

C I V I L A E R O N A U T I C S B O A R D

ACCIDENT INVESTIGATION REPORT

Adopted: July 26, 1945Released: July 26, 1945

TRANSCONTINENTAL & WESTERN AIR - VAN NUYS - DECEMBER 1, 1944

Summary

TWA's Flight 18, en route from San Francisco to New York on a regular transcontinental scheduled flight, crashed December 1, at night in a heavy fog near Van Nuys, California. The accident resulted in eight fatalities, twelve serious and three minor injuries, and a complete washout of the aircraft.

The flight was cleared to Burbank Airport for a standard instrument approach. During the approach the plane descended under instrument conditions to such a low altitude as to clip the tree tops and strike a power line pole and then crash at a point approximately $6\frac{1}{2}$ miles short of the Burbank Airport. In a normal approach the plane would have flown over this point at an altitude of about 1650 feet above the ground. The specific reasons for the plane's descent below the minimums for instrument approach were not determinable, nor was it possible to tell whether the deviation was a voluntary one. Investigation did reveal, however, that a number of deviations were made from the company's standard Civil Aeronautics Administration approved procedures during this flight.

On the basis of the available evidence the Board determines that the probable cause of this accident was a deviation from the Civil Aeronautics Administration approved standard instrument approach procedure.

This report is based upon evidence acquired in the Board's investigation and the hearing which was held at Los Angeles, California, December 12 and 13, 1944.

NARRATIVE DESCRIPTION OF THE FLIGHT AND ACCIDENT

TWA's Flight 18 departed from San Francisco at 12:54 a.m. on the first leg of a transcontinental flight to New York. The first scheduled landing was Burbank, California. Just prior to departure the flight was redispached by the company and approved by ATC via airways to Palmdale due to unfavorable weather at Burbank. Examination of the captain's flight plan showed that he made no entry to indicate this change. Although this is of minor significance it reveals a degree of non-conformity with standard practice which seems to have characterized this flight.

Radio position reports were made for Evergreen, Los Banos and Fresno, and it would normally be assumed that the plane was flown over these points as indicated by the flight plan; however, a check of the mileages and lapsed times disclosed that the flight must have been made direct from Evergreen to Lebec which would have cut several miles from the normal route via Fresno. This variation, too, is not significant so far as a direct cause of the accident is concerned. Its significance as a further indication of the pilot's non-conformity with the company's established route procedure is discussed later in this report.

While en route the Burbank weather improved to a point above the airport ceiling minimum of 700 feet and at 2:36 a.m. the company cleared the flight to continue, subject to the pilot's discretion, to Burbank on instruments with Palmdale as an alternate. Flight 18 acknowledged this message and requested clearance for a standard instrument approach to Burbank. The company records indicate that an ATC clearance was transmitted to the flight with instructions to cross Newhall at 5000 feet, maintain that altitude and "hold" northeast of Newhall until receipt of the Los Angeles Air Traffic Control clearance into Burbank.

Upon receiving this change in destination the captain evidently swung from the Lebec-Palmdale course and headed toward Newhall as he made no check over Palmdale. At 2:49 a.m. the pilot was issued a standard instrument approach clearance by Air Traffic Control and was given the Burbank altimeter setting of 30.08. This information was acknowledged by Captain Snowden and at 2:51 First Officer Bamberger reported that they were over Newhall and were changing to the Burbank Tower frequency. (No altitude was given.) Immediately thereafter the Burbank Tower issued landing instructions to them which were: Wind calm, runway 7, report when contact. The pilot is believed to have proceeded on the SE leg of the Newhall range as indicated on the accompanying chart. Evidence indicated that he had intersected the NW leg of the Burbank localizer, turned and was proceeding to the Burbank Airport on the proper heading at the time contact was made with the ground. (A detailed description of the Burbank instrument approach procedure is given on Page 7 of this report.) There were no further contacts with Flight 18 after it checked over Newhall.

At approximately 2:58 a.m., about seven minutes after the last contact, the plane crashed $6\frac{1}{2}$ miles west-northwest of the Burbank Airport.

From Newhall to the point of the crash normally requires approximately six minutes of flying.

The crash was heard by several nearby residents. A registered nurse and her daughter were the first to reach the scene and with the assistance of later arrivals extricated occupants and rendered aid. Later the Van Nuys Police and Fire Departments arrived and took charge of the rescue work and placed a guard about the wreckage. According to witnesses there was a heavy fog in this area and the visibility was practically zero.

The captain, first officer and six passengers were killed, the hostess and 11 passengers received serious injuries, while three other passengers sustained only minor injuries.

Examination of the markings on trees, power line pole and ground scars established the direction of the flight path and the attitude of the plane for several hundred feet prior to final impact. The plane was directly on course headed for the Burbank Airport and first clipped the tops of trees while in a slight angle of descent at a height of approximately 40 feet above the ground. The elevation of the ground at this point is about 860 feet above sea level and approximately 150 feet above the Burbank Airport. The plane continued approximately 300 feet across a highway and then, climbing slightly, struck and severed an electric power line pole and wires. This caused the plane to begin to disintegrate. It then struck and uprooted tall trees beyond the power line and crashed. The main portion of the wreckage came to rest at a point about 1000 feet from the first contact with the tree tops.

THE BOARD'S INVESTIGATION

The Santa Monica Office of the Civil Aeronautics Board received notification of the accident about 4 a.m., December 1, and the Board immediately ordered and initiated an investigation in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. Air Safety Investigator Frank K. McKlveen of the Santa Monica Office arrived at the scene of the accident at 5 a.m. and placed the wreckage under official guard which was maintained until the investigation was completed and the wreckage released to TWA. Senior Air Safety Investigator Ralph A. Reed of the Santa Monica Office arrived at the scene about 6 a.m. and Air Safety Investigator A. E. Cabana of the Reno Office arrived at 4:30 p.m. the same day to assist in the Board's investigation. Later William K. Andrews, Chief, Investigation Section, and Kenneth C. Sonner, Air Safety Specialist (Powerplants), Safety Bureau of the Board, arrived from the Washington Office and participated in the investigation and hearing.

Hearing

In connection with the investigation the Board ordered a public hearing which was held in Los Angeles on December 12 and 13, 1944. William K. Andrews served as Presiding Officer. In addition the following members of the Safety Bureau staff participated: Investigators Reed, McKlveen and Cabana, and Kenneth C. Sonner.

SUMMARY AND ANALYSIS OF EVIDENCE

Air Carrier

TWA was operating as an air carrier under a certificate of public convenience and necessity and an air carrier operating certificate, both issued pursuant to the Civil Aeronautics Act of 1938, as amended. These certificates authorized the company to engage in air transportation with respect to persons, property and mail between various points in the United States including San Francisco and Burbank.

Flight Personnel

The crew of Flight 13 consisted of Captain John Pollard Snowden, First Officer Thomas Leo Bamberger and Hostess Donna Elizabeth Marr.

Captain Snowden, age 35, held an airline transport pilot certificate with G-3000 h.p. single and multi-engine land ratings. He had flown approximately 5400 hours including 4315 hours for TWA on DC2 and DC3 equipment. He was employed by TWA as a student first officer on September 18, 1939, and was promoted to first officer on January 11, 1940. On September 20, 1941, he became a reserve captain and was promoted to captain on January 1, 1943. His last physical examination required by the Civil Air Regulations was passed August 12, 1944. He satisfactorily passed his last company en route flight check on July 25, 1944, and his last instrument flight check on August 29, 1944.

First Officer Bamberger, age 29, held a commercial pilot certificate with G-325 h.p. and instrument ratings. He had accumulated approximately 1087 hours of flying time, including about 136 hours on DC2 and DC3 equipment, 69 of which were acquired in the service of TWA. He was employed by TWA as a student first officer on September 15, 1944, and was assigned as a first officer on October 25, 1944. His last physical examination required by the Civil Air Regulations was passed November 3, 1944.

Hostess Marr had been in the employ of TWA since November 22, 1943.

Aircraft

The Douglas DC3, NC 17322, serial number 1963, was manufactured by the Douglas Aircraft Company in August 1937 and was purchased new by TWA.

It had been operated continuously in this company's service and at the time of the accident had been flown approximately 22,180 hours. It had been flown 25 hours and 33 minutes since its last major overhaul. In December, 1940, this aircraft was converted from a G-102 to a G-202A. It was equipped with two Wright G-202A engines and two Hamilton Standard hydromatic propellers. The left engine had been operated a total of 892 hours, the right a total of 9593 hours. Each had been operated 25 hours and 33 minutes since overhaul. The total time on the propellers was 25 hours and 33 minutes.

At the time of departure from San Francisco the aircraft was loaded to 25,194 pounds gross, which was within the allowable limits. The weight was distributed properly with respect to the center of gravity. There were 390 gallons of fuel on board at the time of take-off, divided equally between the two main tanks.

Examination of the Wreckage

Investigation showed that the landing gear was down at the time of the crash and that the flaps were in the retracted position. One of the survivors also testified that he looked out just prior to the crash and noted that the flaps were retracted. The passengers' seat belts were fastened.

There was definite indication that power was being developed at the time of impact with the power line pole and subsequent contacts with trees. There were no indications of any mechanical failure or malfunctioning of the engines or propellers. The throttle and carburetor heat controls were so badly damaged that their respective settings could not be determined. The oxygen and CO₂ bottles were found in good condition. The right main fuel tank was sheared off and badly mutilated but the outer end contained some fuel. The saturated ground and the extremely strong fumes indicated that an appreciable amount of fuel had been in this tank. The left main tank remained with the wing and contained 15 gallons of fuel at the time it was examined. Due to the damaged condition of the fuel tanks no conclusions could be drawn as to the actual amount of fuel in them prior to impact.

There were two pertinent differences between the plane flown by Captain Snowden on Flight 18 and the ones flown on his two previous trips. The plane used on Flight 18 was not equipped with a fuel cross-feed. Instead, it had two electric pumps installed in the lines and to operate them it was necessary to flip an electric switch. Also this plane was equipped with a dual fuel system, whereas the planes on the two previous trips were each equipped with a single fuel system.

Consideration was given to the possibility that one tank might have been permitted to run dry and that a critical amount of altitude had been lost before normal power was restored. Although investigation did not preclude this possibility, there was no evidence that this had occurred. Fuel difficulty, therefore, is not believed to have contributed to the cause of the accident. Actual flight tests were made as a part of the research on this subject. They indicated that the time interval from the

operation of the fuel selector valve to the full restoration of power could result in a loss of as much as 500 feet of altitude. These data, of course, were obtained under ideal conditions in which the pilot knew what to expect. Under the stress of an emergency with a fully loaded plane, a somewhat greater loss of altitude might be expected.

Both altimeters were badly damaged. It was possible, however, to ascertain that the altimeter setting prior to the crash was at or very near the value of 20.03 given to the pilot.

The possibility of either the malfunctioning or the misreading of the altimeter was given exhaustive study. A number of tests were made by the Kollsman Company at their West Coast laboratory to determine the amount of lag which might be possible under the conditions of this flight. An instrument placed in the glass chamber was taken from a simulated altitude of 20,000 feet to sea level in about a second with a resultant lag of less than one second. Tests to determine the amount of restriction required in the line which would induce an element of lag showed that the normal 3/16" diameter opening could be reduced to approximately 1/64" with no appreciable lag. It appears that it would be quite necessary to practically close the line before the instrument would become ineffective.

A defect could occur to one altimeter head or in the line connecting it to the common header (vent line to the pilot-static tube.) A defect could also occur after the start of the let-down and could not be detected by either pilot. Although altimeters have been found to vary 100 feet or more due to mechanical malfunctioning the investigation revealed no evidence that there was such malfunctioning. Other pilots who fly this route stated that they experienced no particular lag in the altimeter due to the rapid descent necessary for the Burbank instrument approach from Newhall Pass. Pilots stated that it was common practice to check the altimeters against each other just prior to starting the descent but that no further cross-check is made. Although there is always the possibility of a misreading of the altimeter there was no evidence to indicate that misreading occurred in this accident.

It could not be determined whether the pilot or copilot was flying the airplane at the time of the accident.

Weather

The general synoptic situation was one common to the winter months, namely, a low center off the northwest coast of the United States, with a trough of low pressure running southeast through the interior of California to the lower Colorado River Valley. This is a typical winter-time stratus and fog condition for the coastal area of Southern California. With this type of situation a shallow layer of marine air invades the coast and coastal valleys, increasing in depth as the low center moves inland to the north. While the layer of marine air is shallow, fog develops at night on the surface and as it deepens, a ceiling forms and visibility improves at the surface. This forming of a ceiling and improvement of visibility occurs first at lower elevations and is delayed at the higher valley areas, except when strong pressure gradients occur,

which was not the case at the time of the accident. Surface winds were not very significant as they were light and variable due to the effect of radiation and air drainage. This also had differing local effects as to the time of improvement of visibility and is so complex that it cannot be forecast accurately for each particular locality, although the general trend can usually be forecast.

The following is a summary of weather conditions in the Los Angeles area near the time of the accident, as reported by the U. S. Weather Bureau: (The times given are PWT.)

Van Nuys, Calif.: At 11:30 p.m., November 30 the ceiling was unlimited and visibility one mile due to light fog. Thickening of ground fog reduced the visibility to $3/8$ mile at 12:30 a.m., December 1 and resulted in zero ceiling and $5/16$ mile visibility by 1:30 a.m. This latter condition prevailed until 2:30 a.m. but improved immediately thereafter with ceiling 300 feet and visibility $1/4$ mile reported at 2:35 and 3:30.

Burbank, Calif.: At 11:30 p.m., November 30, the ceiling was zero and visibility $3/16$ mile on account of fog. Slight improvement was reported at 12:30 a.m. and 1:30 a.m. December 1, indicating ceiling 100 feet and visibility from $1/4$ to $3/8$ mile. More rapid improvement followed with 300 feet and $1\frac{1}{2}$ miles reported at 1:45 a.m., 600 feet and 2 miles at 2:00, and 700 feet and 2 miles at 2:30. At 3:30 the ceiling dropped to 600 feet with lower scattered clouds at 300 feet and visibility remaining at 2 miles.

Glendale, Calif.: At 11:30 p.m. November 30, the ceiling was reported as 900 feet with 2 miles visibility. This condition remained essentially the same until 1:30 a.m. December 1, after which the ceiling dropped to 100 feet and visibility $1/2$ mile, as reported at 2:05 a.m. Improvement followed with 300 feet and one mile reported at 2:23 and 2:30, and 500 feet and 2 miles reported at 3:30.

Los Angeles Airport: At 11:30 p.m. November 30, the ceiling was unlimited and visibility was 6 miles, followed by 1400 feet and 3 miles at 12:30 a.m. December 1, with slight improvement prevailing through to 3:30 a.m.

During the early morning of December 1, the general trend did show improvement of ceiling, fog conditions, and visibility in the San Fernando Valley, although even considering the difference in elevation between Van Nuys and Burbank, the improvement was not as marked at Van Nuys as it was at Burbank. At present, weather reporting facilities do not indicate the point between these two places where weather minimums would first occur.

Hourly weather reports are available from Van Nuys, near the location of the range station. Although not required, it appears that it might have been helpful in the case of Flight 18 if the Van Nuys weather report had been furnished the pilot.

Standard Instrument Approach Procedure

The monitor records of the radio ranges, together with pilot's reports, indicated that all navigational facilities involved in this flight were functioning normally throughout the period of the accident. Radio reception was reported to have been good, as evidenced by the frequent contacts between TWA ground stations and Flight 18.

Testimony given in this investigation revealed that several of the company's pilots were somewhat vague in their understanding of the approved Burbank instrument approach procedure and were varying the procedure to suit themselves. TWA's Operations Manual shows that the Civil Aeronautics Administration approved instrument approach procedure for Burbank Airport is as follows:

WHEN TOP OF OVERCAST IS 5000 FEET OR LESS

"Final Approach Leg SE leg (137°) of Newhall range at 5000', which must be maintained until 3 minutes after passing Newhall cone and then descend on this leg and NW leg (98°) KBLA

Procedure Turn

Minimum Altitude

Altitude over Range Station on Final Approach Burbank (KBLA)

	<u>Day</u>	<u>Night</u>
Douglas	1300'	1400'
Boeing	1500'	1500'

Magnetic course after passing Range Station NH-KBLA Int (137°)
KBLA Int-KBLA cone (98°)

Distance Range Station to Airport NH to KBLA cone, 18 miles.
(KBLA on SW corner airport)"

WHEN TOP OF OVERCAST IS OVER 5000 FEET BUT NOT OVER 7500 FEET

"Initial and final approach over Newhall must be made at not less than 500 feet above top of overcast.

"After passing NH on initial approach, proceed out NW leg 3 min. and/or 6 miles gear down and airspeed 120 m.p.h. Make procedure turn on East side of NW leg at 500 feet above top and return to NH.

"When NH is crossed on final approach at an altitude above 5,000 feet, descent shall be started immediately after passing NH, and regulated to arrive at not less than 5,000 feet at a point 3 minutes SE of NH.

"Remainder of approach shall follow the standard procedure for instrument entry into Burbank.

"If landing not accomplished or ground contact not established at minimum indicated altitude, 1400 feet night (Douglas), within 9 minutes after passing NH cone or at time of passing KBLA cone, immediately start climbing out on SE leg (105°) of KBLA to 2500 feet. After reaching 2500 feet, make right-hand climbing turn to a heading of (260°) and proceed to the NW leg of the Los Angeles radio range (260kcs.)"

Several test flights were made in an attempt to determine the course and altitudes flown by Captain Snowden which would bring the plane in contact with the ground at the crash point. Personnel of TWA, the Civil Aeronautics Administration and the Civil Aeronautics Board participated in these simulated approaches. In the flight which appeared most nearly to simulate the approach path taken by Captain Snowden a descent at the rate of 800 feet per minute was made from an altitude of 5000 feet and started when over the Newhall Range Station. (This is indicated by Position A on the accompanying chart.) As previously stated the normal position for starting the let-down is three minutes out on the southeast leg of the Newhall Range. (Indicated by Position B on the accompanying chart.) In the simulated flight, after letting down for three minutes on the southeast leg (137°) a course of 150° was assumed and followed until it intersected the northwest leg of the Burbank localizer. This is also a deviation from the company's standard procedure. However, company pilots explained that it was customary for them to vary their heading to the right of the 137° leg in order to provide more time for bracketing-in for the final approach on the localizer. The course flown in this simulated flight varied, it will be seen, from the standard approach in two respects - the let-down was begun over the Newhall Station rather than three minutes out and a heading to the right of the normal 137° was made. The course flown in this simulated flight, if continued, would have brought the plane to the location of the crash in six minutes. The time lapse for Flight 18 from the time the pilot reported over Newhall until the crash was approximately seven minutes. A rate of descent of 800 feet per minute is not considered excessive for the Burbank approach, in view of the elevation and proximity of the Newhall Mountains.

The fact that TWA pilots questioned at the hearing indicated that they were not very familiar with company policies and procedures and that they were not conforming strictly to the approved standard procedure for instrument approaches to Burbank denotes a laxity on the part of the company as well as the pilots. Although the Civil Aeronautics Administration is charged with the responsibility of checking the company operation from time to time to ascertain whether or not they are maintaining their route competency and conforming to prescribed procedures a CAA representative testified that few, if any, of these checks had been made recently due to a shortage of personnel. He explained that TWA operations over their entire route, including Burbank, are handled through Kansas City where the headquarters of the company are located.

DISCUSSION AND FINDINGS

To summarize, consideration was given to the possibility of either altimeter error or error in reading the altimeters. Consideration was also given to the possibility of a fuel tank running dry and the loss of excessive altitude while "switching over." However, the evidence is insufficient to raise either of these possibilities to the level of probable cause. It is obvious that for the airplane to have contacted the ground where it did, a departure from the standard instrument approach procedure would have had to occur. Whether such a deviation was entirely voluntary on the part of the pilot was not determined.

The investigation did, however, establish the fact that the flight was not conducted in accordance with standard company procedure. No correction was made on the pilot's work sheet of the change in flight plan from Burbank to the alternate at Palmdale. It was also quite evident by entries made on the flight work sheet that the indicated route was not followed. Company personnel stated further that the pilot failed to report over Palmdale in accordance with company procedure. This disregard of standard company procedures might also indicate a deviation from the standard instrument approach procedure in making the let-down at Burbank. The investigation did not reveal whether the pilot or the copilot was flying the airplane at the time of the accident. In the event the plane was flown by the copilot the operation of the flight was still the responsibility of the captain. Testimony of several company pilots indicated that they also were varying from the company's standard procedures.

With all the foregoing facts and considerations in mind the Board finds that:

1. There was no mechanical failure or malfunctioning of any part of the airplane at the time of the accident. Both engines were developing power just prior to final impact.
2. The plane first struck tree tops in a slight angle of descent, then, after several hundred feet and in a slight angle of climb, struck and broke an electric power line and pole and crashed.
3. Visibility was zero at the scene of the accident although Burbank Airport was open to instrument flight at the time.
4. All navigational facilities used in the Burbank approach were functioning properly. Radio reception was good.
5. The pilot deviated from standard procedures in that he:
(a) failed to correct his work sheet to show the change in flight plan;
(b) flew a direct course from Evergreen to Lebec instead of following airways as specified in his clearance; and (c) failed to report over Palmdale as required by company procedure.

6. The plane descended to an altitude below that specified in the company instrument approach procedure.

PROBABLE CAUSE

On the basis of the evidence available the Board finds that the probable cause of this accident was the pilot's deviation from the standard instrument approach procedure when he descended below the established safe minimum altitude. A contributing factor was the company's failure to enforce adherence to company procedures.

BY THE CIVIL AERONAUTICS BOARD:

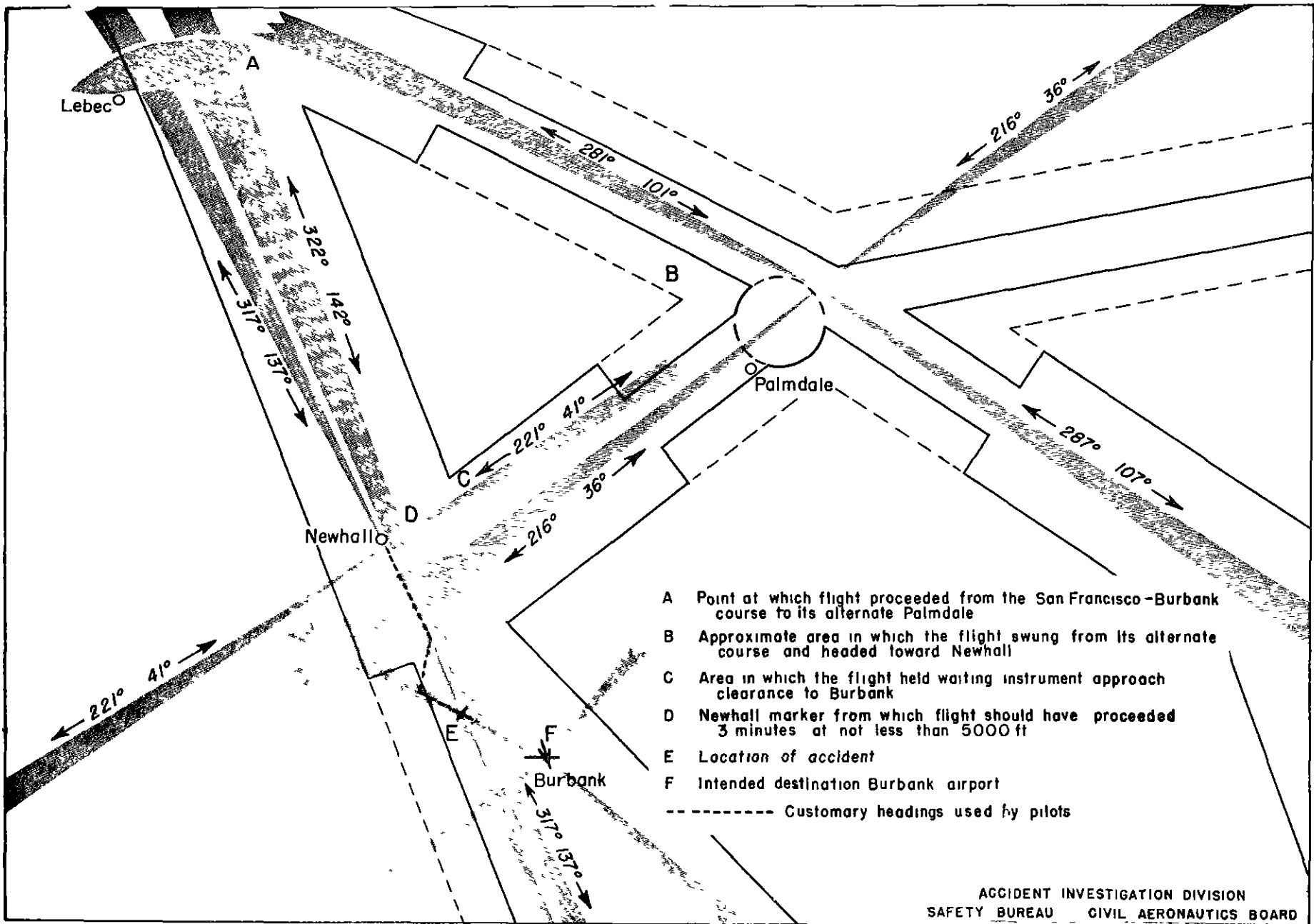
/s/ L. Welch Pogue

/s/ Edward Warner

/s/ Harllee Branch

/s/ Josh Lee

Oswald Ryan, Member of the Board, did not take part in the adoption of this report.



ACCIDENT INVESTIGATION DIVISION
 SAFETY BUREAU CIVIL AERONAUTICS BOARD