Instrument Approach

3A-335

CIVIL AERONAUTICS BOARD

File No. 1-012

AIRCRAFT ACCIDENT REPORT

ADOPTED: March 20, 1959 **RELEASED:** March 26, 1959

NORTHEAST AIRLINES, INC., CONVAIR 240, N 90670,
NANTUCKET, MASSACHUSETTS, AUGUST 15, 1958

SYNOPSIS

About 2334,[1] August 15, 1958, Northeast Airlines Flight 258 crashed during an instrument approach to the Nantucket, Massachusetts, Memorial Airport. The crew of 3 and 22 of 31 passengers received fatal injuries. The 9 surviving passengers were seriously injured. The aircraft, which burned after impact, was destroyed.

The accident occurred during a straight-in VOR (very high frequency omni range) instrument approach to runway 24 (240 degrees). An analysis of all the available evidence indicates that the approach was continued after receipt of a below-minimum visibility report. At low altitude in the area of the "H" facility (a low-power nondirectional radio beacon), the flight encountered heavy fog in which the pilot lost orientation and ground reference. The aircraft contacted the ground almost simultaneously with the initiation of an attempt to discontinue the approach.

The accident investigation and public hearing by the Board, and an operational inspection of the company by the Civil Aeronautics Administration[2] (CAA), disclosed discrepancies which reflected adversely on some of the policies and procedures of the company and on the adequacy of the implementation of these policies and procedures These criticisms are stated in the body of this report.

Through communications with company officials and the Administrator, the Board has been informed that positive steps have been taken by the company to eliminate the deficiencies and that rapid and substantial progress has been made.

The operational factors which were identified as deficiencies during this investigation were generally known and accepted by the local CAA agents prior to the accident. Recognizing that the responsibilities of the CAA were not fully discharged, the Administrator took action to correct the local situation at Boston. He also established an inspection process whereby closer supervision can be maintained over the effectiveness of all local CAA offices throughout the country.

1/ All times herein are eastern daylight based on the 24-hour clock Distances are nautical miles and altitudes are above the ground.

2/ The term CAA (Civil Aeronautics Administration) rather than FAA (Federal Aviation Agency) is used herein because this accident occurred prior to December 31, 1958.

Investigation

Northeast Airlines Flight 258 is a scheduled operation which originates at La Guardia Airport, New York, and terminates at Martha's Vineyard, Massachusetts, with one intermediate stop serving Nantucket, Massachusetts. The flight is scheduled to originate at 2020 and arrive Nantucket and Martha's Vineyard at 2128 and 2210, respectively.

On August 15, 1958, the flight crew assigned to the operation consisted of Captain John T. Burnham, First Officer David C Carey, and Stewardess Arlene Dabek. Following routine preparations by the crew the flight departed La Guardia at 2225 with 31 passengers, including one infant Departure was about two hours late which was attributed to cumulative traffic and ramp delays encountered by earlier flights using the aircraft, Convair 240, N 90670

Weather information pertinent to the route indicated that at departure visual flight rules (VFR) weather conditions existed but that by the time the flight reached Nantucket fog might necessitate an instrument approach. Accordingly, the flight departed VFR but on a dispatch release and flight plan which authorized instrument operation, if necessary; on this contingency Boston was designated the alternate airport.

At takeoff the gross weight of the aircraft was computed to be 38,478 pounds, with the maximum allowable 40,800 pounds. The load was properly distributed according to the center of gravity limitations of the aircraft. Computations also showed that upon reaching Nantucket the existing wind conditions and weight of the aircraft, 37,002 pounds, permitted landing on the usable length, about 3,800 feet, of runway 24.

Flight 258 operated over Victor Airway 46 to Nantucket Investigation showed that while en route the flight was in radio communication with the company radio located in the Nantucket terminal building and with Otis RAPCON (Radar Approach Control). The latter is manned by CAA personnel as an Air Traffic Control facility which has as part of its responsibility the control of instrument traffic for Nantucket. It is located at Otis AFB, Falmouth, Massachusetts

The radio communications between Northeast flights and the company radio are not electronically recorded although the essence of each is entered in a radio log by the ground communicator The entry is made in the radio log when the communication is completed and at that time the actual time is noted and affixed to the entry Operating the company radio and maintaining the radio log are among the duties of Northeast agent personnel and during the evening of August 15 these duties were performed by the senior agent and one subordinate. On its face the log showed several errors and omissions and one time entry was changed, apparently to correct a mistake, although the original entry may not have been in error Because of these discrepancies Board investigators found it mandatory to corroborate the evidence presented by the log before accepting it

The radio transmissions between flights and Otis RAPCON are electronically recorded. Through "playback" and timing of the tapes it was possible to determine accurately the content of each radio transmission between Flight 258 and this facility as well as the time each communication occurred

N 90670 was equipped with one VHF communications transmitter and one VHF communications receiver; therefore, Flight 258 could not communicate with Otis RAPCON and Nantucket company at the same time. This fact, and learning that the Northeast and Otis clocks were in accord, made it possible to compare the times of the Otis communications with the time entries in the radio log.

Because weather information given the flight was very important, comparisons were made between the recorded observations by the Weather Bureau and those recorded as having been furnished the flight. Further, the times of the observations were compared with the times they were passed to the flight. During this work it was learned that the Weather Bureau clock was one minute faster than the Northeast and Otis timepieces. To avoid confusion this error has been eliminated in this report and the times indicated are corrected to the Northeast clock.

Comparisons were made for analytical purposes using the times from the Otis tape, the Northeast log, and the Weather Bureau log. In addition, the essence of the transmissions, the sequence of the transmissions, the testimony regarding the events, and the time involved in the VOR approach were all painstakingly compared to establish or refute the accuracy of the times entered in the radio log. The preponderance of this evidence sustains the accuracy of the time entries especially the portion of the log kept by the senior agent beginning at 2328

It was the testimony of a Northeast agent that the initial contact between Flight 258 and Northeast radio occurred about 2314 when the flight asked for the Nantucket weather. He stated he transmitted the 2259 hourly sequence report which was: scattered clouds 500 feet, ceiling 12,000 feet, broken; visibility 4 miles; fog. The agent stated that at this time the senior agent took the microphone from him and in essence advised the flight that this weather report was obsolete and, according to a special report of 2311, the weather was "partial obscuration, three-fourths mile, fog." The agent stated that during this communication the flight also requested the strobe lights[3/] be turned on. Transmission of the special weather report was logged at 2311 and, although the information was acknowledged, according to the agent, this was not reflected by the radio log. The agent stated he requested the strobe lights be turned on by the CAA communicator who controlled the lights.

At 2314 the flight contacted Otis RAPCON and according to the recorded conversation advised Otis it was "visual" and past the Newport intersection (located 50 miles southwest of Nantucket on Victor Airway 46) at 2312. The flight requested an instrument approach clearance to Nantucket estimating it would reach Nantucket at 2326. The clearance was issued at 2315.

About 2324 Flight 258 advised Otis it was going to company frequency for "the altimeter, etc." The company radio log reflected that information as to the active runway, surface wind, and altimeter setting was given the flight and logged at 2314 Investigation showed this time was entered following an erasure and that the time originally affixed was 2326. Because at approximately 2324 the flight stated it would request the information from the company it would seem the time entry of 2314 should have been 2326 as originally fixed Further, because the CAA communicator who turned on the strobe lights testified it was done during the five-minute period preceding 2330, it is entirely probable that the request for lights occurred when

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3/ Two condenser discharge flashing approach lights located in the approach zone 250 feet from the threshold lights, one on each side of the runway edge extended

the flight requested other landing information rather than during the previous communication. Certainly an inbound flight would request the lights and landing information more logically two or three minutes rather than 14 minutes before an instrument approach

From investigation and testimony obtained at the public hearing it was indicated that the senior Northeast agent did not know the current operating status of the strobe lights or, in particular, that one which had been inoperative was repaired earlier that day Also, there was no defined procedure for informing ground personnel of the current airport field conditions. In fact, it was not clear to the working ground personnel how or by whom the day-to-day field inspection was made. Also, it was not clear how the working groups would learn of pertinent field conditions, and the procedure for passing such information between shifts was ill-defined. The transmissions over the company radio were amplified; however, during periods of IFR conditions and when one flight was at the terminal a heavy workload would occur which could result in the radio being left unguarded. Similarly, weather information passed over the intercom could be missed and unknown to Northeast personnel until the Weather Bureau observer, according to procedure, brought it in typed form to the Northeast office.

It was the testimony of the senior Northeast agent that he gave Flight 258 a special weather report of "partial obscuration, one-half mile visibility, fog " This observation, according to the Weather Bureau observer and Weather Bureau log, was completed and logged at 2327 and immediately given Northeast over an intercom system. The senior agent stated he transmitted it to another Northeast flight, 2289, which was awaiting takeoff, and to Flight 258. The time affixed to the radio log entry was 2328. The log showed an acknowledgment from Flight 2289 but not from Flight 258. The senior agent stated acknowledgment should have been recorded because he was very positive the information was received and associated it with a personal conversation between First Officer David Carey of Flight 258 and himself This conversation was overheard by several persons near the radio room, the transmissions being normally amplified by the radio equipment. The senior agent testified that after giving the one-half mile visibility he said, "Did you get that half-mile, Dave?" First Officer Carey replied, "Roger, you know how I love Nantucket." The senior agent responded, "Don't plow up the field " The senior agent said this conversation was uncalled for and to him had no significance He said that he recognized First Officer Carey's voice and added that Carey had worked on the Island for Northeast and they were personal friends

Northeast Flight 2289 left the Nantucket terminal about 2321 and taxied to runup position beside runway 24. The captain recalled asking the company for the latest Martha's Vineyard weather. To this Flight 258 volunteered that Martha's Vineyard would be no problem and then asked, "How's it down there?" The holding flight replied, "Not too good." The captain testified that he recalled Flight 258 being given "partial obscuration, three-fourths mile" and that it was acknowledged He stated that thereafter he recalled visibility reports from the company radio of one-half mile, one-fourth mile, and one-eighth mile. These, he said, were given in rapid sequence and he recalled no response from Flight 258 for any of them. The captain stated the reports occurred after his flight reached runup position, about 2324, and thought the accident and one-eighth mile report occurred close together but could not recall which occurred first. He did not know the time of the accident nor was he able to state with accuracy the times of the other events which occurred or the sequence in which they happened.

According to the Otis RAPCON transcription, at 2327 Flight 258 did not respond to a call from Otis but before 2328 returned to the Otis frequency. At 2328, in response to an inquiry, Flight 258 stated it had not started procedure turn but was " . . . just past the marker outbound." Thereafter, at 2330, the flight transmitted "and Otis this is Northeast 258, procedure turn." Otis responded, "Roger, Northeast 258 change to company." There were no other communications between the flight and Otis.

At 2330 special observation number 21 was logged by the Weather Bureau observer as "partial obscuration, one-eighth mile visibility, fog." This was given Northeast immediately, according to the observer, and it was the testimony of the senior Northeast agent that he promptly transmitted it to Flight 258. He stated he gave the information twice with a substantial pause between each transmission and while there was no verbal response from Flight 258 he recalled a sound over the radio which he thought was a "mike click." He said the sound followed each of the two transmissions of one-eighth mile visibility. The captain of 2289 did not hear this sound nor did he click his microphone. The senior agent estimated that the action occurred during a 60-90 second interval before he logged it at 2333. He also stated that at no time was a one-fourth mile visibility report given over the radio. Examination of the Weather Bureau observation log reflected no one-fourth mile observation and the Weather observer stated he made no such observation

The senior agent testified that the next occurrence was a report of a fire in the approach area to runway 24 This was transmitted by Flight 2289. The agent testified he stepped outside, looked toward the area, and because of the fog saw nothing. He then returned and logged the report at 2336 which he estimated was about one minute after the report was transmitted to him

The Nantucket Memorial Airport is located on the south central side of the Island. It has no tower and is equipped with two crossing runways. Each is 4,000 feet in length and 150 feet wide although at the time of the accident runway 6-24 was being extended to 5,000 feet. This work at the southwest end restricted the usable length to approximately 3,800 feet. The airport has a regular clear-green, medium-intensity, 3,000,000-candlepower rotating beacon.

Runway 24 is the instrument approach runway. There is no ILS (Instrument Landing System) or ladder-type approach light system. The instrument runway, as well as the others, is equipped with conventional threshold lights and medium-intensity elevated runway lights of low-, medium-, and high-intensity settings.

The strobe lights previously noted were designed as a visual lighting aid to the instrument approach They were installed by Northeast Airlines after considerable testing for this purpose. The condenser discharge lights were located 250 feet from the threshold lights, 150 feet apart, in the approach area They flash two times each second emitting a beamed white light rated at 10,000,000 candlepower. A technical witness stated the beam was projected into the approach zone at an angle of 3.4 degrees above horizontal so that the lower side of the projected beam would be 300 feet above the ground over the "H" facility located six-tenths of a mile from the runway threshold. This position and altitude would be coincident with the approximate position of an aircraft at minimum altitude during the instrument approach. The witness stated that below the projected beam the light diminished rapidly and estimated it would be diminished 75 percent approximately 50 feet below the lower edge of the beam.

The record indicates that the strobe lights were on several minutes before the accident, and clearly shows that airport beacon, threshold lights, and runway lights were on. the latter set to high brilliance

The reported weather conditions required that Flight 258 execute a straight-in VOR instrument approach. For the procedure the ground radio facilities consisted of the VOR station located 1 9 miles from the runway threshold and a Northeast-owned and maintained "H" facility (a low-power nondirectional radio beacon) positioned six-tenths of a mile from the threshold of runway 24, between the VOR station and runway on an inbound track of 240 degrees. The manuevering area for the approach is over relatively flat unobstructed terrain with the elevation of the runway 47 feet mean sea level.

The CAA-approved VOR instrument approach procedure required establishment of a 60-degree outbound track after station passage. This is followed by a standard procedure turn on the north side of the track within 10 miles of the VOR station. Minimum altitude in the procedure turn is 1,300 feet. An inbound track of 240 degrees is then required to again cross the VOR station and "H" facility to the runway. Minimum altitude over the VOR is 600 feet after which descent is permissible to the appropriate landing minimum altitude. Flown in a normal manner the approach procedure from the VOR station outbound to the VOR station inbound requires about five minutes. In the Convair about 55 seconds are required from the VOR to the runway threshold.

The basic weather minima for the VOR straight-in instrument approach at Nantucket are ceiling 400 feet, visibility one mile. According to the ACA Form 511, with both the VOR and "H" facility in operation, the minima for Northeast Convair flights are ceiling 300 feet and visibility one mile. CAA witnesses testified that these minima were the result of a deviation authorized by the CAA after the carrier requested it. It was stated that such deviation is provided for in Civil Air Regulations and, because it required no significant deviation from the approach obstruction criteria, it was permissible for the local CAA office to grant the request. After consideration of many factors involved, this was done It was explained that the carrier was authorized the "Sliding Scale" which is a provision of the Operations Specifications applicable to the straight-in approach. Operations Specifications are rules of particular applicability prepared and issued by the Civil Aeronautics Administration under the enabling provisions of Part 40 of the Civil Air Regulations. Under "Airport Authorization and Limitations" it is stated "For each increase of 100 feet above the minimum ceiling specified, a decrease of 1/4 mile in visibility is authorized, until a visibility of 1/2 mile is reached." Because at the time of the accident a partial obscuration, which does not constitute a ceiling, was reported, the "Sliding Scale" was therefore applicable to Flight 258 and it was authorized to make the approach in 1/2-mile visibility. The authorized minimum altitude of 300 feet was unaffected by the "Sliding Scale" provision.

It is important to note the responsibilities required of the pilot involved when below-minimum weather conditions are reported to a flight during an instrument approach. Civil Air Regulations Part 40, Section 40.406(d) is applicable and states, "If an instrument approach procedure is initiated when the current report prepared by the U. S. Weather Bureau or by a source approved by the Weather Bureau indicates that the prescribed ceiling and visibility minimums exist and a later weather report indicating below minimum conditions is received after the airplane (1) . . . (2) is on a final approach using a radio range station or comparable facility and has

passed the appropriate facility and has reached the authorized landing minimum altitude (3) . . such approach may be continued and a landing may be made in the event weather conditions equal to or better than the prescribed minimums for the airport are found to exist by the pilot in command upon reaching the authorized landing minimum altitude." Except under the aforestated conditions, the approach should be discontinued Obviously, to meet the terms of this regulation the below-minimum weather report must be received by the pilot

The conditions necessary for a descent below minimum altitude during an instrument approach for landing are stated in Air Carrier Operations Specifications. Item 32 of these rules under "Limitations on Descent Below Authorized IFR Landing Minimums" states, "No aircraft shall descend below the minimum altitude for landing specified in the applicable Form ACA-511 unless clear of clouds. Thereafter, except when landing minimums of 1000-2 or better are authorized, no aircraft shall descend more than 50 feet below such altitude, unless (1) it has arrived at a position from which normal approach can be made to the runway of intended landing, and (2) either the approach threshold of such runway or the approach lights or other markings identifiable with such runway are clearly visible to the pilot If, at any time, after descent below the clouds the pilot cannot maintain visual reference to the ground or lights, he will immediately execute the appropriate missed approach procedure prescribed in the applicable Form ACA-511 " (Emphasis added)

The testimony of Northeast supervisory operational personnel indicated that "other markings identifiable with such runway" need not be located at the runway threshold and need not be markings which are part of the runway threshold complex Company witnesses stated it was their interpretation that the markings should be of a permanent immobile nature and named as examples "a city dump, a swath through trees, and a distinguishing feature of a shore line "

It was the testimony of CAA Air Carrier Safety Agents associated with Northeast that only markings located at the threshold area of the runway which were a part of the threshold complex could be considered "other markings identifiable with such runway." These witnesses indicated the Northeast interpretation was unsatisfactory to them and until the hearing were unaware of the Northeast interpretation From all the testimony surrounding the subject it was obvious that the wording of the specification did not state a clear meaning.

Investigation disclosed there were several 55-gallon drums spaced along the extended centerline of runway 24 The drums were spaced along this line for a distance of 1,700 feet beginning at the "H" facility and extending toward the runway. The tops of the drums were painted white The testimony of Northeast officials indicated the drums were put there at the instance of the company in 1953 and originally extended from the "H" facility to the runway threshold, but those which originally were located over the last 1,800 feet were removed to satisfy a problem they created relating to use of the land Company witnesses stated the barrels were intended to identify a ground position over terrain which had no other distinguishing features or contrast.

It was the testimony of the assistant chief pilot that the barrels were not intended to lead the pilot to the runway threshold and that it was doubtful if the barrels could be seen at night, especially in poor visibility. Company supervisors also stated the barrels did not qualify as "other markings identifiable with such runway" because they could be moved and thereby lacked the permanency required. It

was stated that no operational aspect of the instrument approach procedure was predicated on the barrels. The assistant chief pilot did not recall any company material issued to its pilots explaining the purpose of the barrels or that the installation had been made. He stated, in response to questions, that it was conceivable a pilot might use the barrels as a guide to the runway in poor visibility or might consider them as "other markings . . ."

Several persons located at the Nantucket Airport terminal saw Flight 258 when it initially arrived over the vicinity of the airport. Most stated this occurred a few minutes before the crash and that the aircraft was viewed through breaks in heavy fog flying on an easterly or northeasterly heading.

Another witness, a highly qualified pilot and thoroughly familiar with the VOR instrument approach procedure, also saw the flight. He was located about 1-1/2 miles west of the airport. He stated that he recognized the aircraft as a Convair and when he first saw it, it was on an easterly heading. While he watched, the flight turned left to a northeasterly heading and proceeded toward the VOR station. He said the flight at this time appeared to be intercepting the 60-degree inbound radial. Being familiar with the location of the VOR station he estimated that the flight overheaded the facility He discontinued watching as the aircraft proceeded northeasterly toward the procedure turn area. He testified that it was evident that the instrument approach procedure was in progress and surmised that instrument weather must have existed at the airport although at his location the weather was clear. The witness stated that the aircraft was clearly visible and it looked and sounded normal.

Several persons located northeast and northwest of the VOR station saw the aircraft. Most observed it casually and stated it was then flying southwest toward the airport. One, located about 1-1/2 miles northeast of the VOR, stated the aircraft seemed low and estimated it to be about 200-250 feet above the terrain. Nearly all said it looked and sounded normal, and again the weather conditions in this area were described as generally clear.

There was no reliable description of the flight path of the aircraft from the area of the VOR to the crash.

Witnesses at the terminal, about one mile from the crash site, said that fog became evident at the airport about 2300 and thereafter until the crash it became very dense. The fog was described as sea fog which moved in from the ocean in layers and waves. It moved northeasterly from the ocean across the airport into the approach area of runway 24 Some noted the lights of Flight 2289 which was waiting takeoff about one-half mile from the terminal. They stated these lights were visible a few minutes before the crash but at the time of the accident they were blotted out in fog

One witness at the terminal said that he observed the right or rear side of a heavy fog bank moving with the other fog across the airport. This, he said, blotted out the lights of the DC-3 (Flight 2289) and was moving toward the approach area. While watching for Flight 258 to land he saw a light appear, the beam of which, he said, was triangular, narrow at the top and broad at the bottom. This he thought was the landing lights of Flight 258. The light appeared only momentarily but it was sufficient to illuminate the fog bank and to outline the right or rear side and the top; the latter was estimated to be about 200-250 feet above the ground. He said the light emanated from behind or from within the fog bank. Several others saw a light; however, they described it as an explosive-like flash at ground level.

The description of the weather conditions by the weather observer on duty did not differ substantially from the description given by ground witnesses. He noted that stars were visible through breaks in the fog and estimated the fog was about seven-tenths coverage at 2311, increasing to nine-tenths coverage at 2330. He stated that when he took the one-eighth mile observation he thought the fog seemed fairly uniform and at that time he did not note a fog bank as such but being outside only for a short period he could have been in it at the time The observer said that in his experience it was not unusual to have a heavy fog at the airport with the surrounding areas generally clear. The observer testified that in measuring the one-eighth mile visibility there were references which showed the visibility to be equal to this value and not less He said, however, that measuring visibility at Nantucket was hampered by the lack of reference in all quadrants and at varying distances

The weather observer testified that, according to Weather Bureau procedures, after physically obtaining the observation data he returned to the office where it was recorded in the Weather Bureau log. He stated that the time affixed in the log was observed at or near the completion of the recording and immediately the information was passed to Northeast over the intercom. He said their normal procedure was then to type the observation and give it to CAA for teletype transmission. The witness said this procedure was followed on the night of the accident and estimated that no more than 15 seconds transpired from the log entry time of his observation until it was passed to Northeast.

According to the existing Weather Bureau procedure at the time of the accident, special weather reports were teletyped to Otis RAPCON on the scan periods (20 and 40 minutes past the hour). Special weather observations between these periods were not available to this control facility although Northeast flights were in communication with Otis during important phases of the instrument approach and, as noted, when communication with the company was precluded. Witnesses at the public hearing agreed that all important weather reports should be available immediately to Otis so they could be furnished to a flight when on the Otis radio frequency.

A similar situation existed with respect to the transmission of weather information to the Boston Northeast dispatch office. This, it was stated, resulted in a lack of timely weather information and hampered in some degree the execution of dispatching responsibility.

Investigation at the accident scene disclosed that N 90670 initially contacted the ground approximately 1,450 feet short of runway 24 and about 650 feet to the left (inbound) of the extended runway centerline. The initial contact was shown by light tire tracks made by the tires of all three landing gear components. The lightness of the tracks in soft ground showed the aircraft had little, if any, rate of sink or descent at initial contact. Because all the tracks began nearly simultaneously it was also evident that the aircraft was nearly level laterally and longitudinally. Tire tracks by all landing gear components continued for about 145 feet along a magnetic heading of 233 degrees and over bumpy but flat terrain which averaged about 50 feet mean sea level

There was a series of 14 left propeller cuts in the ground across the left tire tracks, beginning after about 50 feet of rollout and spaced over a distance of 100 feet. The first three cuts, about three to four inches deep, were well defined and the distance between the first and second cuts was 4.1 feet. The later slashes

were of lesser depth and about equal in width to the blade chord showing that the blades were being treated and bent rearward as the cuts progressed. Obviously, such deformation destroyed the propeller function.

The wheel tracks ended after about 145 feet when the wheels contacted a sharp but not high rise in the ground and the aircraft catapulted into the air. It crossed a dirt road and passed through a clump of scrub pine trees. A branch of one of these trees was marked by a blade of the right propeller. Examination of the cut showed it was made at the bottom of the propeller arc and by the tip of a blade. This information and the height of the mark showed the aircraft was rolling rapidly left at this point.

Approximately 400 feet from the initial ground contact the left wing struck the ground and progressively disintegrated as it dragged for the next 300 feet. The aircraft entered a scrub pine thicket cutting a swath the narrowness of which showed the aircraft was then nearly vertical in its roll axis.

The aircraft veered left to a magnetic heading of 190 degrees and reached an attitude slightly past inverted. Nose down in this attitude the aircraft plunged to the ground making simultaneous contact with the right wing and powerplant and the nose section of the airplane. The center section and fuselage then cartwheeled forward to an upright attitude and, on a magnetic heading of 205 degrees, slid 125 feet to a stop, some 1,100 feet from the initial contact. The fuselage stopped, facing across the wreckage path, and the center section, broken from the fuselage during the cartwheel and slide, faced about 90 degrees to the left of the fuselage.

Fuel from the shattered wings was hurled into the main wreckage area and ignited. The resulting fire consumed a major portion of the wreckage.

All major components of the aircraft, including flight control surfaces, were accounted for in the wreckage or along the ground path. All attach fittings were secure or there was ample evidence indicating they were secure before the ground impact. It was determined all doors and access panels were closed and secure at impact. There was no evidence of fatigue failure and from the examinable structure there was no suggestion of inflight failure.

The control system could be traced only from fuselage station 200 rearward because of complete impact and fire destruction to the forward fuselage and cockpit areas. Within the examinable area there was no evidence of control malfunction or failure.

Examination of the landing gear components disclosed the right main gear was retracted and locked. It also revealed the left main and nose gears were in the retraction cycle when early impact forces severely damaged the retraction mechanisms and tore off the nose gear. Later in the sequence the left gear was also torn off Examination of the flap gear box showed the wing flaps were extended about 15 degrees when the aircraft came to rest.

Both powerplants were in the main wreckage area. The No. 1 (left) powerplant was torn out and came to rest adjacent to and facing the center section of the aircraft. The No. 2 (right) engine, also torn out, was located back along the wreckage path about 40 feet from the main fuselage. The nose section and propeller were broken off and located about 75 feet from the engine. Both engines received ground

fire damage; however, there was no evidence of fire in flight. A detailed examination revealed no indication of engine malfunction or failure or other conditions which would adversely affect their normal operation prior to impact.

Both propellers were tight on their shafts and although all blades were bent or broken the blades or stub ends remained in their hubs. Examination of the spider shim plates revealed impact markings. These, when measured to determine the propeller blade angles, disclosed an angle of 37 degrees for the left propeller blades and an angle of 43 degrees for the right.

The propeller governors were bench checked to ascertain the r. p. m. settings. Results showed settings of 2,330 and 2,362 for the left and right governor, respectively, and closely approximating 2,300 r. p. m. normally used during the approach. Using an r. p. m. of 2,330 and the distance of 4.1 feet between the first and second propeller slash in the ground, the resulting computation of groundspeed for the aircraft when the cuts were made was 126 knots. This, allowing for the effect of the reported surface wing, indicated an airspeed of 131 knots. Further computations using the groundspeed, propeller blade angles, and r. p. m. permitted an estimate of power being developed at the instant the shim plates were marked, for the left engine when its propeller slashed the ground and for the right engine at final impact, or approximately five seconds later. The resultant estimates were 1,342 b h.p. (brake horsepower) and 2,450 b. h. p. for the left and right engines, respectively. The values also approximate approach power for the left engine and maximum power for the right.

Nearly all of the radio communications and navigational equipment sustained severe and extensive impact damage. In some instances only fragmentary portions of this equipment were recovered

The VHF (very high frequency) communications transmitter and receiver and the HF (high frequency) transceiver were destroyed. Both VHF navigation receivers were crushed and inoperative; however, the tuning dial for the first officer's was found indicating 117.0 mcs., the Nantucket VOR frequency. The captain's tuning dial showed 115.4 mcs., an unrelated setting. Both omni bearing indicators showed approximately 60 degrees.

Both omni mag indicators were badly damaged, inoperative, and could not be tested. Reassembly of the course selector gears of the captain's instrument revealed a course selection of 240 degrees. The "To-From" indicator indicated "From." The comparable instrument from the first officer's position showed a course selection indication of 24-, the last digit obliterated. It may be recalled that the inbound track of the instrument approach is 240 degrees.

After replacing broken tubes the first officer's ADF (automatic direction finder) was operable but with low sensitivity. The captain's was damaged beyond testing. The tuning condensers showed 244 kcs. and 236 kcs. for the left and right positions, respectively; however, both showed evidence of having been pulled and shifted by impact. The "H" facility frequency to which at least one of these units would normally be tuned is 224 kcs.

Of the gyrosyn instruments, the two gyrosyn compasses and one of the two gyrosyn amplifiers were recovered. One of the compasses, though badly mutilated by impact and fire, showed an indication of 190 degrees which closely approximated the

final ground impact heading. The other compass provided no useful information. The amplifier when checked functioned normally.

The top plate assembly from each of the two flight altimeters was recovered although its installed position (right or left) could not be determined. Both assemblies were badly crushed and burned and partially melted away. Using the fragmentary evidence available it was concluded that one altimeter was set at 29.92 and the other at 29.65 when both were subjected to intense fire. There was evidence indicating that an object was thrown against the setting knob of the latter assembl causing it to turn and change the setting before being exposed to the fire. The latest altimeter setting furnished the flight was 29.91.

During the public hearing the company vice president of operations and the assistant chief pilot described the company's operational policies and procedures relating to initial pilot selection, pilot training and upgrading, and continued pilot proficiency. In general, the testimony described policies and procedures which intended a program within their areas comparable to those of other air carriers. In some areas, however, the adequacy of implementation of the program and consequently its effectiveness was questionable.

Concurrently with the accident investigation the CAA undertook an operational inspection of the carrier. It was undertaken under the CAA responsibility for the supervision of air carrier operations and was prompted by three fatal accidents experienced by the carrier since 1956. The inspecting team was composed of several air carrier safety inspectors other than those assigned to the Boston office. It functioned under the Regional Administrator.

The accident investigation by Board investigators and the conclusions reached by the CAA team were similar in several areas, some of which have already been presented. Of other areas, one of the most important was operational training which was considered inadequate, the result of several factors.

Testimony of Northeast witnesses indicated that the use of Northeast aircraft in the scheduled operations took priority over their use in training. Board investigators determined that at times this resulted in interruptions of the training function and reduced the overall effectiveness of the program The CAA team concluded that inefficient scheduling of aircraft over the system reduced the availability of aircraft for training. Lack of training personnel also contributed to the problem.

The CAA team indicated that undesirable factors in the pilot check program contributed to the evaluation. It concluded that there was a need for greater standardization of flight check procedures among the check pilots and more explicit instructions to them regarding their duties and responsibilities. The team concluded that supervisory personnel needed delegated authority commensurate with their positions. Allied to the check program was a requirement for greater stress on the importance and use of recurrent training.

During the CAA inspection, Northeast captains received flight proficiency checks. The results substantiated the conclusions of the team when a number of these pilots were graded unsatisfactory on their first check

It was the testimony of the local CAA air carrier safety inspectors having responsibility for the supervision of the operational phases of the carrier that,

in general, they were satisfactory. Obviously this judgment was not in accord with the CAA inspecting team

During the accident investigation Board investigators found it difficult to determine, from the available company records, some of the current qualifications of line pilots. It was learned that some of the information on which the company relied was submitted by each pilot rather than being obtained from the record system

Analysis

Available evidence indicates that except for a late departure Flight 258 operated in a normal manner to Nantucket. Position reports, requiring the use of navigational equipment, and other communications from the flight gave no indication of operational or equipment difficulty Although portions of the aircraft wreckage were destroyed or badly mutilated no evidence was found to indicate the aircraft or its equipment contributed to or caused the accident.

It is believed that at or about 2311 the flight was given the Nantucket 2311 special weather observation of "partial obscuration, visibility 3/4 mile." This is supported by the Northeast agent who stated it was given and by an appropriate entry in the Northeast radio log Receipt of the information is supported by action of the flight when, shortly thereafter, at 2314, it contacted Otis, asked for, and received an instrument approach clearance. Because the flight had operated VFR before this and reported it was "visual" when the clearance was requested it would be logical to assume the crew knew IFR conditions existed at Nantucket and therefore requested the IFR clearance.

As indicated earlier, the Board is of the opinion that the landing information given the flight and logged as being given at 2314 was in fact given just before 2326, the original entry. This opinion is supported by several factors. First, Flight 258 informed Otis at 2324 it was going to company frequency to obtain this information Second, logic dictates that such information would normally be requested by an inbound IFR flight two to three minutes before an instrument approach rather than 14 minutes. This is especially true in deteriorating and near-minimum weather conditions which existed Furthermore, for these reasons the Board believes the surface observation would be requested again or would be given as a matter of practice by the radio operator with the landing instructions. Therefore, in all probability the "partial obscuration, visibility 3/4 mile" report was repeated at 2326. This would account for the crew of Flight 2289 having heard this report given to Flight 258 about that time.

There is no question that the special observation of "partial obscuration, 1/2 mile visibility" was transmitted by the Northeast senior agent. Because the crew of Flight 2289 did not hear an acknowledgment and the radio log did not reflect one, there was a question of whether or not Flight 258 was on the company frequency when the weather information was transmitted. This information was available to the senior agent immediately after 2327 and according to his testimony it was immediately given to the flight. This was completed and the action was logged at 2328 The Otis tape shows that Flight 258 did not return to that frequency until 2327:40, therefore, the Board is of the opinion the flight was on company frequency when the weather report was issued. This analysis permits the Board to accept the recollection of the senior agent which should have been most vivid, recalling the personal conversation that transpired between himself and First Officer Carey when the one-half mile visibility report was issued

A question of even greater concern is whether or not Flight 258 received the special weather report of "partial obscuration, visibility 1/8 mile" and, if so, when the report was received. This concern is generated because the reported visibility was below the authorized landing minimum for the flight; if, as has been explained, the report was received before the flight reached the radio facility on final approach, the captain was required to discontinue the instrument approach After arduous study and careful evaluation of all the evidence, it is the opinion of the Board that the report was received and at a time when the approach should have been discontinued. This opinion is based on a determination of the time of the accident and again upon the accuracy of the Northeast radio log. Each of these supports the other and the Otis tape supports both.

At 2328, according to the Otis tape, the flight reported, "We're just past the marker outbound," and at 2330 it reported, "Procedure turn." These reports and ample evidence that the entire approach procedure was flown would place the accident very close to 2334. This time correlates reasonably to the report about 2335 from Flight 2289 that there was a fire at the end of the runway, which the senior agent recorded at 2336 after using approximately one minute to look for the reported fire. The time of the accident also substantiates the accuracy of the radio log. Its accuracy is further established by the fact that at 2330, according to the Otis tape, Flight 2289 was advised to obtain its clearance through the company and according to the radio log this action was completed and logged at 2331 For this action the various times involved correlate in a precise manner.

From the above evidence the Board accepts as accurate the log entry and the testimony of the company agents regarding the issuance of the below-minimum weather report. Testimony of the senior agent indicates the information was transmitted two times during a 60-90-second interval preceding 2333 when the action was completed and logged. Correlated to the timing of the approach procedure Flight 258 would not have passed the VOR inbound and, more specifically, should have been in its procedure turn when the information was first transmitted. Because Flight 258 was released from Otis to company frequency at 2330 and because each transmission of the 1/8 mile visibility was followed by a sound identified as a mike click the Board believes the information was received.

The nature of the local weather conditions may have been a factor in Captain Burnham's decision to continue the approach. From the available evidence it is apparent that a heavy rolling sea fog extending to at least 300 feet existed over the airport and into the approach area It is believed that the fog was very heavy to the "H" facility, rapidly decreasing in density northeastward, until in the area of the VOR the conditions were generally clear. It is possible that as Flight 258 passed over the vicinity of the airport, lights on the airport were clearly visible vertically through the fog. This, together with generally clear conditions in the VOR area, could have led the captain to believe weather conditions were much better at the approach end of runway 24 than at the terminal where the conditions were being measured.

The approach was most likely continued inbound with reference to the ground and by the time the flight reached the "H" facility it was at a low altitude. The low altitude is shown clearly by the light touchdown of the aircraft and the short distance from the "H" facility to the touchdown. Considering the distance, the computed groundspeed, and that practically all descent had been arrested at touchdown, only an excessive rate of descent would permit the flight to have passed the "H" facility much above 100 feet. At this altitude and position the Board is con-

vinced that intervening fog between the flight and runway threshold precluded visual reference to the threshold complex. This is clearly substantiated in that the ground tracks of the aircraft were proceeding away from rather than toward runway alignment It is considered that the relatively short runway may have influenced the descent to low altitude and it is possible that a desire to pick up and follow the line of barrels was a contributing reason.

At low altitude in the area of the "H" facility it is believed that the flight entered the heavy fog bank, described by an eyewitness. It is believed that at this time all ground reference was lost and before transition to instruments could be made and the approach discontinued the remaining altitude was lost and the aircraft contacted the ground.

Conclusions

In this report the Board has entered criticism of some of the Northeast operational policies and procedures and of the implementation of the operational program. The criticisms are the product of a combined effort--the Board's accident investigation process and a CAA inspection, both of which had the cooperation and assistance of Northeast personnel. The work was accomplished with a common purpose of producing greater aviation safety through improvements wherever possible.

Following the accident the company believed it advisable to discontinue the use of the "Sliding Scale" at Nantucket for a period of re-evaluation. In the absence of an ILS and ladder-type approach lights and in consideration of the authorized deviation, this action appears wise.

With reference to the ILS and approach lights the Board, through meetings with the CAA and the Weather Bureau, has learned that the installation of a tower, ILS, approach lights, and "end of the runway" electronic weather reporting equipment at Nantucket is being actively considered. Such installation would be in accordance with provisions of the CAA planning standards allowing for the installation as an exception to the general requirements. Many factors in the Nantucket situation qualify it as an exception. Installation of "end of the runway" weather reporting equipment would be in accordance with a Weather Bureau policy to install this equipment as part of the ILS package. Obviously, the above action would be a significant step toward modernization of the airport.

In the meantime, and following the accident, the Weather Bureau took measures to provide Otis RAPCON with all weather observations taken at Nantucket during IFR conditions.

From the considerable testimony regarding the correct interpretation of Item 32 of the Operations Specifications (Limitations on descent below authorized IFR landing minimums) the Board believes that the best operating policy clearly requires adherence to the CAA interpretation In order to effect its interpretation and because the interpretation is not clearly expressed, the Administrator is presently considering a revision to the language of Item 32

The company has taken positive steps to eliminate deficiencies in its operational training program which were disclosed in the Board's accident investigation and the CAA inspection. The foundation of the action was a re-emphasis of the training function under company supervisors with appropriate delegated authority. Accordingly, company policy now requires that the use of aircraft for training receive the

highest priority. It also requires that the various training phases and curriculums not be interrupted by controllable factors. An increased emphasis on recurrent training provides that in addition to the existing program each pilot captain will receive a concentrated ground and flight training period preceding each semiannual instrument check.

Through communications and meetings with company officials and the Administrator and his staff the Board has been kept informed of the aforementioned action as well as other allied measures. It has been reported that a determined effort has been made by the company to satisfy each criticism even though in some specific instances the company believes the criticism was not wholly warranted. The Board believes that rapid and substantial progress has been made and in many instances the deficiencies have already been corrected.

Most of the areas in which deficiencies were found are the subjects of express provisions of the Civil Air Regulations, some of which require approval of the CAA. Under the responsibility of the Administrator all of the areas require his continued scrutiny through his local staff. Obviously, the operational factors which were identified as deficiencies were generally known and accepted by the local CAA agents prior to the accident. The Administrator, recognizing this, took action to correct the local situation and also to establish an inspection process whereby closer supervision can be maintained over the effectiveness of CAA offices throughout the country having the same responsibilities.

Probable Cause

The Board determines that the probable cause of this accident was the deficient judgment and technique of the pilot during an instrument approach in adverse weather conditions in failing to abandon the approach when a visibility of one-eighth mile was reported, and descending to a dangerously low altitude while still a considerable distance from the runway.

BY THE CIVIL AERONAUTICS BOARD:

/s/ JAMES R. DURFEE

/s/ CHAN GURNEY

/s/ HARMAR D. DENNY

/s/ G. JOSEPH MINETTI

/s/ LOUIS J. HECTOR

SUPPLEMENTAL DATA

Investigation and Hearing

The Civil Aeronautics Board was notified of this accident shortly after its occurrence and initiated an investigation in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. A public hearing was held by the Board in Bennett Hall, Nantucket, Massachusetts, on October 1, 2, and 3, 1958.

Air Carrier

Northeast Airlines, Inc , is a Massachusetts corporation with its principal offices located in Boston. The carrier is engaged in the transportation by air of persons, property, and mail The company operates under a currently effective certificate of public convenience and necessity issued by the Civil Aeronautics Board and operating certificate issued by the Civil Aeronautics Administration.

Flight Personnel

Captain John T. Burnham, age 36, was employed by Northeast Airlines on May 24, 1951. He became captain September 27, 1956. He possessed a currently effective airman certificate with an airline transport rating and DC-3 and Convair type ratings. Captain Burnham had accumulated 5,608 flying hours with the company, of which 4,028 were in the DC-3, 165 were in the DC-4, and 1,416 were in the Convair He had flown the route involved numerous times while copilot and captain and had received a satisfactory route check on June 26, 1958. His latest physical examination was satisfactorily accomplished on March 17, 1958

Records on Captain Burnham showed the satisfactory completion of all semiannual instrument flight checks except one which was flown on October 14, 1957, and graded unsatisfactory. Following additional Link and flight instruction a recheck on October 16, 1957, was completed satisfactorily Both the October 14 and 16 flights were accompanied by CAA inspectors and the checking pilot was the assistant chief pilot. Testimony of these persons indicated the discrepancies were not of a serious nature and following training all were corrected

First Officer David C. Carey, age 23, was employed by Northeast Airlines on June 27, 1957. He held a currently effective airman certificate with commercial and instrument ratings. He was qualified as a first officer on the Convair on July 30, 1957. At the time of the accident First Officer Carey had accumulated 614 flying hours, 296 prior to employment and 318 during employment, of which 132 were in the Convair. First Officer Carey was on leave of absence to complete college from September 15, 1957, until June 15, 1958 His latest physical examination was satisfactorily completed May 9, 1958

Stewardess Arlene Dabek, age 23, was employed by the company on November 25, 1957, and received stewardess training until December 10, 1957. Miss Dabek received her annual physical examination November 25, 1957. She had flown regular schedules from December 14, 1957, until the accident.

The Aircraft

N 90670, a Convair 240, was manufactured August 22, 1948, and sold to Pan American World Airways. It was purchased by Northeast Airlines April 24, 1954, and

of 18,019 hours on the airframe, 8,773 were accumulated by Northeast. Since the last major aircraft overhaul N 90670 had flown 1,605 hours. The aircraft was powered by Pratt and Whitney R-2800 CB-3 engines, both of which had operated 1,155 hours since overhaul. The engines were equipped with Hamilton Standard propellers, model 43E606895-12. The left and right propellers, respectively, had operated 1,870 hours and 869 hours since overhaul.