SA-371

File No. 1-0(

CIVIL AERONAUTICS BOARD

AIRCRAFT ACCIDENT REPORT

ADOPTED: October 8, 1963 **RELEASED:** October 11, 1963

SLICK AIRWAYS, INC
LOCKHEED CONSTELLATION 1049H, N 9740Z
SAN FRANCISCO INTERNATIONAL AIRPORT
SAN FRANCISCO, CALIFORNIA
FEBRUARY 3, 1963

SYNOPSIS

A Slick Airways Lockheed 1049H, N 9740Z, crashed and burned during an ILS approach to runway 28R at the San Francisco International Airport at approximately 1207 P.s.t., February 3, 1963. Due to an inoperative glide slope receiver, the crew was listening to radar advisories on the localizer receiver for altitude information. The aircraft struck approach lights 1,170 feet from the runway threshold, climbed to about 200 feet and then crashed approximately 1,900 feet beyond the threshold and on the left edge of runway 28L. Of the three crew members and five passengers aboard, the captain, first officer, and two passengers received fatal injuries. The remaining persons aboard received serious injuries. The aircraft was destroyed by subsequent fire.

The Board determines the probable cause of this accident was the continuation of an instrument approach after adequate visual reference was lost below authorized minimums Inadequate monitoring of the instrument approach by the PAR controller was a contributing factor.

nvestigation

Slick Airways, Inc., Lockheed 1049H, N 9740Z, departed the Naval Air Station, orfolk, Virginia, on February 1, 1963, en route to the Naval Air Facility, China Lake, alifornia, with an en route stop at Dallas, Texas. The flight operated as a cargo light under the provisions of Part 42 of the Civil Air Regulations.

The aircraft departed Dallas at 2257 c.s.t., en route to China Lake. The crew onsisted of Captain Richard A. MacCallum, First Office William H. Coryell, and Flight ngineer John J. Walik. After departing Dallas, the flight engineer noted the alternating current (AC) voltmeter pegged at the maximum reading of 150 volts. Shortly terwards, the first officer informed the engineer that he had lost all of his radio avigation instruments. A check by the flight engineer revealed that all AC radio ises had been blown and that the AC voltmeter read 150 volts in all positions of the oltmeter selector switch. In-flight attempts to restore power to the navigation quipment were futile and, in the vicinity of Albuquerque, New Mexico, it was decided land and repair the aircraft's malfunctioning equipment. The landing at Albuquerque s made at 0105 m.s.t.

There were four inverters in the AC electrical system of Slick 40Z. These consted of a 400-cycle, 115-volt, single phase NESA inverter and three 400-cycle,

115-volt, three phase inverters for radar, radio and flight and engine instruments. By a system of switches, the instrument, radio and NESA inverters may be utilized to supply AC power for other than their normal functions during emergency situations. All four inverters initially checked out satisfactorily during the ground checks following the landing at Albuquerque. Further troubleshooting by the flight engineer and local technicians did not disclose the origin of the electrical malfunctions.

When initial troubleshooting failed to bring the radios back to service, Captain MacCallum contacted the Slick Airways offices at San Francisco International Airport. Arrangements were made to dispatch a repairman to Albuquerque. Another Lockheed 1049H Slick 25C was to be dispatched to Albuquerque from Dallas, Texas. Captain MacCallum was instructed to transfer the cargo from Slick 40Z to Slick 25C and ferry Slick 40Z to San Francisco International Airport for maintenance.

At approximately 1500 m.s.t , February 2, the crew of Slick 40Z decided to obtain quarters for crew rest and departed the airport for a motel.

At approximately 2200 m.s.t., February 2, the Slick repairman arrived at Albuquerque to begin repairs of the radio equipment aboard Slick 40Z. He determined that the power supply units for both VOR navigation receivers were burned out; the power transformers for both ADF receivers were burned out; and the ILS glide slope receiver had burned out tubes and filter condensers.

Subsequently, Slick 25C, the replacement aircraft, arrived from Dallas and the transfer of cargo from Slick 40Z was begun.

When continued troubleshooting by the Slick repairman failed to correct the malfunctions, the No. 2 VOR power supply unit and the complete No. 2 automatic direction finder unit were replaced with units from Slick 25C. On completion of the radio repair and troubleshooting procedures, Slick 40Z had two functioning VHF transmitters and receivers, one functioning VOR receiver installed in the No. 1 or pilot position, and one functioning ADF receiver installed in the No. 1 position. The glide slope receiver was inoperative. No testing was performed on the marker beacon receiver since its power source is direct current (DC) power which was not involved in the previous electrical malfunctions.

At approximately 0300 m.s.t , February 3, the crew of Slick 40Z returned to the airport.

Because of space limitations aboard the replacement aircraft, 3,750 pounds of cargo consisting of two missile motors were reloaded aboard Slick 40Z with the knowledge and consent of Captain MacCallum. Arrangements were made with company personnel to have a truck meet the aircraft at San Francisco International Airport to off-load the motors.

The crew checked the current and forecast weather conditions for the route and for the San Francisco terminal several times while at Albuquerque, the last check being made just prior to departure. This last weather check indicated essentially unrestricted conditions of ceilings and visibility at stations along and near the proposed route. The San Francisco weather at 0800 m.s.t., was 5,000 feet scattered clouds; estimated 14,000 feet overcast; visibility 2 miles in ground fog and smoke; temperature 53 degrees; dewpoint 52 degrees; wind calm. The valid San Francisco terminal forecast for 1200 to 1600 m.s.t., was ceiling 5,000 feet broken clouds; visibility 7 miles; occasional very light rain

Slick 40Z departed Albuquerque at approximately 0823 m.s.t., on a visual flight rules (VFR) flight plan with San Francisco International Airport as the destination with an estimated time en route of 4 hours 15 minutes Gross weight and the center of gravity were within prescribed limits. There were five non-revenue passengers aboard. No briefing of the passengers on emergency procedures and exits was accomplished by the crew nor was one required. Among the survivors, only two testified that they were familiar with the location of the emergency exits and how they operated

Following departure from Albuquerque, no en route radio contacts were made with FAA traffic control facilities until 1038[1/], at which time the Paso Robles, California, Flight Service Station was contacted by the flight. They requested the San Francisco, Alameda, and Oakland weather. The San Francisco weather given the flight was the 1025 Special indefinite ceiling 300 feet; sky obscured; visibility 1/16 mile in fog and smoke, temperature 56; dewpoint 56; wind from the north at 6 knots; altimeter 30.13; runway 28R visual range (RVR)[2/] 1,900 feet. The 1000 Alameda weather was indefinite ceiling 200 feet sky obscured, visibility 1/4 mile in fog, temperature 52; dewpoint 50; wind from the east-northeast at 5 knots. The 1000 Oakland weather was balloon ceiling 16,000 feet broken clouds; overcast cirriform; visibility 1/2 mile in ground fog; temperature 58, dewpoint 55; wind calm; runway 29 visual range 3,200 feet; runway 27R visibility 7/8 of a mile

At 1053, the crew of Slick 40Z contacted Oakland Flight Service Station, reported their position over the Mt Hamilton Intersection, and closed out their VFR flight plan. The crew requested and was given the San Francisco 1200-1600 terminal forecast of 3,000 feet scattered clouds; ceiling 10,000 feet overcast; visibility 3 miles in ground fog.

The flight from Albuquerque to the San Francisco area was flown in visual weather conditions, and there were no in-flight failures of radio equipment en route.

At approximately 1056, the crew of Slick 40Z reported that they were descending in accordance with VFR and requested an IFR clearance into San Francisco. San Francisco Approach Control advised that the San Francisco weather was indefinite ceiling 200 feet; sky obscured, visibility 1/16 mile in fog and smoke; and that the visibility was forecast to improve to one mile in a half hour. The crew of Slick 40Z advised that they would hold in the San Jose area and maintain VFR, and they were given an altimeter setting of 30.11.

Slick 40Z continued to hold VFR and at 1122, 1140, and 1151, the crew was advised of the weather at San Francisco International Airport. The 1140 and 1151 reports indicated weather at and slightly above the landing minimums of 200 feet ceiling and 1/2 mile visibility, although the RVR readings for runway 28R were less than 2,000 feet At 1152, the crew called San Francisco Approach Control and gave their position as just north of the Woodside VOR at 3,000 feet on a heading of 150 degrees and requested an approach to the San Francisco International Airport. Instructions

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1/ All times in the remainder of this report are Pacific standard based on the 24-hour clock.

2/ In the U. S., runway visual range is defined as an instrumentally derived value, based on standard calibrations, which represents the horizontal distance a pilot will see down the runway from the approach end, it is based on the sighting of either high intensity runway lights or on the visual contrast of other targets, whichever yields the greater visual range.

were issued by Approach Control for radar identification. The aircraft was declar in radar contact and subsequently vectored to the ILS final approach course Slic 40Z was advised that it would be the third aircraft to land following a United Air Lines DC-8 (later identified as United 8009, a Convair 340), which was five miles ahead.

At approximately 1155, Approach Control advised that the San Francisco cloud cover had not changed (5,000 feet scattered, 15,000 feet overcast), but that the visibility had now improved to 3/4 mile in ground fog and smoke, and runway 28R visual range was less than 2,000 feet The crew then advised that they would " . like radar advisories on localizer approach."

Slick 40Z was then vectored in a wide circle during the period 1155 to 1201, and the crew was advised that they were nine miles from the outer marker and clear for an ILS approach. During this period, Approach Control informed the flight that the RVR had increased to 2,800 feet on runway 28R; and visibility remained at 3/4 mile.

At 1203, the flight was advised to continue inbound on the ILS, to contact San Francisco Tower on 120.5 mcs., and that radar advisories would be available on localizer voice.

At 1204, Slick 40Z contacted the tower and again stated " . . . we'd like radar advisories glide slope on the localizer frequency." The local controller cleared the flight to land and acknowledged the request with " . . . radar advisories on localizer voice "

During the approach, the Precision Approach Radar (PAR) controller gave the flight its radar position relative to the glide slope and localizer course on localizer voice frequency of 109.5 mcs. These positions were acknowledged and, in one stance, requested by the crew on frequency 120.5 mcs

The following are the final significant 109.5 and 120.5 mcs. transmissions·

109.5 mcs.	1204:15	SLICK FOUR ZERO ZULU PASSING OUTER MARKER ALTITUDE OK AND ONE HUNDRED FEET RIGHT OF COURSE.
109.5 mcs.	1204:49	SLICK FOUR ZERO ZULU DO YOU HEAR PRECISION RADAR ON LOCALIZER VOICE.
120.5 mcs.	1204:50	(SAN FRANCISCO TOWER) SLICK FOUR ZERO ZULU, THERE APPEARS TO BE A FOG BANK ON THE APPROACH END OF RUNWAY TWO EIGHT OR TWO EIGHT LEFT EXTENDING UP TO ABOUT RUNWAY ONE RIGHT RUNWAYS VISIBILE WESTWARD FROM THAT POINT.
109.5 mcs.	1205:04	SLICK FOUR ZERO ZULU IS TWO HUNDRED FEET ABOVE GLIDE-PATH. FOUR MILES FROM TOUCHDOWN ONE HUNDRED FEET RIGHT OF COURSE.
109.5 mcs.	1205:37	SLICK FOUR ZERO ZULU RUNWAY TWO EIGHT VISUAL RANGE TWO EIGHT RIGHT VISUAL RANGE TWO THOUSAND FIVE HUNDRED.
109 5 mcs.	1205:57	AND FOUR ZERO ZULU IT'S NOW TWO THOUSAND SEVEN HUNDRED.

120 5 mcs	1206:12	(SLICK 4OZ) REQUEST GLIDE SLOPE POSITION FOR FORTY ZULU.
109.5 mcs.	1206:15	SAY AGAIN.
109.5 mcs.	1206:17	SLICK FOUR ZERO ZULU SEVENTY FIVE FEET ABOVE GLIDEPATH A MILE AND A HALF FROM TOUCHDOWN AND ONE HUNDRED FEET RIGHT OF COURSE.
109.5 mcs.	1206·26	RUNWAY TWO EIGHT RIGHT VISUAL RANGE TWO THOUSAND SIX HUNDRED.
109.5 mcs.	1206·36	SLICK FOUR ZERO ZULU IS A HUNDRED FIFTY FEET LEFT OF COURSE PASSING THE MIDDLE MARKER FIFTY FEET ABOVE TWENTY FIVE FEET ABOVE GLIDEPATH.

No additional radar advisories appear on any of the communications recordings after the flight had passed the middle marker.

The PAR controller did not attempt to contact the flight after it passed the middle marker; however, he said he continued to monitor the aircraft's position and did not observe the aircraft's radar target leave the glide slope at any time until he observed the aircraft target climb to about 200 feet in a slight left turn when in the vicinity of the approach end of the runway. He then notified the coordinator that Slick 4OZ was making what appeared to be a missed approach.

At about 1207, a loud sound was heard by controllers in the tower cab and approximately 10 seconds later the aircraft was observed as it slid, out of the fog bank, on fire. It came to rest at the southeast corner of the intersection of runways 28L and 1R. The local controller recorded the time of the accident on the 120.5 mcs. tape as 1207:30

An intense fire engulfed the aircraft and the cockpit filled with smoke. Three passengers and the flight engineer escaped. One passenger could not recall how he exited. The other two and the flight engineer went out the right crew entrance door, although it could not be raised more than 12 to 14 inches because of jamming by the opened smoke removal window. This smoke removal window had been opened by the flight engineer before the door was raised. Attempts by firemen to open this crew door further and the left front cargo door from the outside were unsuccessful. The captain, copilot and two passengers died of thermal burns and smoke inhalation.

Initial impact of the aircraft was made upon the approach light structure 1,170 feet from the threshold of runway 28R, approximately 11 seconds after passing the middle marker. The threshold of runway 28R is at 13 feet m.s.l. Damage occurred to both main and nose landing gears when they contacted the approach light structure which projects outward along the runway 28R centerline, into the bay a distance of approximately 3,000 feet. These lights are at 18 feet m s.l. in groups or stations at 100-foot intervals, and they are numbered 1 through 30 out from the runway threshold. The aircraft struck approach light stations 11 through 5

The climb angle from the point of last contact with Station 5 to a radar observed point 200 feet above and 950 feet past the runway threshold was 7.5 degrees. From the apex of the ascent to first ground contact the angle was 12.5 degrees. The distance from the middle marker to the ILS touchdown point is 4,716.5 feet. The distance from the initial impact point to the ILS touchdown point is 2,304 feet.

The height of the glide slope is 222.4 feet above field elevation at the middle marker, and 109.3 feet at the initial impact point

The first ground contact was with the left wing tip and No. 1 propeller at a point 350 feet left of the centerline and approximately 1,900 feet from the thresh old center of runway 28R. The aircraft slid an additional 800 feet where it came to rest on the east side of runway 1R and to the south edge of runway 28L. Ground impact damage to the fuselage was confined to the underside from the nose aft to about fuselage station 1000.

Orange paint smears, similar in color to that appearing on the approach light structure, were present in a puncture area at the midspan of the right horizontal stabilizer and on the nose gear shock strut.

The investigation revealed no evidence of failure in the propellers or engin The propeller impact blade angles were a minimum of 15 degrees positive on Nos. 1 2, and 3 propellers. The No. 4 propeller had a minimum impact blade angle of 21 degrees positive. The Nos. 1, 2, 3, and 4 propeller governors had engine r.p.m. settings of 2393, 2507, 2375, and 2364, respectively. The flight engineer's testi mony reflected normal operation of the propellers and engines prior to initial im pact with the approach light structure.

The nose gear assembly was found in the down and locked position, but the en tire assembly had been forced rearward, as a unit, into the fuselage. The upper drag struts were found penetrating the flight deck flooring near the flight engineer's station. Flight control, trim tab, and engine control cables in this area were found either severed or pinched. Hydraulic lines in the same area were seve by the penetration, and evidence of intense arcing was found at the nose gear wel electrical junction box. Both tires of the nose gear assembly were cut and torn. The nose gear sliding door was located in the water at the base of the No. 3 approach light station, which is 270 feet from the runway threshold.

The entire left main landing gear assembly was found separated from the aircraft. However, the tires remained inflated and received no extensive cutting. The right main landing gear assembly had collapsed rearward, causing the tires to protrude through the upper wing surface. Impact damage was confined to the tires which were severely gashed. Both main gear downlock mechanisms indicated the gear were extended and locked at initial impact.

The flaps were found in the approach or 66 percent setting with no indicatio of an asymmetrical condition

The flight engineer testified that during the approach, he heard the copilot tell the pilot that " . . he was right on." He also recalled the copilot saying that lights were in sight to the right and that he believed the captain made a slight correction to the right as a result of the statement. The flight engineer stated further that the throttles were retarded and he thought the airplane was in good position to land just before he felt the initial impact.

The San Francisco International Airport was below landing weather minimums fo several hours prior to the accident because of ground fog. The first approach to 28R was commenced at 1140 following weather improvement. The aircraft, a Lockheed Electra, abandoned its approach to runway 28R at 1152 due to fog, circled the fie

and landed on runway 1R The next aircraft, a Boeing jet, abandoned an approach to runway 28R at 1159 due to fog and eventually landed at another airport. The third aircraft, a Convair 340, which immediately preceded Slick 40Z, landed on runway 28R at 1202. Each of the crew members of these flights agrees that the approach light system (ALS) was operating, but none could recall seeing the sequence flashing lights (SFL), nor could they state that they were operating The local controller in the San Francisco Tower stated that the runway lights and the ALS light switches were on position No. 5 full up and the SFL switch was on.

To guard against an undetected malfunction of the ALS/SFL system, the control panel in the tower cab has an alarm feature to indicate a failure of the system. This alarm contains a buzzer which sounds when there is an interruption in power or failure of a given number of lights The volume of this buzzer is controlled by a rheostat which can be controlled from the tower cab. The buzzer can be turned down to a point where no sound can be heard. None of the tower controllers recall hearing the buzzer immediately prior to, during, or subsequent to the time Slick 40Z was making its approach. The lights were found to be inoperative 3 hours and 20 minutes after the accident occurred.

A flight check of the ILS at the San Francisco International Airport was made by the FAA on February 3, 1963, as a result of the accident. The facility performance was satisfactory.

All the weather observing equipment at San Francisco International Airport was in operational order at the time of the accident. There were two methods of obtaining the official visibility at San Francisco International Airport for determining landing minimums of an aircraft operating under Part 42 of the Civil Air Regulations: Prevailing visibility and RVR.

Prevailing visibility is the greatest visibility which is attained or surpassed throughout half of the horizon circle, not necessarily continuous. To determine prevailing visibility under non-uniform visibility conditions, the horizon circle is divided into several sectors of equal size in each of which the visibility is substantially uniform. The prevailing visibility is then the highest value that is equal to or less than the visibility of sectors that cover at least one-half of the horizon circle. The prevailing visibility at 1155 and 1208 was reported as 3/4 mile over half of the horizon circle and more specifically to the east or toward the threshold of runway 28R.

Runway 28R at San Francisco International Airport is equipped with RVR. The equipment used in this system includes a transmissometer, a digital display, and a recorder which charts the transmissivity of the atmosphere. The transmissometer of the San Francisco RVR system is located parallel to runway 28R; the projector is 1,500 feet from the threshold, and the receiver is 500 feet further west. The initial impact point was 2,570 feet east of the projector.

The applicable minimums for a straight-in approach to runway 28R at San Francisco International Airport are 200 feet ceiling and 1/2 mile visibility provided all components of the ILS installation and related airborne equipment are operating satisfactorily The Operations Specifications for Slick Airways specify that a landing may be made at an airport when the local visibility is reduced to not less than 1/2 mile by purely surface weather conditions such as smoke, haze, dust, ground fog, blowing snow or sand, provided the ceiling is not less than 1,000 feet, the aircraft is aligned with the runway of intended landing before entering the local surface visibility conditions, and the runway of intended landing is plainly visible allowing the pilot to have adequate visual reference to the line of forward motion at all times during final approach and landing.

Other than by pilot reports, there was no way to determine the visibility within the fog bank extending out over the approach light system for runway 28R. No pilot reports were given during the 15-minute period preceding the accident.

The service to be provided by a PAR controller in a radar monitored ILS approach is set forth in the FAA Air Traffic Procedures Manual.3/ It states that:

"Instrument approaches . . shall be monitored and radar advisories shall be furnished whenever the reported weather is below basic VFR minima. Such advisories shall be issued in accordance with the following.

"B. Pilots shall be notified immediately whenever radar observation reveals a situation which, in judgment of the controller, is likely to affect the safety of the flight;

"C. Flight making an approach shall be advised . . .

2. Of the distance from touchdown each mile on final . . . ."

"E. Regardless of the type of approach being monitored, advisories shall be terminated and the pilot so advised when:

1. The pilot reports the approach lights or runway in sight, or

2. The Controller observes the aircraft to have reached the position when the azimuth safety zone lines terminate, whichever is earlier. If the pilot does not make such report upon reaching the position where the azimuth safety zone lines terminate, the flight shall be monitored to the approach end of the runway and advisories issued in accordance with B above."

On the PAR scopes in use at the San Francisco International Airport facility at the time of the accident, the safety zone lines terminated at the ILS middle marker.

The controller testified that a deviation of at least 25 feet from the glide slope would be noticeable on the 3-mile radar scope and further that " . . . if aircraft made a steep descent at the middle marker I would consider that a hazardous condition." He stated further that he had monitored the aircraft throughout the approach and did not observe the target deviate below the glide slope after passing the middle marker.

The provisions of Special Civil Air Regulation No. 445 stipulate that the p in command of aircraft being operated in controlled airspace under instrument fl rules must report immediately any in-flight malfunctions of navigation or commun tions equipment to Air Traffic Control.

Analysis

The ILS glide slope receiver was known to be inoperative at the time of departure from Albuquerque. It could not be determined if this was a result of th previous in-flight malfunctions or because of mishandling during the troubleshoo process at Albuquerque.

3/ AT P 7110.1A Paragraph 345.2.

From the San Francisco terminal forecast, the crew could have expected VFR weather conditions for the arrival and would not necessarily be anticipating an instrument approach.

Since the flight had 3,750 pounds of revenue freight aboard, Slick 40Z was a Part 42 operation from Albuquerque to San Francisco and not a ferry flight.

The flight to the San Francisco area was conducted in VFR weather conditions. However, as early as 1038, when the aircraft reported to the Paso Robles Flight Service Station, the flight was advised of the instrument weather conditions at San Francisco.

Following arrival at the Mt. Hamilton Intersection at 1053, the crew canceled the VFR flight plan and was given the San Francisco forecast. The flight advised it would hold in the San Jose area and maintain VFR. At no time did they inform ATC personnel of its inoperative glide slope receiver or that the flight would be dependent solely on radar advisories for glide slope information, nor was any request made for a different type of approach.

Although on two occasions the crew of Slick 40Z was made aware of the above minimum weather existing at the Oakland International Airport, it is apparent that they intended to wait until the weather improved at San Francisco rather than land at another airport. This decision may have been influenced by the facts that San Francisco International Airport was the Slick maintenance base, and arrangements had been made to off-load the two missile motors at San Francisco International Airport.

Up to the time that the flight received clearance for an ILS approach, the air traffic services provided Slick 40Z were routine and in accordance with standard procedures.

At 1204, Slick 40Z began its final approach to runway 28R. Because of the low visibility, radar monitoring of the ILS approach was required by ATC procedures. This service was being provided by the San Francisco Precision Approach Radar Controller.

The crew of Slick 40Z made a request for radar advisories which was acknowledged by the local controller as "Radar advisories on localizer voice." This acknowledgement indicates that the air traffic control facility was aware of the crew's desire for radar advisories on the approach. During the approach to the middle marker, Slick 40Z was initially high on the glide slope and to the right of the localizer course, as indicated by the advisories given the flight. At one point in the approach, the local controller advised the flight of a fog bank on the approach end of runway 28 or 28L which extended to a point where runway 1R crossed. The last advisory given the flight placed it 100 feet left of course passing the middle marker and 25 feet above the glidepath.

The advisory service provided Slick 40Z was not in accordance with the procedures for this type of an approach which prescribed that the flight "shall" be advised of the distance from the touchdown each mile on final. On this particular approach, five radar advisories should have been given, one for each mile en route to the runway. In this case, only two radar advisories given the flight contained the distance from the touchdown point. Further, the procedures state that if during an ILS approach, the pilot fails to report the runway approach lights or runway in sight, the PAR controller shall advise the pilot that radar advisories are being terminated when the aircraft reaches the point where the azimuth safety zone lines terminate or, in this

instance, at the middle marker. The controller shall then continue to monitor the aircraft's position and so advise the pilot whenever a radar observation reveals a situation which, in the judgment of the controller, is likely to affect the safety of the flight.

The transcript of communications of the PAR controller and Slick 40Z discloses that the flight did not report having the approach lights or runway in sight and that the PAR controller failed to advise the flight that radar advisories were being terminated.

The aircraft first struck the approach lights at a point which was 109.3 feet below the glide slope and 1,100 feet from the end of the runway Had the controller been monitoring the approach as he stated, he should have observed the aircraft's dangerous descent below the glide slope and should have advised the crew. Therefore it can only be concluded that he failed to monitor the flight during that portion of the approach from the middle marker to the point of contact with the approach light, an estimated 11 seconds

It is apparent that the flight continued to descent following passage of the middle marker and was following the approach lights while entering a condition of restricted local surface visibility. Although the aircraft was aligned with the runway of intended landing, the crew did not have adequate visual reference during this phase of the approach due to the fog condition and permitted the aircraft to descend into the approach lights.

Another factor which may have contributed to the accident was the possible loss of functioning sequence flashing lights. From 1140, when weather improved sufficiently along runway 28R for additional approaches, until 1207, the time of the accident, three air carrier aircraft made instrument approaches to runway 28R. The crews of these aircraft reported that the high intensity lights of the ALS were lighted, but none remembered seeing the SFL in operation. When Slick 40Z struck the approach lights at 1207, substantial damage to the lights occurred and the entire light system went out. This should have activated the alarm on the control panel in the tower cab, but investigation revealed that the warning buzzer was not heard by controller personnel in the tower. Tower personnel were not aware of the malfunction of the ALS/SFL System until approximately 3 hours and 20 minutes after the accident, at which time they were notified by an FAA technician that the ALS had been damaged and was inoperative. FAA personnel who checked the ALS/SFL System after the accident established that no malfunction was found in the alarm system. The Board believes that the outages of the ALS/SFL System were not discovered by tower personnel because the buzzer was turned too low; hence, a failure of the system prior to the time of the accident would have been undetected for the same reason.

The pattern of heavy damage inflicted by the main and nose landing gears when the aircraft struck the approach lights corresponds to an aircraft bank angle of about 3 degrees right wing down at a nearly nose level attitude. The fracture angle of the nose gear sliding door to the nose gear strut fairing attachment hinge bearing indicates a rearward movement of the nose gear strut to at least 35 to 40 degrees from the vertical. Since the strut, in its down and locked position, has a forward rake of 12 degrees, the total rotation of the strut was 47 to 52 degrees. This amount of rotation was sufficient to penetrate the flight deck flooring, causing substantial damage to the control cables and hydraulic lines which are routed through this area. Therefore, it is concluded that following initial impact with the approach lights, the airplane was no longer fully controllable.

It was disclosed that the passengers had not been briefed regarding emergency evacuation of the aircraft and that only two of the survivors were familiar with the location of the emergency exits or how they operated. Three of the four survivors, one a flight crew member, managed to exit through the crew entrance door which, because of incorrect emergency procedures, could only be raised a few inches from the flight deck. One survivor is believed to have exited through the aft right emergency window exit. One of the survivors stated that he saw one victim attempting to kick a window out in an effort to evacuate the aircraft. Although a briefing was not required, it is believed that had all personnel aboard had adequate knowledge of emergency evacuation procedures, additional lives might have been saved and the injuries sustained by the survivors would have been of a less serious nature.

It is realized that no in-flight radio navigation malfunction occurred during the portion of the flight conducted under instrument flight rules and that the provisions of SR-445 were not applicable to this flight However, had the crew of Slick 40Z notified ATC personnel of the known glide slope receiver outage, it is believed that the maximum amount of assistance consistent with the equipment at the controller's disposal would have been provided.

Probable Cause

The Board determines the probable cause of this accident was the continuation of an instrument approach after adequate visual reference was lost below authorized minimums. Inadequate monitoring of the instrument approach by the PAR controller was a contributing factor.

BY THE CIVIL AERONAUTICS BOARD:

/s/ ALAN S. BOYD
Chairman

/s/ ROBERT T. MURPHY
Vice Chairman

/s/ G. JOSEPH MINETTI
Member

/s/ WHITNEY GILLILLAND
Member

CHAN GURNEY, Member, did not take part in the adoption of this report.

SUPPLEMENTAL DATA

Investigation

The Civil Aeronautics Board was notified of this accident at 1215 on February 3, 1963. Civil Aeronautics Board investigators were immediately dispatched to the scene and an investigation was conducted in accordance with the provisions of Title VII of the Federal Aviation Act of 1958, as amended. A public hearing was ordered by the Board and held at the Sir Francis Drake Hotel, San Francisco, California, March 20-22, 1963.

Air Carrier

Slick Airways is an operating division of The Slick Corporation. The corporate charter is issued by the State of Delaware, and the Civil Aeronautics Board has issued to The Slick Corporation (Slick Airways) an indefinite certificate of public convenience and necessity to operate U. S. Air Freight Route 101. It also holds an FAA air carrier operating certificate.

Flight Personnel

Captain Richard A. MacCallum, age 42, was employed by Slick Airways on July 15, 1946. He held an airline transport pilot rating No. 410656 with airplane multiengine land rating. He was rated in the Curtiss-Wright C-46, Douglas DC-3, DC-4, DC-6/7, and the Lockheed Constellation with commercial privileges in the Lockheed 18 and Douglas B-23. His first-class medical certificate was issued on November 13, 1962, with no limitations. He had a total of approximately 18,000 hours, 6,800 night hours, 368 instrument hours, and 882:31 captain hours in the Lockheed 1049H. Within the 90 days prior to the accident, he had flown 212 hours, which included 131 night hours, 6:30 instrument hours, and 154 hours in the Lockheed 1049H.

He received an FAA check in L-1049H aircraft on November 15, 1961, and his initial L-1049H company line check on November 17, 1961. His last L-1049H check was July 4, 1962, and his last instrument check was on January 10, 1963. He completed 20 hours of Recurrent Ground School Training School in the L-1049H on December 21, 1962.

First Officer William H. Coryell, age 48, was employed by Slick Airways on June 1, 1947. He held an airline transport pilot rating No. 39825 with airplane multiengine ratings. He was rated in the Curtiss-Wright C-46, Douglas DC-4, DC-6/7, Lockheed Constellation, and had commercial privileges in airplane single engine land airplanes. He was issued a first-class medical certificate on December 7, 1962, with no limitations. His total time was approximately 18,600 hours, 8,365 night hours, 200 instrument hours as of 1949, and 232 hours in the L-1049H. Within the 90 days prior to the accident, he had flown 232 hours in the L-1049H and at least 60 hours of night time.

First Officer Coryell was rated captain in Lockheed L-749s on April 11, 1961, while working for Paramount Airlines. He was given a 24-hour Difference Course L-749 to L-1049H by Slick Airways on October 31, 1962. He was given a company L-1049H flight check on November 2, 1962, and a company line check in L-1049H on November 30, 1962.

Flight Engineer John J. Walik, age 41, was employed by Slick Airways on Septem-ber 9, 1961. He holds a flight engineer certificate No. 1383484. He was issued a class II medical certificate on January 9, 1963, with no limitations. Mr. Walik has

a total of approximately 4,000 hours as a flight engineer, of which 700 are in th L-1049H. In the 90 days prior to this accident he flew 142 hours, of which 113 w in the L-1049H.

He was rated as a flight engineer on August 16, 1957, and qualified in L-104 on April 23, 1962. He received his company line check on April 26, 1962, and Recurrent Ground School in the L-1049H on January 8, 1963.

Aircraft

Lockheed 1049H, serial No 4851, was purchased by Trans Canada Airlines on December 13, 1958, from the manufacturer, Lockheed Aircraft Corporation. Califor Airmotive of Burbank, California, purchased the aircraft from Trans Canada Airlin on August 8, 1962. The aircraft was then designated as N 9740Z

Tracy Lease and Finance Corporation of 901 Hillsborough Boulevard, Hillsboro California, purchased the aircraft from California Airmotive of Burbank. Slick A ways of San Francisco leased the aircraft on October 16, 1962.

Slick Airways operated the aircraft under their Part 42 certificate for a to of 683:28 hours prior to the accident Total air time prior to the accident was 4,257.52 hours.

The powerplants were Wright Aeronautical Division Model 988TC18 with Hamilto Standard propellers, model 43H60-331.

Investigation revealed that compliance with all applicable directives on the airplane engines and components was current.