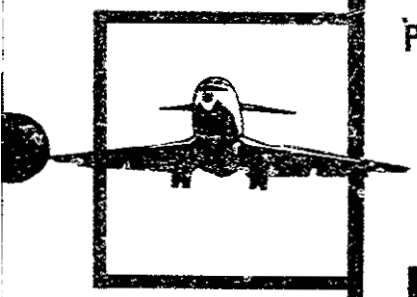

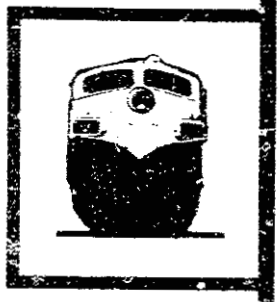

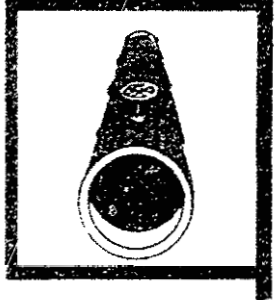

PB84-910405

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

LAS VEGAS AIRLINES FLIGHT 88
PIPER PA-31-350
GRAND CANYON, ARIZONA
AUGUST 17, 1983

NTSB/AAR-84/05

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

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15. Supplementary Notes

16. Abstract On August 17, 1983, Las **Vegas** Airlines Flight 88, a Piper **PA-31-350,** N88LV, **was** being operated as a scheduled Grand Canyon sightseeing flight from Las Vegas, Nevada, to Tusayan, Arizona. About 1142 p.s.t., Las Vegas 88 departed North Las Vegas Airport as the second of five Las Vegas Airlines airplanes flying to Grand Canyon National Park Airport. The first portion of the flight over the Las Vegas Strip and Lake Mead was uneventful; however, weather conditions precluded the pilot of Las Vegas 88 from flying over the Shivwits Plateau under visual conditions as normally done, so he flew into the west end of the Grand Canyon at 5,000 feet. Radio conversations between the pilot and other company pilots indicated that Las Vegas 88 encountered deteriorating weather conditions in the Canyon and that the pilot had decided to abort the flight and climb out. Later attempts to contact Las Vegas 88 were fruitless. The wreckage was found on August 18, 1983, by company pilots on the west wall of a mesa inside the Canyon. The airplane was destroyed by impact and by posrimpact fire. The pilot and all nine passengers were killed.

The National Transportation Safety Board determines that the probable cause of this accident was the pilot's failure to maintain adequate visual flight references to positively identify his position while flying below the rim of the Grand Canyon which resulted in his selection of an inappropriate flightpath snd consequent collision with the terrain during an attempt to climb the airplane in instrument meteorological conditions to a ssfe altitude above the rim of the canyon.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

AVIATION ACCIDENT REPORT

Adopted: May 15, 1984

LAS VEGAS AIRLINES,
N88LV, PIPER PA-31-350,
GRAND CANYON, ARIZONA
AUGUST 17, 1983

SYNOPSIS

On August 17, 1983. Las Vegas Airlines Flight 88, a Piper PA-31-350, N88LV, was being operated as a scheduled Grand Canyon sightseeing flight from Las Vegas, Necaoa, to Tusayan, Arizona. About 1142 p.s.t., Las Vegas 88 departed North Las Vegas Airport as the second of five Las Vegas Airlines airplanes flying to Grand Canyon National Park Airport. The first portion of the flight over the Las Vegas Strip and Lake Mead was uneventful; however: weather conditions precluded the pilot of Las Vegas 88 from flying over the Shivwits Plateau under visual conditions as normally done, so he flew into the west end of the Grand Canyon at 5,000 feet. Radio conversations between the pilot and other company pilots indicated that Las Vegas 88 encountered deteriorating weather conditions in the Canyon and that the pilot had decided to abort the flight and climb out. Later attempts to contact Las Vegas 88 were fruitless. The wreckage was found on the west wall of a mesa inside the Canyon on August 18, 1983, by company pilots. The airplane was destroyed by impact and by postimpact fire. The pilot and all nine passengers were killed.

The National Transportation Safety Board determines that the probable cause of this accident was the pilot's failure to maintsin adequate visual flight references io positively identify his position while *flying* below the rim of the Grand Canyon which resulted in nis selection of an inappropriate flightpath and subsequent collision with the terrain during an attempt to climb in instrument meteorological conditions to a safe altitude above the rim of the Canyon.

1. FACTUAL INFORMATION

1.1 History of *the* Flight

On August 17, 1983, Piper PA-31-350, N88LV (Las Vegas 88) was being operated by Las Vegas Airlines as one of five Las Vegas Airlines airplanes to depart North Las Vegas Airport to conduct sightseeing tours of the Grand Canyon. The pilot of Las Vegas 33, the first airplane, a single-engine Piper PA-32 Lance, indicated that he departed North Las Vegas Airport on schedule at 1133 p.s.t. 1/ The pilot of Las Vegas 88 called for taxi instrcctions at 1135 and for takeoff clearance at 1141. The flight was cleared for takeoff, and, *at* 1142, Las Vegas 88 departed runway 7 with the pilot and nine passengers, all Italian nationals, aboard.

1/ All times are Pacific daylight saving time based on the 24-hour clock unless otherwise noted.

At 1143, the pilot of Las Vegas 88 contacted departure control, 2/ and after clearing the TCA at 1148, he contacted the Las Vegas Flight Service Station (FSS) to activate a pre-filed visual flight rules (VFR) flight plan as follows:

Las Vegas 88
1148:37 Vegas Eighty Eight to open a one way flight plan to the Grand Canyon, Gustafson, ten souls on board, airborne at four three.

FSS
1148:47 Las Vegas Eighty Eight, flight plan activated and he advised, sir, there has been a convective SIGMET issued now for Arizona, basically from Needles to Prescott southbound to sixty miles southeast, correction, sixty miles east of Prescott, areas of embedded thunderstorms moving from the south at one five knots, maximum tops three eight thousand feet, cells will move northwesterly at one five kncts, Air Cortez just departed a few minutes ago and they were unable to maintain VFR conditions below clouds, they broke up at, correction, they broke out at one one thousand five hundred feet and that position where they broke out was six zero miles east of the Las Vegas area sir.

Las Vegas 88
1149:30 Thank you very much.

Las Vegas 88 proceeded en route and the pilot made no further contact with any other ATC facility or supporting facility.

The third flight, Las Vegas 19, a PA-31-350 airplane, departed at 1145, followed at intervals of about 20 to 25 minutes by Las Vegas 77 and Las Vegas 22, both also twin-engine PA-31 airplanes.

Las Vegas Airlines flights are normally conducted under visual flight rules (VFR). The preferred tour itinerary was to fly south over the Las Vegas strip, then easterly over the Hoover Dam, over Lake Mead, over the Shivwits Plateau, over the Grand Canyon rim, and along the Colorado River to the Grand Canyon National Park Airport, Tusayan, Arizona. From the east end of Lake Mead, the airplanes were to fly easterly at appropriate visual altitudes over the Shivwits Plateau and then descend into the Grand Canyon at a point about 65 miles west of the Grand Canyon Airport. (See figure 1.) The flight routes are not fixed since the pilots may have to deviate to maintain visual meteorological conditions (VMC). In this area: the width of the Canyon varies from about 4 to 15 miles and the elevation of the rim varies from about 6,300 to 8,000 feet. 3/ The return flights were to be made at higher altitudes (10,000 feet or above) direct from Grand Canyon Airport to North Las Vegas Airport.

2/ The Las Vegas terminal area is designated as a Group II Terminal Control Area (TCA) and all flights departing North Las Vegas Airport are required to contact departure control and are assigned coded departure (and arrival) routes, dependent on the runway in use at McCarran Airport which is 9 miles south of the North Las Vegas Airport. Pilots using these coded departure and arrival routes must operate in VFR conditions at all times and must inform approach control if weather conditions preclude the continuation of a flight. Radar service is automatically terminated when a departing aircraft leaves the TCA.

3/ All altitudes are mean sea level, unless otherwise noted.

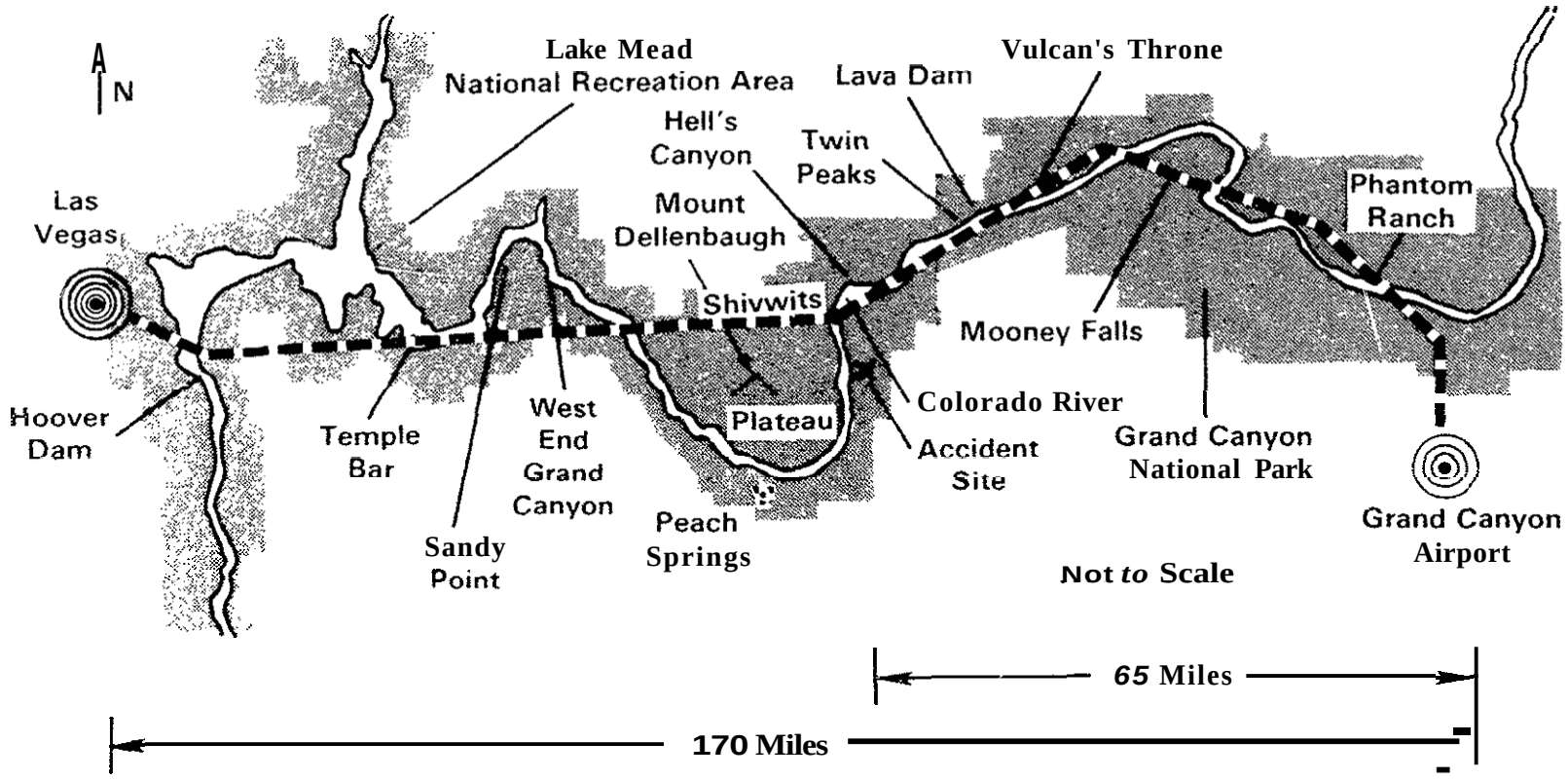

Figure 1. —Sightseeing route.

Las Vegas Airlines pilots and all other commercial pilots communicate with each other while flying Grand Canyon sightseeing tours from Las Vegas to Grand Canyon Airport on discrete frequency **123.05** MHz before entering the Canyon, and on discrete frequency 122.75 MHz for the remainder of the route. The pilots communicate with each other on **123.05** MHz for the entire route from Grand Canyon Airport. Consequently, all flights at appropriate visual altitudes are on one frequency and those flights in the Grand Canyon are on another. Communications concern airplane position, weather conditions, tour information, and other operational information.

The pilot of Las Vegas **33** stated that Las Vegas 88 passed **2** miles to the right of and about 1,000 feet above his airplane just east of Temple Bar, Arizona (the Piper **PA-31** has a higher cruise speed). The pilots of Las Vegas **33,** Las Vegas 88, and Las Vegas 19 communicated among each other en route on the appropriate discrete frequency concerning the weather and possible routing. Las Vegas 88 called over Sandy Point, Arizona, and stated that he was proceeding north to avoid a rain shower, which was located just south of the west end of the Grand Canyon. Shortly thereafter, Las Vegas 88 reported that he was entering the Canyon west of the Shivwits Plateau. This transmission was followed by a communications exchange between Las Vegas **33** and Las Vegas 88 regarding whether or not they could proceed across the south end of the Shivwits Plateau. Las Vegas 88 reported that the weather looked bad to the north (on the Shivwits) and that he was heading south to the Colorado River. Las Vegas 88 began calling radials off the Peach Springs VORTAC while flying at 5,000 feet. The pilot of Las Vegas **33** recalled hearing the 340° radial. The pilot of Las Vegas 19 later estimated that the radials called by the pilot *of* Las Vegas 88 would have placed the airplane in the canyon between Peach Springs and Mount Dellenbaugh. Then, the other pilots heard the pilot of Las Vegas 88 transmit that he was just short of Twin Peaks, but that he could not see them yet. The last transmission from Las Vegas 88 that was overheard by other Las Vegas pilots was "Its getting too bad in here, I'm getting out." Las Vegas **33** attempted twice to contact Las Vegas 88 lo suggest that Las Vegas 88 proceed north of Mt. Dellenbaugh. However, there was no response to either call.

When the pilot of Las Vegas 88 reported that he was entering the Canyon, the pilot of Las Vegas [redacted] stated that he decided not to enter the Canyon in the single engine airplane and that he turned back to the west. He then climbed northwest over the Shivwits Plzteau, where the weather was better, and then east, proceeding north of Mt. Dellenbaugh at 9,500 feet. He then headed southeast and descended into the Canyon just west of Lava Dam Rapids and continued the tour.

The pilot of Las Vegas 19 indicated that he heard a radio conversation between the piiots of Las Vegas **33** and Las Vegas 88 in which they discussed the weather north on the Shivwits and that he decided to fly into the Canyon. He heard the pilot of Las Vegas 88 call the Peach Springs radials and then state that he was in the area of Twin Peaks and climbing out. At this time, Las Vegas 19 was flying north in the Canyon south of Twin Peaks, ahead of Las Vegas 88, and the pilot stated that the cloud cover ahead precluded visual flight so he climbed in VMC between layers to 9,000 feet and flew east about 10 miles before reentering the canyon east of Twin Peaks. He was then able to complete the Grand Canyon tour.

Las Vegas 77 and Las Vegas 22 completed their sightseeing trips in VMC by flying over the Shivwits Plateau north of Mt. Dellenbaugh.

Las Vegas 82 crashed about 1227 during daylight hours at coordinates 36°59'50" N. latitude and 113°17'15" W. longitude at **an** altitude of **6,320** feet. The next day, about 1200, two company pilots flying a search mission *in* Las Vegas 48 found the wreckage of Las Vegas 88 on the west side of a mesa inside the Grand Canyon.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others	Total
Fatal	1	9	0	10
Serious	0	0	0	0
Minor/None	0	0	0	0
Total	1	9	0	10

13 Damage to Airplane

The airplane was destroyed by impact forces and the postaccident ground fire.

14 Other Damage

None.

15 Personnel Information

The pilot was certificated and qualified for the flight. (See appendix B.) At the time of the accident, the pilot had been on duty for 2.25 hours and had flown for about 45 minutes. Before reporting for duty on August 17, he had been off duty since 1700 the day before. He had flown 5.3 hours on August 16, 1983, and 1.8 hours on August 15, 1983. Other company pilots stated that he appeared well rested and acted normal before the flight.

Pilots employed by Las Vegas Airlines, Inc., are paid per flight based on a varying scale dependent upon the type of flight. Pilots report for duty at least 1 hour before scheduled departure time; they review the airplane records, obtain a passenger manifest, calculate weight and balance based upon passenger load, pick up the appropriate language tape for the tour, obtain weather information if required, then, escort and board the passengers on the airplane at the appropriate time. Pilots are required to enter the time they report for duty on the completed weight and balance form and to sign the following statement-.

> I certify that I have had 10 hours of rest and will not exceed 8 hours of Commercial flying during the 24 hours preceding the planned completion of this assignment.

The pilot of Las Vegas 88 had signed the form.

1.6 Aircraft Information

The aircraft was certificated, equipped, and maintained in accordance with Federal Aviation Administration (FAA) requirements. (See appendix C.) The gross weight and center of gravity (c.g.) were within prescribed limits. At takeoff, 110 gallons of fuel were onboard the airplane; on the basis of probable fuel consumption about 70 gallons remained at the time of the accident.

A review of the maintenance records for Las Vegas 88 disclosed that the pilot's and copilot's altimeters were replaced on August 15, 1983. The work was accomplished in compliance with the 24-month altimeter inspection as required by 14 CFR 91.170. Both altimeters were functionally tested and certified to 35,000 feet by Hughes Aviation Services, Las Vegas, Nevada, on August 8, 1983. During the inspection,

the transponder encoder also was replaced. The encoder was functionally tested and certified to 25,000 feet by Hughes Aviation Services on July 25, 1983. Both altimeters were pressure tested after installation; however, the encoder was not calibrated with the transponder before the accident. flight. Although this failure to calibrate would not affect the accuracy of the pilot's altimeter, Las Vegas Airlines operating procedures require that the encoder be calibrated before the airplane is used for instrument flight. Calibration Of the encoder is required for instrument operation in controlied airspace.

1.7 Meteorological Information

The hourly surface weathei observations for Grand Canyon National Park Airport (GCN), 64 miles east of the accident site, and for McCarran International Airport, Las Vegas, Nevada (LAS), 105 miles west of the accident site on the day of the accident were, in part:

LAS Time--1150; type--record special; clouds--500 feet scattered, ceiling estimated 1,500 feet broken, 4,000 feet overcast; visibility—4 miles; tower visibility--2 1/2 miles; weather--light rain showers and fog; temperature--73° F; dewpoint--68° F; wind--140° 4 knots; altimeter--30.03 inches; remarks -- cumulonimbus all quadrants moving north, surface visibility 4 miles, wind variable.

Time--1204; type--special; clouds--500 feet scattered, ceiling estimated 1,500 feet broken, 4,000 feet overcast, visibility--? miles: weather--none; wind--120° 4 knots; altimeter--30.02 inches; remarks—cumulonimbus all quadrants moving north, rain ended 1205.

GCN Time--1145; type--surface aviation; clouds--1,000 feet scattered, ceiling estimated 2,000 feet broken, 10,000 feet overcast: visibility--20 miles; weather--none; temperature--68° F: dewpoint--missing; wind--210° 6 knots; altimeter--30.26 inches: remarks--occasional light rain showers. rain showers intensity unknown all quadrants, occasional lightning cloud to ground northwest.

Time--1245; type--surface aviation; ceiling--estimated 2,000 feet broken, 10,000 fee? overcast: visibility—20 miles; weather—none: temperature—69° F.; dewpoint--missing; wind—calm: altimeter--30.25 inches; remarks--rain showers intensity unknown all quadrants, occasional light rain showers, occasional lightning cloud to ground southeast.

Time—1315; type—special; ceiling—weather 400 feet obscured; visibility-- 1 mile, light rain and fog; wind—230° 5 knots; aitimeter--30.26 inches.

The 1130 radar overlays from the National Weather Service Offices at the Palmdale and Salt Lake City Air Route Traffic Countrol Centers showed two large cloud systems of light rain showers with isolated thunderstorms: one to the south of Las Vegas which extended east, and one immediately west of Las Vegas which extended north. Both systems were observed moving to the norrh at about 10 knots.

The 1230 overlays showed that the two large cloud systems had joined and that the northern edge of the system had moved over the accident site. The precipitation area ccnsirted of light rain shower with a few moderate rain showers.

The following terminal forecasts for Las Vegas and the Grand Canyon were issued at 0840/17 by the National Weather Service Forecast Offices at Keno and Phoenix, respectively, and were valid from 0900/17 to 0900/18.

Las Vegas.

1100: Ceiling 8,000 feet broken. Occasionally ceiling 5,000 feet broken with light rain showers. Chances of ceiling 1,000 feet broken, visibility 2 miles in thunderstorms with light rain showers with wind gusts to 30 knots.

Grand Canyon.

1100: Clouds 5,000 feet scattered, ceiling 10,000 feet broken, scattered variable broken. Chance of ceiling 4,000 feet broken visibility 5 miles in thunderstorms with moderate rain showers or just moderate rain showers, wind gusts to 35 knots til 2200.

The following convective SIGMETs were issued by the National Severe Storms Forecast Center, Kansas City, Missouri:

July 17, 1055
Convective SIGMET 6W
Arizona
From Needles to 60 miles east of Prescott to 50 miles east-northeast of Tucson to Needles.
Area of embedded thunderstorms moving from 170° at 15 knots. Tops to 38,000 feet. Forecast to 1255: Area will move northward at 15 knots through 1255.

July 17, 1155
Convective SIGMET 7W
Arizona
From 20 miles east of Prescott to 80 miles southwest of Saint Johns to 60 miles north of Tucson to 20 miles southwest of Prescott to 20 miles east of Prescott.
Area of embedded thunderstorms moving from 170 degrees to 15 knots. Tops to 38,000 feet. Forecast to 1355: Area will move northward at 15 knots through 1355.

In 1982, the weather at Las Vegas McCarran Airport 4/ was below VFR minimums (1000-foot ceiling and less than 3 miles visibility) for .03 percent of the surface observations, and below marginal VFR (MVFR) minimums 13,000-foot ceiling and 5 miles visibility) for .2 percent of the surface observations. The weather at Pulliam Airport, Flagstaff, Arizona, 5/ was below VFR minimums for 9.5 percent of the observations and below MVFR minimums 17 percent of the observations. The percentages are representative of the existing weather in hours based upon the time that the airport tower is operational. There were no observations at either airport below VFR minimums in the months between April and September. The FAA manager of the Grand Canyon Control Tower 6/ stated that the airport is below VFR minimums about 5 percent of the time, and that it is rarely below VFR minimums in the summer months.

4/ Tower is operated continuously.
5/ Tower is operated from 0600 to 2200 daily.
6/ Tower is operated from 0900 to 1630 - November 1 to March 31, from 0800 to 1530 - April 1 to May 15, from 0700 to 2100 - May 16 to September 30, and from 0830 to 1630 - October 1 to October 31.

The pilot of a U.S. Geodetic Survey contract helicopter stated that he was flying in the Canyon near Hells Canyon, about 14 miles north of the accident site, between 1000 and 1300 on August 17, 1983. He stated that, "The weather. . .around 1000 was about 6000 scattered and rapidly getting worse. About 1230, the weather had diminished from 6000 scattered to 4500 broken to completely overcast looking west and southwest from the Hells Canyon area. Looking west from Hells Canyon, the clouds were literally rolling along at ground level, which was 4,500 feet. The weather seemed *to* be building from the southwest and moving to the northeast. All these altitudes are conservative and fairly accurate."

1.8 Aids to Navigation

There were no reported navigational aids difficulties.

19 Communications

There were no reported communications difficulties

1.10 Aerodrome Information

North Las Vegas Airport and Grand Canyon National Park Airport were fully operational at the time of the accident.

1.11 Flight Recorders

The airplane was not equipped with either a cockpit voice recorder or a flight data recorder, and neither was required.

1.12 Wreckage and Impact Information

The accident site was within the Grand Canyon on the wes? face of a freestanding mesa on the eastern shore side of the Colorado Rive;, about 66 miles/255° from the Grand Canyon Airport. The wreckage came to rest on a narrow, 45° sloped talus ledge about 400 feet below the upper ledge of the southwest rim of the mesa. (See figure 2.) The normal return route of the sightseeing airplanes from Grand Canyon Airport to Las Vegas passes over the area of the eccident site.

Initial impact was in a crevasse in the vertical face of the mesa's wall about 160 feet below the rim. Portions of the forward cockpit/cabin were lodged in the crevasse. Circular marks on the face of the mesa wall corresponded to engine and propeller dimensions, and impact marks indicated that the aircraft struck in a near wings level ettitude on a north-northeasterly heading.

Photographs of the area and the wreckage taken *on* August 20, 1983, frcm a helicopter chartered by the Safety Board showed that the main wreckage fell onto the talus slope about 200 feet below the initial impact point. Loose rocks and the steep grade precluded a landing by the helicopter on the talus slope, but three Safety Board investigation teammembers were able to observe the wreckage closely. Both wings had separated from the fuselage carry-through structure at or near the wing root area. The right wing was resting upside down on top of a pile of wreckage. ?he right main landing gear door appeared flush with the lower surface *of* the wing. The right wing trailing edge flaps were attached to the wing and appeared to be retracted. The left wing lay on a

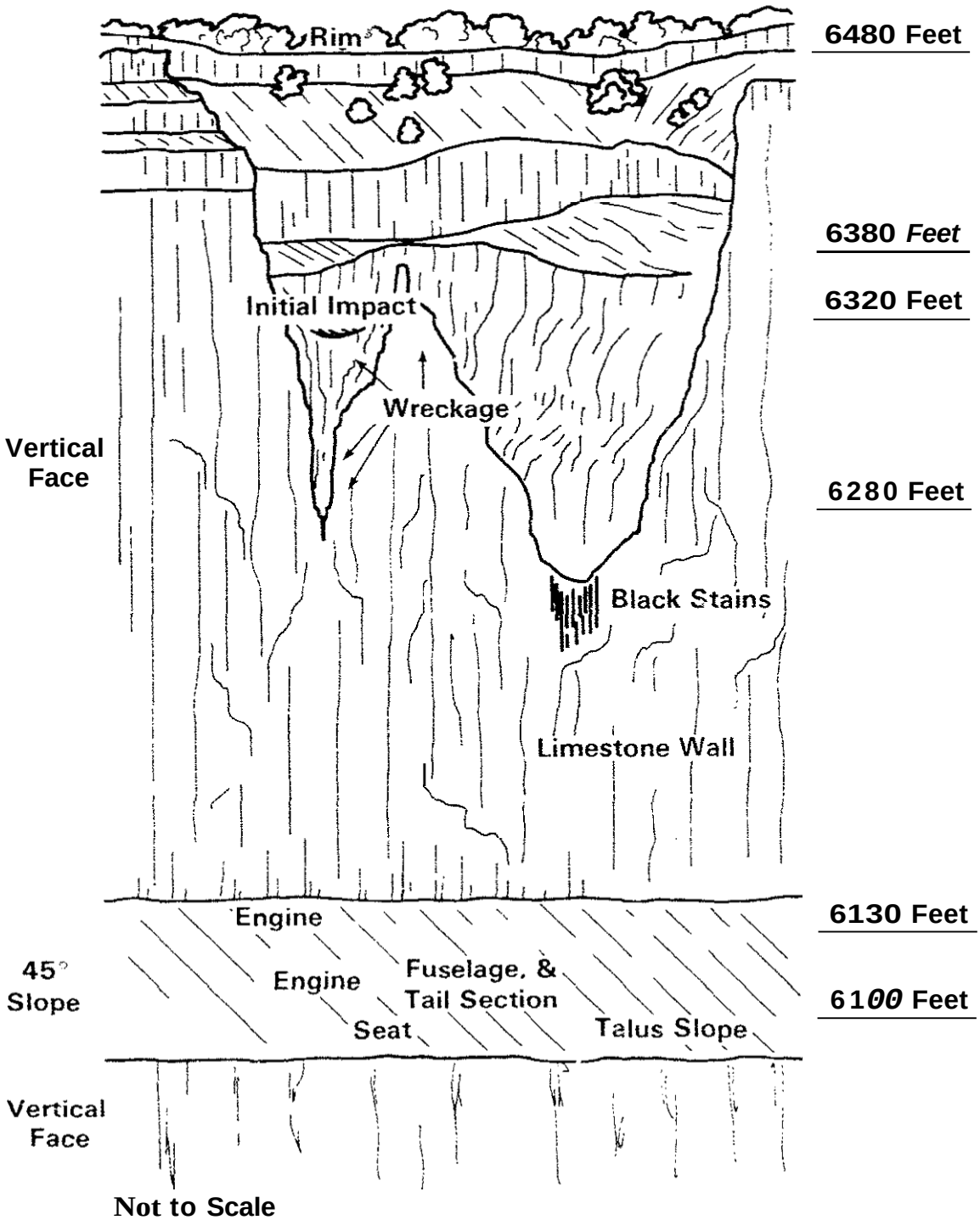

Figure 2.—Wreckage diagram.

bearing of about 315° about 75 feet from the large pile of wreckage. The left wing was broken and structurally deflected upward about 30° near the wing midspan. The rudder remained in place on the vertical fin. An airspeed indicator, found on a ledge about 75 feet below the talus slope, indicated about 170 knots indicated airspeed (KIAS). A vertical speed indicator, found near the eirspeed indicator. indicated an ascending vertical speed of about 2,000 feet per minute.

One propeller blade was recovered; about 6 inches of the tip were missing, the end tip was curled rearward with respecr to the forward plane of propeller rotation, the front face of the blade had heavy circular scratch marks, and the blade's leading edge exhibited deep cuts and gouges transverse to the longitudinal axis of the blade.

1.13 Medical and Pathological Information

Postmortem examination by the Coconino County Medical Examiner on August 23, 1983 revealed that the pilot had sustained extensive multiple traumatic injuries caused by impact. There was no evidence of pre-existing disease. Tissue samples analyzed by the FAA's Civil Aeromedical Institute (CAMI) in Oklahoma City, Oklahoma. were negative for drugs end alconoi. Insufficient hemoglobin in the tissue samples precluded analysis for carbon monoxide.

1.14 Fire

There was no evidence of in-flight fire. However, evidence indicated a postimpact flash fire in the main wreckage.

1.15 Survival Aspects

Impact forces were beyond human tolerances; therefore, the accident was not survivable.

1.16 Tests and Research

1.17 Additional Information

1.17.1 Operational. Authorization and Procedures

Sightseeing flight operations in the Grand Canyon are conducted in uncontrolled airspace. Title 14 CFR 135.205 provides that no person may operate an airplane under VFR in uncontrolled airspace when the ceiling is less than 1,000 feet unless flight visibility is at least 2 miles. Additionally, 14 CFR 135.203 states that except when necessary for takeoff or landing, no person may operate an airplane under VFR--

(1) During the day, below 500 feet above the surface or less than 500 feet horizontally from any obstacle.

Las Vegas Airlines, Inc., is authorized to operate within the continental United States, excluding Alaska, as an on-demand charter service and commuter air carrier service using the authorized categories and classes of aircraft, and operating single engine and multiengine land airplanes under visusl flight rules (VFR) and instrument flight rules (IFR) day and night for the transport of passengers (9 or less) and cargo. In addition to the Grand Canyon sightseeing service, Las Vegas Airlines offers Disneyland Tours and charter service. The company also operates under the name of Las Vegas Piper and offers a full range of fixed base operator services, such as flight instruction, aircraft sales, maintenance, aircraft rentals, and aircraft delivery.

Las Vegas Airlines, Inc., operates its Grand Canyon flights using VFR flight plans which are pre-filed with the Las Vegas FSS. No arrangements have been made for pre-filed IFR flight plans. Occasionally, IFR flights are conducted to the Grand Canyon Airport; however, since the sightseeing purpose of the flight cannot be accomplished in instrument meteorological conditions (IMC), these flights are rare and normally are done to position airplanes and/or passengers. Company pilots have the option of calling approach/departure control or Los Angeles Center for an IFR flight plan when flying a twin-engine airplane if meteorological conditions preclude the continuation of VFR while flying the Grand Canyon route. The airplane must remain in VMC until the flight plan is approved. This option is most often used to obtain approach clearance when instrument conditions occur at the Grand Canyon Airport. Use of the autopilot system is authorized in lieu of a second pilot-in-command, when passengers are carried under IFR or in actual instrument weather conditions, when the pilot has met the proficiency flight check requirements for instrument flight utilizing an autopilot.

When weather conditions may affect VFR sightseeing flights, Las Vegas Airlines procedures require that the president of the company or, in his absence, the chief of aircrev: standarization call the Las Vegas FSS and obtain a weather briefing. Because there are no weather reporting stations in the Canyon, reports and forecasts for stations nearest the Canyon are evaluated. First hand observations obtained from the Grand Canyon Airport are also used. Las Vegas Airlines personnel stated that weather information was posted on an operations bulletin board on August 17, 1983, for the pilot's pre-flight use. Piiots are encouraged to call the Las Vegas FSS for a recorded or personal weather briefing if they have any specific questions about conditions. Weather criteria for cancellation of flights is based on below minimum weather or high winds at either airport or runway conditions (snow) at Grand Canyon Airport.

A review of Las Vegas Airlines records indicated that sightseeing tours were cancelled on 12 days because of weather conditions between January 1981 and March 1984. The exact number of flights involved is not known since the number of airplanes scheduled is adjusted to passenger loads. All of the tour cancellations occurred between the months of October and March. Las Vegas Airlines personnel also stated that if weather conditions warrant, the first airplane, normally a single engine PA-32R, is launched earlier than scheduled to observe actuai weather conditions and to report on alternate flight routes. The first airplane then joins the other airplanes and all the pilots remain in contact with each other.

Las Vegas Airlines personnel indicate that when the Shivwits Plateau is cloud covered, the Canyon and the south rim often are not obscured since they are at a lower elevation. When this condition exists, as it did on the day of the accident, airplanes may fly an alternate route involving entering the west end of the Canyon at Lake Mead and following the Colorado River to the Grand Canyon Airport. The chief of aircrew standardization estimated that the alternate route is used by each pilot 10 to 20 times yearly. He also stated that the lower portion of a rock formation in the Canyon on the north rim of the Shivwits Plateau near the accident site resembles the canyon formation of Twin Peaks.

1.17.2 Scope of Operation

About 250,000 visitors annually use some form of air transportation to visit the Grand Canyon. These visits include flyovers in fixed wing or helicopter aircraft and day or night stopovers. In 1983, about *50,000* passengers flew into Grand Canyon Airport via some 900 air carrier flights and 200,000 passengers flew in on some 33,500 air taxi flights similar to Las Vegas Airlines flights. The frequency of the flights varies

seasonally, with more flights during the tourist season. There are about 90,000 total flight Operations 7/ at Grand Canyon Airport annually. On August 17, 1983, there were 294 operatiens, including 257 air taxi sightseeing operations and 6 aircarrier operations, 18 air taxi instrument operations and 5 air carrier instrument operations.

Operators providing Grand Canyon sightseeing services are primarily based in Las Vegas; however, flights are offered from Phoenix, Arizona, and the basin area of Los Angeles, California. Eight to ten commercial operators in the Las Vegas area offer Canyon sightseeing services. Timing and scheduling of flights are at the discretion of each operator and are dependent on passenger load, positioning of aircraft, personnel available, weather, maintenance capability, and other operational factors. Las Vegas Airlines is one of four operators with more than five airplanes that have advance bookings and published schedules. The schedules are printed in the Official Airline Guide (OAG). However, the flights are *not* flown unless a sufficient number of passengers are booked for the flight. Nearly all Las Vegas Airlines bookings are made through travel agents for foreign visitors and purchased overseas as part of a Las Vegas tourist visit package. Las Vegas Airlines uses modern, air-conditioned buses to transport passengers between their hotels and the operations building at North Las Vegas Airport. The operations building houses the acrivities of the airline and associated businesses. The passenger waiting lounge is clean and well-lit offering comfortable seating, souvenirs, and fast-food machines.

Presently, the company employs nine pilots and utilizes six airplanes (four PA-31-330 and two PA-32 R airplanes) to carry about 19,000 passengers yearly. Some of the larger operators have more airplanes and pilots and carry up to 100,000 passengers yearly.

1.17.3 FAA Surveillance

The FAA's Las Vegas Flight Standards District Office (FSDO) conducts surveillance of Grand Canyon operators in Las Vegas. The office is staffed with twc operations inspectors and one maintenance inspector whose general aviation responsibilities include the Canyon Operators. Each operations or maintenance inspector is responsible for about six to ten air taxi operators.

Surveillance activities governing Part i35 air taxi-commercial operators address maintenance and operations. The maintenance practices of Las Vegas Airlines were in compliance with Part 135, and surveillance did not uncover any outstanding problems or discrepancies. All of the pilots employed by Las Vegas Airlines were retired military pilots who had Air Transport Pilot ratings, which is higher than the commercial pilot's license required for Part i35 operatior.. Each pilot had been given initial checkout. line route end airport checks, and instrument proficiency checks in accordance with applicable regulations. During 1983, Las Vegas Airlines was subject to 1 base inspection, 13 ramp inspections, and 3 flight en route checks. The pilot of Las Vegas 88 was given an en route check on January 10, 1983. None of the inspections revealed any serious discrepancies.

Grand Canyon operators meet yearly at an operational meeting sponsored by the Las Vegas FSDO. Items of mutua! interest and standardization which are discussed at the meeting include radio frequency monitoring, flight altitudes to and from the Canyon, sightseeing points of interest, and selection of preferred rortes.

7/ An aircraft takeoff or landing authorized by an ATC Facility.

1.17.4 Accident History

Since 1977, the Safety Board has investigated three major aircraft accidents involving Grand Canyon/air taxi-charter operators. All of the accidents involved material failure as the primary causal factor.

About 0747, *on* August 30, 1978, Las Vegas Airlines Flight 44, a Piper PA-31-350 (N44LV), crashed in VFR conditions shortly after takeoff from runway 25 at the North Las Vegas Airport, Las Vegas, Nevada. Flight 44 was a charter flight *from* Las Vegas, Nevada, to Santa Ana, California, with nine passengers ana a pilot on board. All 10 persons on board the aircraft were killed. The probable cause of the accident was the backed out elevator down-stop bolt that limited down elevator travel and made it impossible for the pilot to prevent a pitchup ana stall after takeoff. The Safety Board was not able to determine conclusively how the down-stop bolt jam nut locking device came loose and allowed the stop bolt to back out. 8/

About 1352, on November 16, 1979, Nevada Airlines Flight 2504 crashed into a clearing in a heavily wooded area about 1.5 miles north of the departure end of runway 3 at Grand Canyon National Park Airport, Tusayan, Arizona. Flight 2504 was a Grand Canyon sightseeing flight. Of the 44 persons aboard, 10 were injured seriously. The Safety Board determined that *the* probable cause *cf* the accident was the unwanted autofeather of the left propeller just after takeoff and an encounter with turbulence and downdrafts--a combination which exceeded the aircraft's single-engine climb capability which had been degraded by the high density-altitude *and* a turn to avoid en obstacle in the flightpath. Also, the available climb margin was reduced by the rising terrain along the flightpath. The cause(s) for the unwanted autofeather of the left propeller could not be determined. 9/

At 1702, on July 21, 1980, *Scenic* Airlines. Flight 306, a Cessna 404, VFR commuter flight to Phoenix, Arizona, crashed approximately 3 miles south of runway 21 after takeoff from the Grand Canyon National Park Airport, Tusayan, Arizona. The pilot and six of the seven passenger were killed in the accident. One passenger survived the accident but died 5 days later as a result of thermal injuries. The Safety Board determined that the probable cause of *the* accident **was** a substantial loss oi power from the left engine at a eriiieai.point in the takeoff 2nd the failure of the pilot to establish x minimum drag configuration which degraded the marginal single-engine climb performance of the aircraft. The loss of power resulted from seizure of the turbocharger following progressive failure of the turbine wheel blades initiated by foreign object ingestion which had occurred previous to this flight ana was not detected during maintenance *on* the engine 4 days before the accident. 10/

2. ANALYSIS

2.1 The Airplane

The airplane was certificated end maintained in accordance with approved FAA procedures. There was no evidence of preaccident failure or malfunction of the airplane's structure, powerplants, or systems.

8/ Aircraft Accident Report--"Las Vegas, Piper PA-31-350, N44LV, Las Vegas, Nevada, August 30. 1978" (NTSB-AAR-79-8).

9/ Aircraft Accident Report--"Nevada Airlines. Inc., Martin 404, N40438, Tusayan, Arizona, November 16, 1979" (NTSB-AAR-80-7).

10/ Aircraft Accident Report--"Scenic Airlines, Inc., Cessna 404, N26835, Near Grand Canyon National Park Airport, Tusayan, Arizona, July 21, 1980" (NTSB-AAR-81-2)

A review of the maintenance record indicated that the pilot's and copilot's altimeters on N88LV were replaced on August **15, 1983,** in compliance with the 24-month inspection required by **14** CFR **91.170.** The altitude encoder also was replaced at that time; however, as of August **17, 1983,** the encoder had not been calibrated with the transponder installed aboard N88LV. In cases where calibration has not been conducted, Las Vegas Airlines operating procedures restrict those airplanes to visual flight. However, lack of calibration of the encoder with the transponder would not have affected the accuracy of the newly installed and checked altimeters.

2.2 The Pilot

A review of the pilot's flight and medical certificates, flight log, and training records indichted that he was properly certificated and had received the training and off-duty time prescribed by Federal regulations. He had been employed by Las Vegas Airlines since April **16, 1980,** and he had amassed continuous experience flying the Grand Canyon tour since that time. According to other company pilots, he appeared normal before the flight. Because of his level of experience, the Safety Board concludes that the pilot was familiar with the geographical landmarks around the Grand Canyon.

2.3 The Weather

The weather in the Las Vegas area was above VFR minimums all day on August **17, 1983,** and none of the departing or arriving Las Vegas Airlines Flights reported difficulty in maintaining visual conditions. The weather at the Grand Canyon Airport was well above VFR minimums before the eccident occurred. About **48** minutes after the accident, the ceiling lowered to **400** feet with **1** mile visibility in light rain and fog. This condition cleared rapidly and **30** minutes later conditions were again visual and remained so the rest of the day.

The **1230** weather overlay indicates that the area of the accident site was on the northern edge of a cloud system that contained scattered light rain showers and a few moderate rain showers.

The SIGMETs in effect were for areas about 100 miles south of the Las Vegas Grand Canyon route and would have had no effect on the flight of Las Vegas 88. The weather forecast for the area was essentially correct. There is no history of below VFR minimum conditions at Las Vegas and Flagstaff Airports or below IFR minimum conditions at Grand Canyon Airport during the summer months. For the most part, flying conditions during the summer months in the Canyon area are VMC. There were no records of any Las Vegas Airlines flight being cancelled for weather conditions in the months of May threugh September from January **1981** to March **1984.** Consequently, the pilot of Las Vegas **88** probably did not anticipate that he would not be able to complete the Canyon portion of the flight successfully in visual conditions and the landing at Grand Canyon Airport in either visual or instrument conditions.

The pilot of Las Vegas 19, who was in the Canyon ahead of Las Vegas 88, stated that he climbed VMC between layers to 9,000 feet because the cloud cover prevented visual flight south of Twin Peaks. The pilot of a helicopter flying about **14** miles north of the accident site stated that "clouds were.. .rolling along at ground level.. .4,500 feet" southwest of his position at about 1230. These clouds may have been those encountered by Les Vegas 88 which prompted his decision to abort the flight since clouds at **4500** feet would obscure both rims of the Canyon.

Safety Board investigators were unable to find evidence that the pilot had received a personal weather briefing before takeoff; however, since weather information obtained by the president of the airline was available, the pilot may have obtained a recorded weather briefing by telephone from the Flight Service Station before departure, and he received SIGMET information from the Las Vegas FSS after takeoff. The pilot of Las Vegas 88 and the other pilots had sufficient weather information available to them for appropriate pre-flight and in-flight preparation and decisionmaking. All air traffic control services provided to the pilot of Las Vegas 88 were normal and in compliance with directives.

2.4 Operation in Limited Weather conditions

Las Vegas Airlines, Inc., conducts its sightseeing tours in uncontrolled airspace in the Grand Canyon under VFR. Pertinent regulations provide that pilots may not operate airplanes under VFR in uncontrolled airspace when the ceiling is less than 1,000 feet unless flight visibility is at least 2 miles and that they must remain at least 500 feet above the surface and 500 feet away from obstacles. The sightseeing flights normally follow the preferred routing if weather conditions permit. However, deviations from the preferred route to avoid weather are not unusual and, in fact- are required from time to time to conform with VFR and to comply with federal safety requirements.

The conduct of the sightseeing flights by Las Vegas Airlines pilots on August 17, 1983, was consistent with company procedures for operations during marginal weather. The pilot of Las Vegas 33, the first airplane to depart North Las Vegas Airport, reported weather conditions as he observed them and made a decision to fly northwest over the Shivwits Plateau to visual conditions and to enter the Canyon near Lava Dam Rapids. The pilots of Las Vegas 88 and Las Vegas 19, both twin-engined airplanes, decided to enter the west end of the Canyon and to fly the route following the Colorado River--a fairly common practice when the Shivwits is obscured by clouds. This practice is implemented during 10 to 20 flights yearly. The pilot of Las Vegas 19 completed his flight by climbing VMC between layers to 9,000 feet and flying east for about 10 miles before turning and reentering the Cenyon. Las Vegas 22 and Las Vegas 77, which had taken off about 23 to 28 minutes. respectively, after Las Vegas 88, flew over the Shivwits Plateau north of Mount Dellenbaugh and entered the canyon in visual conditions. The 257 air taxi sightseeing operations at Grand Canyon Airport on August 17, 1983, indicate that there were about 125 Canyon tour flights that day; none reported any difficulties.

Las Vegas Airlines pilots have the option of calling approach/departure control or Los Angeles Center for an instrument flight rules (IFR) "pop-up" if meteorological conditions preclude the continuation under VFR while flying the Grand Canyon route. This option is sometimes used for approach clearance into Grand Canyon Airport when it is below VFR minimums. The pilot of Las Vegas 88 did not elect to hold and to request an IFR clearance when he could not fly over the Shivwits Plateau under visual conditions but instead elected to fly into the Canyon as he and other sightseeing pilots had done on other occasions. After entering the canyon, he could not contact any ATC facility because of the limitations of line of sight radio communications. Consequently, once in the Canyon, the pilot was required by regulation to maintain visual conditions to continue his flight.

Shortly before his last transmission, the pilot of Las Vegas 88 indicated that he was "just short of Twin Peaks." According to the pilot of Las Vegas 19, the radials called by the pilot of Las Vegas 88 would have placed the airplane in the Canyon between Peach Springs and Mount Dellenbaugh. Company pilots stated that bluff formations near the accident site resemble Twin Peaks, which is further upriver about 20 miles northeast of the accident site. Since the rim was obscured, the pilot of Las Vegas 88 could not confirm

his position. Kad the pilot been in the area of Twin Peaks when he encountered the lowering clouds which prompted his decision to abort, the flightpath he selected to climb out of the Canyon probably would have enabled the airplane to ciear the rim. Since the pilot believed he was in the area of Twin Peaks, he most likely did not consider alternate courses **of** action to deal with his situation other than the decision *to* climb. The Safety Board concludes that the pilot misidentified his position and selected a flightpath which took the airplane into the face of the mesa, rather than safely out of the Canyon.

While the August **17,** 1983 accident may be regarded an isolated instance wherein the pilot of the airplane misidentified his position in deteriorating weather, the Safety **Board** is concerned that there are not more positive or effective procedures to control **this** type of commercial flight. The scope of these operations is extensive and flights are offered on a large scale to the traveling public, both in the United Stares and abroad. About **34,400** flights carrying over 250,000 passengers operate annually to the Grand Canyon Airport. There are about **33,500** air-taxi sightseeing flights annually that operate in the Canyon. While VFR rules stipulate that the pilot remain clear of the weath :r, other aircraft, and obstacles, because of the scope and number of operations at Grana Canyon Airport, additional procedural guidelines may be required to insure that Grand Canyon sightseeing passengers are provided a level of safety equal to ihst offered to other air taxi passengers.

3. CONCLUSIONS

3.1 Findings

1. The airplane was certificated, equipped, and maintained in accordance with approved procedures except that the encoder had not been calibrated with the transponder. This lack of calibration would not have affected the accuracy of the newly installed and checked altimeters.

2. There was no evidence of preaccident failure *or* malfunction of the airplane powerplants, structures, or flight controls.

3. The pilot was properly certificated and medically qualified for the flight.

4. Area weather forecasts were substantially correct.

5. The pilot of Las Vegas 19 which preceded Las Vegas 88 into the Canyon encountered lower clouds south of Twin Peaks and climbed VMC between layers to 9,000 feet.

6. The pilot of Las Vegas 88 probably encountered ceilings as low as 4,500 feet m.s.l., and lowered visibilities near the accident site, which was at. 6320 feet m.s.l.

7. The pilot of Las Vegas 88 probably misidentified his position in the Grand Canyon and believed that he was in the vicinity of Twin Peaks, which was located about 20 miles northeast of the accident site.

8. The pilot probably flew a flightpath which would have enabled him to clear the rim of the Canyon if **he** had been positioned near Twin Peaks; however. from his actual position, the selected flightpath took the airplane into the face of the mesa.

9. The pilot probably was not operating clear of the clouds when the airplane struck the mesa.

32 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the pilot's failure to maintain adequate visual flight references to positively identify his position while flying below the rim of the Grand Canyon which resulted in his selection of an inappropriate flightpath and subsequent collision with the terrain during an attempt to climb in instrument meteorological conditions to a safe altitude above the rim of the Canyon.

4. RECOMMENDATIONS

As a result of its investigation, the Safety Board recommended that the Federal Aviation Administration:

> Examine the operating procedures used by Grand Canyon sightseeing tour operators and, if necessary, develop and publish standards for operating procedures, including route selection, flight scheduling, and altitude selection for sightseeing flights in the Canyon, and require that operators reflect these standards in their operations specifications. (Class II, Priority Action) (A-84-52)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Acting Chairman

/s/ PATRICIA A. GOLDMAN
Member

/s/ G. H. PATRICK BURSLEY
Member

/s/ VERNON L. GROSE
Member

April 15, 1984

5. APPENDIXES

APPENDIX A

INVESTIGATION AND REARING

1. Investigation

The Safety Board was notified of the accident about **2000** on August **17,** 1983. A partial team was dispatched from the Washington, D.C. headquarters after the wreckage was found and arrived onscene on Auyst 19, 1983. Working groups were established for structures, powerplants, maintenance records, **and** air traffic control/operations.

Parties to the investigation were the Federal Aviation Administration, Las Vegas Airlines, Piper Aircraft Corporation, and AVCO–Lycoming.

2 Public Hearing

A public hearing was not held. Depositions were not taken.

APPENDIX B

PERSONNEL INFORMATION

Captain Wallace Stanley Gustafson, Jr.

Captain Gustafson, 48, the single pilot aboard Las Vegas 88, was born on June 23, 1935. He was a retired United States Air Force (USAF) fighter pilot and was hired by Las Vegas Airlines on April 16, 1980. He qualified as pilot-in-command (PIC) on May 30, 1980. He held Airline Transport Pilot certificate No. 1362853 with a rating in multiengine land airplanes and with commercial privileges in single-engine land airplanes. He also possessed a glider rating. His most recent first class medical certificate was dated July 27, 1983, with the limitation "Holder shall wear glasses which correct for distant vision while exercising the privileges of his airman certificate."

Captain Gustafson's most recent flight check, completed on June 27, 1983, was rated satisfactory in compliance with 14 CFR 135.297, Pilot in command: instrument proficiency check requirements; and 14 CFR 135.299, Pilot in command: Line checks: routes and airports. At that time, Captain Gustafson listed 1,732.2 total hours time and 1,728.3 hours of PIC time in the PA-31-350. Additionally, he listed 7,219.5 total hours PIC, 381.4 hours second in command, 322.8 hours instruction, and 384.1 hours completed in ground trainers.

The pilot's total flying time logged as of July 31, 1983, was 8,053.2 hours. As of August 16, 1983, the day before the fatal flight, he had logged 45.8 flight-hours for the month. His total flying time as of the day before the fatal flight was 8,099 hours.

A review of Captain Gustafson's training records indicated that he had received recurrent training in the PA-31/PA-32R/PA-32RT during 1982 and the first two quarters of 1983. He was graded satisfactory.

APPENDIX C

AIRCRAFT INFORMATION

The Piper Aircraft Corporation PA-31-350 is a twin-engine retractable landing gear, normal category airplane. The design maneuvering speed is 160 knots indicated airspeed (KIAS). The fuselage is a conventional semi-monocoque structure. The Wing is an all-metal, cantilever, semi-monocoque structure. The Chieftain is powered with turbocharged Avco-Lycoming TIO-540-J and LTIO-540-J series engines. The left engine rotates clockwise and ?he right engine rotates counterclockwise as viewed from the piiot's seat. The six-cylinder engines develop 350 hp each at 2,575 rpm.

The airplane is equipped with Hartzell. three-blade, constant speed, controllable pitch and full feathering propellers. They are controlled by a propeller governor on each engine. The governor is controlled by the corresponding propeller control in the pedestal.

The maximum takeoff and landing weight for the PA-31-350 is 7.000 pounds with a forward c.g. limit of 126.0 percent MAC and a rear c.g. limit of 135.0 percent MAC. For the flight on August 17, 1983. N88LV weighed 6,907 pounds ana the c.g. was **132.4** inches.

Las Vegas Airlines maintains its cirplanes under Approved Inspection Plan So. **LVAM** 31350 for Piper PA-31-350 airplanes. The plan was examined and approved on May 8, 1981, by the Las Vegas Flight Standards District Office. The records reviewed reflected a documentation of maintenance and modifications on the aircraft, engines, and components. The maintenance checks and inspections alsc indicated that the aircraft was being maintained in accordance with FAA rules and regulations.

Piper PA-3i-350, N88LV, serial *So.* 31-7752118 had about 4.325 flying hours at the time of the accident.

Powerplant history

	Left Engine	Right Engine
Engine Model	TIO-540-J2BD	TIO-540-J2BD
Engine Serial No.	L 029-61A	L-1121-68A
Engine Total Time (TT), (hours)	4,027.4	3,470.3
Date of Last Overhaul	3/28/80	9/28/81
Time Since Last Overhaul (TSO), (hours)	2.234.6	1,370.6
Date of Last Inspection	7/22/83	8/7/83
Time Since Last Inspection (TSLI), (hours)	92.0	36.0
Last Oil Analysis Date	6/9/83	6/9/83
Status of Last Oil Analysis	Normal	Normal
Date Engine Installed this Airplane	4/9/81	9/29/81

Propeller history

	Left Propeller	Right Propeller
Propeller Manufacturer	Hartzell Propeller Company. Piqua, Ohio	
Propeller Mode:	HC-E3YR-2ATF	HC-E3YR-2ALTF
Propeller Serial No.	DJ-4071	DJ-1917
Propeller Total Time (hours)	2,153.0	N/A

Propeller history

	Left Propeller	Right Propeller
Propeller Time Since Overhaul (TSO), (hours)	1,270.2	**640.4**
Date of Last Overhaul	7/19/80	9/02/82
Time Since Last Inspection	92.0	36.0
Date of Last Inspection	7/22/83	8/07/83