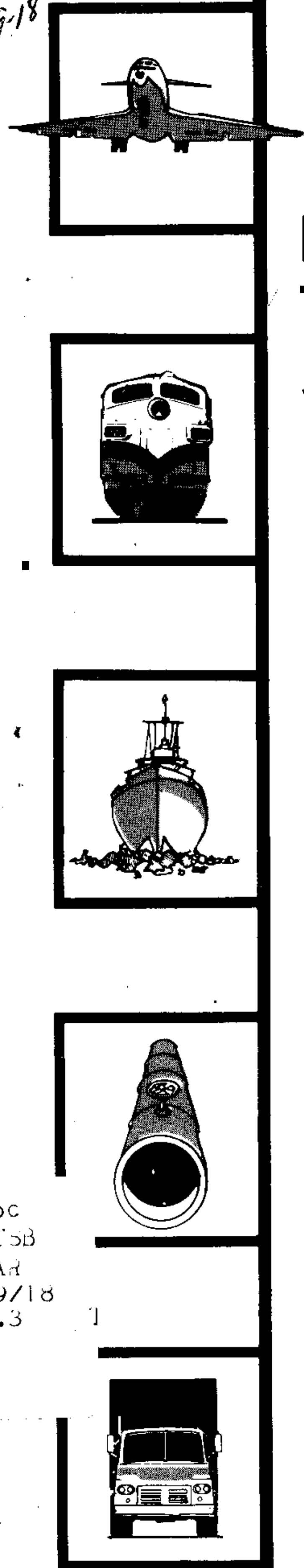

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

INLET MARINE, INC.
GATES LEARJET N77RS
CENTURY III, MODEL 25C
ANCHORAGE INTERNATIONAL AIRPORT
ANCHORAGE, ALASKA
DECEMBER 4, 1978

NTSB-AAR-79-18

UNITED STATES GOVERNMENT

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16. Abstract

About 1450, Alaska standard time, on December 4, 1978, Gates Learjet N77RS crashed alongside runway 06R at the Anchorage International Airport., The accident occurred during the landing phase following a visual approach. The aircraft was destroyed. Light to moderate icing was forecast in clouds below 12,000 ft in the Anchorage area and turbulence, accompanied by gusting winds, was reported in the airport vicinity. The flight path was normal almost to touchdown when the aircraft suddenly pitched up and began to bank steeply from side to side. The aircraft rolled to the right and continued over until the right wing struck the ground. Both pilots and three passengers were killed; two passengers survived.

The National Transportation Safety Board determines that the probable cause of this accident was an encounter with strong, gusting crosswinds during the landing attempt, which caused the aircraft to roll abruptly and unexpectedly. The ensuing loss of control resulted from inappropriate pilot techniques during the attempt to regain control of the aircraft. Suspected light ice accumulations on the aerodynamic surfaces may have contributed to a stall and loss of control.

17. Key Words

Learjet; strong, gusting crosswinds; pilot overcontrol; ice-induced stall; stick shaker and stick pusher; stall characteristics

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SYNOPSIS

On December 4, 1978, N77RS, a Gates Learjet Model 25C, was being operated privately under 14 CFR 91 as a nonrevenue flight between Juneau and Anchorage, Alaska. The National Weather Service surface weather analysis showed that during the flight there would be a low-pressure area 150 mi southwest of Anchorage, with an occluded front extending to the north and northwest from this low-pressure area. Weather advisories stated that light to moderate rime icing was forecast in clouds below 12,000 ft within 200 mi northeast of the low center and the occluded front. Light icing was forecast elsewhere. Severe turbulence was forecast below 14,000 ft in the area 150 mi northeast of the Alaska Aleutian Range and below 10,000 ft in the rest of the area, which included Anchorage.

At 1315, the Learjet departed Juneau with two pilots and five passengers on an instrument flight rules clearance. The flight was uneventful, and at 1446, the pilot contacted the Anchorage local air traffic controller, who cleared the flight for a runway 06R instrument landing system approach. Two minutes later, the flight was cleared to land, and the pilot was advised that moderate turbulence was reported from 800 ft to the surface. A tower controller stated that the flightpath was normal until the aircraft pitched up just before it touched down. The aircraft momentarily regained level flight before the nose rose almost vertically and the wings began a series of rolls. The aircraft began to roll inverted and crashed beside runway 06R. The pilots and three passengers were killed.

The National Transportation Safety Board determines that the probable cause of this accident was an encounter with strong, gusting crosswinds during the landing attempt, which caused the aircraft to roll abruptly and unexpectedly. The ensuing loss of control resulted from inappropriate pilot techniques during the attempt to regain control of the aircraft. Suspected light ice accumulations on the aerodynamic surfaces may have contributed to a stall and loss of control.

1. FACTUAL INFORMATION

1.1 History of the Flight

On December 4, 1978, N77RS, a Gates Learjet Model 25C, was being operated privately under 14 CFR 91 as a nonrevenue flight between Juneau and Anchorage, Alaska. The Learjet had departed Anchorage about 0949 1/ for a 1 1/2-hour ferry flight to Juneau, where the flightcrew of two pilots was to pick up passengers for a return flight. The Anchorage flight service station (FSS) had given the flightcrew a weather briefing before departure. The flight to Juneau was uneventful. After the flight arrived in Juneau, a return flight plan was filed at 1135 with the Juneau FSS. At that time, the pilot told FSS personnel that he had received a previous weather briefing, and he requested only the current Anchorage International Airport weather observation, which he was given along with the Anchorage terminal weather forecast.

The National Weather Service (NWS) surface weather analysis showed that during the flight there would be a low-pressure area 150 mi southwest of Anchorage with an occluded front extending to the north and northwest of this low-pressure area. Weather advisories stated that light to moderate rime icing was forecast in clouds below 12,000 ft within 200 mi northeast of the low center and the occluded front. Light icing was forecast elsewhere. Severe turbulence was forecast below 14,000 ft in the area 150 mi northeast of the Alaska Aleutian Range and below 10,000 ft in the rest of the area, which included Anchorage.

At 1315, the Learjet departed Juneau with five passengers on an instrument flight rules (IFR) clearance and was instructed by the Juneau air route traffic control center (ARTCC) to proceed via the B1 departure route with a Yakutat transition, and to maintain flight at 41,000 ft. 2/ At 1417, the flight contacted the Anchorage ARTCC, which cleared the Learjet to descend to 16,000 ft. Seventeen minutes later, when the flight was at an altitude of 10,000 ft and 8 mi east-northeast of Yeska VOR intersection, the flight was cleared to Anchorage approach control, which then cleared the Learjet to descend and maintain 8,000 ft. At 1439, the flight was cleared to descend to 6,000 ft, followed a minute later with a descent clearance to 1,600 ft. At this time, the approach controller requested the flight to reduce speed to 200 kns indicated airspeed (KIAS).

At 1442, the controller asked the Learjet pilot if the flight had experienced any turbulence or icing during the descent, and the pilot replied that the flight had encountered moderate turbulence and light ice. At 1445, the aircraft was 10 mi from the Anchorage outer marker, and at 1446, the Anchorage local controller cleared the flight for a runway 06R instrument landing system (ILS) approach. Two minutes later, the controller cleared the flight to land. The pilot was told that braking action was fair to good as reported by a Boeing 737 and that moderate turbulence reportedly existed from 800 ft to the surface. Runway 06R wind velocity was reported to the pilot as 130° at 19 kns. The local controller stated that no radio transmissions were received from the Learjet after the pilot

1/ All times herein are Alaska standard time, based on the 24-hour clock.
2/ All altitudes and elevations herein are mean sea level unless otherwise specified.

acknowledged the landing clearance. At 1450, the local controller saw the Learjet in "an unusual noseup attitude," and it then crashed north of runway 06R near the intersection of the W-3 taxiway and the approach end of runway 06L. Another tower controller stated that the flightpath was normal until the aircraft pitched up just before it touched down. Airport crash and rescue personnel were notified at 1450:50 and immediately responded.

A witness who observed the accident from the airport terminal ramp stated that he first noticed the right wing raise and the aircraft pitch up slightly. The aircraft momentarily regained level flight before the nose rose almost vertically. The nose began to oscillate and the wings began roll reversals. The yawing motions continued as the right wing dropped and the aircraft rolled with increasing bank angles. As the aircraft banked to the left and back to the right, the nose dropped to the right and the aircraft began to roll inverted. The witness lost sight of the aircraft behind a slight hill before the aircraft, with its wings nearly vertical, struck the ground.

Both pilots and three passengers were killed. During postaccident interviews, the two survivors stated that they slept during the last portion of the flight. One survivor said that he awakened as the aircraft was on the downwind leg of the landing pattern and, at that time, he was aware that the aircraft was flying through precipitation. He also recalled light, occasionally moderate, turbulence throughout the approach. His seat was facing the rear of the aircraft and his first view of the runway was through the cabin windows. He realized that the aircraft was rolling because his view of the parallel lines of the runway markings through the windows on opposite sides of the aircraft changed. He believed that the unstabilized maneuver began as the aircraft flared, and he recalled an oscillating sequence, which he said started when the right wing raised as the aircraft began pitching up. He had the sensation that the aircraft then descended slightly. The aircraft then rolled to the left and the left wing struck the runway. He said that engine thrust was increased immediately, and he believed that the pilot was starting to abandon the landing attempt and starting to climb. Simultaneously, the aircraft rolled back to the right while assuming a steep attitude. The aircraft tail began "swishing" and engine thrust noises were surging. He recalled that the initial wing rolling motion may have been 45° from the horizontal plane and the bank angles increased with each roll reversal.

The other survivor stated that he was awakened by engine thrust being increased during the landing maneuver and he believed that a violent wind gust had struck the aircraft. He believed that the pilot was attempting to stabilize the aircraft, regain lost airspeed, flare again, and continue the landing. His belief was based on his recollection that the pilot seemed to have applied less than takeoff thrust. However, the aircraft rolled to the right, banked rapidly to the left, and back to the right. He also believed a wing may have struck the runway while the aircraft was banking. Neither survivor believed that the aircraft wheels touched the runway at any time.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Other
Fatal	2	3	0
Serious	0	2	0
Minor/None	0	0	0

1.3 Damage to Aircraft

The aircraft was destroyed.

1.4 Other Damage

None

1.5 Crew Information

The pilot and copilot were properly certificated and medically qualified. However, according to records, neither pilot was properly qualified to serve as a crewmember in a turbojet-powered multiengine airplane. The pilot-in-command had completed his last proficiency check in July 1977. The proficiency check was performed in a Gates Learjet aircraft. Title 14 CFR 61.58 requires a pilot-in-command who operates an aircraft certificated for more than one required pilot to satisfactorily complete a proficiency check or flight chtck every 12 calendar months. The Gates Learjet is certificated for two pilots. No record was found that this required check was completed by the pilot of the Learjet after July 1978, when the check was due. (See appendix B.)

There were no records found to 'indicate that the copilot had fulfilled all required provisions of 14 CFR 61.55(b), 3/ which also are a requirement of 14 CFR 91.213. The provisions of these Federal regulations applied to the accident aircraft. The voice on tapes of communications with the Learjet immediately before the accident was identified as that of the copilot.

The Federal Aviation Administration (FAA) operations inspector who conducted the pilot-in-command's flight check stated in a postaccident interview that the pilot "...just wasn't as smooth on the controls as he could have been." He further stated that the subject pilot "...manhandles the aircraft." During the

3/ "... no person may serve as second in command of a large airplane, or a turbojet-powered multiengine airplane type certificated for more than one required pilot flight crewmember, unless since the beginning of the 12th calendar month before the month in which he serves, he has, with respect to that type airplane: ...(2) [made] ...(i) Three takeoffs and three landings to a full stop as the sole manipulator of the flight controls; and (ii) Engine-out procedures and maneuvering with an engine out while executing the duties of the pilot in command. This requirement may be satisfied in an airplane simulator acceptable to the Administrator."

flight check, the pilot-in-command satisfactorily demonstrated go-around maneuvers. However, the FAA inspector recalled that "his reaction to the command 'go-around' was a little abrupt in that he sat upright, added power, and adjusted attitude a bit more abruptly than necessary." (See appendix B.)

1.6 Aircraft Information

The accident airplane was a Gates Learjet, Model 25C, registration number N77RS, serial number 094. It was powered with two General Electric CJ 610-6 turbojet engines. A major airframe alteration was completed on January 9, 1977, when the airplane was updated by the installation of the Century 111 Performance Modification Kit in accordance with Gates Learjet Engineering Change Record (ECR) 1511A. The last entry in the airplane log, dated June 4, 1978, stated that the airplane had flown 1549.4 hrs.

The Learjet had an empty weight of 8,158.51 lbs, a maximum authorized takeoff gross weight of 15,000 lbs, and a maximum authorized landing weight of 13,300 lbs. Cenfer of gravity limitations were from 8 to 30 percent mean aerodynamic chord. A formal weight and balance form of the accident aircraft was not required and none was found. Therefore, the actual fuel load, center of gravity, and gross takeoff weight are not known. Postaccident computations of the weight and balance manifest for this flight indicated that the airplane was within weight and balance limitations both at takeoff and at the time of the accident.

1.7 Meteorological Information

The 1400 NWS surface weather analysis for December 4, 1978, showed a low-pressure area 150 mi southeast of Anchorage with an occluded front extending to the north and northwest from this low-pressure area. Isobars were oriented approximately southwest to northeast in the Anchorage area, with lower pressures to the north.

The terminal forecast for Anchorage International Airport issued by the NWS Forecast Office in Anchorage at 1140, valid from 1200 on December 4 'until 0600 on December 5, was as follows:

> Ceiling indefinite 400 ft sky obscured, visibility 3/4 statute mi, light snow, fog, occasionally ceilings 1,200 ft broken, 2,500 ft overcast, visibility greater than 6 statute mi, light snow, surface winds 140° at 25 kns gusting to 45 kns.

Inflight weather advisories issued by the NWS Forecast Office in Anchorage, were, in part, as follows:

> Sigmet Golf 1 Issued 1400, valid 1400-1800. Flight precaution ...Cook Inlet, Susitna Valley. .. Severe turbulence below 14,000 ft, above and to 150 mi northeast Alaskan Aleutian Range and below 10,000 ft remainder of area [which included Anchorage].

Airmet Bravo 1. Issued **1400**, valid **1400-2000**. Flight precaution. .. Cook Inlet, Susitna Valley. . . . Ceilings frequently below 1,000 ft, visibility below **3** mi in snow mixed with rain, southwestern inlet North Gulf Coast. Areas moderate rime icing in clouds below **12,000** ft, lowest conditions and heaviest icing southwesterly exposures.

Surface weather observations taken by NWS-certified weather observers at the Anchorage International Airport near the time of the accident were as follows:

1355, record: **1,500** ft scattered, measured ceiling **2,700** ft broken, 5,000 ft overcast, visibility **35** statute mi, temperature **36'** F, dewpoint 24° F, wind **160'** at **15** kns gusting to **25** kns, altimeter setting **29.96** inHg, runway 06R wind 180° at **15 kns** gusting to **25 kns**.

1455, record: **1,500** ft scattered, measured ceiling **2,300** ft broken, **5,000** ft overcast, visibility **30** statute mi, temperature 34° F, dewpoint **24° F**, wind **160'** at **14** kns gusting to **22** kns, altimeter setting **30.00** inHg, runway 06R wind 180° at **15 kns**, peak wind 160° at **26 kns** at **1420**.

Gust recorder data for the airport center field anemometer disclosed that from **1430** to **1510**, the maximum recorded gust was **22 kns**. At the time of the accident, the range of wind speeds observed from the **06R** anemometer was **20** to **28 kns**.

Pilot weather reports were, in part, as follows:

Anchorage -- Kenai, **1320**, flight level unknown/type aircraft DH 6/icing moderate rime, light freezing rain, during descent, **4,000-2,000** ft.

During descent into Merrill Field, **1439**, flight level **900** ft, on final runway **33** wind shear. [Merrill Field is located about **5** mi north-northeast of Anchorage International Airport.]

Four miles south of Merrill Field, **1455**, flight level **1,000** ft, PA **23**, turbulence moderate to heavy.

1.8 Aids to Navigation

A full instrument landing system (ILS) serves runway **06R** at Anchorage. The outer marker (LOM), middle marker (MM), and inner marker (IM) are located **4.1**, **0.5**, and **0.16** mi from the runway. Glide slope angle depression was.**'3** Touchdown zone elevation was **124** ft, and threshold clearance height was **53** ft. The ILS system was fully operational at the time of the accident.

1.9 Communications

There were no known communications problems.

While the aircraft was in flight, the automated terminal information service broadcast the following:

> Anchorage International Information November two three five three Greenwich. Weather one thousand five hundred scattered. Measured ceiling two thousand seven hundred broken, five thousand overcast, visibility three five temperature three six, wind one three zero at one five, gusts two five, altimeter two niner niner six. ILS runway six right approach in use. Landing and departing runway six right and one three. Runway six left and two four right closed. The last seven hundred feet of runway one three closed. Runway six right braking action fair to good by a seven thirty seven. Runway one three braking action **poor** by a Twin Otter. Advise you have November.

1.10 Aerodrome and Ground Facilities

Airport elevation was 124 ft. Runway 06R was 10,897 ft long and 150 ft wide. The usable length beyond the glide slope intercept point was 9,862 ft. The runway was equipped with high-intensity runway lights, centerline lights, touchdown zone lights, and a high-intensity approach light system with sequence flashers (ALSF-2). Automated terminal information service was provided.

The approach to runway 06R is flown over water. The runway threshold was about 1,800 ft from the shoreline at Cook Inlet. The terrain to the south of the runway is characterized by higher elevations and wooded hills.

1.11 Flight Recorders

The aircraft was not equipped with a flight recorder, nor was one required.

1.12 Wreckage

As the aircraft was landing on runway 06R at Anchorage International Airport, the left wing tip tank struck the runway. The aircraft's right wingtip,tank then struck the ground 211 ft to the left of the runway centerline at a point 4,250 ft downstream from the approach end, and the aircraft crashed north of the runway in 10 in of snow. The aircraft broke up when the right wing struck the ground. The total aircraft wreckage was confined to an area 638 ft long and 98 ft wide. There was no evidence of ground fire.

The aircraft broke into three sections upon impact—the cockpit and cabin; the empennage, with engines; and the wing structure. The forward section of the fuselage, containing the passenger cabin and cockpit, separated from the aft section at the aft pressure bulkhead. The top right side of the forward section from the copilot station aft to the pressure bulkhead was flattened. The windshield and forward right-side passenger window were broken. The nose landing gear was extended.

The aft fuselage section, consisting of the tailcone, empennage, and engines, came to rest inverted. There was little impact damage. The right engine inlet/nacelle was crushed and the right stabilizer tip was bent downward. The navigational antennas on each side of the vertical stabilizer were undamaged. The empennage flight control surfaces were still attached to their main structure.

The flattened area of the cockpit/cabin section, the crushed right engine inlet/nacelle, and 2 ft of the bent outboard right horizontal stabilizer lined up on the same plane to form a lateral impact angle of 52° with the ground.

The left stall warning vane and both left and right pitot masts were undamaged. The right stall vane was broken off. All antennas and the rotating beacon on the underside of the fuselage were undamaged. The keel beam carry-through structure, under the wing section, was torn away but attached by flight control cables.

The wing structure, consisting of left and right wings, separated from the fuselage upon initial impact and landed inverted. There was minimal damage to the left wing and wingtip tank. The right wingtip tank was severed from the wing and broken into five large sections. Deformations in the inboard side of the tank indicate that the tank was pushed into the wingtip and then was torn off. The wingtip was torn and bent down at wing station **126.** The outboard section of the aileron was crushed and torn. There were scuffmarks on the underside of the left wingtip tank and under the fin extending outward from the tailcone. The scuffed area on the tank was **7** in wide, centered at the 7 o'clock position (looking forward), and extended from tank stations **117** to **140.** Measurement of the bcuffed area indicated the tank struck the runway with the aircraft in a 13° left wing-down and **16"** nose-up attitude.

The stabilizer trim actuator was attached to the stabilizer and vertical stabilizer spar. The actuator drivescrew and housing were bent. During the postcrash inspection, the actuator was removed and measured between the upper and lower attach bolthole centerline. The actuator measurement of **13 5/8** in corresponds to **8"** stabilizer nose-down position.

The aileron system from the control wheel to the fuselage break was intact and operable. One bridle cable that connected the aileron system to the autopilot servo was broken. The aileron cables were severed at the fuselage break. The aileron cable system in the wing section was in place and appeared to be operable except for a break in the left aileron down cable in the left wing inboard section. The left aileron was undamaged and operable. The trim tab, located on the left aileron, was in the neutral position. The right aileron was damaged extensively throughout. All hinge attachments were accounted for and the aileron appeared to have been in an operable condition before impact.

The rudder control system from the rudder pedals to the bellcrank under the floorboard was intact and operable. The two cables continuing aft from this point separated from the bellcrank because the links used for attachment failed. A Safety Board metallurgical examination showed the link fractures were typical of a tensile overload failure. The separated cables were attached to the aft section of the fuselage. The rudder system from this point to the rudder was undamaged and operable. The rudder suffered no visible damage and was operable through its entire travel range. The trim tab was in the neutral position.

The elevator control system from the control column aft to the fuselage break was intact and appeared operable. The elevator system from this point aft was intact and operable. There was no damage to the left elevator. The right elevator tip was bent down slightly. Both elevators moved freely.

The left flap was undamaged and locked in the 40° down position. This was determined by measuring the extended length of the actuator—18.62 in. The flap interconnect cable was intact and undamaged, indicating that the right flap was also at the 40° down position. The right flap sustained some damage at the inboard end. The inboard end of the flap was bent downward starting from the inboard flap track. There was no visible damage to the spoilers. Both spoilers were locked in the retracted position.

The main landing gears were locked in the extended position. There was no visible damage to the gear or tires. The wheels turned freely with no unusual noise. The gear doors were damaged slightly. The doors were hinged on the fuselage carry-through keel beam which was torn away when the wing separated from the fuselage.

1.13 Medical and Pathological Information

The pilot, copilot, and three of the five passengers died as a result of this accident. The two surviving passengers received serious injuries. Autopsies, which were performed on only the pilot and copilot, indicated that the pilot incurred fatal injuries to the head and blunt trauma to the thorax. The copilot sustained fatal head and cervical spine injuries. Toxicologic samples from the crew were negative for carbon monoxide, basic, acidic, or neutral drugs, and ethyl alcohol. The passenger deaths were attributed to severe chest injuries.

1.14 Fire

There was no fire.

1.15 Survival Aspects

The aircraft interior was configured with two pilot seats which were separated from the passenger area by wooden refreshment and vanity cabinets. A side-facing combination toilet/seat was located at the right forward side of the passenger area. At the rear of the cabin there was a divan seat for three occupants. A baggage area was located aft of this seat. Two individual swivel seats were located forward of the divan seat. All seats except the center divan seat were occupied. A two-piece passenger boarding door, with stairs mounted on the lower fuselage, was located at the forward left side of the cabin. An emergency window exit was located on the right side of the fuselage near the divan seat.

On impact, the fuselage, wing structure, and the empennage separated. The fuselage came to rest inverted, which caused severe damage to the right cockpit ceiling and reduced considerably the copilot's occupiable space. The upper right side of the passenger cabin was damaged less. The primary damage was to the forward fuselage in the area of the upper right side of the cockpit. The cockpit instrument panels and pilot flight controls were deformed slightly. Terrain or ground structures did not intrude into the cabin, except for snow which entered through the broken windshield. Although the fuselage was distorted, the cabin volume was not decreased significantly. There was a circumferential break of the fuselage at the aft end of the baggage compartment.

The wooden cabinet located between the copilot's seat and the side-facing passenger seat had shifted and was distorted. The sharpedged top of this unpadded cabinet was forced aft and downward by fuselage bending above this unit. The side-facing seat was torn loose, although it was held in position by the floor-attached, passenger seatbelt. There were no other seat failures. However, the back of the left swivel chair was found in a 45° reclined position because of a distortion in the back-angle adjustment mechanism. The passenger in this seat survived the accident. Both swivel seats were facing rearward at the time of impact although a placard warned that "seats must face forward during takeoff and landing."

There were no shoulder harnesses installed on the pilot or passenger seats. All seatbelts had metal-to-metal type buckles with three-bar slides for belt length adjustment. The webbing of the pilot's seatbelt had separated? in above the left (outboard) attachment point. No sharp metal or material that could have cut this belt or caused wear was found. A slightly distorted three-bar seatbelt slide was found loose on the cockpit floor. The webbing of both seatbelt halves of the left swivel chair had been partially ripped at the three-bar slide location.

Emergency personnel reached the wreckage at 1454 within 3 min after crash notification, but they were unable to enter the fuselage because the main cabin door was jammed and the right emergency window exit was underneath the fuselage. Rescuers attempted to cut into the fuselage with an air-operated power chisel which could cut through the aircraft skin but not the rib frame. Chisel bits, were changed but the ribs could not be cut. Members of the Air National Guard arrived to assist and provided a gasoline-powered rescue saw. This saw cut an entrance to the cabin and the two survivors were freed from the aircraft about 1510.

1.16 Tests and Research

1.16.1 Performance Characteristics

To better understand the aircraft performance aspects of this accident and to aid in the investigation of other recent Learjet accidents, the Safety Board studied the performance of models of the Century III Learjet and the Mark II (Raisbeck) Learjet. Findings relating to the Century III model are contained in this report.

The objectives of the study were to:

- o Examine operation of the stall warning system shaker and pusher of the modified aircraft under the maneuvering conditions related to landing and gc–around regimes of flight;

- o Determine the most probable effect of small amounts of wing ice on the stall performance of the modified aircraft; and

- o Investigate the low-speed handling qualities of the modified aircraft in an attempt to determine the cause of the large out-of-control roll reversals observed just before several recent Learjet accidents.

The accident aircraft had been modified with the Gates Learjet Century III performance modification kit. The modification kit, among other things, incorporates an increase in the radius of the wing leading edge to delay the stall of the wing, a modification of the stall warning system, the addition of an electronic computer to automatically raise the stall warning speeds to compensate for accelerated stall entry, and an addition of a strake at the juncture of the wing and the tip tank to improve the effectiveness of the aileron.

The Safety Board evaluated the stall warning system operation during flight tests on February 26 and 27, 1979. Because of the wing rolloff characteristics at the stall of basic Learjet models and models with the Century III modification, FAA certification procedures require the addition of a stick pusher system which activates before the stall to assist in preventing a rolloff encounter at the stall. Department of Transportation Order 8110.6, Review Case No. 38, Learjet Model 23 requires that: "Dual independent stick shaker stall warning systems are provided. Each system is to actuate in such a manner as to give an unmistakable, reliable warning to the pilot(s) with an adequate margin ahead of the stall." The shakers were considered to be excessively weak in the test aircraft, and during periods of high pilot workload, onset of stickshaker action was overlooked. Evidence indicated that the present deficiency may be the result of a change in design, because earlier model Learjets have not had this problem. Review Case No. 38 also requires that: "The operation of the stick pusher is such that' it automatically disengages when it has decreased the angle of attack of the airplane to a point less than that at which the pusher is set for actuation." This requirement did not appear to be satisfied, because the pusher appeared to unlatch at the same angle of attack that it initially activated. Otherwise, general system operation was satisfactory.

During the flight tests, simulated ice shapes were constructed to resemble light ice accumulation and were applied symmetrically to both wings. With these shapes installed, aerodynamic rolloff always occurred before shaker or pusher actuation. The study concluded from these tests that a very small amount of ice or other foreign matter on the wing leading edge, except immediately in front of the aileron, can possibly negate the shaker–pusher stall warning system. In a landing configuration at representative gross weights and center of gravity positions, the rolloff occurred about 10 kns above the target pusher speed. At the lightweight condition, rolloff was easily controllable, but at heavy weights the rolloff was difficult to control. The Safety Board believes that, at the time of the accident, Learjet N77RS was in a mediumweight condition.

Following these flight tests, the Gates Learjet Corporation issued a bulletin to all Learjet aircraft owners and operators which stated that failure to use the anti-ice systems in accordance with airplane flight manual procedures may allow an accumulation of ice on the wing leading edge and small accumulations of wing ice which can cause aerodynamic stall before actuation of the stickshaker and/or pusher. The company further advised that if an approach and landing must be made with any ice on the wing leading edge, the approach and touchdown speeds should be 15 kns above normal as stall warning devices are programmed to the stall speed of an ice-free leading edge.

During landing approaches without simulated wing ice, no abnormalities were observed in the low-speed handling characteristics from Vref to pusher actuation. Missed approach maneuvers were performed at safe altitudes and the airplane was easily controlled in all axes. The flight test study found that sideslip had no apparent effect on stall speed, or on stickshaker or pusher actuation speeds in the landing configuration. On go-around attempts at speeds above stickshaker speeds (about 1.07 Vs or greater), no problems were encountered. However, when the go-around was initiated from speeds lower than the stickshaker actuation speed and combined with a rapid roll input, the downgoing wing stalled and resulted in the wing's rolling nearly vertical. On some occasions, the pusher did not actuate as it was programmed to do.

During postaccident testing, the stall warning system and various portions of the autopilot, including the yaw damper, operated as programmed on N77RS.

1.16.2 Seatbelt Failures

The failed seatbelts of the pilot and one of the passengers were tested statically by the Protection and Survival Laboratory of the Civil Aeromedical Institute (CAMI). It was not possible to dynamically test the seatbelts as they were configured in the accident situation. However, the belt webbing was determined to have an ultimate tensile strength of about 2,200 lbs. This is 68 percent over the strength required by Technical Standard Order C-22f. Tests to destruction showed that one of the belt failures originated in the webbing at the three-bar slide, which secures the belt to the anchor fitting. The CAMI found the three-bar slide to have been improperly installed, which resulted in the ultimate failure. The improper installation consisted of doubling the webbing at the slide so as to stow loose belt ends. This installation overloaded the slide and probably caused the accident belt to tear where the belt contacted the metal slide. The belt manufacturer stated to the CAMI that its belt users will be advised to abandon this practice if, in fact, the belts are being improperly installed.

1.17 Turbulence in the Anchorage Area

The terrain in the vicinity of the Anchorage airport has unique geophysical features which significantly affect local flying. The airport is surrounded by mountains on three sides with a small east/west line of hills paralleling runway 06R. These hills are known to effectively disrupt southerly air flows across the airport, and in doing so, create windshears over runway 06R. Turnagain Arm, a large body of inland water, encircles the airport from the east to the northwest, and its location contributes to localized turbulence.

Wind speed observations at Anchorage are taken at two anemometer sites. 4/ The wind speed observed at the centerfield anemometer was about 10 kns at 1450 and 17 kns at 1451. The runway 06R wind velocity was observed by the tower controller to be 175° at 10 kns at 1447 and 155' at 21 kns 1 min later. 5/ The NWS observer recalled that about the time of the accident he saw a maximum wind speed at the runway 06R anemometer of 31 kns.

1.17.1 Icing

A review of the Anchorage radiosonde disclosed that the Learjet would have entered the clouds about 7,000 ft and would have descended to about 1,600 ft in instrument meteorological conditions. The freezing level in the airport vicinity was estimated to be 300 ft. At an estimated descent rate derived from pilot-reported altitudes, the aircraft would have been in the clouds about 5 minutes. With an assumed liquid water content in the clouds of 0.25 gm $^{-3}$ and a 100-percent collection efficiency, the possibility exists that sections of the unheated airframe could have accumulated about 0.3 in of ice. Examination of the cockpit wreckage found the deicer switches in the off position.

It could not be determined from examination of the wreckage if the pilot had used the deicing system during the descent through the clouds; however, the pilot may have deactivated the system when descending under the cloud base. There was no evidence of airframe ice on the wing or horizontal stabilizer. However, evidence of ice may have disappeared when foam was applied by emergency personnel as a fire precautionary measure. There was an accumulation of ice, however, on the pylon connecting the engine nacelles to the fuselage. (See figure 1.) This ice was a rough-textured mixture of rime and clear ice and may have been indicative of similar accumulations on the wing leading edges.

1.18 New Investigative Techniques

None.

4/ A postaccident check of wind speed calibration of the runway 06R anemometer found the readings to be 5.2 kns low at 54.2 kns. A 10 percent error throughout the wind range was assumed. Wind speeds in this report contain the correction.

5/ The centerfield anemometer is located 5,900 ft east of the runway 06R threshold and 368 ft north of the runway 06R centerline. Another anemometer is located 1,348 ft south of the runway 06R threshold. The readings of both anemometers are displayed in the tower cab and the NWS facility where the centerfield winds are recorded.

Figure 1.--Ice accumulation on left engine pylon.

2. ANALYSIS

The Accident

The flightcrew was certificated properly. However, there was no evidence to indicate that either pilot was properly qualified. The pilot's records indicated that he should have taken a required annual proficiency flight check 6 months before the accident, but the records did not show that the flight check had been performed. The copilot's flight time record did not indicate that he had received the training required to perform as second-in-command of a turbojet-powered multiengined airplane certificated for more than one pilot crewmember. Nevertheless, the Safety Board concludes that under the circumstances of this accident, the qualification status of the pilots was not a primary causal factor. Also, there was no evidence that medical factors might have affected their performance.

The aircraft was certificated and maintained in accordance with applicable regulations and procedures. There was no evidence of any aircraft malfunction which could have caused or contributed to the accident. No evidence was observed in any examined structure to indicate that an inflight fire, explosion, or bird strike had occurred before impact.

A former copilot stated in a postaccident interview that he was not allowed to pilot Learjet N77RS until he had served as copilot for about 6 months. Therefore, he did not believe that the newly-hired copilot on the accident aircraft would have been at the flight controls at the time of the crash. Accepted cockpit procedures normally call for the nonflying pilot to handle radio communications. Since the copilot was identified as the person operating the aircraft radios immediately before the accident, the Safety Board concludes that the pilot-in-command, not the copilot, was flying the airplane.

The terrain south of runway 06R probably influenced the varying wind velocities encountered by the Learjet. The Safety Board's weather analysis indicated that the maximum wind speed encountered from the approach end of runway 06R to the accident touchdown area was not greater than 31 kns and the wind direction varied between 155' and 180. The evidence disclosed that about 'the time of the accident a maximum gust spread of 22 kns may have existed from the approach end of runway 06R to a point 2,000 ft from the runway approach end. Vertical and horizontal windshear probably existed over the runway from the surface through 100 ft above ground level. However, evidence was not sufficient to conclude that the effects of windshear played a significant role in the erratic maneuvers of the aircraft; rather, the turbulence of the gusting crosswinds provided the destabilizing influence. Immediately before the accident, the maximum wind velocity at the runway 06R anemometer was determined to be 170° at 31 kns and the maximum wind velocity observed at the centerfield anemometer was determined to be 160° at 21 kns.

As the Learjet was approaching the planned touchdown point in gusty crosswind landing conditions, the passengers were aware of turbulence and a violent gust encounter. The time interval from the maximum to mimimum wind speeds may have been seconds. Any change to the balance of forces and moments, due either to a pilot control input or an atmospheric disturbance, would have caused the airplane to lose its state of equilibrium. The relatively large wind speed changes and varying wind direction changes acting perpendicular to the intended flightpath could have caused the aircraft to react rapidly, changing flight track directions. During the landing flare, the left wing dropped and the wingtip tank struck the runway. The scraping and indentations found on the left wingtip tank indicated that at this time the aircraft had rolled left 13° and pitched nose-up 16°. The scraping of the tip tank probably would have immediately produced an extremely distracting situation to the pilot. After the tip tank hit the runway, erratic flight maneuvers occurred which included sharp increases in engine thrust, steep nose-up pitching movements, rolling motions of the wings, and vigorous yaw reversals. The exaggerated attitudes of the flight profile probably caused rapid deceleration which in turn led to loss of aircraft control. The Safety **Boards** study of Century III Learjet performance indicated that at speeds between the stall and stickshaker speeds, a wing stall may be caused by abrupt pitch and roll inputs with less than full power.

Because of the absence of wind conditions during flight testing similar to those at the time **of** the accident, the Safety Board's study on Learjet performance could not address the effects of turbulence on low-speed handling characteristics. However, the yaw conditions observed in the attempted go-around probably resulted from excessive rudder inputs with the yaw damper off. Such rudder inputs may have been introduced to correct for yaw caused by the gusting crosswinds **or** by an attempt to stop the drift and align the aircraft. **The** wing rolling probably resulted from pilot overcontrol and, without well-timed and coordinated flight control inputs, the adverse winds sustained the wing rolling. However, the winds did not exceed the crosswind certification limitation of the aircraft. Flight tests indicated that adequate control authority, when properly applied, was available to counter such wind conditions.

Because no postcrash evidence of mechanical **or** structural problems was found and the aircraft had demonstrated the ability to be flown under similar crosswind conditions, the Safety Board concludes that the aircraft's uncoordinated maneuvers were induced by gusting crosswinds. The Safety Board further concludes that the maneuvers were intensified by the inappropriate flight control inputs by the pilot.

The Safety Board's study of Learjet performance reviewed the effect of ice on the stall characteristics and the fidelity of the stall warning system. Both of these may have contributed to this accident, although there is no conclusive evidence that ice had accumulated on the accident aircraft wings. Considerable testing was conducted by the FAA and the manufacturer during the original development **of** the "hot" leading edge anti-icing system on the Learjet wings. As in most recent certifications, the majority of the data available is analytical. On all certified anti-ice systems dependent upon heat from an engine bleed air source, a specific minimum power setting is required to obtain effective wing anti-icing. With the specified minimum power setting, the outermost portions of the Learjet 25 wings were found in certification testing to be susceptible to collecting ice in the extreme corners of the icing envelope set forth in 14 CFR 25. For this reason, Gates Learjet Corporation and the FAA had flown large "horn" ice shapes on the outer section of the wing. Stall speeds and stall characteristics were not degraded by these ice formations, and similar ice formations are not believed to have been involved in this accident. Nevertheless, examination of airframe icing found on the engine-fuselage pylon disclosed that Learjet N77RS had been flown in icing conditions.

Although the anti-icing selector switches of Learjet N77RS were found in the off position, the selector switches may have been actuated by the pilot during the descent and turned off as the aircraft descended below the overcast. However, failure to use the anti-ice system during the descent into Anchorage could have permitted so much ice to accumulate on the leading edge of the wing that the stall speed or wing rolloff speed could have been raised 10 to 12 kns. In this situation, as found by the performance study, the stall warning system shaker may not have activated before the initial wing rolloff. Flight tests conducted at altitude found that with simulated wing ice, the wing rolloff at stall was abrupt. The test program disclosed that if a stall occurs in landing or in an attempt to go around, the resulting loss of altitude would not have permitted wing roll reversals before ground impact unless the rolling was induced before the stall. Ground effect or variations in flight control inputs could alter this finding, however, and could have adversely affected pilot assessment of lateral control before wing stall.

During landing approaches without simulated wing ice, no abnormalities were observed in the low-speed handling characteristics from Vref speed to pusher activation. On go-around attempts at speeds above stickshaker speeds (about 1.07 Vs or greater), no flight control problems were encountered. However, during go-around exercises at speeds below 1.07 Vs, the downgoing wing stalled and resulted in the wings rolling nearly vertical.

Performance findings indicate that without wing ice, the accident aircraft must have slowed to near shaker speed before power was added in an attempted go-around. It is also possible that, in a flare extended as a result of an encounter with gusting crosswinds and with an increase in stall speed due to ice, the normal margins above the stickshaker provided by Vref speed and an added gust factor could have been negated. Failure to add sufficient airspeed to compensate for the gusting winds could have reduced the margin above an ice-induced stall speed. The Safety Board concludes that, in either case, tardy application of less than full power after abrupt flight control inputs at speeds near the stall led to catastrophic wing rolloff.

Survival Aspects

On the basis of the pilot's seatbelt failure, the injury patterns observed in this accident, and the known tolerance of the human body to impact forces when restrained by seatbelts only, it is estimated that the crash forces experienced by the occupants may have been 20 to 30 g's. This estimate is based on the pilot's seatbelt failure and the tensile strength of the webbing of 2,200 lbs. Given a 170-lb occupant, a static load of 13 g's would be required for the seatbelt to fail if the entire load were to be applied to one side of the belt. If 35 percent of the total load were carried by the other half of the seatbelt because of the asymmetry of loading in this case, the pilot may have experienced as much as 20 g's when the seatbelt failed. The incipient failure of the seatbelt on the left swivel chair in the cabin is corroborative of these estimates. Also, crash injury literature reveals that human tolerance to impact forces when a person is restrained by a seatbelt only is limited to about 18 to **20 g's.** 6/ The abdominal injuries suffered by the copilot were compatible with seatbelt trauma, according to medical authority. Thus, the Safety Board concludes that forces in excess of **20 g's** were experienced in the cockpit.

A typical pattern of injuries also was evidenced in the fatalities located in the cabin. Severe chest injuries typically occur when persons are thrown violently against nonyielding objects—in this case the right cabin wall. The injuries sustained by the occupant of the left divan seat indicate that he may have struck the arm rest of the right swivel chair. There was evidence to indicate that he had secured his left seatbelt half to the right half of the unoccupied seat next to him, allowing him to move freely within his restraint system.

The survival of the occupant of the left aft-facing swivel chair is attributed to the support afforded by his seatback, to the fact that he had his seatbelt tightly fastened, which limited the flailing radius of his upper torso, and to the absence of obstacles on his immediate left. The survival of the occupant on the right divan seat, who received only a mild cerebral concussion, is less easily explained since all other occupants on that side of the aircraft received fatal injuries. One possibility is that his survival was due to his relatively short height which may have limited his flailing radius.

Thus, while this accident was only marginally survivable, the Safety Board concludes that shoulder harnesses, if they had been available and used, would have restricted the flailings of the upper torsos of persons in this accident and thus could have increased the chance of survival for the fatally injured occupants. This concept of increased restraint to enhance occupant survival has been addressed by the Safety Board in the past. On December 8, 1977, the Safety Board recommended that the FAA amend 14 CFR 23.785, 14 CFR 91.33, and 14 CFR 91.39 to require installation of approved shoulder harnesses at **all** seat locations as outlined in **NPRM 73-1.** At the time of this report, the recommendations are carried in an open status pending the outcome of FAA research. While these recommendations addressed occupant restraint in light general aviation airplanes, this concept appears equally valid for passengers of the larger aircraft in the general aviation fleet. 7/

6/ "Limits of Seatbelt Protection During Crash Deceleration;' **U.S.** Army Research Command, Ft. Eustis, Virginia, TR-61-115, 1961.

7/ Improvements in general aviation crashworthiness standards have been made a Special Safety Objective by the Safety Board.

Flight Recorders

Flight recorders are not required by regulation for general aviation aircraft in 14 CFR 91 operations, such as the aircraft involved in this accident. However, information from these recorders would provide invaluable assistance to investigators in identifying the causal factors of an accident involving such aircraft. The lack of this information has hampered some Safety Board investigations. 8/ On April 13, 1978, during its investigation of an accident in McLean, Virginia 9/, the Safety Board made three recommendations (A-78-27 through -29) to the FAA regarding the mandatory use of recorders in these aircraft. The Safety Board reiterated the recommendations on December 21, 1978, in its report of an accident in Richland, Washington, and on September 20, 1979, in its report of an accident in Sanford, North Carolina. 10/ The FAA has not completed regulatory action that would implement these recommendations. The Safety Board, for the third time, reiterates these recommendations and urges the FAA to expedite the regulations that would require the use of flight recorders in certain general aviation aircraft.

3. CONCLUSIONS

3.1 Findings

1. The aircraft was certificated and maintained in accordance with approved procedures.

2. There was no evidence that the aircraft structure, systems, flight controls, or powerplants were involved in the cause of this accident.

3. The flightcrew was certificated properly. However, there was no evidence to indicate that either pilot was properly qualified.

4. NWS weather advisories forecast light to moderate rime icing in clouds below 12,000 ft in the Anchorage area. Severe turbulence was also forecast below 10,000 ft. The forecasts were verified by pilot reports.

5. At the time of the accident, strong, variable crosswinds were observed at the landing runway.

8/ "Aircraft Accident Report—Jet Avia, Ltd., Learjet LR24B, N12MK, Palm Springs, California, January 6, 1977" (NTSB-AAR-77-8); "Aircraft Accident Report—Johnson and Johnson, Inc., Grumman Gulfstream II, N500J, Hot Springs, Virginia, September 26, 1976" (NTSB-AAR-78-4).

9/ "Aircraft Accident Report—Southern Company Services, Inc., Beech-Hawker-125-600A, N40PC, McLean, Virginia, April 28, 1977" (NTSB-AAR-78-11).

10/ "Aircraft Accident Report—Columbia Pacific Airlines, Beech 99, N199EA, Richland, Washington, February 10, 1978" (NTSB-AAR-78-15); "Aircraft Accident Report—Champion Home Builders Company, Gates Learjet 25B, N999HG, Sanford, North Carolina, September 8, 1977" (NTSB-AAR-79-15).

6. During the landing flare, witnesses saw the accident aircraft begin a series of erratic maneuvers which were followed by the aircraft rolling over abruptly. When nearly inverted, the aircraft crashed alongside the runway.

7. The aircraft's erratic maneuvers were induced by strong gusting crosswinds.

8. The tardy application of less than full power after abrupt flight control inputs at speeds near the stall led to catastrophic wing rolloff.

9. Flight testing **of** low-speed handling characteristics indicated that a wing stall may be caused by abrupt pitch and roll inputs with less than full power at airspeeds near the stall.

10. Performance flights found that during go-around exercises at speeds below stick shaker actuation, the downgoing wing stalled and resulted in the wings rolling nearly vertical.

11. Performance testing with simulated ice shapes found that except in front of the aileron, a very small amount of ice on the wing leading edge always caused aerodynamic rolloff to occur before stickshaker **or** pusher activation.

12. An accumulation of rime and clear ice which was found on the engine pylons indicated that the aircraft had descended through icing conditions. Evidence of ice accumulations on the wings and horizontal stabilizer may have been destroyed by rescue operations.

13. If the anti-icing system was not used during descent, or if it was used without adequate system temperatures, ice may have been present on the wing leading edge during the landing. The ice would have led to stall speeds above those at which the stall warning system is activated.

14. The minimal recovery altitude made the pilot's response time critical and produced a situation wherein the pilot's ability to make a safe landing was greatly diminished. Further, the aircraft's ability to cope during the low-speed circumstances was possibly marginal.

15. The accident was marginally survivable. The closeness of a sharpened cabinet top to a passenger seat contributed to the fatal injuries of the passenger occupying that seat. The lack of shoulder harnesses contributed to the injuries of all the passengers and the pilots.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was an encounter with strong, gusting crosswinds during the landing attempt, which caused the aircraft to roll abruptly and unexpectedly. The ensuing loss of control resulted from inappropriate pilot techniques during the attempt to regain control of the aircraft. Suspected light ice accumulations on the aerodynamic surfaces may have contributed to a stall and loss of control,

4. RECOMMENDATIONS

As a result of this accident and several others involving general aviation aircraft, the National Transportation Safety Board reiterates the following recommendations made to the Federal Aviation Administration on April 13, 1978:

> Develop, in cooperation with industry, flight recorder standards (FDR/CVR) for complex aircraft which are predicated upon intended aircraft usage. (Class II, Priority Action) (A-78-27)
>
> Draft specifications and fund research and development for a low-cost FDR, CVR, and composite recorder which can be used on complex general aviation aircraft. Establish guidelines for these recorders, such as maximum cost, compatible with the cost of the airplane on which they will be installed and with the use for which the airplane is intended. (Class II, Priority Action) (A-78-28)
>
> In the interim, amend 14 CFR to require that no operation (except for maintenance ferry flights) may be conducted with turbine-powered aircraft certificated to carry six passengers or more, which require two pilots by their certificate, without an operable CVR capable of retaining at least 10 minutes of intracockpit conversation when power is interrupted. Such requirements can be met with available equipment to facilitate rapid implementation of this requirement. (Class II, Priority Action) (A-78-29)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ PATRICIA A. GOLDMAN
Member

/s/ G. H. PATRICK BURSLEY
Member

FRANCIS H. McADAMS, Member, dissented.

December 13, 1979

Member McADAMS filed the following dissenting statement:

The majority states that the loss of control was due to inappropriate pilot techniques, and also "suspected" light ice accumulations may have contributed. In my opinion there were several other factors which should have been cited as the reasons for the loss of control.

The pilot encountered several severe adverse conditions when the aircraft was in its most vulnerable configuration, viz., in the landing flare with gear and flaps down, low airspeed, 20 feet or less of altitude, very strong gusting crosswinds causing the wing to strike the runway due to a premature stall or partial stall, a very strong vertical and horizontal wind shear,1/ a very strong possibility of ice on the wings which would increase the stall speed,2/ the pusher-shaker system negated due to ice,3/ and the abrupt wing rolloff characteristics of the aircraft with no prior aerodynamic buffet.

Under the circumstances, the aircraft's ability to cope was extremely marginal, and a safe recovery may have been beyond the normal capability of the pilot.

The aircraft has a low roll-control sensitivity. There is an abrupt atypical wing rolloff with little or no aerodynamic buffet before stall entry. For this reason a stall warning system was required to meet certification standards. The FAA issued an Airworthiness Directive following the accident, 79-12-05, on June 18, 1979, which stated that the operation of the stall warning system requires an increase in the V-ref and touchdown speeds by 15 knots when ice accumulation is suspected. The pilot of the accident aircraft was not aware of the need for the higher speed nor that the stall warning system was inoperative due to ice.

In my opinion, the probable cause was:

> "...an encounter with strong gusting crosswinds accompanied by strong vertical and horizontal wind shear, resulting in loss of control of the aircraft.
>
> "An increased rate of descent was probably induced by the encounter with the low altitude wind shear at a critical

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1/ The evidence showed a strong vertical and horizontal wind shear of 9 knots per 100 feet existed over the runway.

2/ Tests showed that only a trace of wing ice can increase the onset of stall by at least 12 knots.

3/ Flight tests showed that as little as 1/16 inch of ice on the wing leading edge can negate the entire stall warning system.

point in the landing, accompanied by strong horizontal gusts, and ice accumulation on the wings. The stall warning system was negated by ice accumulation and the aircraft rolled abruptly to the left due to a stall or partial stall of the left wing. The minimal altitude made the pilot's response time critical and under the circumstances produced a situation where the pilot's ability to make a safe landing or a go-around was greatly diminished. The aircraft's ability to cope under these circumstances was marginal at best due to its low roll sensitivity, and a safe recovery may have been beyond the normal capability of the pilot."

/s/ FRANCIS H. McADAMS
Member

5. APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The Safety Board was notified of the accident about 2330 e.s.t., on December 4, 1978, and an investigation team was dispatched immediately to the scene. Investigative groups were established for operations, weather, witnesses, structures, systems, maintenance records, powerplants, human factors, and airplane performance.

Parties to the investigation included the Federal Aviation Administration, the National Weather Service, Gates Learjet Corporation, Inlet Marine, Inc., General Electric Company, and the Professional Air Traffic Controllers Organization.

2. Public Hearing

No public hearing or depositions were held.

APPENDIX B

CREW INFORMATION

Richard Sykes, Jr.

Mr. Sykes, 45, held private pilot certificate No. 1788182, with airplane multiengine land, airplane single-engine land and sea, rotorcraft-helicopter, and instrument privileges. His initial training in the Learjet was obtained at the Gates Learjet Corporation Flight Training Department, operated by Flight Safety, Wichita, Kansas. He was issued a type-rating in the Learjet on June 24, 1976, and completed his last annual Learjet proficiency flight check in July 1977. His flight log indicated about 2,000 hrs of total flight time of which 650 hrs were in the Learjet; no record of Mr. Sykes' flight hours was found from May 1970 to June 1976. However, on an application for an airman medical certificate (FAA Form 8500-8) dated July 25, 1977, he listed his total pilot time at over 7,000 hrs. His pilot time in the Learjet during the 30-day period before the accident was 15 hrs. He was issued a second-class medical certificate on July 25, 1977, with no limitations.

Richard James Church

Mr. Church, 25, held commercial pilot certificate No. 574263132, with airplane single-engine and multiengine land and instrument privileges. In August 1978, Mr. Church had a familiarization flight in Learjet N77RS. As of November 13, 1978, he had accumulated about 2,635 flight hrs, of which 21 hrs were in the Learjet. His first-class medical certificate was dated June 13, 1978, with no limitations.

APPENDIX C

AIRCRAFT INFORMATION

The accident aircraft, a Gates Learjet Model 25C, United States registry N77RS, serial number 094, was purchased from Combs Gates Learjet Department, Denver, Colorado, on June 16, 1976. The airplane was registered to Richard Sykes, Jr., and leased to Inlet Marine, Inc., Anchorage, Alaska.

The engines were maintained in accordance with applicable regulations and procedures. General Electric Model CJ 610-G engine serial number 251-331A was installed in the left position and engine serial number 251-340A was installed in the right position. The thrust rating for this engine model **is** 2,950 lbs. The engines' times since new (TSN) and cycles since new (CSN) **as** of July 31, 1978, were:

	TSN	CSN
251-331A	1615.2 **hrs**	1177 (est.)
251-340A	1585.5 hrs	1153 (est.)

It was estimated that 112 more hrs had been accumulated at the time **of** the accident. The last Hot Section Inspection was accomplished 1011 hrs previously on January 14, 1975.

Upon completion of the onscene investigation, both engines were delivered to the Strother Service Shop, General Electric Company, Arkansas City, Kansas, where they were disassembled for examination. There was no evidence of any engine malfunction which could have caused or contributed to the accident.