air and about 2,800 feet from Delta. It would have been physically impossible for the Delta first officer to have seen Flying Tiger until 0910:25 — even if he had been leaning forward in his seat. According to the diagram, Appendix D, Near Collision Tracks, and using an arc of 137 degrees (the maximum number of degrees that the first officer could see from the normal cockpit position), he had a view of no more than 575 feet down the centerline of runway 9. Using an absolute reasonable maximum visibility arc of 145 degrees, his view along the centerline was approximately 1,960 feet. At this time, Flying Tiger was still 2,800 feet from Delta. With Delta on a heading of 118 degrees, and Flying Tiger on a heading of 90 degrees, the Flying Tiger aircraft would be beyond the 145 degree arc, which is more than 60 degrees behind the Delta first officer's shoulder. This acute angle would have made a sighting of Flying Tiger beyond the extreme physical limits of visibility from the Delta cockpit.

Further, the Board does not discuss the poor judgment of the ground controller in clearing Delta to cross the runway at 0910:00 when Delta was approximately 800 feet from clearing the south edge of runway 9R. The controller stated he had observed a radar target 3.5 miles from the runway threshold at this time. According to the flight data recorder, Flying Tiger had an average approach air speed of 190 mph (180 mph ground speed), or 3 miles per minute. Flying Tiger would have been over the runway in 70 seconds. It would have taken Delta at least 60 seconds to taxi the 800 feet to completely clear runway 9. In my opinion, 10 seconds is not a sufficiently safe margin.

As a result of this accident and several other runway incursion accidents and incidents, the Board should have recommended to the FAA that either positive coordination be required between ground and local control with no exemptions before an aircraft is cleared to cross an active runway, or that only the local controller should have the authority to issue a taxi clearance to cross an active runway.

In conclusion, I would not have included Delta as a primary cause to this accident, because it was physically impossible for the Delta crew to have seen Flying Tiger until it was too late due to restricted meteorological conditions and physical visual limitations from the Delta cockpit.

/s/ FRANCIS H. McADMAS
Member

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5. APPENDIXES

APPENDIX A

Investigation and Hearing

1. Investigation

The National Transportation Safety Board was notified of the accident about 0915 on February 11, 1979. Investigators from the Safety Board's Chicago Field Office and Washington, D.C., headquarters went to the scene. Working groups were established for operations, air traffic control, systems, and structures. The Federal Aviation Administration was party to the investigation.

2. Public Hearing

A public hearing was not held.

APPENDIX B

Personnel Information

Mr. Bernd D. Cox

Mr. Cox was working the outbound ground control position at the time of the accident. Mr. Cox is a full performance level journeyman controller and he is certificated as a surface weather observer by the National Weather Service (NWS). He had been employed by the FAA for 2 years 9 months on February 11, 1979. Except for several months at the FAA Training Academy, Oklahoma City, Oklahoma, all of his employment has been at ORD. The scheduled duty shift for the day watch began at 0700 and ended at 1500. Mr. Cox was the outbound ground controller from 0900 to 0917.

Mr. Gerald L. Fisher

Mr. Fisher was working the local control position at the time of the accident. Mr. Fisher is a full performance level journeyman controller and he is certified as a surface weather observer by the National Weather Service (NWS). He worked the local control day shift position from 0801 to 0922. He had been employed by the FAA for about 10 years on February 11, 1979. During the past 4 years he has been assigned to ORD tower. Mr. Fisher had 3 years of experience as a military tower controller and radar controller.

Captain James Roy Walls

Captain Walls, 40, was the pilot-in-command of DL 349. He was employed by Delta Air Lines, Inc., on August 7, 1965. He has Airline Transport Pilot Certificate No. 1616061, with multiengine land ratings in DC-9, B-727, B-377 aircraft. His first-class medical certificate, dated September 19, 1978, had no limitations. His total flight time was about 8,000 hrs with 1,200 hrs in the B-727. He had flown 2.5 hrs in the past 24 hrs, followed by a 20.5-hr rest period.

First Officer Arthur A. Molitor, Jr.

Mr. Molitor, 38, was second-in-command pilot on DL 349. He was employed by Delta Air Lines, Inc., on April 18, 1971. He has Commerical Airman Certificate No. 1896064, without ratings. His first-class medical certificate, dated October 17, 1978, had no limitations. His total flight time was about 6,500 hrs, with 1,100 hrs in the B-727. He had flown 2.5 hrs in the past 24 hrs, followed by a 20.5-hr rest period.

Second Officer Kenneth Daryl Musser, Jr.

Mr. Musser, 29, was the flight engineer on DL 349. He was employed by Delta Air Lines, Inc., on June 24, 1973. He has Commerical Airman Certificate No. 1901628, without ratings and Flight Engineer Certificate No. 316485286, with turbo-jet rating. His first-class medical certificate, dated April 24, 1978, had no limitations. His total flight time was about 4,000 hrs, with about 1,600 hrs in the B-727. He also had flown 2.5 hrs in the past 24 hrs, followed by a 20.5-hr rest period.

Captain Richard P. Petrick

Captain Petrick, 53, was the pilot-in-command of FT 74. He was employed by Flying Tigers, Inc., on December 5, 1950. He has Airline Transport Pilot Certificate No. 345488, with ratings in 10 multiengine aircraft including the B-747. His first-class medical certificate, dated September 13, 1978, had a provision requiring the holder to possess glasses for near vision. His total flight time was 12,567 hrs, with 498 hrs in the B-747. During the past 24 hrs he had flown a total 3 hr 7 min. He had a 12-hr rest period before the accident flight.

First Officer David E. Hooker

Mr. Hooker, 39, was the second-in-command pilot of FT 74. He was employed by Flying Tigers, Inc., on September 10, 1961, as a navigator. He was upgraded to second officer on Feburary 15, 1967, and qualified as a first officer on August 6, 1978. He has Commercial Airman Certificate No. 1594381, without ratings. His first-class medical certificate, dated January 16, 1979, had no limitations. His total flight time was 5,279 hrs, with 278 hrs in the B-747. During the past 24 hrs he had flown 3 hrs 7 min. He had a 12-hr rest period before Flight 74.

Second Officer Donald N. Singer

Mr. Singer, 48, was the flight engineer on FT 74. He was employed by Flying Tigers, Inc., on September 19, 1956. He has flight engineer certificate No. 1328391, with turbo-prop and turbo-jet ratings. His second-class medical certificate, dated January 4, 1979, had no limitations. His total flight time was 14,648 hrs, with 2,275 hrs in the B-747. He had flown 3 hrs 7 min during the past 24 hrs and he had a 12-hr rest period before Flight 74.

Mr. Robert Monell

Mr. Monell was working the west approach control operating position at the time of the accident. He is a full performance level journeyman controller. He worked the west approach control position from 0836 to 0452. He has been employed by the FAA for about 10 years. All of this employment time has been at the O'Hare facility. Mr. Monell has had 8 years prior experience as an air traffic controller with the United States Air Force.

Mr. Matthew Dunne

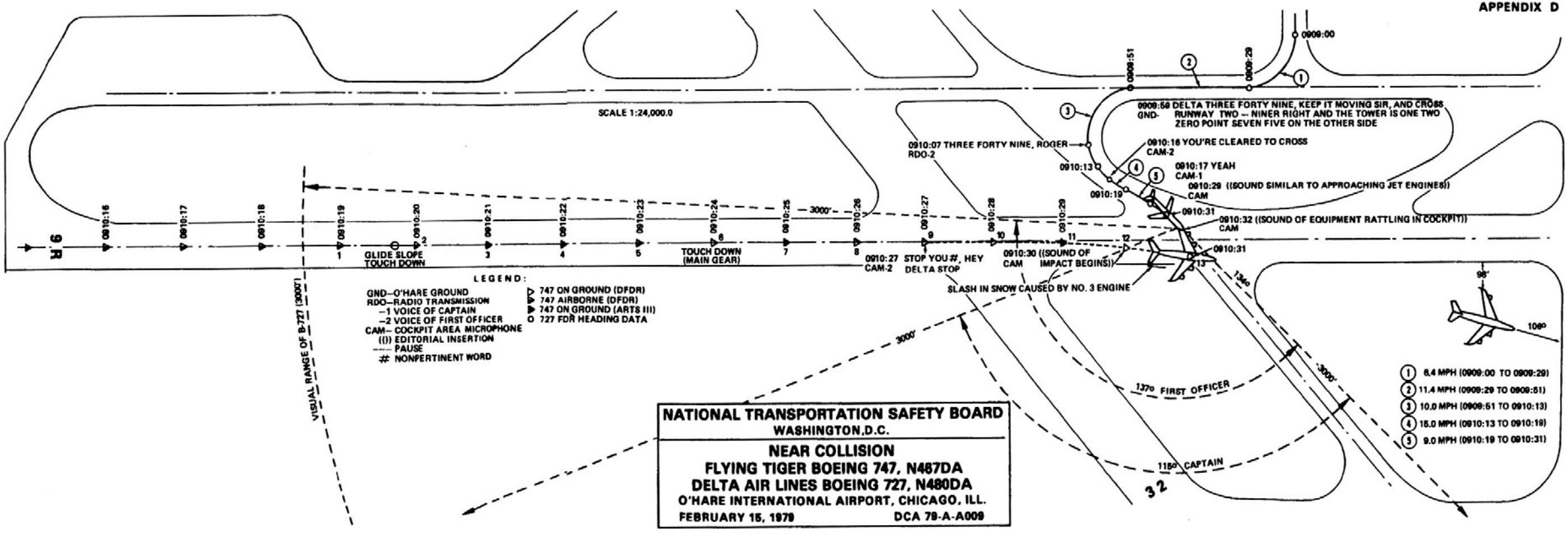
Mr. Dunne was working the O'Hare approach control 9R parallel monitor operating position at the time of the accident. He is a full performance level journeyman controller. Mr. Dunne worked the parallel monitor position from 0836 to 0952. He has been employed by the FAA for about 6 years. He has been employed at O'Hare since September 1977. Additionally, Mr. Dunne has had about 2 1/2 years experience as an air traffic controller with the United States Army.

APPENDIX C

Aircraft Information

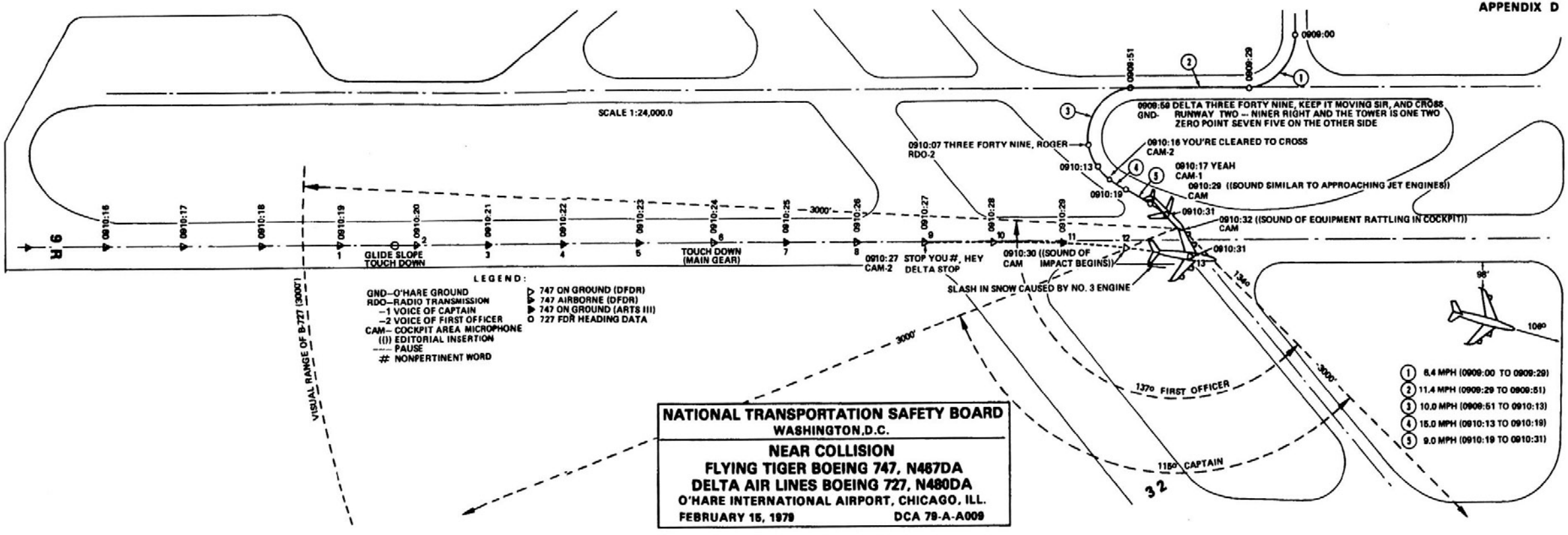
N467DA, a Boeing 727-200, was manufactured on September 14, 1973, and was assigned manufacturing serial number 20744. It was equipped with three Pratt & Whitney JT8D-15 engines. The aircraft had accumulated 16,825 hours. The time since the last major inspection was 8,516 hrs and the time since the last line maintenance inspection was 784 hrs.

N804FT, a Boeing 747-100F, was manufactured on September 30, 1971, and assigned manufacturing serial number 20246. It was equipped with three Pratt & Whitney JT9D-7AH engines and one JT9D-7A engine. The time since the last major inspection was 7,186 hrs and the time since the last line maintenance inspection was 551 hrs.



NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

NEAR COLLISION
FLYING TIGER BOEING 747, N487DA
DELTA AIR LINES BOEING 727, N480DA
O'HARE INTERNATIONAL AIRPORT, CHICAGO, ILL.
FEBRUARY 15, 1979 **DCA 79-A-A009**



NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

NEAR COLLISION
FLYING TIGER BOEING 747, N487DA
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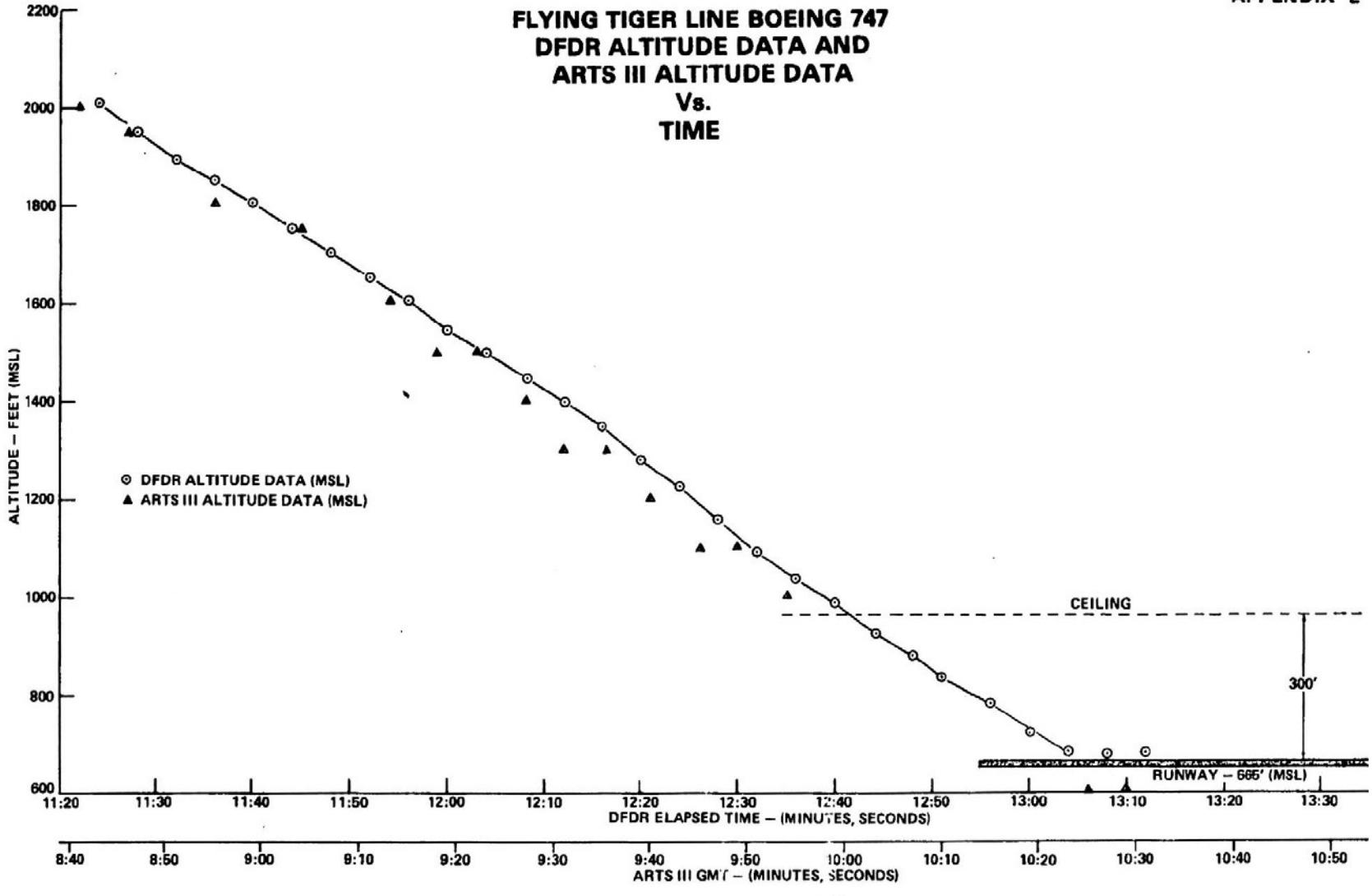
O'HARE INTERNATIONAL AIRPORT, CHICAGO, ILL.
FEBRUARY 15, 1979 **DCA 79-A-A009**

FLYING TIGER LINE BOEING 747
DFDR ALTITUDE DATA AND
ARTS III ALTITUDE DATA
Vs.
TIME



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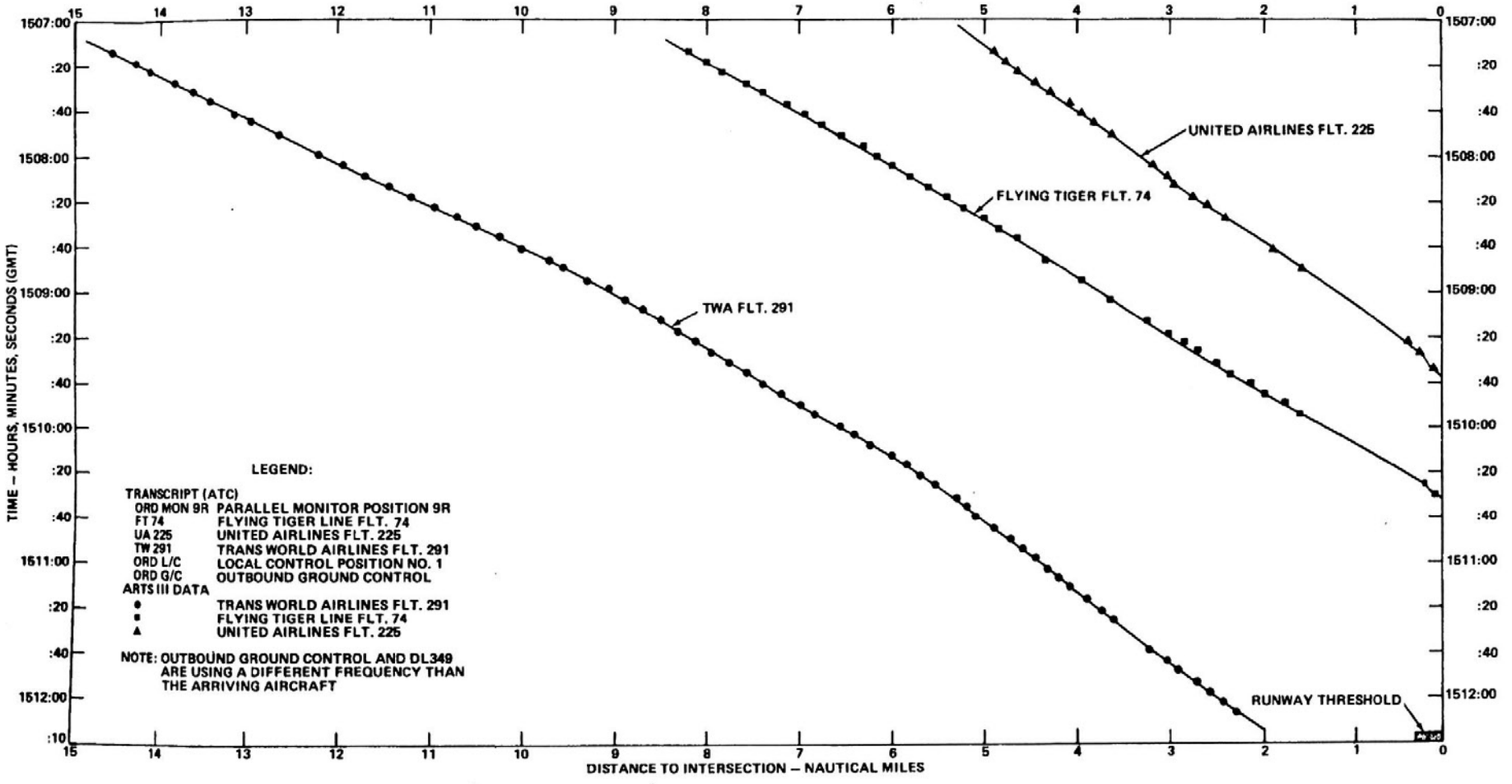
PLOT OF LANDING SEPARATION
DISTANCE Vs. TIME (GMT)

APPENDIX F

SELECTED EXCERPTS FROM ATC TRANSCRIPT

1507:05	ORD MON 9R	Tiger seventy four monitor slow to your final approach speed now
	FT 74	Roger
1507:10	UA 225	This United two twenty five heavy at Deana inbound
1507:15	ORD L/C	United two twenty five heavy runway nine right cleared to land report the lights in sight runway nine right visual range three thousand rollout six thousand
1507:25	UA 225	United two twenty five roger
1507:35	ORD MON 9R	Jerry
	ORD L/C	Yes
	ORD MON 9R	You send the Tiger around if you need to there he just wasn't talkin to him soon enough
1507:40	ORD L/C	Yes I heard ya
1508:26	FT 74	O'Hare Tower Tiger seven four sh Deana
	ORD L/C	Tiger seven four is number two continue the approach for nine right
1508:30	FT 74	Roger
1509:35	ORD L/C	United two twenty five heavy turn left at the first available ground point niner when you're clear let me know when you're start'n your return
1509:40	UA 225	Okay
1509:45	ORD L/C	Tiger seventy four report the lights
	FT 74	Roger
1509:50	UA 225	Two twenty five's starting to turn
1509:55	ORD L/C	Two twenty five thank you ground on point nine
1510:00	ORD L/C	Tiger seventy four is cleared to land nine right
1510:00	ORD G/C	Delta three forty nine keep it movin' sir and cross runway niner right and the tower is one two zero point seven five on the other side
1510:05	FT 74	Roger and we have the lights Tiger seven four
	ORD L/C	Roger
1510:05	DL 349	Three forty nine roger
1510:30	FT 74	(Unintelligible) Hey Delta stop
1510:55	TW 291	Tower TWA two ninety (unintelligible) Deana



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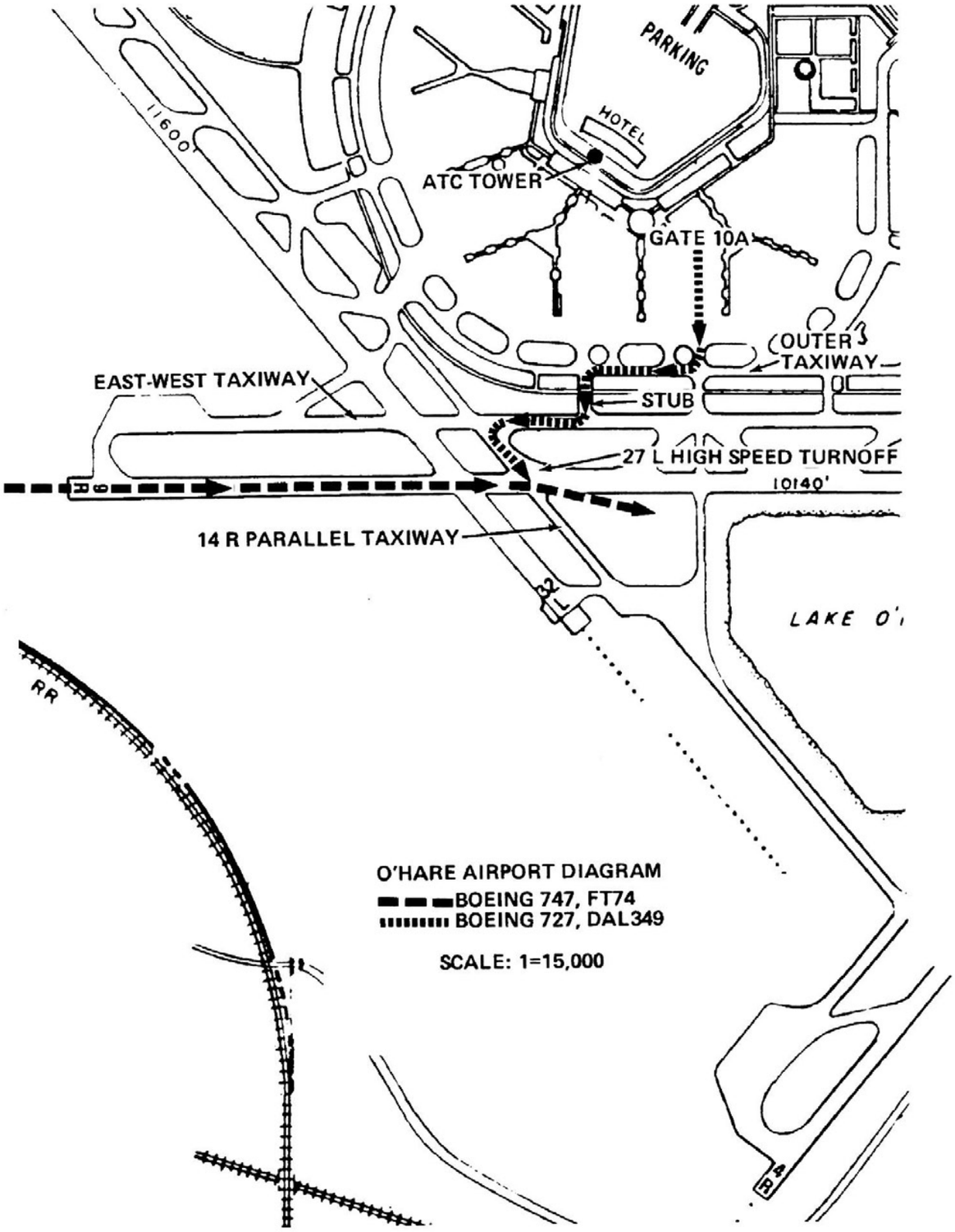
APPENDIX G


PARKING
HOTEL
11600
ATC TOWER
GATE 10A
OUTER TAXIWAY
EAST-WEST TAXIWAY
STUB
27 L HIGH SPEED TURNOFF
10140'
14 R PARALLEL TAXIWAY
LAKE O'
RR
O'HARE AIRPORT DIAGRAM
BOEING 747, FT74
BOEING 727, DAL349
SCALE: 1=15,000

APPENDIX H

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: June 8, 1979

Forwarded to:

Honorable Langhorne M. Bond

Although the Board is not able to identify specific changes in ATC procedures or equipment to resolve the problems evident in the Chicago and Memphis accidents, it believes that the seriousness and complexity of the problem warrant initiation of a directed safety study to examine all aspects of the runway incursion problem and to identify the corrective action needed.

In the interim, all pilots and terminal area controller personnel should be alerted to the problem and to their importance in helping to resolve it. The information disseminated should appeal to controllers and pilots to aid each other in the resolution of the incursion problem by individual effort to maintain visual surveillance during taxi operations that involve runway crossings. Visual confirmation that a safe crossing can be made is needed to verify a clearance. When visibility conditions are restricted to less than 1/2 mile, pilots should be encouraged to reaffirm a clearance to cross an active runway if they believe it necessary. Under such visibility conditions ground controllers should be encouraged to verify, with local control, taxi clearances to cross active runways, to the extent possible.

While the suggested interim course of action is not a solution to the problem, we believe it has potential safety benefits which are needed immediately.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Conduct a directed safety study, on a priority basis, to examine the runway incursion problem and to formulate recommended remedial action to reduce the likelihood of such hazardous conflicts. (Class II, Priority Action) (A-79-42).