



National Transportation Safety Board Aviation Accident Final Report

Location:	SALT LAKE CITY, UT	Accident Number:	SEA97FA067
Date & Time:	03/02/1997, 1913 MST	Registration:	N117WM
Aircraft:	Beech 200	Aircraft Damage:	Substantial
Defining Event:		Injuries:	1 Fatal, 3 Serious

Flight Conducted Under: Part 91: General Aviation - Executive/Corporate

Analysis

The flight was on a coupled instrument landing system (ILS) approach with 1/2 mile visibility in snow showers. Three successive fixes on the localizer are defined by distance measuring equipment (DME) paired with the ILS; prior to the ILS DME commissioning 6 months before the accident, the DME fixes were defined by a VORTAC 4.7 nautical miles past the ILS DME. The aircraft was 800 feet high at the first fix and 1,500 feet high at the second, but approximately on altitude 4.7 nautical miles past the first and second fixes, respectively. It passed the outer marker 900 feet high and captured the glide slope from above about 1.8 nautical miles from the threshold, 500 feet above decision height (DH) and 700 feet above touchdown. The aircraft was on glide slope for 28 seconds, during which time its speed decayed to stall speed; it then dropped below glide slope and crashed 1.3 nautical miles short of the threshold. The pilot's FLT DIR DME-1/ DME-2 switch, which control the DME display on the pilot's horizontal situation indicator (HSI), was found set to DME-2; the NAV-2 radio was set to the VORTAC frequency. Up to 800 feet may be required for stall recovery.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain adequate airspeed on the ILS approach, resulting in a stall. Factors included: low visibility; the pilot's selection of the improper DME for the approach; his resulting failure to attain the proper descent profile for the approach; and insufficient altitude available for stall recovery.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT

Phase of Operation: APPROACH - FAF/OUTER MARKER TO THRESHOLD (IFR)

Findings

1. (F) WEATHER CONDITION - OBSCURATION
2. (F) APPROACH RECEIVER - IMPROPER - PILOT IN COMMAND
3. (F) PLANNED APPROACH - NOT ATTAINED - PILOT IN COMMAND
4. (C) AIRSPEED(VSO) - NOT MAINTAINED - PILOT IN COMMAND
5. STALL - PILOT IN COMMAND
6. REMEDIAL ACTION - NOT POSSIBLE

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER

Phase of Operation: DESCENT - UNCONTROLLED

Findings

7. TERRAIN CONDITION - GROUND

Factual Information

HISTORY OF FLIGHT

On March 2, 1997, approximately 1913 mountain standard time, a Beech 200 Super King Air, N117WM, registered to Coast Hotels and Casinos Inc. of Las Vegas, Nevada, collided with terrain approximately 1.3 nautical miles short of the runway while on an instrument landing system (ILS) approach to runway 34R at Salt Lake City International Airport, Salt Lake City, Utah. The airplane was substantially damaged and, of the airplane's four occupants, one passenger was fatally injured and the airline transport pilot-in-command and the aircraft's other two passengers were seriously injured. The 14 CFR 91 executive/corporate flight originated at McCarran International Airport, Las Vegas, Nevada. Night instrumental meteorological conditions existed at the time, and the flight was on an instrument flight rules (IFR) flight plan.

The pilot reported that the flight proceeded uneventfully to the Fairfield VOR, and initial approach fix (IAF) for the ILS runway 34R approach. The pilot stated that he was then given a vector by air traffic control (ATC) to intercept the runway 34R localizer. A transcript of the communications between N117WM and Salt Lake Approach indicated that at 1859:56, after the pilot of N117WM checked in at an altitude of 15,000 feet, Salt Lake Approach instructed N117WM: "...roger two six miles from plage turn right heading zero one zero cross plage at or above one one thousand cleared ILS runway three four right approach." (NOTE: PLAGÉ, SCOER, and KERNN intersections are successive fixes on the ILS approach. All are located on the runway 34R localizer course, with KERNN being collocated with the outer marker.) The Salt Lake approach controller then advised "lear seven whiskey mike" that the runway visual range (RVR) for runway 34R was out of service, and that the visibility was 1/2 mile. According to the ATC transcript N117WM replied "(unintelligible) seven whiskey mike" to this. ATC recorded radar data indicated the N117WM began its descent from 15,000 feet at 1901:45, 18 nautical miles south of PLAGÉ. The pilot indicated in his report of the accident that the aircraft's autopilot was coupled in the approach mode for the approach.

At 1901:48, Salt Lake Approach asked N117WM to "say air speed", and the pilot of N117WM replied that he was "indicating one eight zero." Salt Lake Approach then instructed N117WM to "maintain best forward speed." According to the ATC radar data, N117WM subsequently started a left turn to the localizer, at about 1903:45. At 1904:49, Salt Lake Approach instructed N117WM to "...maintain best forward speed until ah score [sic] cross kernn at one seven zero knots contact tower now one one niner point five." The transcript indicated that the best possible interpretation of the pilot's reply was, "(score [sic] forward speed) best forward speed till score [sic]."

At 1905:25, N117WM checked in with Salt Lake Tower, reporting out of 12,500 feet for 11,000 feet. Salt Lake Tower instructed "king air one one seven whiskey mike" to continue, at 1905:25, then corrected the call sign at 1906:16, instructing "king air one seven whiskey mike" to continue. The pilot of N117WM replied "say again" to this, at 1906:23 and again at 1906:28, and the controller repeated the instruction to continue at 1906:40. The ATC radar data indicated the N117WM passed abeam PLAGÉ about 1906:32, at an altitude of 11,800 feet (800 feet above the minimum altitude specified in the ATC clearance and 1,300 feet above the published minimum altitude at PLAGÉ) and abeam SCOER about 1907:55, at an altitude of 10,500 feet (1,500 feet above the minimum altitude at SCOER depicted on the published

approach procedure.) At 1910:17, Salt Lake Tower called: king air one one seven whiskey mike caution wake turbulence boeing seven fifty seven six miles ahead wind three six zero at one five runway three four right cleared to land." (N117WM was following DAL616, a Boeing 757 [B-757] aircraft, on the ILS approach. ATC radar data showed that at the time DAL616 arrived over the runway threshold, N117WM was approximately 5.4 nautical miles behind the B-757. ATC minimum radar separation distance for landing, for a small aircraft following a B-757, is 5 miles.)

The approach procedure specifies that a descent to a glide slope intercept altitude of 7,100 feet (minimum) is initiated at SCOER. Based on the published glide slope angle of 3.00 degrees, threshold crossing height (TCH) of 53 feet, and touchdown zone elevation (TDZE) of 4,222 feet, glide slope intercept at 7,100 feet altitude was computed by investigators to occur approximately 8.9 nautical miles from the runway threshold, or about 6.5 nautical miles past SCOER. ATC radar data indicated that N117WM crossed KERNN, the outer marker, at 1910:51, at 7,00 feet and a radar-indicated speed of 163 knots. The glide slope altitude at KERNN, as depicted on the approach procedure profile view, is 6,095 feet.

At 1911:14, Salt Lake Tower informed N117WM of an Embraer EMB-120 aircraft holding in position on the runway; the acknowledgment of this call by N117WM, at 1911:20, was the last reported radio transmission from the accident aircraft. ATC radar data indicated that the aircraft remained above the glide slope from KERNN until attaining the glide slope from above about 1.8 nautical miles from the threshold, at 1912:42, 4,900 feet altitude (478 feet above decision height) and a radar ground speed of 103 knots. The aircraft remained generally on the glide slope for 28 seconds, from 1912:42 until 1913:10, at which point its radar ground speed indicated 73 knots. During the 28-second period the aircraft was on the glide slope, its average rate of radar groundspeed decay increased from 0.54 knots per second (between KERNN and the time of glide slope capture) to 1.07 knots per second.

At 1913:14, the aircraft dropped well below the glide slope and its radar speed reached its minimum value of 70 knots. The loss of 200 feet of altitude (from 4,700 to 4,500 feet) from 1913:10 to 1913:14, in combination with the radar ground speed of 70 knots during this interval, was computed to correspond to an average downward vertical flight path angle during the interval of 20.3 degrees below the horizontal. The last radar return recorded was at 1913:18, at 4,400 feet altitude (approximately 200 feet above the touchdown zone elevation) and 71 knots. The crash site was approximately 1.3 nautical miles short of the runway 34R threshold, about 1/4 mile left of the localizer centerline.

The pilot's recollection of the accident sequence, as given in the narrative in his report of the accident, was as follows:

...Being slightly above the glide slope, the auto-pilot did not capture the altitude. The rate of descent was increased and the auto-pilot captured the glide slope.

At this time, the aircraft was entering the cloud deck, all anti-icing and de-icing systems were verified on, approach flaps were lowered and the gear was extended. Power was adjusted to approximately 600 ft. lbs. [torque] per engine in order to maintain 140 [k]nots IAS. From this point until the last few seconds of the flight I have no memory recall.

My next recollection is descending through 400 ft. AGL on the radar altimeter.

The aircraft did a sudden, uncommanded, skidding yaw to the left, with a following nose down, wing down roll to the left. My instinctive reaction was full right aileron, full right rudder, full

power and nose up pitch. At this time I had visual outside the aircraft. The control input slowed the rate of roll and the aircraft started to return to level flight.

As I began to relax the controls [inputs], the rolling motion returned. At this time I could see a large, white space in front of me, and I could visually see that the aircraft was descending. I had full control input in, attempting to level the aircraft prior to impact. I do not recall the impact.

The two surviving passengers, one of whom was sitting in the copilot's seat, reported that the approach initially seemed normal to them, and that they could see objects on the ground at first (the reported weather at the time consisted of an obscuration with 1,100 feet vertical visibility). They reported that at some point after the point which ground objects became visible (none were visible directly out the front of the windscreen, according to the copilot's seat passenger), the aircraft suddenly rolled left and struck the ground. One passenger, who was sitting in the back of the aircraft (on the right side, across the aisle from the fatally injured passenger) at the time of the accident, reported that the aircraft rolled left, straightened out, then rolled left again (more severely) and struck the ground. The other passenger, who was sitting in the copilot's seat at the time, reported that the airplane rolled left and struck the ground approximately 2 to 3 seconds after the left roll, and that the aircraft rolled left despite the pilot moving the control yoke noticeably to the right. Both passengers reported briefly hearing what they thought was a warning horn of some type during the event, but could not recall noting any significant changes in the engine noise during the accident sequence.

The accident occurred during the hours of dusk, approximately 53 minutes after local sunset and 7 minutes before the end of the evening twilight (as computed by a U.S. Air Force astronomical data program), at approximately 40 degrees 45.1 minutes North and 111 degrees 58.4 minutes West.

PERSONNEL INFORMATION

The pilot was the chief pilot for the El Cortez Hotel in Las Vegas, and also flew part-time for Coast Hotels & Casinos, which owned the accident aircraft. He held an airline transport pilot certificate with airplane multiengine land rating, and was type-rated in the Cessna 500, Mitsubishi 300, and Beech 400 turbojet aircraft. The pilot was also a certificated flight instructor with airplane single engine and instrument instructor ratings. According to his accident report, he had 8,172 hours total time, of which 1,841 were in the Beech 200 aircraft. The pilot stated in an interview with investigators on April 28, 1997, that he received initial training on the type in 1986 and recurrent training on the aircraft in 1987, both from Flight Safety International of Long Beach, California. The pilot stated that he had not received any formal training of the Beech 200 since the 1987 recurrent training. He reported that his most recent pilot proficiency check was a pilot proficiency evaluation conducted in a Beech 400 jet aircraft simulator on April 6, 1996. The pilot stated during the April 28, 1997, interview that he had flown 39.8 hours in the Beech 200 (approximately 1/3 of which was instrument time) during the 6 months prior to the accident; and on his report of the accident, the pilot indicated that he had flown 61 total hours in the past 90 days, including 6 hours in the Beech 200, 20 hours at night, and 10 hours of actual instrument time.

Log book information supplied by the pilot indicated that he was current for night, instrument and multi-engine flight at the time of the accident, but had not flown into or out of Salt Lake City within the past 6 months.

AIRCRAFT INFORMATION

The Beech 200 has a maximum takeoff weight of 12,500 pounds for operations under 14 CFR 91, and does not require a type rating to operate as pilot-in-command. The aircraft is approved for operation by a single pilot in operations under 14 CFR 91. The accident aircraft was found to be equipped with a Sperry SP-200 automatic flight control system with Sperry AZ-241 air data computer, a King KNC-610 area navigation system, and a Collins VIR-30A VOR/ILS receiver installed as NAV-1. The accident aircraft was not equipped with a cockpit voice recorder (CVR) or flight data recorder (FDR).

An estimated weight-and-balance computation for the aircraft at the time of the accident was performed by investigators. The following parameters were used for the computation: aircraft empty weight of 8,242 pounds (from aircraft maintenance records); pilot weight of 210 pounds (from FAA records); passenger weights of 210, 235, and 132 pounds (from surviving passenger interviews and medical examiner report); cargo weight of 360 pounds (weighed after accident); fuel load of 2,400 pounds at takeoff (reported by pilot); and estimated fuel burn of 983 pounds (based on reported time airborne and cruise fuel flow data in Raisbeck supplemental pilot's operating handbook.) Using these values, the estimated gross weight of the aircraft at the time of the accident was computed to be 10,811 pounds. Based on the above weights and reported aircraft loading, the aircraft was estimated to be within center of gravity limitations at the time of the accident.

The accident aircraft was modified in accordance with supplemental type certificates (STCs) held by Raisbeck Engineering INC. of Seattle, Washington. Modifications to the aircraft included installation of four-bladed Hartzell propellers, enhanced performance leading edges, a ram air recovery system in engine intakes, fully enclosed main landing gear doors, and dual ventral strakes on the aft fuselage. According to the FAA-approved Raisbeck supplemental pilot's operating handbook (POH) for the aircraft, a Raisbeck-modified Beech 200 at gross weight of 11,000 pounds and flaps extended 40% (the approach flap setting) has a stall speed of 81 knots calibrated airspeed (KCAS). At a density altitude of 3,700 feet (the computed Salt Lake density altitude at the time of the accident, based on reported temperature and altimeter setting), 81 KCAS was computed to correspond to a true airspeed of 86 knots. Based on the radar ground speed of the aircraft from the 1913:10 and 1913:14 radar returns (73 and 70 knots, respectively) and the wind reported by Salt Lake Tower to N117WM at the time of landing clearance (360 degrees at 15 knots), N117WM's true air speed at 1913:10 (immediately before it was recorded well below glide slope) was computed to be 88 knots, dropping to 85 knots at 1913:14 (at which time it was recorded well below glide slope)

The Raisbeck supplemental POH states that altitude loss experienced while conducting stalls in accordance with 14 CFR 23.201 was 800 feet. At 1913:10, the aircraft's altitude (as recorded by radar) was 4,700 feet or 478 feet above the TDZE of 4,222 feet.

The Raisbeck supplemental POH gives landing approach speeds at 11,000 pounds gross weight of 113 KIAS at 0% flaps, and 90 KIAS at 100% flaps.

According to the Beech 200 FAA-approved POH, the normal operating range of engine torque (marked by a green arc on the engine torque indicators) is 400 to 2,230 foot pounds.

The FAA-approved airplane flight manual supplement for the Sperry SP-200 automatic flight control system states that in the event of an autopilot malfunction, the autopilot may be disengaged by one of five different methods, or may be overpowered by the pilot. The

supplement states that maximum altitude losses during malfunction tests were 80 feet for coupled ILS approaches.

According to the aircraft maintenance records, the airplane was on a manufacturer-approved airworthiness inspection program. No discrepancies were noted in the aircraft maintenance records regarding required inspections, to include the altimeter and static system tests required for IFR operations.

METEOROLOGICAL INFORMATION

An 1845 Salt Lake City SPECI observation gave the conditions as: obscuration with 1,300 feet vertical visibility; visibility 1 statute mile in light snow showers; temperature 1 degree C; dewpoint 0 degrees C; and wind 350 degrees at 23 knots.

The 1851 Salt Lake METAR hourly observation gave conditions as : obscuration with 1,100 vertical visibility; visibility 1/2 statute mile in snow showers; temperature 1 degree C; dewpoint 0 degrees C; and wind 340 degrees at 18 knots.

During N117WM's approach, Salt Lake Approach advised "lear seven whiskey mike" that the runway 34R RVR was out of service, and visibility was 1/2 mile. Salt Lake Tower advised N117WM at the time of landing clearance that winds were from 360 degrees at 15 knots.

Conditions reported in a Salt Lake SPECI observation taken at 1927, approximately 14 minutes after the accident, were identical to those reported in the 1851 METAR observation.

The pilot of the accident aircraft reported in the April 28, 1997, interview that his ride down final was smooth, and that the aircraft did not accumulate any ice on the windshield or wings of the aircraft during the approach. The pilot further stated during this interview that the weather at the time was "exactly like the ATIS", with very heavy snow.

The Salt Lake City FAA air traffic manager reported that there were no pilot reports of wind shear or icing conditions to ATC during the time frame of the accident. There were also no wind shear alerts recorded by the airport's low level wind shear alerting system (LLWAS). An FAA inspector who responded to the accident scene on the night of the accident reported by telephone to the NTSB investigator-in-charge (IIC) that, although surface temperature was near freezing and there was no fire, he observed no evidence of ice on the aircraft.

AIDS TO NAVIGATION

The ILS to Salt Lake runway 34R, identifier ISLC, operates of 109.5MHz. Approach minima for this system are published down to ILS category IIIB. The ILS has an associated, frequency-paired distance measuring equipment (DME) system, with the ILS DME antenna located approximately 0.1 nautical mile south of the runway 34R threshold. A telephone query to the FAA Northwest Mountain Region air traffic procedures division disclosed that the ILS DME was commissioned on or about September 11, 1996, approximately 6 months prior to the accident. The localizer course, in conjunction with the ISLC ILS DME, is used to define the three successive fixes on the ILS approach procedure; PLAG (ISLC 20.5 DME), SCOER (ISLC 15.3 DME), and KERNN (ISLC 5.5 DME, which is collocated with the outer marker.) The runway 34R ILS approach procedure specifies that DME or radar is required for the approach.

There were no facility alarms or pilot reports of anomalies with the ISLC ILS system, other than the reported RVR outage, during the time frame of the accident. A post-accident flight inspection of the ILS was not performed.

The Salt Lake City VORTAC (identifier SLC), a high-altitude class radio navigation aid (NAVAID), provides civil VHF omnirange (VOR) azimuth, military tactical air navigation (TACAN) azimuth, and military and civil DME signals. The VOR operates on a frequency of 116.8 MHz; a DME paired to the frequency is collocated with the VOR. This NAVAID is located approximately 4.7 nautical miles north of (i.e. beyond) the ISLC ILS DME antenna, approximately on the Salt Lake runway 34R extended centerline. Prior to the commissioning of the ILS DME, fixes on the ILS runway 34R approach were defined using DME from the Salt Lake City VORTAC. The FAA Northwest Mountain Region air traffic procedures division reported that the change to the ILS approach procedure, in which the approach fixes were defined by the ILS DME rather than by the Salt Lake City VORTAC, was published on August 7, 1996, with an effective date of September 12, 1996.

COMMUNICATIONS

According to the ATC communications transcript, at 1900:00, Salt Lake Approach transmitted to "lear seven whiskey mike" that the runway 34R RVR was out of service and the visibility was 1/2 mile. N117WM responded: "(unintelligible) seven whiskey mike."

AT 1901:45, approximately the time that radar indicated N117WM beginning its descent from 15,000 feet, Salt Lake Approach asked N117WM to "say air speed", to which the pilot of N117WM replied that he was indicating 180 knots. The Salt Lake approach controller then again transmitted to "lear seven whiskey mike", instructing it to "maintain best forward speed." N117WM replied "whiskey mike" to this instruction, according to the transcript.

Following N117WM's initial check-in to the Salt Lake tower frequency, at 1905:25, the Salt Lake tower controller replied "king air one one five whiskey mike salt lake tower roger continue." The transcript indicated that 46 seconds later, Salt Lake Tower then transmitted: "king air one one seven whiskey mike continue", to which N117WM replied "... say again" twice, at 1906:23 and again at 1906:28. Salt Lake Tower repeated the instruction to continue 12 seconds after the pilot's second "say again" call, at 1906:40, and N117WM then acknowledged. The ATC radar data indicated that N117WM passed abeam PLAGÉ, 800 feet above the minimum altitude for which it was cleared, at about 1906:32, while this exchange between the pilot of N117WM and the Salt Lake tower controller was taking place.

AERODROME AND GROUND FACILITIES

Salt Lake City International Airport is the primary airport for a Class B airspace area. The airport serves as a hub in the Delta Air Lines route system as well as that of its regional airline affiliate Skywest, and is also served by several other 14 CFR 121 scheduled air carriers.

The Salt Lake ILS runway 34R approach procedure profile view specifies that PLAGÉ is crossed at a minimum altitude of 10,500 feet or 9,000 feet if authorized by ATC. (The ATC transcript indicated that N117WM was instructed to cross PLAGÉ at or above 11,000 feet at the time it was cleared for the ILS approach.) At PLAGÉ, a descent may be initiated to a minimum of 9,000 feet until passing SCOER. At SCOER, a descent to glide slope intercept altitude of 7,100 feet (minimum) is initiated. The glide slope altitude depicted at KERNN on the profile view is 6,095 feet. The published decision height (DH) is 4,422 feet (200 feet above touchdown.) The published minima for the approach are 1,800 feet RVR or 3/8 mile visibility. The required descent gradients from PLAGÉ to SCOER and from SCOER to glide path intercept at 7,100 feet were computed by the NTSB IIC and were found to be close to, but within, the 300 feet per mile maximum specified by FAA Order 8260.3B, U.S. Standard for Terminal Instrument

Approach Procedures (TERPS), for intermediate approach segments.

ATC radar data indicated that N117WM was 800 feet above the minimum cleared altitude) (1,300 feet above the published minimum altitude) crossing PLAGE, 1,500 feet above the published minimum altitude crossing SCOER, and 905 feet above the glide slope at KERNN. The aircraft captured the glide slope from above approximately 1.8 nautical miles from the runway threshold, about 500 feet above decision height, 36 seconds prior to the time of the aircraft's last recorded radar return.

N117WM's recorded radar altitude at two additional positions, approximately 4.7 nautical miles past PLAGE and 4.7 nautical miles past SCOER (corresponding to the distance of the Salt Lake VORTAC north of ISLC ILS DME) on the approach, was checked. The ATC radar data indicated that at 4.7 nautical miles past PLAGE (i.e., 15.8 DME from ISLC, or 1/2 nautical mile prior to SCOER), the aircraft was at approximately 10,600 feet, and 4.7 nautical miles beyond SCOER (i.e., 10.6 DME from ISLC), the aircraft was between 8,900 and 9,000 feet. N117WM's recorded altitudes at these two positions were within 100 feet of the published minimum altitudes at PLAGE and SCOER, respectively.

WRECKAGE

The airplane wreckage was examined at the accident site on March 3, 1997. The crash site was in a level livestock pasture, approximately 1.3 nautical miles south of the runway 34R threshold and 1/4 mile west of the runway 34R extended centerline. All aircraft components were located at the crash site. The majority of the aircraft wreckage was contained along a line approximately 225 feet long and oriented 290 degrees magnetic from the first point of ground damage observed to the main aircraft wreckage. The aircraft's tail light cover and tail tie down were found within 20 feet to the west of the first ground damage point. Additionally, the tail light was located 37 feet west of the first ground damage point, and a ventral fin from the tail of the aircraft was located 52 feet west of the first ground damage point. The nose gear wheel and a nose gear door had separated from the aircraft, and were located 31 feet west of the first ground damage point. The left outboard flap had separated and was located 53 feet west of the first ground damage point, to the left of the line from the first ground damage point to the main wreckage. The right outboard flap had also separated and was found 116 feet west of the first ground damage point, to the right of the line from the first ground damage point to the main wreckage. A major ground scar was located 87 feet west of the first ground damage point.

The main aircraft wreckage comprised the complete primary structure of the aircraft, which had come to rest upright, headed 030 degrees magnetic. The fuselage structure of the nose and cabin remained largely intact. Investigators were able to enter the cabin through the primary entry door and negotiate a path to the pilot's and copilot's seats, although the cabin headliner had collapsed and seats and interior cabin furnishings were damaged and/or separated from their mountings. A variety of debris was scattered throughout the cabin interior. The net for the cargo compartment was found unsecured. Cargo carried in the aft cargo compartment included pots and pans, dishes, various types of food, and beverages; some of this cargo was found scattered in the cabin and outside the aircraft, which was broken to the left immediately aft of the aft pressure bulkhead but otherwise largely intact. The nose landing gear strut was also separated, and was located immediately to the right of the nose.

The left wing was largely intact, although both flaps had separated (the left inboard flap was located immediately aft of the left wing.) The right wing was broken immediately outboard of

the nacelle, but was present in its entirety with the exception of the separated outboard flap. Both engine nacelle were broken in a direction pointing to the right of the aircraft. The flap actuators were found in a position corresponding to approximately 20 degrees flap extension. Both main landing gear struts were observed in the down position; however, both main landing gear wheel trucks had separated from the struts. One main gear wheel truck was located 63 feet off the aircraft's nose (030 degrees from the main wreckage), while the other main gear truck was located 240 feet northwest of the main wreckage. No attempt was made by investigators to match the main gear trucks to their struts.

The left propeller exhibited forward bending on two blades, leading edge gouging on the third blade, and S-bending on the fourth blade. The power lever linkage on the left engine was found 3/8 inch back from the maximum stop, and on the aircraft instrument panel, the left engine torque indicator was found frozen at an indication of 1,500 foot-pounds. The left engine ice vane selector switch was found in the extend position. Oil was found on the engine dipstick. No evidence of a containment failure of the left engine was observed. A detailed internal examination of the left engine was not performed.

The right propeller exhibited forward bending on two blades, leading edge gouging and slight S-bending on a portion of the third blade, and torsional twisting, leading edge polishing, and chordwise scratching on the fourth blade. The power lever linkage on the right engine was found at the maximum stop, and on the aircraft instrumental panel, the right engine torque indicator was found frozen at an indication at 2,080 foot pounds. The right engine ice vane selector switch was found in the extend position. Oil was found on the engine dipstick. No evidence of a containment failure of the right engine was observed. A detailed internal examination of the right engine was not performed.

On the aircraft instrument panel, the FLT DIR DME-1/DME-2 selector switch, on the left side of the pilot's instrumental panel, was found in the DME-2 position. This switch selects which DME presents information on the DME display on the pilot's horizontal situation indicator (HSI). The NAV-1 radio was tuned to 109.50 MHz (the ISLC ILS frequency), and the NAV-2 radio was tuned to 116.80 MHz (the Salt Lake City VORTAC frequency.) The stall warning and two pitot heat switches (L and R) were found in the OFF position. (NOTE: The stall warning and the pitot heat switches were located on the lower right side of the pilot's instrument panel, immediately above the pilot's right leg, which was trapped in the wreckage after the accident and required extrication by rescue personnel in order to free the pilot from the wreckage.)

A loose sheaf of Jeppesen approach plates, secured together by a paper slip, was found wedged behind the pilot's left rudder pedal. The plate on top of this sheaf was the ILS category II/III approach procedure to Salt Lake runway 34R (page 11-4A, dated September 27, 1996.) The approach fixes PLAGE, SCOER, and KERNN on this approach plate were defined using the ISLC ILS DME. (NOTE: The category II/III ILS approach, which requires special aircrew and aircraft certification, is flown to the same altitudes at PLAGE, SCOER, and glide path intercept as the category I ILS approach, but is flown to a radio altimeter DH of 100 or 151 feet [for category II approaches], or no DH is specified [for category IIIA and IIIB approaches.]) The DH alert "bug" on the aircraft's radio altimeter was set to 180 feet. The Salt Lake ILS runway 34R approach (page 11.4) is printed on the other side of the page from the category II/III ILS approach procedure, such that page 11-4 faced inward in the sheaf as it was found clipped together.

Fuel was found in the aircraft's left and right main tanks. The left and right auxiliary fuel tanks

were found empty. A strong odor of jet fuel was present at the accident site, and fuel leakage was observed from the aircraft.

Flight control cable continuity was established at the accident site from the break in the fuselage back of the elevators and rudder, and was also established to both ailerons. There was no evidence of fire anywhere in the aircraft wreckage.

MEDICAL AND PATHOLOGICAL INFORMATION

Following the accident, the pilot was taken to LDS Hospital, Salt Lake City, Utah, for emergency medical treatment. A consent to release of records was obtained from the pilot, and the pilot's treatment records were obtained from LDS Hospital. The pilot's treatment records indicated that at the time of admission, a drug and alcohol screen was performed on the pilot. The pilot tested negative for all drugs screened, and also tested at less than 0.01% serum ethyl alcohol volume.

An autopsy on the fatally injured passenger was performed by the Utah State Medical Examiner's Office, Salt Lake City, Utah, on March 3, 1997. The immediate cause of death was given as blunt force injuries to the head. The report stated the examiner's opinion that "She was apparently struck from behind by an object causing an acute hyperflexion of the head forward."

SURVIVAL ASPECTS

Local fire and rescue services responded to emergency calls from local citizens regarding the crash and extricated the three survivors from the aircraft wreckage. The fatally injured passenger was determined to be dead at the scene. The survivors were taken to local hospitals for treatment.

The fatally injured passenger was seated in the left rear seat, immediately forward of the aircraft entry door and cargo compartment. There was a cabin bulkhead immediately behind her seat, between her seat and the cargo compartment; this bulkhead forms the entryway to the aircraft. No objects containing evidence that they struck the fatally injured passenger's head were identified by investigators. In the April 28, 1997, interview with the pilot, the pilot stated that her personally secured the cargo compartment net before takeoff.

TESTS AND RESEARCH

The pilot's HSI, attitude director indicator (ADI), and altimeter, and the aircraft's air data computer, flight director computer, automatic flight control computer, and autopilot servos were sent to the Honeywell Central Support Center, Wichita, Kansas, for functional testing under the supervision of the FAA Wichita Manufacturing Inspection District Office (MIDO). Although isolated test failures were recorded on each of these components, the FAA manufacturing inspector who supervised the tests on these components reported: "The general feeling of the test personnel and me is that the instruments with the noted discrepancies would not have placed the aircraft in jeopardy, would have caused conditions that the pilot would be aware of, or may have been caused by the impact." No failures of parameters identified as "AW/PS CRITICAL" (which, according to the test documentation provided by Honeywell, "require 100% test") were reported on any of the components.

The aircraft's NAV-1 VOR/ILS receiver was shipped to Rockwell Collins Avionics, Melbourne, Florida, for functional testing under the supervision of the FAA Orlando, Florida, Flight Standards District Office (FSDO). The FAA inspector supervising this test reported: "Receiver

sensitivity was weak at some parameters, but overall indications were positive. The sensitivity issue was not deemed unusual or overly significant by the engineers conducting the testing or the bench technician. No other unusual circumstances were observed." Rockwell Collins Avionics, in a letter to the FAA dated June 3, 1997, further stated that despite the observed test failures, the overall test findings "indicate that the unit is capable of providing accurate navigation guidance." The test data furnished by Collins indicated that the unit passed the glide slope receiver sensitivity test at a glide slope frequency of 332.60 MHz (the glide slope frequency paired with a localizer frequency of 109.50 MHz, according to the FAA Aeronautical Information Manual.)

The Aircraft's pitot probe heater elements and airspeed indicators were functionally tested at Aero-Mach Labs Inc., Wichita, Kansas, under supervision of the FAA Wichita MIDO. The FAA inspector supervising this testing reported that the acceptance test for the pitot probe heater, and functional testing of both airspeed indicators, was completed with no discrepancies observed on these tests.

The aircraft's KNC-610 area navigation computer was functionally tested by AlliedSignal General Aviation Avionics, Olathe, Kansas, under the supervision of the FAA Kansas City, Missouri, FSDO. AlliedSignal reported that the unit's mode select switch, as received, was in the VOR/DME position, and that the DME window of the unit displayed a reading of 1.5 nautical miles. The AlliedSignal report of the examination stated that "no problems or inaccuracies were noted that would have precluded safe and normal operation" of the unit.

ADDITIONAL INFORMATION

The glide slope deviation of DAL616, the B-757 ahead of N117WM, from KERNN to DH was computed by the NTSB IIC. It was found, in comparing DAL616's ATC radar-recorded altitudes versus distances from threshold to the computed ILS glide slope profile, that DAL616 did not deviate more than 93 feet above the ILS glide slope at any point during final approach. DAL616 was computed to be 52 feet above glide slope at 1.8 nautical miles from the threshold, and its average glide slope deviation for its last 11 radar returns (corresponding to 1.8 nautical miles from the threshold down to DH) was computed to be approximately 4 feet low. The ATC radar data indicated the DAL616 passed 1.8 nautical miles from the threshold at 1910:09, approximately 2 minutes and 33 seconds ahead of N117WM.

To evaluate the possibility of pitot icing, an airspeed comparison was done for two reference points of known or assigned airspeed, at 1901:50 (when the pilot reported he was indicating 180 knots) and a KERNN (which N117WM was assigned by ATC to cross at 170 KIAS.) For the 1901:50 comparison, the report of 180 KIAS was converted to true airspeed (TAS) for a density altitude of 15,000 feet (the aircraft's approximate radar-recorded altitude at the time.) For the comparison at KERNN, the ATC-assigned crossing speed of 170 KIAS was converted to TAS for a density altitude of 7,000 feet (the aircraft's altitude as observed on ATC radar at the time of the crossing.) These values were compared to the aircraft's radar-observed ground speed, plus headwind component reported for the two respective altitudes (calculated from WSR-88D Doppler radar wind data contained in the meteorology group chairman's factual report.) For the 1901:50 comparison, the radar-derived TAS correlated to the true airspeed based on the 180 KIAS pilot report to within 1 knot. For the comparison at KERNN, the radar-derived TAS at the time of crossing was computed to be 10 knots slower than the TAS based on assigned crossing speed of 170 KIAS (at 7,000 feet.) The Jeppesen Instrument Commercial Manual states that there are two possible effects of a pitot tube blockage. With both the ram air input

tube and drain hole obstructed, the airspeed indicator will function as an altimeter (i.e. the airspeed indication decreases with decreasing altitude), and with a blocked ram air input tube but an unobstructed drain hole, the airspeed indication will drop to zero.

The airplane wreckage was released to Mr. Kelly McLendon of United States Aviation Underwriters, Inc., Englewood, Colorado, on February 19, 1998. Mr. McLendon is the insurance adjuster representing Coast Hotels & Casinos.

Additional Persons Participating in this Accident Investigation (continued):

James D. Raisbeck Raisbeck Engineering, Inc. Seattle, WA 98178

Pilot Information

Certificate:	Airline Transport	Age:	55, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	Airplane Single-engine; Instrument Airplane	Toxicology Performed:	Yes
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	Last Medical Exam:	09/26/1996
Occupational Pilot:		Last Flight Review or Equivalent:	
Flight Time:	8172 hours (Total, all aircraft), 1841 hours (Total, this make and model), 8150 hours (Pilot In Command, all aircraft), 61 hours (Last 90 days, all aircraft), 25 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	Beech	Registration:	N117WM
Model/Series:	200 200	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	BB-662
Landing Gear Type:	Retractable - Tricycle	Seats:	10
Date/Type of Last Inspection:	05/23/1996, AAIP	Certified Max Gross Wt.:	12500 lbs
Time Since Last Inspection:	174 Hours	Engines:	2 Turbo Prop
Airframe Total Time:	4692 Hours	Engine Manufacturer:	P&W
ELT:	Installed, not activated	Engine Model/Series:	PT6A-41
Registered Owner:	COAST HOTELS & CASINOS INC.	Rated Power:	850 hp
Operator:	COAST HOTELS & CASINOS INC.	Air Carrier Operating Certificate:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument Conditions	Condition of Light:	Dusk
Observation Facility, Elevation:	SLC, 4227 ft msl	Observation Time:	1927 MST
Distance from Accident Site:	2 Nautical Miles	Direction from Accident Site:	348°
Lowest Cloud Condition:	Unknown / 0 ft agl	Temperature/Dew Point:	34° C / 32° C
Lowest Ceiling:	Obscured / 1100 ft agl	Visibility	0.5 Miles
Wind Speed/Gusts, Direction:	18 knots, 340°	Visibility (RVR):	0 ft
Altimeter Setting:	29 inches Hg	Visibility (RVV):	0 Miles
Precipitation and Obscuration:			
Departure Point:	LAS VEGAS, NV (LAS)	Type of Flight Plan Filed:	IFR
Destination:	(SLC)	Type of Clearance:	IFR
Departure Time:	1700 PST	Type of Airspace:	Class B

Airport Information

Airport:	SALT LAKE CITY INTL (SLC)	Runway Surface Type:	
Airport Elevation:	4227 ft	Runway Surface Condition:	
Runway Used:	34R	IFR Approach:	ILS
Runway Length/Width:		VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	1 Serious	Aircraft Damage:	Substantial
Passenger Injuries:	1 Fatal, 2 Serious	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal, 3 Serious	Latitude, Longitude:	

Administrative Information

Investigator In Charge (IIC):	GREGG NESEMEIER	Adopted Date:	02/28/2000
Additional Participating Persons:	WILLIAM R RANGE; SALT LAKE CITY, UT EDDIE E WEBBER; WICHITA, KS EUGENE TORRISI; SALT LAKIE CITY, UT DON NEWCOMB; WASHINGTON, DC		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.nts.gov/pubdms/ .		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report.