NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

**KENNEDY ELITE CENTER
GATES LEARJET MODEL 23, N866JS
BYRD INTERNATIONAL AIRPORT
RICHMOND, VIRGINIA
MAY 6, 1980**

NTSB-AAR-80-12

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NTSB-AAR-80-12	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Aircraft Accident Report--Kennedy Flite Center, Gates Learjet Model 23, N866JS, Byrd International Airport, Richmond, Virginia, May 6, 1980		5. Report Date November 25, 1980
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address National Transportation Safety Board Bureau of Accident Investigation Washington, D.C. 20594		10. Work Unit No. 2999A
		11. Contract or Grant No.
		13. Type of Report and Period Covered Aircraft Accident Report May 6, 1980
12. Sponsoring Agency Name and Address NATIONAL TRANSPORTATION SAFETY BOARD Washington, D. C. 20594		14. Sponsoring Agency Code

15. On May 5, 1980, an unmodified Gates Learjet Model 23 was being operated by Kennedy Flite Center, Richmond, Virginia, on a flight from Richmond to Louisville, Kentucky, continuing to Gainesville, Florida, and returning to Richmond. The pilot, received the appropriate weather briefings and filed three instrument flight rules (IFR) flight plans. The aircraft departed Richmond at 2128 e.d.t. with two pilots aboard. The flight to Louisville was uneventful, as was the subsequent flight to Gainesville with six passengers aboard. The aircraft departed Gainesville at 0152 on May 6, 1980, with only the two pilots aboard.

Upon arrival in the Richmond area, the flightcrew requested an instrument landing system (ILS) approach to runway 33 at Byrd International Airport. They were cleared for the approach and landing. Witnesses stated that the aircraft crossed the runway threshold "a bit high," started to rock, and rolled inverted as engine thrust increased. The aircraft crashed adjacent to the runway at 0312 and burst into flame. Both pilots were killed.

The National Transportation Safety Board determines that the probable cause of the accident was the pilot's failure to maintain proper airspeed and aircraft attitude while transitioning from final approach through flare to touchdown. The low-speed/high angle-of-attack flight condition precipitated wing rolloff, wingtip strikes, and ultimate loss of aircraft control. The pilot's improper technique during roundout may have been due to fatigue, his limited knowledge, training, and experience regarding the flight characteristics of the Learjet aircraft, and distraction caused by concern over the intensity of the approach lighting.

17. Key Words IFR flight; practice ILS; approach light intensity; flare; wingtip strike; roll; collision with ground; fire; airspeed; aircraft attitude; distraction; pilot technique; flight characteristics. Identifier: Gates Learjet 23 Accident		18. Distribution Statement This document is available to the public through the National Technical Information Service Springfield, Virginia 22161	
19. Security Classification (of this report) UNCLASSIFIED	20. Security Classification (of this page) UNCLASSIFIED	21. No. of Pages 44	22. Price

NTSB Form 1765.2 (Rev. 9/74)

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Adopted: November 25, 1980

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SYNOPSIS

On May 5, 1980, an unmodified Gates Learjet Model 23 was being operated by Kennedy Flite Center, Richmond, Virginia, on a flight from Richmond to Louisville, Kentucky, continuing to Gainesville, Florida, and returning to Richmond. The pilot received the appropriate weather briefings and filed three instrument flight rules (IFR) flight plans. The aircraft departed Richmond at 2128 e.d.t. with two pilots aboard. The flight to Louisville was uneventful, as was the subsequent flight to Gainesville with six passengers aboard. The aircraft departed Gainesville at 0152 on May 6, 1980, with only the two pilots aboard.

Upon arrival in the Richmond area, the flightcrew requested an instrument landing system (ILS) approach to runway 33 at Byrd International Airport. They were cleared for the approach and landing. About 0311:10, the flightcrew requested that the sequenced flashing approach lights be turned down, and the controller asked that the message be repeated. The controller heard two garbled radio transmissions referring to lights, and he dimmed the lights when the aircraft was about 0.5 mile from the runway. Witnesses stated that the aircraft crossed the runway threshold "a bit high," started to rock, and rolled inverted as engine thrust increased. The aircraft crashed adjacent to the runway at 0312 and burst into flame. Both pilots were killed.

The National Transportation Safety Board determines that the probable cause of the accident was the pilot's failure to maintain proper airspeed and aircraft attitude while transitioning from final approach through flare to touchdown. The low-speed/high angle-of-attack flight condition precipitated wing rolloff, wingtip strikes, and ultimate loss of aircraft control. The pilot's improper technique during roundout may have been due to fatigue, his limited knowledge, training, and experience regarding the flight characteristics of the Learjet aircraft, and distraction caused by concern over the intensity of the approach lighting.

1 FACTUAL INFORMATION

1.1 History of the Flight

On May 5, 1980, an unmodified 1/ Gates Learjet 23 (N866JS) was operated by Kennedy Flite Center, Richmond, Virginia, on a purported crew training flight. The pilot called the Newport News, Virginia, flight service station (FSS) about 2105 2/ and received a weather briefing for a flight originating in Richmond to Louisville, Kentucky, continuing to Gainesville, Florida, and returning to Richmond. He filed three instrument flight rules (IFR) flight plans. The first flight plan called for a flight of 1+00 hour from Richmond to Louisville with the pilot and copilot aboard. The second flight plan called for a flight of 1+29 hours from Louisville to Gainesville with the pilot, copilot, and six passengers aboard. The third flight plan called for a flight of 1+10 hours from Gainesville to Richmond with the pilot and copilot aboard. All of the plans requested flight level (FL) 410 as an en route altitude.

N866JS departed Richmond about 2128 with the two pilots aboard, and arrived at Standiford Field in Louisville at 2228 after a routine flight. The aircraft was refueled with 386 gallons of Jet A fuel costing $479.46, which was paid by check. The flightcrew boarded the six passengers, who were friends of the copilot according to the company's flight manager, and the aircraft departed Louisville at 2315. After a routine flight, the aircraft arrived at Gainesville Regional Airport at 0044, May 6, 1980, and the passengers deboarded. Charter Air Center service personnel "topped off" the fuel tanks with 404 gallons of Jet A fuel. The fuel bill was $596.63, which was paid in cash. The flight departed Gainesville at 0152.

Initial climb was to 23,000 feet 3/ with further clearance to FL 370 and final clearance to the requested FL 410. The en route portion of the flight proceeded normally, and at 0257, during descent, the aircraft was handed off at 14,000 feet by the Washington Air Route Traffic Control Center to Richmond approach control.

The Richmond approach controller acknowledged the handoff, gave current weather and wind conditions, and told the flightcrew to expect a visual approach to runway 2 at the Byrd International Airport. The flightcrew requested an instrument landing system (ILS) approach to runway 33. This request was acknowledged, and the approach controller vectored the aircraft to the ILS final approach course, outside of the outer marker, at 2,000 feet.

1/ An unmodified Learjet has wings/lift devices that have not been changed since manufacture. A modified Learjet (for example, Century III and Howard/Raisbeck Mark II) has wings/lift devices that have been changed since manufacture to improve landing performance.
2/ All times are eastern daylight saving time, based on the 24-hour clock.
3/ All altitudes are mean sea level, except as noted.

The approach controller turned the aircraft over to the local control tower operator at 0308. Radio commmunication between the aircraft and the tower controller was established, and the aircraft was cleared to land at 0308:41. While on final approach at about 2 miles from the runway, the pilot asked for a wind check, and the controller responded that the winds were calm.

About 0311:10, the flightcrew requested that the sequenced flashing approach lights be turned down and the controller asked that the message be repeated. The controller heard two garbled radio transmissions within 40 seconds referring to lights, and he dimmed the lights when the aircraft was about 0.5 mile from the runway.

The tower controller stated that the aircraft's flightpath appeared higher than normal and that N866JS seemed,to float down the runway at about 50 feet altitude. He then'saw the wingtip lights rocking back and forth, the nose of the aircraft rising, and the aircraft starting to roll. He stated that he reached for the crash phone when he saw the wings rocking because he was concerned about the safety of the aircraft. He then saw a ball of fire on runway 33 and immediately sounded the crash alert; the time was 0311:58.

A Virginia Air National Guard security guard on duty near an aircraft parking ramp and the "M" taxiway adjacent to runway 33 witnessed the accident. He stated that he was in a parked truck, engine off, with an unobstructed view of the runway approach zone and touchdown area. He said that the aircraft was "a bit high" on its approach, but descended to a normal touchdown attitude and altitude with the noise of the engines winding down. He did not hear the "screech" of the tires which would have been normal if the aircraft touched the runway. Instead, he said that the aircraft yawed right, the nose came up, and the aircraft started to roll to the right. The roll continued to the inverted position accompanied by a buildup of engine noise. He then saw the aircraft strike the ground inverted, catch fire, and explode.

Another security guard on duty at the entrance to the Air National Guard base also witnessed part of the accident sequence. He observed the approach to runway 33 and stated that he thought the aircraft was landing farther down the runway than normal. He did not hear the aircraft touch down, but did hear a sudden rise of engine noise. He saw a white light traveling down the runway followed by an orange fireball and flames.

The aircraft crashed at night during hours of darkness at latitude 37°30' N. and longitude 77°19' W., at an elevation of 168 feet.

12 **Injuries to Persons**

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

1.3 Damage to Aircraft

The aircraft was destroyed by impact forces and postcrash fire.

1.4 Other Damage

The runway surface was damaged slightly. There was ground scarring and fire damage to the airport infield.

1.5 Personnel Information

The flightcrew was certificated and qualified for a training flight. The copilot was not qualified for air taxi flights under 14 CFR Part 135. (See appendix B.) The pilot was employed full-time by Kennedy Flite Center as a charter pilot and flight instructor. He reported for duty at 0900 on May 5, 1980, and was released at 1300. He went home and was active until being recalled at 2100 for this flight. At the time of the accident, he had been awake for about 20 hours. The pilot had been off duty on May 3 and 4, 1980.

The copilot was a part-time employee of Kennedy Flite Center as a charter pilot and flight instructor. He was not on duty on May 5, 1980, and worked at his full-time occupation during the day. He arrived at the Kennedy Flite Center about 2100. At the time of the accident, he had been awake for about 18 hours.

1.6 Aircraft Information

The aircraft was certificated, equipped, and maintained in accordance with Federal Aviation Administration (FAA) requirements. The gross weight and center of gravity (c.g.) were within prescribed limits for takeoff and at the time of the accident. The aircraft was fully fueled (804 gallons useable) with Jet A fuel on departure from Gainesville. (See appendix C.)

1.7 Meteorological Information

The surface weather observation for Byrd International Airport at 0254, May 6, 1980, was: 25,000 feet above ground level (a.g.l.) thin scattered clouds, 10 miles visibility, temperature 64° F, dewpoint 48° F, wind from 180° at 5 knots, altimeter setting 29.64 inHg.

A special observation for Richmond taken at 0319, 7 minutes after the accident, was: 25,000 feet a.g.l. thin scattered clouds, 10 miles visibility, temperature 64° F, dewpoint 50° F, wind from 260° at 3 knots, altimeter setting 29.64 inHg.

When the aircraft was on the ILS final approach, the control tower operator reported to the flightcrew that the wind was calm.

1.8 Aids to Navigation

The ILS approach to runway 33 uses the low-frequency outer marker (KAFKA) as the primary approach fix. This facility is located 4.6 nautical miles from the threshold of runway 33. The middle marker associated with the system is located 0.4 nautical mile from the threshold of runway 33. The 3° glide slope begins on the runway about 2,000 feet down from the threshold and extends back along the approach, crossing the runway threshold at a height of approximately 59 feet a.g.l., crossing the middle marker at approximately 361 feet m.s.l., and crossing the outer marker at approximately 1,700 feet above sea level.

The published procedure for an ILS approach to runway 33 is, proceed inbound on the localizer on a heading of 334°, within 10 nautical miles descend so as to cross the outer marker at not less than 1,700 m.s.l., then descend along the glidepath to a minimum height of 361 feet m.s.l. (200 feet a.g.l). The published minima for a straight-in approach landing on runway 33 with the ILS system fully operable are 200 feet ceiling, and runway visual range (RVR) 1,800 feet or 1/2 mile visibility.

At the pilot's request, N866JS was radar-vectored to intercept the ILS for runway 33. When the local air traffic controller cycled up the main runway 33 ILS, an alarm rang and an "abnormal" light illuminated, indicating that an abnormal condition existed within the system. The controller switched to the backup ILS localizer; the alarm silenced and the abnormal light stayed on. This is the way the system is designed and there is no deterioration of radiated signal when the backup system is used.

The runway 33 ILS system was flight-checked by an FAA flight inspection crew on May 6, 1980. They reported, "all parameters of ILS equipment and associated equipment used with this procedure inspected and found satisfactory."

1.9 Communications

There were no reported communications difficulties between the aircraft and FAA control facilities on any of the flights. The last two or three transmissions from the aircraft before the accident referring to sequenced strobe approach lighting were garbled. The aircraft's communications radios and asociated equipment were destroyed by impact and ground fire.

The Kennedy Flite Center accident investigation coordinator was present when the air traffic control tapes were reviewed on May 7, 1980. He stated that he recognized the voice in the radio transmissions to the Richmond approach and tower controllers as that of the pilot. Kennedy Flite Center procedures call for one pilot to handle the radios and navigation while the other pilot flies the aircraft.

1.10 Aerodrome Information

The Richard E. Byrd International Airport is located 7 miles east of Richmond. The airport has three runways and is surrounded by level terrain. Land use is a mixture of suburban and rural.

Runway 33 is 8,999 feet long and 150 feet wide. There are 1,000-foot overruns at each end of the runway. The last 4,999 feet of the runway has 75-foot-wide paved shoulders. Runway lighting consists of high-intensity runway edgelights spaced 200 feet apart, standard centerline lighting, touchdown zone lighting, and high-intensity approach lights with sequenced flashing. The elevation of the runway 33 threshold is about 161 feet.

1.11 Flight Recorders

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

1.12 Wreckage and Impact Information

The first ground impact marks on the runway were parallel scrape marks about 16 inches apart starting at 1,755 feet beyond the threshold about 32 feet right of the centerline. The right scrape mark was 58.5 feet long and the left mark was 28 feet long. Another set of parallel runway scrape marks about 16 inches apart started 365 feet farther down the runway about 33 feet right of the centerline. The right scrape mark was 34 feet long and the left mark was about 15 feet long. The angle between the centerline and all marks was about 3°. These scrape marks were lighter in color than the runway and had a gray, metallic cast.

An additional impact scar was found in the grass adjacent to the right side of the runway at 4,475 feet. The horizontal tail spar section and pieces of red glass were. found in the scar at that point. The ground scarring and marks continued in a straight line to the main wreckage 665 feet farther along the side of the runway. Pieces of the aircraft scattered between the initial ground contact point and the main wreckage included access covers, wing skin, horizontal stabilizer, tip of left elevator, and left engine. There was a fire/soot pattern running throughout the wreckage path.

The main wreckage came to rest 5,140 feet beyond the runway threshold 150 feet right of the centerline on the edge of the runway. The wreckage consisted of the cockpit/cabin area, fuselage,. empennage, right wing, right engine, and a part of the left wing. The wreckage was damaged by ground fire. (See appendix D.)

1.13 Medical and Pathological Information

Postmortem examinations of both pilots were performed by the Office of the Chief Medical Examiner, Commonwealth of Virginia, Richmond, on May 6, 1980. Their examination showed that both crewmembers died of similar multiple traumatic injuries. Toxicological specimens for both crewmembers were screened for alcohol, drugs, and carbon monoxide, and the results were negative. There was no evidence of any disease or physical condition that would have affected the pilots in the performance of their duties.

Among the injuries sustained, the pilot had a dislocation of the right thumb and metacarpal-phalangeal joint. He also sustained wrist, arm, and leg fractures. The copilot sustained a fracture of the right fourth finger.

1.14 Fire

The Safety Department of the Capital Region Airport Commission at Byrd International Airport responded to the crash notification with three vehicles and four firefighters. They arrived onscene in less than 2 minutes and extinguished the fuselage fire within 2 minutes. They expended 160 gallons of chemically treated water from two vehicles.

1.15 Survival Aspects

This accident was not survivable by occupants in the cockpit. The cockpit area was crushed and broken open during the crash sequence, and both pilots were ejected from the aircraft. The two aft passenger seats were relatively intact and the surrounding fuselage was not significantly deformed. However, it cannot be determined if crash forces were light enough to have been survivable.

The source of the ground fire was primarily fuel from the ruptured left and right wing fuel tanks, and the ignition source was probably an engine or a shorted electrical system.

1.16 Tests and Research

1.16.1 Aircraft Parts

Components of the angle-of-attack, yaw damper, flight control, and autopilot systems were disassembled and examined at the facilities of the Gates Learjet Corp., at Wichita, Kansas, the week of August 18-22, 1980. These components included the aileron servo, the horizontal stabilizer twin actuator motors, the stickshaker motors, and the guidevanes and computers from the stall warning system. All units were functional and operated normally.

1.17 Additional Information

1.17.1 Landing Weights and Data

The maximum allowable landing weight for this aircraft is 11,880 lbs. The landing weight for N866JS at the time of the accident was about 10,017 lbs. This weight, according to the FAA-approved Learjet 23 flight manual landing approach speed chart, indicated a Vref airspeed of 113 knots with the landing gear extended and the flaps full down. The pilot's airspeed bug was set at 118 knots.

Kennedy Flite Center pilots use a rule of thumb to determine airspeed by adding one-half of the fuel weight in hundreds of pounds to a base speed of 103 knots. The aircraft had about 2,900 lbs of fuel remaining at the time of the accident.

1.17.2 Fuel Management

According to Kennedy Flite Center management personnel,. company procedures for fuel management of N866JS were in accordance with the FAA-approved airplane flight manual for Learjet Model 23. The manual states that the procedures for aircraft 23-003 through -069 are:

A. During starting - main fuel boost pump switches - ON.
B. Before takeoff - main and standby boost pump switches - ON; tip tank transfer switches - OFF.
C. Cruise
   1. Main and standby boost pump switches - ON.
   2. Fuselage transfer switch - ON after airplane is below maximum landing weight of 11,880 lbs.
   3. Fuselage transfer switch - OFF when tank is empty.
   4. Tip tank transfer switch - OFF until 600 lbs remaining in each, then ON until tanks are empty.

NOTE Some fuel will flow from the wing tanks back into the empty tip tanks and should periodically be pumped into wing tanks.

These procedures were considered in computing weight and balance information for landing and for estimating remaining fuel equilibrium.

1.17.3 Use of Yaw Damper

The company manual also specifies that the yaw damper must be "ON" for all flight conditions except takeoff and landing. The manual states:

NOTE

After opposite engine has been started, set autopilot master switch (if installed) to ON or depress AFCS circuit breaker if it was pulled. Perform yaw damper check in accordance with yaw damper operational check, this section.

Page 2-6: After takeoff (checklist)

A. Landing gear switch - gear up.
B. Flaps - up prior to 170 [knots indicated airspeed1 .
C. Yaw damper - ON.
D-J. [Not applicable] .

The yaw damper is not mentioned again in the manual checklists that apply to various phases of flight (cruise, before starting descent, during descent, before landing, on landing, or after clearing the runway). The yaw damper is mentioned in the operational checklist carried in the aircraft (landing final (checklist) item No. 5-Yaw damper OFF).

1.17.4 Approach and Landing Techniques

The Gates Learjet Flight Training Manual describes standardized procedures and maneuvers for pilots transitioning into model 20 series Learjet aircraft. Those portions devoted to approach and landing state in part,

Normal Approach for Landing

Several factors influence the requirement for utilizing a smooth, shallow power-on approach. Two of the basic factors are: First, if an approach angle is relatively shallow, airspeed control is generally improved. Secondly, by using a relatively shallow approach with adequate power, the rate of descent is held to an acceptable value. At idle or low power in a high rate descent (steep glideslope), the airplane on flare will only rotate; however, rate of descent will not appreciably change.

A cautionary word about approach speeds: The [indicated airspeed1 on final approach with any jet aircraft has to be more precise than with a propeller driven aircraft. Too often, pilots have a tendency to add on extra knots "for the wife and children, etc." Each extra knot over and above the appropriate Vref can cause an additional 80 to 100 feet of "floating" after the flare (calm wind conditions). Flying the final approach slower than Vref can cause surprises such as extremely hard and/or premature touch downs.

Landing

Jet aircraft in general have certain landing characteristics. Deceleration is not rapid when power is reduced to idle. While in idle, the engines still produce forward thrust. In ground effect, the jet aircraft can "float" for a long distance.

The Gates Learjet in landing configuration at Vref (1.3 VS1) is in a near landing attitude. Constantly trim pitch to neutral. Maintain Vref until within a few feet of the runway surface. Reduce thrust to idle. Raise the nose very slightly from the attitude you maintained on final approach. (With aft mounted engines the nose will tend to rise as power is reduced. Very little back pressure is required.) Maintain that attitude and allow the aircraft to fly on to the runway surface.

During the slight flare indicated above, do not keep raising the nose higher and higher (known as "holding it off") as the airspeed decreases. Doing so induces a long float. Flaring the aircraft too high also elongates the float.

Occasionally during landing training, a pilot might hold the Learjet into such a long float that the stickshaker actuates. If that ever occurs, he should release some of the control column back pressure being held and allow the airplane to land. Consequently, a pilot should not prolong the flare in an attempt to make an extremely smooth landing.

In any event, the stall warning switches should be left ON. The stall warning system is on the Learjet to give pilots an extra margin of awareness when approaching a stall, If a pilot actuates the shaker and/or pusher during landing, his technique needs improving. He should not blame the stall warning system for annoying him. It is doing what it is supposed to do.

1.17.5 Money Pound in Wreckage

During the wreckage examination, a bundle of U.S. currency totaling $2,592 with a slip of paper secured by a rubber band was found in the cockpit. The paper, written by the bookkeeper for Kennedy Flite Center, stated,

Louisville to Gainesville to Richmond 1687 S. Miles

$2,952.25
236.18
$3,188.43

1.18 New Investigative Techniques

None.

2. ANALYSIS

The aircraft was properly certificated and had been maintained in accordance with approved procedures. There was no evidence of preimpact failure or malfunction of the aircraft structure, powerplants, flight controls, or systems.

Weather was not a factor in this accident. The accident occurred on a dark night, with high thin clouds, 10 miles visibility, and little or no surface wind.

Although the runway 33 ILS system was operating in the backup mode, with an illuminated "abnormal" light on the controller's panel at the time of the accident, there is no evidence to indicate that the system was not working satisfactorily, There is no indication of the involvement of improper air traffic control procedures in the accident.

The flightcrew was properly certificated and qualified for a copilot training mission flown in accordance with 14 CFR Part 91. The flight manager of Kennedy Flite Center stated that the purpose of the flight was crew training and that the passengers carried from Louisville to Gainesville were friends of the copilot. Despite an extensive investigation, the Safety Board and other Federal agencies were unable to learn the identities of the passengers. The Safety Board believes that the $2,952.25 figure on the paper found with the currency in the wreckage indicated the total cost for the 1,687-statute mile flight at a rate of $1.75 per mile. Revenue flights are subject to an 8-percent sales tax. The Safety Board believes the $236.18 figure on the paper indicated this 8-percent sales tax. A sales tax would be charged only if the flight was a commercial flight under 14 CFR Part 135. If the cash amount of $596.63 paid for fuel in Gainesville is subtracted from $3,188.43, the remainder is $2,591.80, about the amount of money found in the wreckage. Additionally, the flight plan indicated that six passengers would be aboard the aircraft from Louisville to Gainesville. Consequently, the Safety Board believes that the basic purpose of the flight was an on-demand air taxi flight from Louisville to Gainesville. The copilot was not certified for that segment of the flight.

While postaccident medical testing did not reveal any disease or physical condition that would affect performance, the pilot had been active for about 20 hours prior to the accident and the copilot had been awake for about 18 hours. Air Force Manual 161-1, Aerospace Medicine, describes fatigue as "a detrimental alteration or decrease in skilled performance related to duration or repetitive use of that skill, aggravated by physical, physiological, and psychic stress." In a flying situation, fatigue is generally identified in two overlapping categories: acute skill fatigue and chronic fatigue. There is no evidence that either pilot suffered from chronic or long-term fatigue. However, the extended periods both pilots were without sleep and a late-night, early-morning, three-segment flight could induce acute single-mission skill fatigue. Skill fatigue is simply that attrition of skill resulting from the repetition of a task during a long mission or repeated short missions. Its symptoms are lassitude and disinclination to further activity. The Safety Board believes that the flightcrew reactions may have been degraded by the effects of their long day and the multiple flights.

While the pilot did have about 300 hours of Learjet flying time, all of that time was flown at the Kennedy Flite Center during training missions or while performing on-demand air taxi flights. He attended Learjet ground school in September 1979; however, he did not attend a Learjet flight school nor did he ever receive any Learjet simulator training. The Learjet was the only turbine-powered aircraft the pilot had ever flown, and the bulk of his multiengine experience was in the Cessna 400 series aircraft, whose flight characteristics are less demanding than the Learjet.

The copilot also attended a Learjet ground school, but he neither attended a Learjet flight school nor received any Learjet simulator training. His 10 hours of Learjet time was acquired on air taxi flights. Because company procedures called for one pilot to handle the radios and navigation while the other pilot flew the aircraft, and the pilot's voice was identified on the air traffic control tapes, the Safety Board concludes that the copilot was operating the aircraft at the time of the accident. The Safety Board believes that while the training this flightcrew had received met FAA requirements, the copilot was minimally qualified to make a night landing and neither crewmember had the experience necessary to prevent or cope with the aircraft control excursions noted in the accident.

There have been five Learjet landing/takeoff accidents since October 1978 that have had some similar characteristics:

In Lancaster, California, on October 17, 1978, an unmodified Learjet 24, crashed during a training flight. 4/ The training schedule (lesson No. 3) for Learjet type rating called for the introduction of single-engine approaches and simulated engine failure on takeoff at or after V1 speed during this series of planned touch-and-go landings. The instructor pilot in the right seat held Cessna Citation as well as Learjet ratings. The pilot trainee in the left seat held commercial, instrument, airplane single- and multiengine ratings (AMEL-limited to centerline thrust). The trainee had flown the Learjet 28 hours and had a total accumulation of about 1,500 flighthours including his military jet time.

The aircraft made a circling approach to the runway and touched down, according to a witness, about 600 feet beyond the threshold. The aircraft rolled to the center taxiway before this witness heard a power increase for takeoff. Another witness saw the aircraft bank sharply to the left upon becoming airborne, and then bank 90° to the right. From a point about 550 feet from the end of the runway, the aircraft veered off to the right at an angle of 38°. The right wingtip made initial contact about 360 feet from the side of the runway. One pilot was killed, the other was seriously injured, and the aircraft was destroyed. The Safety Board concluded that the pilot did not maintain directional control of the aircraft.

A Learjet 25, with a Century III wing modification, crashed in Anchorage, ,Alaska, on December 4, 1978, during the landing phase of flight following a visual approach. 5/ Light-to-moderate icing was forecast in clouds below 12,000 feet in the Anchorage area and .turbulence accompanied by gusting winds was reported in the airport vicinity. The flightpath 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. Five occupants were killed, two suffered serious injury, and the aircraft was destroyed.

One controller told the pilot that moderate turbulence reportedly existed from 800 feet to the surface and that the wind was 130° at 19 knots. At the time of the accident, the range of wind speeds observed from a runway anemometer was 20 to 28 knots. No radio transmissions were received from the pilot after his acknowledgment of the landing clearance.

4/ NTSB Accident Docket No. 3-3022.

5/ "Aircraft Accident Report--Inlet Marine, lnc., Gates Learjet N77RS, Century III, Model 25C, Anchorage International Airport, Anchorage, Alaska, December 4, 1978" (NTSB-AAR-79-18).

The Safety Board determined that the probable cause of this accident was an encounter with strong, gusting crosswinds during the landing attempt, followed by inappropriate pilot technique 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.

In Minneapolis, Minnesota, on December 20, 1978, a Learjet 25, Howard/Raisbeck Mark II Conversion, aircraft, with a crew of two and five passengers aboard, crashed during takeoff. 6/ The aircraft was cleared for takeoff 1 minute 20 seconds after a Boeing 727-222 took off. Witnesses stated that after liftoff the Learjet rolled to a 45° right bank, then to an 80° to 90° left bank, and finally to an 80° to 90° right bank. It was estimated that the aircraft reached a maximum altitude of 100 to 150 feet. The aircraft struck the ground approximately 5,300 feet beyond the approach end the runway in a nose-high attitude and then bounced and skidded about 800 feet before coming to a stop. The five occupants received serious injuries, and the aircraft was destroyed.

Witnesses stated that the aircraft was covered with about 3/8 to 1/2 inch of snow when it taxied from the terminal area. The passengers said they were unable to see out the cabin windows because the windows were covered with snow. The airplane had been towed from a hanger which was heated to 55° F about an hour before departure. It was snowing at the time and the outside temperature was 29° F.

The copilot stated that the flaps had been set at 10° for takeoff with the pitch trim set in the green,arc. The Dee Howard Company states that when power is removed from the aircraft, the pitch trim indicator will indicate in the green arc. The aircraft was found to have 28° of flaps and full noseup pitch trim after the accident.

Causal factors related to this accident involved pilot preflight preparation, snow/ice on the aircraft, improper flap setting, and improper pitch trim setting.

On January 19, 1979, a Learjet 25D, equipped with a Century III wing modification to improve slow-speed performance and to permit operations on shorter runways, and piloted by two pilots who held Learjet type ratings, crashed during a night, nonprecision approach. 7/ During descent, the aircraft flew in light to moderate, occasionally severe icing conditions. Shortly before the Learjet was to land, a McDonnell Douglas DC-9 took off. Witnesses saw the Learjet cross the threshold in a normal landing attitude, and seconds later the aircraft began a series of violent rolls. The aircraft was in a steep right bank when the right wingtip fuel tank struck the runway 2,640 feet beyond the threshold, and the airplane burst into flames. All six occupants of the aircraft were killed, and the aircraft was destroyed.

6/ NTSB Accident Docket No. 3-4353.
7/ "Aircraft Accident Report--Massey-Ferguson, Inc., Gates Learjet 25D, N137GL, Detroit, Michigan, January 19, 1979" (NTSB-AAR-80-4).

The Safety Board determined that the probable cause of this accident was the pilot's loss of control of the aircraft for unknown reasons. The loss of control may have been initiated by wake turbulence of the departing aircraft, by a premature stall caused by an accumulation of wing ice, by delayed application of engine thrust during an attempted gc–around, or by a combination of all these factors.

At Pueblo, Colorado, on July 6, 1979, an unmodified Ultra Air Learjet 25B crashed on landing. 8/ The purpose of the flight was an FAA checkride for the two well-qualified crewmembers. After 40 minutes of routine airwork, the aircraft was configured for a single–engine ILS approach and landing. When the aircraft was stabilized on the final approach, the FAA inspector left the cockpit and belted himself in a passenger seat for landing. He stated that the aircraft may have touched down and that it went through severe yawing and rolling oscillations. Witnesses recall seeing'the aircraft nose–high, with the wings rocking through several cycles. The aircraft, with high engine power applied, climbed steeply to 50 feet, rolled inverted, and crashed. Both pilots were killed, the FAA inspector was seriously injured, and the aircraft was destroyed.

Rudder trim was found to be set at zero after the accident. The pilot apparently was holding rudder to compensate for the retarded engine during the approach rather than trimming off the pressure. Causal factors involved included the improper rudder trim setting and the possibility that the heel of the pilot's cowboy boot may have jammed between the bottom of the rudder pedal and the cockpit floor scuff plate.

There are certain flight manuevers which were common to all five of these accidents. All of the aircraft experienced steep banking with high roll rates immediately before the loss of control. None of the flightcrews was able to recover the aircraft after the rolling started, and the addition of engine thrust appears to have aggravated the severity of bank attitude. During its investigations of these accidents, the Safety Board concluded that a number of factors could create a situation causing the wing roll and subsequent control loss. These factors included ice/snow accumulation on control surfaces and other aircraft structures, gusty winds, wake vortex turbulence, mistrimmed flight control surfaces, cockpit flight control interference, and asymmetrical thrust application. Each of these factors was carefully considered during the investigation of the Richmond accident.

There is no evidence to indicate that any of these conditions found in the other five accidents contributed to the initial wing rocking noted by witnesses to the Richmond accident. The pilot's decision to go around, indicated by the increase in engine noise heard by witnesses, rather than continue the landing, was probably prompted by the rapid roll reversals and/or the wingtip ground strikes. Whatever influenced the pilot's decision, the addition of thrust was closely followed by the aircraft rolling inverted and striking the ground. Since none of the previously cited factors was present to initiate the wing rocking, the approach and landing technique of the pilot must have been the crucial factor in this case.

8/ NTSB Accident Docket No. 3–3982

From all indications, the entire flight was normal until the last phase of the approach. The flightcrew called for the control tower operator to lower the intensity of the sequenced approach lighting on the final approach, indicating that the lights may have distracted the flightcrew. Witnesses noted that the aircraft was slightly high over the approach end of the runway and that the aircraft was in a nose-high attitude. As the wing loading and angle-of-attack increased, the wing may have stalled. When the Learjet wing stalls, there is a wing drop or rolloff that occurs simultaneously with the stall; it is not normally preceded by wing rock. The wing rocking and the aircraft roll noted by witnesses are not consistent with known stall characteristics.

During its investigation of the Detroit and Anchorage accidents, the Safety Board conducted a study and flight tests to examine the performance aspects of stall characteristics, low-speed handling qualities in landing/go-around, and other stall-related matters of Learjet aircraft. The analysis of the Detroit accident stated, in part:

> During the Safety Board's performance study, go-around maneuvers from 20° bank angles were simulated at altitude by simultaneously applying takeoff power, applying aft elevator control to prevent contact with a simulated groundplane, and applying full opposite aileron to level the airplane. On go-around attempts at speeds above stickshaker activation (approximately 1.07 Vs or greater), no problems were encountered. However, during similar go-around attempts at speeds within the shaker range, the downgoing wing was observed to stall and resulted in nearly vertical bank angles. . . . It is possible the Learjet may have slowed to this airspeed and the go-around attempt in this comparative speed range caused the aircraft to begin the rolling maneuver, which resulted in a loss of altitude and ground impact. Such an occurrence would be consistent with the findings of the performance study. However, the Safety Board could not determine the airspeed or acceleration of the Learjet as the go-around attempt was begun, and, therefore, cannot draw a conclusion in this regard.
>
> The Safety Board found during flight performance studies at altitude that after wing rolloff following the stall, lateral control was not effective. The roll could be reversed with aileron and rudder, but at such a rate that 500 ft of altitude was lost during the reversal. After the stall, there was no tendency for the aircraft to abruptly reverse roll direction. The roll control power of the aircraft was good until stall entry; however, roll damping was low and control wheel centering due to force feedback was low. The low roll control sensitivity was due to the large 110° wheel throw and a release of roll input did not stop the roll rate.

These handling characteristics are different from lower performance aircraft and could account for response actions in which some pilots might tend to overcontrol if they used sudden, large and untimely control wheel displacements. In this accident, low roll control sensitivity and the possibility of a sudden pilot reaction might have sustained the rolling maneuvers following the initial wing drop.

The influence of ground effect on the Learjet's lateral control during the rolling maneuvers is not known and the Safety Board was not able to explore the potential influence of ground effect at large bank angles because of the obvious risks involved in flight testing under these conditions. However, as ground effect increases wing lift, induced drag decreases and the total effect on the wing may increase roll control authority near stall airspeed. The influence of ground effect on a stalled wing rolling downward, however, would probably be neutralized as the descending wing entered deeper into the stall. Therefore, if a rapid roll occurred at low altitude and near the stall speed, recovery to level flight would be unlikely. . . .

. . . According to the flight test data, stalls accelerated by landing flares can be achieved with a rapid pitch increase and result in abrupt wing drops. A simultaneous increase of engine thrust may have accelerated the aircraft above the stall entry speed and reinstituted roll control. The changes in airfoil characteristics and airspeed while near the stall airspeed might have made the aircraft susceptible to roll oscillations. The combination of ground effect and the increased thrust may have been sufficient to keep the aircraft above the stall speed and above the runway during the roll reversals until the bank angle and roll rate increased to the extent that the descending wing stalled at an altitude too low for recovery. 9/

The Safety Board believes that this analysis describes the conditions of the Richmond accident also. Witnesses stated that the aircraft rounded out slightly high, followed by wing drop, roll reversals, thrust addition, and loss of aircraft control. Since none of the factors cited in the five earlier Learjet landing accidents were causal in this accident, it is apparent that pilot input can place the aircraft in a nose-high, low-airspeed condition close to the ground with equally disastrous results.

Prevention of this type accident lies in precise pilot control of airspeed and attitude during the final phase of landing. This preciseness can be obtained through adequate initial and continuing training of Learjet crewmembers. Learjet crewmembers must recognize that they are flying a high-performance aircraft that

9/ NTSB-AAR-80-4, pp. 20-22.

requires professional and precise control at all times, with particular attention to approach speed and angle-of-attack through power reduction and touchdown. The copilot in the Richmond accident had asked for a reduction in the sequenced approach lighting intensity at 0.5 mile on final approach and may have been distracted by this concern over the lighting during the last moments of the flight.

Based on its investigation of the six accidents, the Safety Board issued safety recommenations A-80-53 through -55 on June 27, 1980, calling for the FAA to:

> Convene a Multiple Expert Opinion Team to evaluate the flight characteristics and handling qualities of Series 20 Learjet aircraft, with and without slow flight modification, at both low- and high-speed extremes of the operational flight envelope under the most critical conditions of weight and balance (and other variable factors) and to establish the acceptability of the control and airspeed margins of the aircraft at these extremes. (Class I, Urgent Action) (A-80-53)
>
> Advise all Learjet operators of the circumstances of recent accidents and emphasize the prudence of rigid adherence to the specified operational limits and recommended operational procedures. (Class I, Urgent Action) (A-80-54)
>
> Evaluate information contained in the Gates Learjet Service News Letter 49 dated May 1980 pertaining to procedures to be followed if the aircraft inadvertently exceeds Vmo/Mmo and, based on this evaluation, require appropriate revisions to the aircraft flight manual. (Class I, Urgent Action) (A-80-55) [News Letter 49 discussed procedures relating to aircraft overspeeds that exceed Vmo/Mmo (maximum allowable speed, maximum allowable Mach). Procedures included use of spoilers and landing gear, power application, and flight control manipulation.]

(See appendix E for the FAA response to these recommendations.)

In response to the Safety Board's recommendations, the FAA issued two extensive airworthiness directives pertaining to all Learjet model aircraft. The directives include aircraft procedures concerning in-flight deployment of spoilers, checking of trim systems, stall restrictions, yaw damper operation, runaway trim emergency procedures, increased takeoff and landing distance data, reduced maximum takeoff and landing weights, autopilot mechanical checks, and increased landing approach speeds. (See appendix F.)

3. CONCLUSIONS

3.1 Findings

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

2. There was no evidence of preexisting failure of the aircraft structure, powerplants, flight controls, or systems.

3. Weather, navigational aids, and the air traffic control system were not factors in this accident.

4. Airframe icing, wind shear, wake vortex turbulence and deformation of the leading edge of the wing were not factors in this accident.

5. The basic purpose of the flight was the carriage of passengers from Louisville, Kentucky, to Gainesville, Florida, for remuneration. That segment of the flight was subject to 14 CFR Part 135 requirements.

6. The pilot was properly certified for the flight; however, the copilot was not certified for 14 CFR Part 135 operations.

7. The copilot was operating the aircraft during the approach/landing phase of the flight. Injuries to the pilot indicate he was at the controls when the aircraft struck the ground.

8. The flightcrew's performance may have been affected by fatigue since the pilot had been awake for 20 hours and the copilot for 18 hours.

9. The pilot may have been distracted by a concern over the intensity of the sequenced approach lighting during the final approach.

10. The flightcrew was minimally qualified, and had not had formal in-flight or simulator Learjet training.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the pilot's failure to maintain proper airspeed and aircraft attitude while transitioning from final approach through flare to touchdown. The low-speed/high angle-of-attack flight condition precipitated wing rolloff, wingtip strikes, and ultimate loss of aircraft control. The pilot's improper technique during roundout may have been due to fatigue, his limited knowledge, training, and experience regarding the flight characteristics of the Learjet aircraft, and distraction caused by concern over the intensity of the approach lighting.

4. RECOMMENDATIONS

Safety recommendations A–80–53 through -55 (see page 17) were issued on June 27, 1980.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PATRICIA A. GOLDMAN
Member

/s/ G.H. PATRICK BURSLEY
Member

JAMES B. KING, Chairman, did not participate.

November 25, 1980

5. APPENDIXES

5.1 APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The Safety Board was notified of this accident at 0330 on May 6, 1980, and a team of investigators departed the Washington, D.C. headquarters that day for Richmond. Working groups were established for operations, structures/powerplants, and systems.

Participants in the investigation were the Federal Aviation Administration, Kennedy Flite Center; Gates-Learjet Corporation, and General Electric Company.

2. Public Hearing

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

5.2 APPENDIX E

PERSONNEL INFORMATION

Pilot George Gary Maul

Mr. Maul, 29, held an Airline Transport Pilot Certificate No. 231621869 with a Learjet rating and commercial pilot privileges for single-engine aircraft. He also held a flight instructor certificate for airplane single-engine instruments. His first-class medical certificate was issued with no limitations on November 2, 1979.

He graduated from National Jets, Inc., Learjet ground school on September 13, 1979, and was assigned to Learjet copilot duties by Kennedy Flite Center. On February 20, 1980, he successfully completed a Learjet type rating and pilot-in-command check flight and was assigned captain duties.

Mr. Maul had a total of about 2,547 flying hours and 301 hours in Learjets. He had flown 4.6 hours in May before this flight, 29.7 hours in April, and 29.2 hours in March. Mr. Maul had 56.1 hours Learjet flying time in the past 90 days, including 9.3 hours at night, with 29 day landings and 5 night landings. His last night landing was on April 25, 1980.

Copilot Richard J. Pilcher

Mr. Pilcher, 28, held commercial pilot certificate No. 230749104 valid for airplane single/multiengine land and an instrument rating. He had a certified flight instructor rating for single-engine land aircraft. His second-class medical certificate with no limitations was issued on March 4, 1980.

He graduated from National Jets, Inc., Learjet ground school on September 13, 1979, and was assigned part-time Learjet copilot duties by Kennedy Flite Center. He had a total of about 905 flying hours with 10.5 hours in Learjets before May 5, 1980. His flying time with Kennedy Flite Center was 1.7 hours in May and 15.3 hours in March.

His logbook had an entry dated August 13, 1979, stating "Meets requirements-Learjet Copilot." However, this entry was not endorsed by an instructor and, therefore, he was not certified to act as copilot on a 14 CFR Part 135 flight.

5.3 APPENDIX C

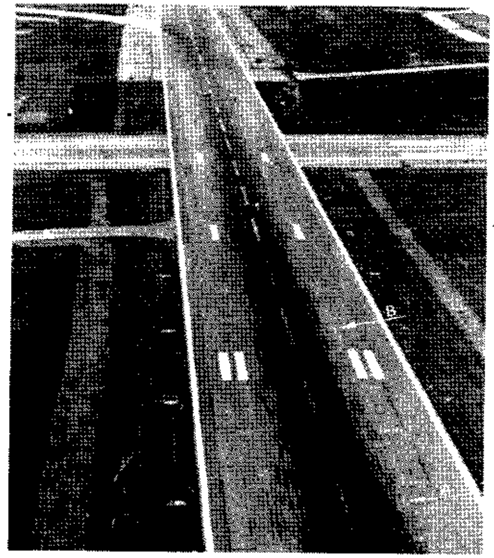
AIRCRAFT INFORMATION

N866JS, a Gates Learjet 23, serial No. 23–018, was operated by several owners until it was purchased by Kennedy Flite Center and registered to it on December 11, 1979. Inspection and maintenance support was provided by the owner.

The aircraft had a 300–hour inspection on May 8, 1979, and a 150–hour inspection on October 9, 1979. Airworthiness Directives had been complied with and the records did not reflect any discrepancies. Total aircraft time at the accident was about 4,861.7 hours.

The aircraft was equipped with General Electric CJ–610–1 engines. The right engine, serial No. 240087, had 4861.7 hours since manufacture and 2,279 hours since the plane was purchased by Kennedy Flite Center. The left engine, serial No. 240083, had 4,861.7 hours since new and 861.7 hours since overhaul.

The computed takeoff weight **for** N866JS at Gainesville was 12,500 lbs, which is the maximum allowable. Landing weight at Richmond, estimating fuel used en route, was 10,017 lbs with the center of gravity (c.g.) at 22 percent mean aerodynamic chord (MAC). MAC limits are 12.2 and 30 percent.

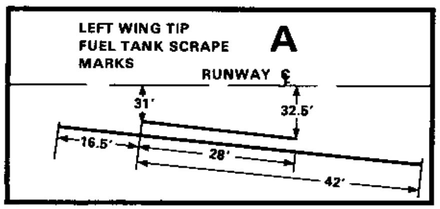


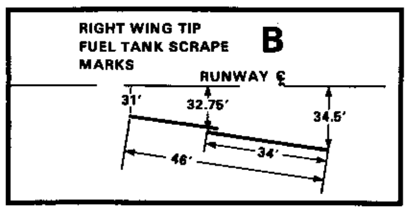
LEGEND:

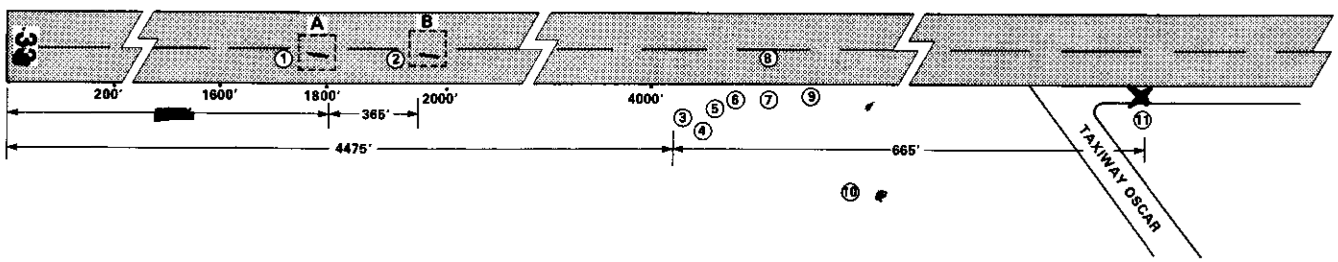
1. LEFT WING TIP FUEL TANK SCRAPE MARKS.
2. RIGHT WING TIP FUEL TANK SCRAPE MARKS.
3. HORIZONTAL STABILIZER IMPACT AREA — HORIZONTAL SPAR SECTION. RED GLASS PIECES, ROCK WITH ALUMINUM SCRAPES.
4. IMPACT MARK — ACCESS COVER, PLATE AND GASKET WING SKIN PIECES, FUEL CAP, VORTEX GENERATORS.
5. IMPACT MARK—ROCK WITH ALUMINUM SCRAPES, RED GLASS PIECES.
6. IMPACT MARK — WHITE PAINT CHIPS, PIECES OF RED GLASS, WIND SHIELD PIECES.
7. HORIZONTAL STABILIZER.
8. TIP SECTION OF LEFT ELEVATOR.
9. BULLET FAIRING.
10. LEFT ENGINE.
11. MAIN WRECKAGE.

APPENDIX D

WRECKAGE DISTRIBUTION







Fusela e The fuselage was inverted and positioned partially on its The uselage upper structure showed severe crushing in the left direction. The fuselage center section had been subjected to an intense ground fire. Fire had consumed portions of the fuselage structure from the **No. 2** cabin window on the right side aft to and including the tailcone access door.

The nose dome was intact and partially attached. The bottom and left side of the dome were crushed inward. The access panels fitted to the upper fuselage nose structure between the cockpit windshield and nose dome had separated. The access panels and various pieces of equipment were recovered along the wreckage path. The cockpit windshield had been shattered as a result of ground impact forces. Small pieces of the windshield were found throughout the wreckage pattern. **A** section of upper fuselage structure adjacent to the cockpit windshield which measured about **4** feet by **4** feet had been torn and bent in the upward direction.

The fuselage keel beam assembly remained intact and in position. This assembly had been subjected to ground fire. Both main landing gear door assemblies were attached to the keel beam structure.

The aft fuselage showed fire damage on its left side with heavy sooting on its right side. The vertical stabilizer leading edge had been crushed and severely burned at its upper area. The dorsal fin remained intact; however, this area had been subjected to intense ground fire. The forward end of the dorsal fin was missing. The rudder assembly remained attached to the aft fuselage structure through the torque tube assembly. The rudder separated from the vertical stabilizer at its mid and upper points of attachment. Both the mid and upper rudder attachment bolts were retained within the vertical stabilizer to rudder attachment brackets.

The cabin entrance door located on the left side of the fuselage remained attached to the fuselage and was noted to be in the closed position.

Left Wing.--The left wingtip fuel tank had separated from its wingbox attachment structure. Portions of the wingtip fuel tank assembly were recovered along the wreckage path. The aft section measured about **4** feet in length and included the fin. Scrape marks were found on the bottom surface of the tip tank. The outboard end of the fin assembly showed evidence of scrape marks and the trailing edge of the fin was feathered. The surface of the leading edge was normal and not covered by any foreign substance.

A section of outboard wing structure, measuring about **5** feet in length, separated and had been subjected to intense ground fire. **A** short section of the left wing flap assembly and the outboard end of the left aileron were with the left wing section and had severely burned. The left wing spoiler assembly had separated from the wing structure.

Right Wing.--The right wing remained intact with continuity existing between the right wing and left wing structure. The right wing had been subjected to ground fire, with no evidence of burn-through. The leading edge of the right wing showed no evidence of ground impact damage; however, the inboard end which was positioned within the fuselage had been subjected to high heat. The surface of the leading edge was normal and not covered by any foreign substance.

Portions of the right wingtip fuel tank remained attached to its wingbox attachment structure. A major portion of the tip tank had been consumed by ground fire. The forward end of the right wingtip fuel tank was recovered in the pattern and showed no evidence of fire damage. The aft end of the tip tank remained with the right wing structure. The fin section showed evidence of scrape marks on its outboard end, bottom side.

The right aileron, including the tab assembly, was attached to the wing. The trailing edge of both the aileron and tab assembly had been consumed by ground fire. The right flap assembly was attached to the wing structure and was in an extended position. The outboard section of the flap was bent downward and the complete trailing edge of the flap had been consumed by fire.

Landing Gear.--Both main and nose gear assemblies were intact and in the extended position. The main gear outboard door assemblies were intact and attached. The doors showed no evidence of damage. The nose gear door assemblies were intact and attached, with no evidence of damage. All landing gear tires were in excellent condition.

Control Cables.--The rudder and elevator control cables were intact and attached from their respective control surface up to the control components within the cockpit. The right wing control surface cables were intact inboard to the fuselage. At this point the cables had separated. The left wing control surface cables were intact inboard to the fuselage and on forward to the control components within the cockpit.

Engines.--The left engine separated from the aircraft and the right engine remained attached. Both engines were examined and showed evidence of rotation at impact. Components and accessories examined showed no evidence of preimpact damage or malfunction.

Cockpit.--The cockpit area was damaged by fire and soot. The flight instrument panel, overhead panel, pedestal, and flight control column were shattered, broken, and loose. Rudder pedals could be moved slightly; however, the cables that jammed on impact prevented full movement. Flap and landing gear handles were down. The spoiler switch was retracted. The pitot heat, rotating beacon, antiskid, and navigation switches were on.

Two flight instruments, an Attitude Direction Indicator (ADI) and a flight director, showed an inverted aircraft and a dive angle of about 20°. The captain's altimeter showed a barometric setting of 29.61 inHg and the copilot's altimeter read 29.63 inHg. Two compass course indicators showed a heading of 340' and another read 240'.

The yaw damper switch was on and the autopilot master switch was off. (The yaw damper is disengaged when the autopilot master switch is off.)

Other Observations.--The flap actuators were fully retracted indicating that the flaps were fully extended. The rudder trim actuator was properly mounted, secure, and indicated 0° turn. The aileron trim actuator was neutral. Balance tabs on the ailerons were properly aligned and adjusted.

The left and right engine fuel shutoff valves were open. The crossflow fuel valve, the fuselage tank refuel valve, and the fuselage tank shutoff valve were closed.

The aircraft batteries were intact with no evidence of thermal expansion. The battery vents were connected, intact, and had sustained ground fire damage. The filaments of both landing lights were stretched and elongated, indicating current flow heating at impact.

The pitot static system was damaged, but was still intact. Maintenance records indicate the system was inspected as required by 14 CFR 91.170.

5.5 APPENDIX E

FEDERAL AVIATION ADMINISTRATION RESPONSE TO RECOMMENDATIONS A-80-53 THROUGH -55

September 25, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue
Washington, D.C. 20594

Dear Mr. Chairman:

This acknowledges receipt of NTSB Safety Recommendations A-80-53 through 55, delivered by the Board on Friday, June 27, 1980, at 5:40 p.m., after close of official business. These recommendations were based on the Board's investigations of accidents involving Series 20 Learjet aircraft in the low-speed landing configuration and high-speed, high-altitude cruise environment.

The Federal Aviation Administration (FAA) is aware of the facts cited by the Board in its June 27 transmittal letter and has aggressively pursued corrective actions relative to these problems. A review of the accident data pertaining to these aircraft was initiated immediately following the May 6 accident at Richmond. On June 9, 1980, the Safety Analysis Division, Office of Aviation Safety submitted an analysis of Learjet accidents and Service Difficulty Reports to the Air Transportation Division, Office of Flight Operations. The analysis indicated a need for reevaluation of Learjet systems and subsystems concerning stick pusher and shaker, autopilot pitch and roll, elevator, aileron and throttle cables.

The analysis determined that aircraft control was involved in approximately 30 percent of the 49 accidents used in the analysis. Aircraft control involved overshoot, undershoot, runway alignment, and flying speed; but pilot flight-hour experience did not appear to be a factor. Based upon the analysis and the information presently available through the accident investigation, we have initiated actions which address the subject of the recommendations as follows.

<u>A-80-53.</u> Convene a Multiple Expert Opinion Team to evaluate the flight characteristics and handling qualities of Series 20 Learjet aircraft. with and without slow flight modification, at both low- and high-speed extremes of the operational flight envelope under the most critical conditions of weight and balance (and other variable factors) and to establish the acceptability of the control and airspeed margins of the aircraft at these extremes.

<u>Comment</u>. This recommendation has already been encompassed in an earlier investigation involving all Learjets, including the Series 20. This investigation was a followup to the February 1979 "Study of Selected Performance Characteristics of Modified Lear Jet Aircraft" in

which the NTSB, FAA, Learjet Corporation, National Aeronautics and Space Administration, and other interested parties participated. *As* a result of the investigation, Airworthiness Directive (AD) 79-12-05 was issued (copy enclosed). Also, a separate investigation was initiated by the FAA on June **17**, 1980, to accomplish a certification review which will also include other areas not specifically addressed in the Board's recommendations. Although this review is still in its initial stages, preliminary information developed as a result of joint FAA and Gates Learjet Corporation flight evaluations has evidenced characteristics at the limits of their operating envelope which in combination with presently approved operating procedures could adversely affect safety of flight. In light of the foregoing, on August **1**, the FAA Central Region issued by airmail letter an emergency airworthiness directive (copy enclosed) to Learjet aircraft owners. Since our investigation and review is incomplete, we will make our findings available to the Board when we complete our research.

A-80-54. Advise all Learjet operators of the circumstances of recent accidents and emphasize the prudence of rigid adherence to the specified operational limits and recommended operational procedures.

Comment. Immediately upon receipt of NTSB Safety Recommendation A-60-54, a notice, which included the Board's entire transmission (copy enclosed), was sent to all Learjet operators. In addition: a GENOT was telegraphed to all FAA General Aviation District Offices (GADO's), Flight Standards District Offices (FSDO's) and Air Carrier District Offices (ACDO's), directing that all Learjet Part 91, 121, and 135 operators be contacted to verify that the operators received the notice and were fully aware of the contents of NTSB Safety Recommendation A-80-54.

A-80-55. Evaluate information contained in the Gates Learjet Service News Letter 49 dated May 1980 pertaining to procedures to be followed if the aircraft inadvertently exceeds V_{mo}/M_{mo} and, based on this evaluation, require appropriate revisions to the aircraft flight manual.

Comment. This recommendation **is** included in **FAA's** investigation described above in our comments relative to NTSB Safety Recommendation A-80-53. Also, FAA's Office of Flight Operations has established a separate team to review the adequacy and effectiveness of Learjet crew training.

In addition to these actions which are being taken in direct response to NTSB Safety Recommendations A-80-53 through 55, a GENOT (copy enclosed) was also distributed on May 22, 1980, to all GADO's, FSDO's and ACDO's. This GENOT requested the immediate inspection of all Learjet aircraft for installation of mach warning cut-out switches. To date we have noted seven instances of aircraft with unapproved cut-out switch installations, and these all have now been removed.

Finally, on June 2, 1980, a special issue of General Aviation Airworthiness Alerts was published (copy enclosed). This alert addressed the subject of unapproved alterations of speed warning systems in both air carrier and general aviation aircraft.

We will continue to keep the Board informed of our findings as the investigation progresses.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

4 Enclosures

APPENDIX F

AIRWORTHINESS DIRECTIVES

GATES LEARJET

Revision

Volume I & II

79-12-05 LEARJET: Amendment 39-3488 as amended by Amendment 39-3614. Applies to the following (1) model and serial number airplanes on which "reduced approach speed system kit" AAK 76-4 has been installed and, (2) model and serial number 24E, 24F, 24F-A, 25D and 25F airplanes, certificated in all categories:

MODELS	SERIAL NUMBERS
24, 24A	24-100 through 24-180
24B, 24B-A	24-181 through 24-217, 24-219 through 24-229
24C, 24D, 24D-A	24-218, 24-230 through 24-328
24E, 24F, 24F-A	24-329 through 24-357
25, 25A	25-003 through 25-060 25-062 through 25-066,
25B, 25C	25-061, 25-067 through 25-201, 25-204, 25-205
25D, 25F	25-206 through 25-278

COMPLIANCE: Required as indicated, unless already accomplished.

A) Effective immediately, temporarily insert the following information in the FAA-Approved Airplane Flight Manual and operate the airplane in accordance with these insertions:

1. In Section I, adjacent to the heading STALL WARNING SYSTEM Limitation, add the following:

Both stall warning systems must be ON and operating for all Normal Flight Operations. The systems may be turned off for Emergency Operations per Airplane Flight Manual Section III Procedures and for stall warning system maintenance per the Maintenance Manual Procedures:

NOTE: Warning lights for both stall warning systems are inoperative when the generator and battery switches are OFF.

To assure proper stall warning system operation, the BEFORE STARTING and AFTER TAKEOFF stall warning system operational and comparison checks in Section II of this Airplane Flight Manual must be completed on each flight,

2. In Section II, under the heading BEFORE LANDING, add the following:

LANDING APPROACH IN TURBULENCE:

Landing Approach — Speed - Computed and bug set. Refer **to** Section IV.

-32-

NOTE: It is recommended that if turbulence is acticipated due to gusty winds, wake turbulence, or wind shear, the approach speed be increased. For gusty wind conditicns, an increase in approach speed of one-half of the gust factor is recommended.

3. In Section II, under the heading ANTI-ICE SYSTEM, add the following:

ANTI-ICE SYSTEM NORMAL OPERATIONS

Observe Airplane Flight Manual's recommendations for normal use of all anti-ice systems.

WARNING: Even small accumulations of ice on the wing leading edges can cause aerodynamic stall prior to activation of the .stick shaker and/or pusher.

4. In Section II, under the heading AFTER TAKEOFF, add the following:

STALL WARNING SYSTEMS COMPARISON CHECK

As a final step in tne AFTER TAKEOFF procedures, the following stall warning system comparison shall be observed.:

ANGLE-OF-ATTACK Indicators - Cross-check pilot's and copilot's indicators for agreement.

5. In Section 11, adjacent to the ICE DETECTION procedures', add the following:

VISUAL ICE DETECTION

A visual inspection may be used to check for ice accumulations on the wing leading edges.

For night operation, the optional wing inspection light located on the right side of the fuselage may be turned on by setting the WING INSPECTION switch ON and checking for ice accumulations on the wing. It should be noted that the wing inspection light in itself is inadequate for detecting the presence of ice near the wing tips.

If the presence of wing leading' edge ice is suspected during operations at night, in atmospheric conditions conducive to icing, the normal approach speeds must be increased per the APPROACH AND LANDING WITH ICE ON WING LEADING EDGES procedures of Section III of the Airplane's Flight Manual.

6. In Section 111, under the heading ANTI-ICE SYSTEM FAILURE, add the following:

APPROACH AND LANDING WITH ICE ON WING LEADING EDGES

Even small accumulations of ice on the wing leading edges can cause aerodynamic stall prior to activation of the stick shaker and/or pusher. If approach and landing must be made with any ice (or suspected ice during night operations) on the wing leading edges:

1. Final Approach Speed - 15 knots above normal
2. Touchdown Speed - 15 knots above normal
3. Landing distance - Increase by 20% Anti-Skid ON or OFF.

7. In Section IV, adjacent to the heading TAKEOFF DISTANCE, FLAPS 8 DEGREES add the following:

Increase all chart Takeoff Distances by:

Model 24 with Century III wings + 4%

Model 25 with Century III wings + 6%

8. In Section IV, adjacent to the heading CRITICAL ENGINE FAILURE SPEED, V1, FLAPS - 8 DEGREES; ROTATION SPEED, VR, FLAPS - T.O. -8 DEGREES; AND ENGINE OUT SAFETY SPEED VZ FLAPS - T.O. - 8 DEGREES charts, add the following:

Increase all chart V1, VR and VZ speeds by:

Model 24 with Century III wings + 2 KNOTS INDICATED AIRSPEED

Model 25 with Century III wings + 3 KNOTS INDICATED AIRSPEED

9. In Section IV, adjacent to the LANDING APPROACH SPEEDS chart, add the following:

Increase all chart Landing Approach Speeds (V REF) by:

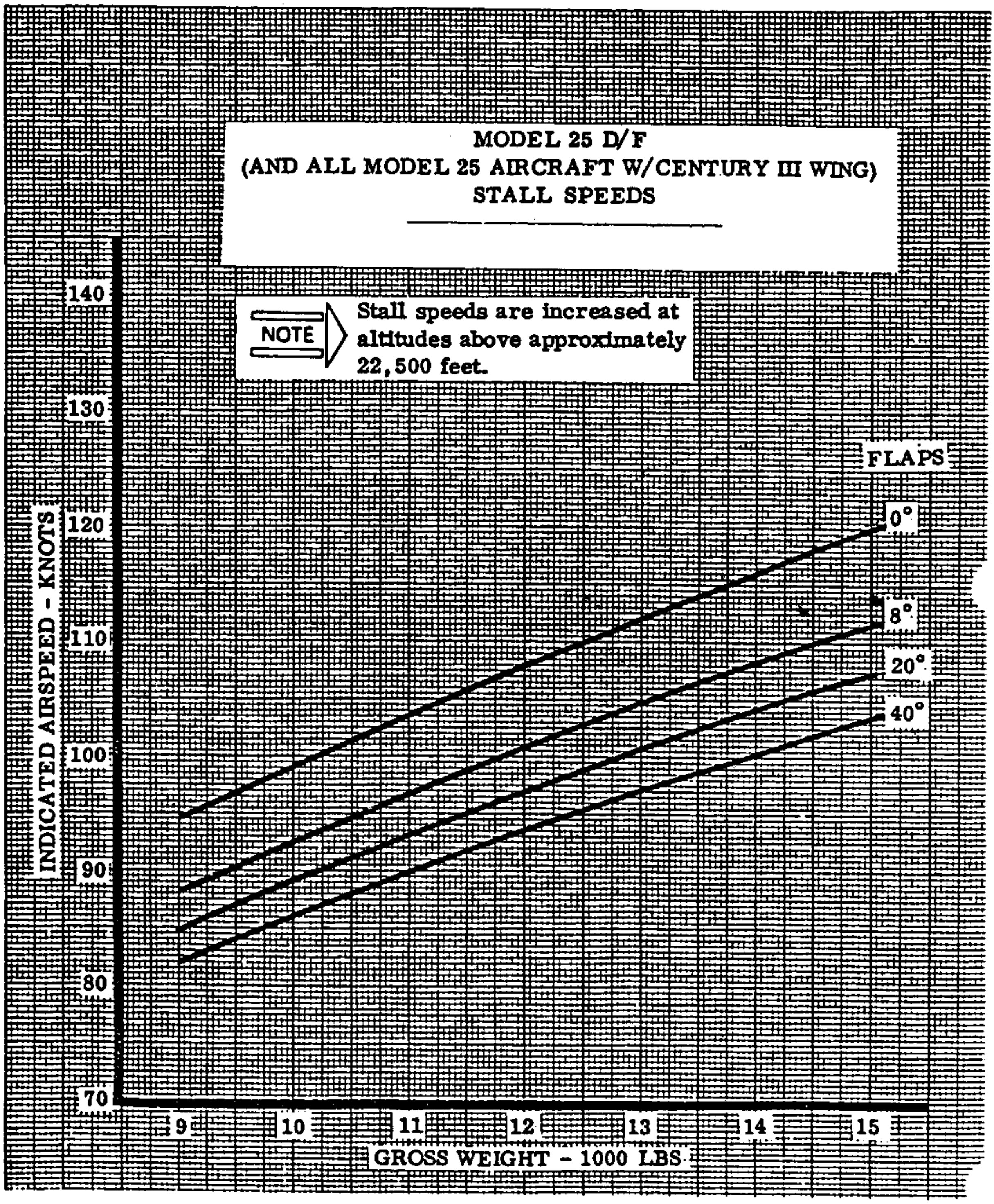
+ 6 KNOTS INDICATED AIRSPEED

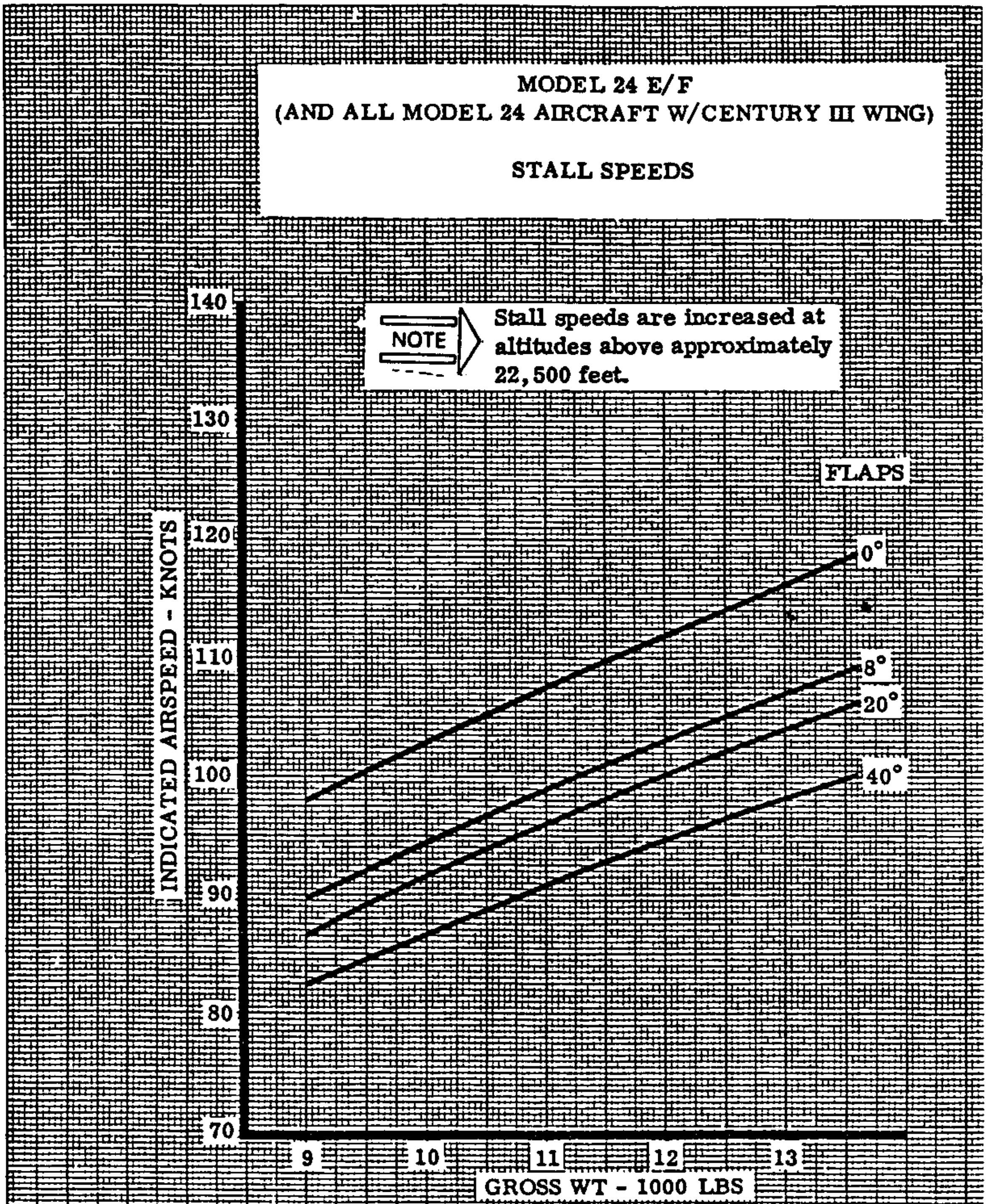
10. In Section IV, adjacent to the LANDIIG DISTANCE chart add the following:

Increase all Chart Actual and Scheduled and Alternate Stops Field Lengths by: +8%

11. In Section IV in place of the current STALL SPEEDS file the following charts:

NOTE: In order to comply with the requirements of paragraph A) of this AD, this airworthiness directive, or a duplicate thereof, may be used as a temporary amendment to the Airplane Flight Manual and carried in the aircraft as part of the Airplane Flight Manual until replaced by the permanent revisions to the Airplane Flight Manual provided by the manufacturer and approved by the FAA.


MODEL 25 D/F
(AND ALL MODEL 25 AIRCRAFT W/CENTURY III WING)
STALL SPEEDS
NOTE
Stall speeds are increased at altitudes above approximately 22,500 feet.
FLAPS
0°
8°
20°
40°
INDICATED AIRSPEED - KNOTS
140
130
120
110
100
90
80
70
9
10
11
12
13
14
15
GROSS WEIGHT - 1000 LBS


MODEL 24 E/F
(AND ALL MODEL 24 AIRCRAFT W/CENTURY III WING)
STALL SPEEDS
NOTE
Stall speeds are increased at altitudes above approximately 22,500 feet.
INDICATED AIRSPEED - KNOTS
140
130
120
110
100
90
80
70
FLAPS
0°
8°
20°
40°
9
10
11
12
13
GROSS WT - 1000 LBS

B) Within the next 300 hours time-in-service after the effective date of this AD, or December 15, 1979, whichever occurs first, adjust the stall warning system and inspect the systems and components that may affect aircraft stall speed in accordance with the procedures provided by Gates Learjet Service Bulletin SB 24/25-294 dated May 25, 1979.

C) When Gates Learjet Airplane Accessory Kit Number AAK 79-10A (including insertion of the applicable Airplane Flight Manual changes in FAA Approved Airplane Flight Manual) is installed, paragraphs A)7. through A)11. and paragraph B) of this AD are no longer applicable.

D) Any equivalent method of compliance with this AD must be approved by the Chief, Engineering and Manufacturing Branch, FAA, Central Region.

Amendment 39-3488 became effective June 18, 1979.

This Amendment 39-3614 becomes effective November 6, 1979.

Airworthiness Directive

Letter

Volume I & II

80-19-11 GATES LEARJET: Letter issued September 9, 1980, Applies to the following models and serial number airplanes, unless noted:

MODELS	SERIAL NUMBERS
23	23-003 through 23-099
24, 24A	24-100 through 24-180
24B, 24B-A	24-181 through 24-217 24-219 through 24-229
24C, 24D, 24D-A	24-218, 24-230 throqgh 24-328
24E, 24F, 24F-A	24-329 and subsequent
25, 25A	25-003 through 25-060
25B, 25C	25-061, 25-067 through 25-201, 25-204, 25-205
25D, 25F	25-206 and subsequent
28, 29	28-001 and subsequent, 29-001 and subsequent
35, 36, 35A, 36A	35-001 and subsequent, 36-001 and subsequent

COMPLIANCE: Required as indicated, unless previously accomplished.

A) Before further flight, insert the following information in the FAA Approved Airplane Flight Manual and operate the airplane in accordance with these insertions:

1. In Section, 1, LIMITATIONS, adjacent to AIRSPEED LIMITS, MAXIMUM OPERATING SPEED VMO/MMO:

a. Delete any procedures relative to exceeding VMO or MMO. .

b. Add the following limitation:

WARNING: **Do** not extend the spoilers, or operate with the spoilers deployed, at speeds above VMO/MMO due to the significant nose down pitching moment associated with spoiler deployment.

2. In Section 1, LIMITATIONS, add a new limitation:
TRIM SYSTEMS

a. To assure proper trim systems operation, the BEFORE STARTING ENGINES trim system checks must be successfully completed before each flight.

WARNING: Failure to conduct a complete pitch trim preflight check prior to each flight increases the probability of an undetected system failure, An additional single failure in the trim system could result in a runaway. In certain critical flight conditions an unrestrained runaway could result in high speeds, severe buffet, wing roll off, loads in excess of structural limit and extremely high forces necessary for recovery.

b. Pitch trim system runaway training that actually involves running the trim in flight to simulate malfunctions is prohibited.

3. In Section 1, LIMITATIONS, adjacent to STALL WARNING SYSTEM, add the following:

On Models 23, 24, 24A, 24B, 24B-A, 24D, 24D-A, 25, 25A, 25B, and 25C with unmodified wings, and the same models with Howard/Raisbeck Mark II wings:

WARNING: Do not intentionally fly .the airplane slower than initial stall warning (shaker) onset.

4. In Section 1, LIMITATIONS, adjacent to YAW DAMPER:

a. Delete any references to disengaging the yaw damper before landing, or landing with the yaw damper engaged.

b. Add the following yaw damper requirements:

On landing, the following yaw damper disengage procedures shall apply:

(1) The airplane shall be configured for landing at least **500** ft. AGL for normal landing:

(2) The yaw damper shall be disengaged during the landing flare.

CAUTION: If landings are attempted in turbulent air conditions with the yaw damper **OFF**, the airplane may exhibit undesirable lateral-directional (Dutch-Roll) characteristics. These characteristics are improved as the wing/tip fuel is consumed. The pilot shall observe the NOTE relative to turbulence contained in the BEFORE LANDING section *of* Section II of the Airplane Flight Manual and increase airspeed as required.

5. In Section II, NORMAL OPERATION PROCEDURES, adjacent to BEFORE STARTING ENGINES Procedures:

a. Delete current preflight procedures **on** all trim systems.

b. Add the following new trim system preflight checks:

NOTE: Some early Model 23, 24 airplanes incorporate a cutoff button that interrupts pitch, roll and yaw axes.

(1) Pitch Trim Selector switch -- EMER (or SEC).

(2) Operate EMERGENCY (or SEC) pitch trim switch NOSE UP and NOSE DOWN and check for stabilizer movement. Stabilizer movement will be approximately one-half **of** the rate of primary trim.

(3) Either Control Wheel Trim Switch - Operate NOSE UP and NOSE DOWN. Trim motion shall not occur.

(4) Pitch Trim Selector Switch - OFF.

(5) Actuate pilot's and copilot's Control Wheel Trim and Trim Arming Switches (if applicable) and pedestal EMERGENCY (or SEC) Pitch Trim Switch. Trim motion shall not occur.

(6) Pitch Trim Selector Switch - NORM (or PRI)

(7) EMERGENCY (or SEC) Pitch Trim Switch - Operate NOSE UP and NOSE DOWN. Trim motion shall not occur.

NOTE: On all Model 23 airplanes and Model 24 (Serial Number 24-100 through 24-169) airplanes, except for those incorporating Accessory Kit AAK70-3, trim motion **will** occur.

(8) Pilot's Control Wheel Trim Switch - Without depressing arming button (if applicable), move switch to LWD, RWD, NOSE UP, and NOSE DOWN: trim motion shall not occur. Depress arming button (if applicable): trim motion shall not occur. Then depress arming button (if applicable) and move switch to LWD, RWD, NOSE UP and NOSE DOWN: trim motion shall occur.

(9) Repeat Step (8) for Copilot's 'Control Wheel Trim Switch.

(10) Trim by positioning Copilot's Control Wheel Trim Switch in one direction: then trim in opposite direction using the Pilot's Control Wheel Trim Switch. Pilot's trim shall override the Copilot's trim. Repeat for all lateral and pitch trim positions.

(11) Pilot's Control Wheel Trim Switch - NOSE UP. While trimming, depress Control Wheel Master Switch (if applicable) or Cutoff Button (if applicable); trim motion shall stop when the Control Wheel Master Switch is held. Repeat procedure for NOSE DN condition: trim motion shall stop. Repeat procedure for LWD & RWD lateral trim on airplanes equipped with Cutoff Button. (The procedures in this paragraph are not applicable to Model 25, S.N. 25-003 through 25-205 and Model 24, S.N. 24-170 through 24-328, except those airplanes modified by AAK76-4A).

(12) Repeat Step (11) using copilot's Control Wheel Trim Switch, and Control Wheel Master Switch (if applicable), or Cutoff Button (if applicable).

(13) YAW TRIM Switch - Operate each half separately (if installed): trim motion shall not occur.

(14) YAW TRIM Switch - Operate both halves simultaneously: trim motion shall occur. On aircraft with Cutoff Button, check that the Cutoff Button stops the trim.

(15) Trim - Set all axes for takeoff.

6. In Section III, EMERGENCY PROCEDURES, add a new PITCH UPSET (NOSE-UP or NOSE-DOWN) Emergency Procedure:

A nose-up pitch axis malfunction or nose-up pitch trim system runaway can result in extremely high pitch attitudes, heavy airframe buffet, and require control forces in excess of 75 pounds for recovery.

A nose-down pitch axis malfunction, nose-down pitch trim system runaway, or nose-down overspeed can result in extremely high airspeeds and require control forces in excess of **75** pounds for recovery. WARNING: **Do** not extend spoilers on any nose-down pitch upset at any speed due to significant nose-down pitching moment associated with spoiler deployment.

NOTE: Control pressures may be heavy. Copilot assistance is recommended with this procedure.

IMMEDIATELY:

a. Attitude Control - As required to maintain aircraft control.

- If in nose-up attitude, roll into bank or maintain existing bank until the aircraft nose passes through the horizon.
- If in nose-down attitude, level the wings before pulling the nose up.

b. Thrust levers - As required. (If in nose-down attitude, immediately reduce thrust levers to IDLE position.)

c. Control Wheel Master Switch or Cutoff Button - Depress and hold until step g. is accomplished.

d. PITCH TRIM Selector Switch - OFF.

e. STALL WARNING Switches - OFF.

WARNING: On any speed excursions beyond MMO, the elevator control must be smoothly and steadily applied to prevent encountering excessive aileron activity and airframe buffet. Beyond .85 M1, a 1.5 g pull-up may be sufficient to excite aileron activity and the g level must be limited to'that required to maintain lateral control.

AFTER AIRCRAFT CONTROL IS REGAINED:

f. Spoilers - Check retracted.

g. Autopilot's Pitch Circuit Breaker - Pull.

h. If control force continues, select other trim system and retrim the aircraft.

i. Isolate malfunctioning system by switching sysems ON one at a time. Pause between activating each system to determine the defective system.

7. In Section IV, PERFORMANCE DATA, adjacent to the appropriate takeoff charts, add the following: Increase all Chart V1, VR and V2 speeds by:

a. Model 23, 24, 24A, 24B, 24B-A, 24D, 24D-A, 25, 25A, 25B, 25C, with unmodified wings, plus 5 KNOTS Indicated Airspeed.

b. Model 23, 24, 24A, 24B, 24B-A, 24D, 24D-A, 25, 25A, 25B, 25C, with Howard/Raisbeck Mark II wings, plus **5** KNOTS Indicated Airspeed. (Increase applies to FLAP 10 and FLAP 20 charts, and is not applicable to FLAP 10 OVERSPEED chart.)

8. In Section IV, PERFORMANCE DATA, adjacent to each TAKEOFF DISTANCE CHART, add the following:

Increase all chart takeoff distances by:

a. Model 23, 24, 24A, 24B, 24B-A, 24D, 24D-A, 25, 25A, 25B, 25C, with unmodified wings, plus 10%.

b. Model 23, 24, 24A, 24B, 24B-A, 24D, **24D-A**, 25, 25A, 25B, 25C, with Howard/Raisbeck Mark II wings, plus 10%. (Increase applies to FLAP **10** and FLAP 20 charts, and is not applicable to FLAP 10 OVERSPEED chart.)

9. In Section IV, PERFORMANCE DATA, adjacent to each TAKEOFF WEIGHT LIMITS chart, add the following:

a. Reduce the Limiting Weight-Brake Energy takeoff weights **for** Model 23, 24, 24A, 24B, 24B-A, 24D, 24D-A, 25, 25A, 25B, 25C, with unmodified wings, 500 lbs.

b. Reduce the FLAP 10 and FLAP 20 takeoff weight limits **for** Model 23, 24, 24A, 24B, 24B-A, 24D, **24D-A,** 25, 25A, **25B,** 25C, with Howard/Raisbeck Mark II wings, 500 lbs, if the airplane 'is at climb limited gross weight **and** if takeoff weight is above 14,500 **lbs.** **For** takeoff weights above '**14,000** lbs. and below 14,500 lbs., reduce the weight to 14,000 lbs. Takeoff weight reduction not applicable to FLAP 10 OVERSPEED.

10. In Section IV, PERFORMANCE DATA, adjacent to LANDING APPROACH SPEEDS chart, add the following:

Increase all chart Landing Approach Speeds by:

a. Model 23, 24, 24A, with unmddified wings, plus 8 KNOTS Indicated Airspeed.

b. Model **23**, 24, 24A with ECR **736** (CJ610-6 engines and increased gross weight), and Model 24B, 24B-A, 24D, 24D-A, with unmodified wings, plus 4 KNOTS Indicated Airspeed.

c. Model 25, 25A, with unmodified wings, plus 3 KNOTS Indicated Airspeed.

d. Model 25, 25A, with unmodified wings with ECR 936 (AAK 70-5), plus 5 KNOTS Indicated Airspeed.

e. Model 25B, 25C, with unmodified wings, plus 5 KNOTS Indicated Airspeed.

f. Model 23, 24, 24A, 24B, 24B-A, 24D, 24D-A, 25, 25A, 25B, 25C, with Howard/Raisbeck Mark II wings, plus 5 KNOTS Indicated Airspeed.

11. In Section IV, PERFORMANCE DATA, adjacent to each LANDING DISTANCE CHART, add the following: Increase all chart landing distances by:

a. Model 23, 24 and 24A, with unmodified wings, plus 10%.

b. Model 23, 24, 24A with ECR 736 (CJ610-6 engines and increased gross weight) and Model 24B, 24B-A, 24D, 24D-A, with unmodified wings, plus 5%.

c. Model 25, 25A, with unmodified wings, plus 4%.

d. Model 25, 25A, with unmodified wings with ECR 936, (AAK70-5) plus 7%.

e. Model 25B, 25C, with unmodified wings, plus 7%.

f. Model 23, 24, 24A, 24B, 24B-A, **24D,** 24D-A, 25, 25A, 25B, 25C, with Howard/Raisbeck Mark II wings, plus 7%.

12. In Section IV, PERFORMANCE DATA, adjacent to the LANDING WEIGHT LIMITS CHART, add the following:

Reduce the Limiting Weight-Brake Energy landing weights as follows:

a. Model 23, 24, 24A, with unmodified wings, **800** lbs.

b. Model 23, 24, 24A, with ECR 736 (CJ610-6 engines and increased gross weight), and Model 24B, 24B-A, 24D, 24D-A with unmodified wings, 400 lbs.

c. Model 25, 25A, with unmodified wings, **300** lbs.

d. Model 25, 25A, with unmodified wings with ECR 936 (AAK70-5), 500 lbs.

e. Model 25B, 25C, with unmodified wings, 500 lbs.

f. Model 23, 24, 24A, 24B, 24B-A, 24D, 24D-A, 25, 25A, 25B, 25C, with Howard/Raisbeck Mark II wings, 500 lbs.

NOTE: In order to comply with the requirements of paragraph A of this Airworthiness Directive, this AD, or a duplicate thereof, may be used **as** a temporary amendment to the

Airplane Flight Manual and carried'in the aircraft as part Of the Airplane Flight Manual until replaced by the identical revisions to the Airplane Flight Manual provided by the manufacturer and approved by the FAA. The temporary Airplane Flight Manual Changes required by paragraph A) of this AD may be accomplished by the holder of at least a private pilot certificate issued under Part 61 of the Federal Aviation Regulations on any airplane owned or operated by that person who must make the prescribed entry in the Airplane Maintenance Records indicating compliance with paragraph A) **of** this AD.

B) Except for the roll axis of the FC-200 autopilot installed on Model 35, 35A, 36 and 36A airplanes, within the next 75 flight hours, conduct the following inspections to assure capability of manually overriding the Automatic Flight Control Systems:

1. Energize the airplane electrical system by applying 28 VDC electrical power.

2. Roll Axis

a. On airplanes equipped with FC-110 autopilot, remove the electricai power from the FC-110 Autbpilot Computer. Open the computer and identify the Roll Calibration Board. On the **Roll** Calibration Board, temporarily install, in parallel with R18 (82 ohm) resistor, a 39 ohm, one watt resistor. Restore the electrical power and engage the Autopilot with the control wheel centered and verify that **the** roll slip clutch breakaway occurs by rotating the control wheel briskly (45 degrees per second) in both directibns. If slippage is not verified, remove the capstan and adjust to proper torque per the appropriate Gates Learjet Service Manual. Return Autopilot Computer to original configuration and accomplish a functional check of the autopilot.

3. Yaw Axis

a. Effective **on** all **models**:

(1) Check and adjust the yaw capstan slip clutch torque (primary and secondary where applicable) in accordance with the appropriate Gates Learjet Service Manual.

4. Pitch Axis

a. Effective on Models 24D, 24D-A, 24E, 24F, 24F-A, 25B, 25C, 25D, 25F, 28, **29**, 35, 35A, **36** and 36A airplanes and airplanes incorporating Gates Learjet Kits AAK71-12 or AMK80-3 (torquers):

(1) With the Autopilot disengaged, turn on both stall warning switches and move the control wheel forward and aft at a rapid rate (one second - stop to stop). Note the drag associated with control movement. Turn off the stall warning switches and repeat the rapid fore and aft movement. Note the decrease in drag, which is an indication that the electric disconnect clutch functions properly by disconnecting the drag of the pitch servo (torquer) from the control system.

b. Effective on Models 23, 24, 24B, 24B-A, 24C, 25 and 25A airplanes except airplanes incorporating Gates Learjet Kits AAK71-12 or AMK80-3:

(1) Check and adjust the pitch capstan slip clutch for proper torque in accordan'ca with the appropriate Gates Learjet Service Manual.

C) On airplane Models 35, 35A, 36 and 36A, within the next 150 flight hours conduct the following inspection of the FC-200 autopilot roll axis to assure capability of manually overriding that axis of Automatic Flight Control Systems:

1. Energize the airplane electrical system by applying 28 VDC electrical power.

2. Check and adjust the roll capstan slip clutch for proper torque in accordance with the appropriate Gates Learjet Service Manual.

D) Submit a written report of any out of tolerance of roll, yaw, or pitch axis capstan slip torque to the Federal Aviation Administration, Aircraft Certification Program, Room 238, Terminal Building 2299, Mid-Continent Airport, Wichita, Kansas 67209. (Reporting approved by the Office of Management and Budget Order **OMB** No. 04-R0174.)

E) To assure proper operation of the Stall Warning Accelerometer Unit, perform, within the next 25 flight hours, inspection **of** the Stall Warning Accelerometer in accordance with appropriate Gates Learjet Service Bulletin SB 23, 24, 25-301A, SB 28, 29-27-3A, or SB 35, 36-27-1211. Submit a written report on any discrepancy discovered during this inspection to Federal Aviatibn Administration, Aircraft Certification Program, Room 238, Terminal Building 2299, Mid-Continent Airport, Wichita, Kansas 67209. (Reporting approved by Office of Management and Budget Order OMB No. 04-R0174.3

NOTE: The owner/operator is responsible for submitting reports required by this AD.

F) Airplanes may be flown in accordance with FAR 21.197 to a location where alterations and inspections required by this directive can be accomplished.

G) Any equivalent method of compliance with this AD must be approved by the Chief, Aircraft Certification Program, **FAA,** Central Region.

This Emergency Airworthiness Directive (AD) letter supersedes the Emergency AD letter dated August 4, 1980, AD 80-16-06, on this same subject.

This airworthiness directive becomes effective upon receipt.

FOR FURTHER INFORMATION CONTACT:

Larry Malir, Aircraft Certification Program, Systems and Equipment Section, Federal Aviation Administration, Room 238, Terminal Building 2299, Mid-Continent Airport, Wichita, Kansas 67209, telephone (316) 942-4281.