



# National Transportation Safety Board Aviation Accident Final Report

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<b>Location:</b>	Salina, KS	<b>Accident Number:</b>	CHI01MA163
<b>Date &amp; Time:</b>	06/12/2001, 1300 CDT	<b>Registration:</b>	N333CG
<b>Aircraft:</b>	Learjet 25D	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>		<b>Injuries:</b>	2 Serious
<b>Flight Conducted Under:</b>	Part 91: General Aviation - Flight Test		

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## Analysis

During a test flight, the airplane encountered an elevator system oscillation while in a high-speed dive outside the normal operating envelope. The 17 second oscillation was recorded on the cockpit voice recorder and had an average frequency of 28 Hz. The aft elevator sector clevis (p/n 2331510-32) fractured due to reverse bending fatigue caused by vibration, resulting in a complete loss of elevator control. The flight crew reported that pitch control was established by using horizontal stabilizer pitch trim. The flightcrew stated that during final approach to runway 17 (13,337 feet by 200 feet, dry/asphalt) the aircraft's nose began to drop and that the flying pilot was unable to raise the nose using a combination of horizontal stabilizer trim and engine power. The aircraft landed short of the runway, striking an airport perimeter fence and a berm. The surface winds were from the south at 23 knots, gusting to 32 knots.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The PIC's delayed remedial action during the elevator system oscillation, resulting in the failure of the aft elevator sector clevis due to reverse bending fatigue caused by vibration, and subsequent loss of elevator control. Factors contributing to the accident were high and gusting winds, the crosswind, the airport perimeter fence, and the berm.

## Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION  
Phase of Operation: MANEUVERING

### Findings

1. (C) FLT CONTROL SYST,ELEVATOR CONTROL - OSCILLATION
2. (C) REMEDIAL ACTION - DELAYED - PILOT IN COMMAND
3. (C) FLT CONTROL SYST,ELEVATOR CONTROL CABLE/ROD - FATIGUE
4. (C) FLT CONTROL SYST,ELEVATOR CONTROL - LOSS,TOTAL

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Occurrence #2: UNDERSHOOT  
Phase of Operation: EMERGENCY DESCENT/LANDING

### Findings

5. (F) WEATHER CONDITION - GUSTS
6. (F) WEATHER CONDITION - HIGH WIND
7. (F) WEATHER CONDITION - CROSSWIND

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Occurrence #3: ON GROUND/WATER ENCOUNTER WITH TERRAIN/WATER  
Phase of Operation: LANDING - ROLL

### Findings

8. (F) TERRAIN CONDITION - BERM
9. (F) OBJECT - FENCE

## Factual Information

### HISTORY OF FLIGHT

On June 12, 2001, at 1300 central daylight time, a Learjet 25D, N333CG, operated by Avcon Industries, was destroyed on impact with terrain while landing at the Salina Municipal Airport (SLN), Salina, Kansas. The test flight was operating under the provisions of 14 CFR Part 91 and was on an instrument flight rules flight plan. The pilot and copilot sustained serious injuries. Visual meteorological conditions prevailed at the time of the accident. The flight departed Newton City County Airport (EWK), Newton, Kansas, at 1155.

According to the flight crew, the purpose of the test flight was to establish a performance baseline prior to a modification to the aircraft. The purpose of the modification was the development of a new supplemental type certificate (STC) for the Learjet model 25 airplane. The test flight profile was to execute a high-speed dive to verify and establish the vibration and buffeting characteristics of the unmodified aircraft prior to a delta-fin modification to the aft-fuselage. The flight crew stated that the airplane was to be put into a dive, at 43,000 feet pressure altitude (Palt) and that they were to follow a predetermined altitude versus speed schedule until reaching 20,400 feet, where they would execute a 1.5-G recovery. The pilot in the left seat was the pilot-in-command (PIC) and flying pilot (PF). The copilot handled the radio communications and other related pilot-not-flying (PNF) duties. According to Avcon's safety assessment procedures, the test flight was determined to be a high risk and was performed with a minimum crew. The test plan noted, "Caution, Learjets may experience aileron buzz and Mach tuck at these high speeds and Mach numbers. Discontinue evaluation if characteristics become objectionable."

The flight crew reported that during the high-speed descent, at approximately 24,000 feet, the control yoke began to vibrate rapidly for approximately 3-5 seconds after which elevator control was lost. The flight crew stated that they declared an emergency with the Federal Aviation Administration (FAA) Kansas City Air Route Traffic Control Center (ARTCC) and requested to divert to runway 17 (13,337 feet by 200 feet, dry/asphalt) at SLN. The flight crew stated that pitch control was established by using horizontal stabilizer pitch trim. The flight crew reported that during final approach to the runway the aircraft nose began to drop and that the flying pilot was unable to raise the nose using a combination of horizontal stabilizer trim and engine power. The aircraft landed short of the runway, striking an airport perimeter fence and a berm.

The accident airplane was equipped with a cockpit voice recorder (CVR), which was recovered from the wreckage and sent to the National Transportation Safety Board (NTSB) CVR Laboratory in Washington, D.C., for readout. The CVR recording began at 1228:22 (hhmm:ss) and continued up to the point-of-impact at 1300:00.

About 1229:35, Denver ARTCC cleared N333CG to descend from 43,000 feet to 14,000 feet.

The following table was compiled from the CVR Group Chairman Factual Report, the test flight card, FAA aircraft radar track data, and ARTCC transcripts of voice communications. The table depicts the high-speed dive portion of the flight:

Time (hhmm:ss)	Altitude (feet Palt)	Target Speed (Knots IAS)	Actual Speed (Knots IAS)
1230:31	43,000	251	227

1231:05	40,000	268	266
1231:27	38,000	280	280
1231:44	36,000	294	293
1232:00	34,000	308	308
1232:18	32,000	323	322
1232:34	30,000	338	336
1232:41	29,000	346	
1232:48	28,000	354	350
1233:02	26,000	369	367
1233:17	24,000	384	384

At 1233:31 a sound of an unidentified chattering noise starts and continues for a period of 17 seconds.

The following selections are from the CVR Group Chairman Factual Report, which is included with the docket material associated with this accident investigation. The labels HOT-1 and HOT-2 refer to the hot-microphone source for the pilot and copilot stations, respectively.

1233:55

HOT-2 I think....

1233:56

HOT-1 I think we lost our elevator.

1233:57

HOT-2 you okay?

1233:59

HOT-1 I think we lost our elevator.

1234:01

HOT-2 okay.

1234:02

HOT-1 I'm using the trim.

1234:03

HOT-2 all right t, keep using trim.

1234:13

HOT-2 okay, I'm gonna slow down.

1234:14

HOT-1 yeah.

1234:16

HOT-2 and we'll, go out here and experiment. I'm gonna go ahead and uh, declare and emergency. is the trim working?

1234:26

HOT-1 uh, trim's working but...

1234:27

HOT-2 okay, okay.

1234:27

HOT-1 ... no elevator.

1234:28

HOT-2 okay, all right. okay, we're gonna go into Salina. long runway, okay?

1234:34

HOT-1 uh, yeah.

1234:36

HOT-2 all right... let me get'em on the other side here. let me get myself hooked up here. we're gonna go out and do some slow flight and all kind of stuff before we try...

1235:03

HOT-1 yeah.

1235:04

HOT-2 ... and go in.

Between 1235:52 and 1236:26, the copilot declared an emergency to Kansas City ARTCC, requested to land at SLN, and N333CG was cleared direct to SLN.

At 1239:19 the copilot informs Kansas City ARTCC, "...we're flying on trim and uh, we'll proceed direct to Salina and uh try to make a, a landing using trim only." N333CG was cleared to descend to 9,000 feet msl.

Between 1239:40 and 1248:03, the pilot and copilot discuss aircraft configuration for the landing and how the approach will be flown.

1243:39

HOT-2 and what do you think? Maintain about a hundred and fifty knots or so on, on final....

1243:42

HOT-1 yeah.

1243:44

HOT-2 ... at, at least.

1243:44

HOT-1 yeah. and we got thrust reversers and we got the chute if we need it.

1243:48

HOT-2                yeah.

1243:48

HOT-1                I got the brakes.

1243:49

HOT-2                yep.

1243:50

HOT-1                we do have hydraulics [unintelligible].

1243:51

HOT-2                we got thirteen thousand feet.

1243:52

HOT-1                yeah. yeah.

At 1243:59, Kansas City ARTCC cleared N333CG to descend to maintain 6,000 feet.

Between 1243:59 and 1253:29, the pilot and copilot discussed approach speeds, aircraft landing weight, landing flap settings, and the copilot began transferring fuel from the aft-fuselage tank.

At 1248:22, SLN tower tells N333CG, "... you can make a long final if you like straight in. give us a call five miles or right base your choice one seven." The copilot responded, "okay, we'll probably just circle out north and then try and set up a long straight in."

At 1249:48, SLN tower cleared N333CG for the visual approach to runway 17.

At 1253:29, N333CG was about 9.5 nm north of SLN and the copilot informed SLN tower that they are turning back toward the airport.

Between 1254:38 and 1255:53, the flightcrew located runway 17 and discussed the landing approach.

At 1256:45, the copilot reported being on a 3 nm final for runway 17 and SLN tower cleared N333CG for landing.

At 1257:15, SLN tower reported the wind as 200 degrees magnetic at 20 knots, gusting to 27 knots.

1257:18

HOT-2                okay, I'd main about a hundred and seventy if you can.

1257:21

HOT-1                okay.

1257:25

HOT-1                eeh, don't get much slower than that.

1257:37

HOT-2                everything's lookin' really good.

1257:43

HOT-2 got about, we're about plus five right now which is fine.

1257:45

HOT-1 oh, okay.

1257:46

HOT-2 about one seventy five. I'm gonna start bringing the power back just a little bit.

1257:50

HOT-1 (unintelligible word) okay.

1257:55

HOT-2 I was trying to set up a real gradual descent here.

1258:05

HOT-2 got a little bit of a right crosswind, a little bit gusty.

1258:08

HOT-1 okay.

1258:08

HOT-2 twenty gusting to twenty seven, out of two ten. airspeed's looking good. we got a hundred and eighty. everything's lookin' good.

1258:14

HOT-1 yeah, that's good, that's okay.

1258:15

HOT-2 okay, we got about a four hundred foot per minute rate of descent. everything's lookin' good.

1258:38

HOT-2 'kay, (unidentified word). hundred and almost a hundred and ninety now.

1258:43

HOT-1 ah, okay.

1258:44

HOT-2 I'll pull back a little bit more on the power.

1258:59

HOT-1 my gear is down, yep.

1259:01

HOT-2 yeah, gear is down.

1259:09

HOT-2                   okay, I got a hundred and nine.

1259:10

SLN Tower   three charlie golf's in sight, wind again two zero zero at two zero gusts two seven.

1259:13

HOT-2                   right.

1259:14

HOT-1            okay.

1259:15

HOT-2                   okay, there's a hundred and ninety knots. a little bit of nose up trim, not much, okay.

1259:25

HOT-2                   almost two hundred knots now. If we can slow 'er up just little bit. little bit slower. okay, keep 'er.

1259:40

HOT-2                   little, nose up trim, nose up trim, nose up trim.

1259:45

HOT-2                   okay, here we go.

1259:54

HOT-2                   nose up trim, nose up trim, nose up trim, nose up trim, nose up trim, nose up trim.

The CVR recording ended at 1300:00.

A witness reported that the airplane came "in low, then started to pull up. The tail hit the ground then it started fishtail in the wheat [field], and landed inside airport fence."

Another witness stated, "I witnessed a lear jet that appeared to be in normal landing configuration on an [approximately] 3 mile final to runway 17. At [approximately] 1.5 miles [north] of the runway the aircraft's nose pitched down [approximately] 30 [degrees] and impacted the ground."

According to a statement provided by SLN airport rescue and fire fighting (ARFF), "As [the accident airplane] came into sight, we noticed the aircraft was really low. As it approached, the aircraft suddenly dove at a 45-degree angle."

#### DAMAGE TO AIRCRAFT

The airplane was destroyed during the impact with terrain and the airport perimeter fence.

#### OTHER DAMAGE

The airport perimeter fence was damaged when the airplane traveled through the fence.



## PERSONNEL INFORMATION

### Pilot-In-Command:

The PIC was the flying pilot and was seated in the left cockpit position. The PIC held a commercial pilot certificate with airplane single-engine land, airplane multiengine land, airplane single engine sea, and instrument airplane ratings. He was type-rated for the Learjet. The FAA issued the commercial pilot certificate on February 2, 2000.

FAA records indicate his last medical examination was completed on January 25, 2001, and that he was issued a second-class medical certificate with the restriction, "Must have available glasses for near vision."

The pilot reported a total flight time of 19,000 hours, of which 16,500 hours were as PIC. He had accumulated 9,000 hours in single engine airplanes and 10,000 hours in multiengine airplanes. He had logged 1,500 hours in the Learjet model 25, of which 1,300 hours were as PIC. He flew 19 hours during the last 3 months, of which 4 hours were in the accident airplane. He had flown 8 hours during the last 30 days, of which 4 hours were in the accident airplane. He flew 2.3 hours during the last 24 hours, all of which were in the accident airplane.

His last flight review, as required by Federal Aviation Regulation (FAR) 61.56, was completed on May 3, 2001, in a Learjet model 25.

The PIC became a naval aviator on December 18, 1953, and was assigned to the Marine Fighter Squadron VMF-451 in El Toro, California. While with the VMF-451 he flew the FJ-2 "Fury" jet fighter in California and Japan. In January 1956 he was assigned to Cherry Point, North Carolina, where he flew the TV-2, FJ-2, and FJ-3 jet fighters. The pilot completed his military career with the Marine Air Reserve in St. Louis, Missouri, and Olathe, Kansas. While with the Marine Air Reserve he flew the FJ-2, F9F-8 "Cougar", F4D "Skyray", and F8U "Crusader" jet fighters.

The PIC joined Learjet Incorporated in March 1965 and became the Chief of Production Flight Test in October 1965. Between October 1965 and March 1972 he flew Learjet models 23, 24, and 25 through the production flight test syllabus. In March 1972 he transferred to the Engineering Flight Test department and flew certification test flights for Learjet models 35/36, 28/29, and 55/55C. The pilot retired from Learjet Incorporated in 1991 and subsequently became a contract flight test pilot for Avcon Industries starting in 1995. The PIC had not completed any formal test pilot training.

According to FAA documents, the pilot received an order of suspension of his commercial certificate on January 7, 1998, for violating an ATC altitude clearance resulting in a loss of safe vertical and lateral separation from a passenger airliner. His commercial certificate was suspended for 15 days, after which his certificate was reauthorized.

The FAA documents indicated that he was PIC of a Learjet model 35 that was performing a certification test flight within an assigned altitude block (37,000 feet to 41,000 feet). While performing flight test maneuvers he lost control of the airplane and descended below 37,000 feet. The pilot requested a lower altitude clearance in order to regain control of airplane; however, ATC instructed the pilot not to descend below 37,000 feet. He reported that he was unable to maintain 37,000 feet. He did not declare an emergency.

## Copilot:

The copilot was the pilot-not-flying and was seated in the right cockpit position. The copilot held a commercial pilot certificate with airplane single-engine land, airplane multiengine land, and instrument airplane ratings. He was type-rated for the Learjet. The FAA issued the commercial pilot certificate on August 24, 1997.

FAA records indicate his last medical examination was completed on August 6, 1999, and that he was issued a second-class medical certificate with the restriction, "Must wear corrective lenses."

The copilot reported a total flight time of 5,168 hours, of which 4,500 hours were as PIC. He had accumulated 3,160 hours in single engine airplanes and 2,008 hours in multiengine airplanes. He logged 470 hours in the Learjet model 25, of which 273 hours were as PIC. He had flown 40 hours during the last 3 months, of which 26 hours were in the accident airplane. He flew 20 hours during the last 30 days, of which 16 hours were in the accident airplane. He had flown 2.3 hours during the last 24 hours, all of which were in the accident airplane.

His last flight review, as required by Federal Aviation Regulation (FAR) 61.56, was completed on May 3, 2001, in a Learjet model 25.

The copilot was a naval aviator and served two tours during the Vietnam war flying the F-4 Phantom. He then spent two years at the Chase Field Naval Air Station as an Advanced Jet Instructor for the F-9 Cougar. After his retirement from the military, he worked for the Cessna Aircraft Company (1976 - 1982) in sales, management, and demonstration pilot positions. He then worked for Piper Aircraft (1982 - 1983) as a Regional Administrator and demonstration pilot. From 1984 - 1992 he worked as the Vice President and General Manager of Kansas City Aviation Center. From 1992 - 1996 he was the Vice President of Sales & Operations for Avcon Industries. Currently he is the President of Avcon Industries. While at Avcon Industries he has worked as a company test pilot, as well as in the research/development and production/maintenance divisions. The copilot had not completed any formal test pilot training.

## AIRCRAFT INFORMATION

The accident aircraft was a Learjet 25D, serial number 262, registered to Butler National Inc., and was equipped with two General Electric turbojet engines. The original airworthiness certificate was issued on October 28, 1978. The airplane was issued a special airworthiness certificate on June 8, 2001, and was certified for experimental category operations. The airplane certification was further categorized as "research and development" and "to show compliance." On June 7, 2001, at 8,419.5 hours airframe total time, 300 and 600 hour inspections were completed. Prior to the accident flight the airframe had 8,422.3 hours total flight time, which included 2.8 hours since a conformance inspection.

The last inspection was performed on June 8, 2001, at 8,419.5 hours total time, to verify the aircraft was in compliance with the conditions listed in FAA issued Type Inspection Authorization (TIA) #SA2192WI-T. The TIA required the aircraft be "a Learjet Model 25 series aircraft equipped with Centruy III wing and Softflite type design or factory retrofit which has no significant external aerodynamic or engine performance modifications from original type design." The TIA further required verification that the "flight controls have been rigged to

specifications and within tolerance ranges... ."

The Learjet model 25 maintenance manual notes the flight control cable tensions (measurements taken at 69 degrees Fahrenheit) should be:

Aileron: 72 lbs (+/- 10 lbs)

Rudder: 69 lbs (+/- 5 lbs)

Elevator: 72 lbs (+/- 5 lbs)

Note: The above values were obtained using a temperature compensated load correction chart to obtain a correction value, which was subtracted from the nominal cable tensions taken at 75 degrees Fahrenheit.

The recorded cable tensions (lbs), taken at the last inspection, were as follows:

	Right	Left
Aileron cable within fuselage:		70            65
Aileron cable in wing - forward:	65	72
Aileron cable in wing - aft:	72	78
Rudder:	66	65
Elevator:	69	65

Note: The temperature at the time of the inspection was 69 degrees Fahrenheit.

The tension of the elevator cable (left hand side) was 2 lbs lower than the allowable limit.

The left engine was a General Electric CJ610-8A, serial number 2518-245A. The engine had accumulated 9,006.9 hours total time (3,950.9 hours since last overhaul).

The right engine was a General Electric CJ610-8A, serial number 2518-246A. The engine had accumulated 9,061.2 hours total time (4,005.2 hours since last overhaul).

An Aircraft Weighing Record, dated June 12, 2001, indicated the pre-departure aircraft weight was 15,526 lbs, with a mean aerodynamic chord of 30.11%.

The airplane was equipped with an experimental instrumentation package, including an instrumented control column, rudder pedals, and glareshield. The left control column was modified with a non-standard control wheel and a strain gauge interface unit that was installed vertically centered on the outboard side of the control column. The instrumentation was not being used during the accident flight to collect data.

## METEOROLOGICAL INFORMATION

The SLN automated surface observing system (ASOS) recorded the following information at 1253:

Wind 180 degrees true at 23 knots gusting to 28 knots; 10 statute mile visibility; sky clear; temperature 33 degrees Celsius; dew point of 20 degrees Celsius; altimeter 29.61 inches-of-mercury. Peak wind of 29 knots from 190 degrees true at 1219.

The SLN ASOS recorded a peak wind of 32 knots from 200 degrees true at 1254.

## AIRPORT INFORMATION

The Salina Municipal Airport is located about 3 miles southwest of Salina, Kansas. The airport has three asphalt runways: 17/35 (13,337 feet by 200 feet), runway 12/30 (8,502 feet by 100 feet) and runway 04/22 (3,648 feet by 75 feet, asphalt). The airport is equipped with airport rescue and fire fighting (ARFF) units under provisions of 14 CFR Part 139.317 Index A.

Runway 17 is equipped with a 4-box visual approach slope indicator (VASI) that depicts a 3-degree glideslope. The VASI is located off the left edge of the runway.

One air carrier and two fixed-based operators serve the airport. The air traffic count for 2001 was 92,870 flights, averaging approximately 254 flights a day.

## FLIGHT RECORDERS

The magnetic tape cockpit voice recorder (CVR), manufactured by B & D, serial number A01214, was removed from the accident aircraft and sent to the NTSB's laboratory in Washington, D.C., for readout and evaluation. A CVR committee convened on June 20, 2001, and a transcription of the CVR was generated. The CVR Specialist's Factual Report of Investigation is included with the docket material associated with this accident investigation.

The accident airplane was not equipped with a flight recorder or similar data acquisition equipment.

## WRECKAGE AND IMPACT INFORMATION

The NTSB on-scene investigation began on June 13, 2001.

A global positioning system (GPS) receiver reported the position of the main wreckage as 38 degrees 49 minutes 01.1 seconds north latitude, 97 degrees 38 minutes 46.9 seconds west longitude. All aircraft structural components and flight controls were identified and accounted for at the accident site.

The airplane first impacted the ground 0.371 nm (2,254 feet) from the end of runway 17 in a level wheat field. The initial ground markings were on the extended runway centerline. The main wreckage, consisting of the fuselage and empennage, came to rest upright about 900 feet from the initial impact, and approximately 85 feet to the right of the runway 17 centerline. Wreckage was located along the entire path. There were three parallel tracks through the wheat crop, which were orientated on a 174-degree magnetic heading. The three tracks were associated with the airplane's three landing gear. All three landing gear and portions of both wingtip fuel tanks were located within the first 530 feet of the wreckage path. The aircraft impacted an east/west orientated airport perimeter fence about 541 feet from the initial impact point. A 49 foot section of the perimeter fence was damaged. After crossing through the perimeter fence the aircraft impacted a 10-foot high berm about 614 feet from the initial impact point. A portion of the left elevator tip was found on the berm. The right wing was found completely separated from the fuselage and was about 832 feet from the initial impact point. The right engine was found completely separated from the airframe, resting alongside the left aft fuselage. The left engine remained attached to the fuselage, but was rotated 90 degrees

down with the engine inlet embedded into the terrain. The left wing was found completely separated from the fuselage and was about 930 feet from the initial impact point.

Both ailerons remained attached to their respective wing hinge points. The aileron trim-tab deflection measured 0.06 inch, corresponding to about 1 degree left wing down. The designed trim-tab range is +/- 8 degrees.

Both wing flaps remained partially attached to their respective hinge points. Wing flap positions could not be conclusively determined due to the extent of damage. Both spoilers were fully retracted.

The horizontal stabilizer was broken away from the vertical stabilizer at the hinge point. The horizontal stabilizer trim actuator measured 17 inches between the upper and lower attachment points, corresponding to a nose-down trim setting of -1.81 degrees. The designed trim range is -0.75 to -8.75 degrees.

Both elevators remained attached to the horizontal stabilizer. Flight control cable continuity was established from the dual cockpit controls to the aft elevator sector. The aft elevator sector clevis rod end fitting (p/n 2331510-32) was fractured. Flight control push-pull tube continuity was established from the aft elevator sector to both elevators. The aft elevator sector (p/n 2315147-2), push-pull tube (p/n 2331510-33), and the fractured clevis fitting were removed for additional examination. The outboard half of the left elevator had significant impact damage and was missing the weighted tip. The elevator tip was found separate, along the wreckage path. The right elevator was not damaged and was removed to verify its static balance. The right elevator was checked for static balance and had an overbalance (leading edge heavy) of 10.2 inch pounds. The approved overbalance range is 10.0 to 10.5 inch pounds.

The rudder remained attached to the vertical stabilizer. The rudder trim-tab deflection measured 0.38 inch trailing edge left, corresponding to about 4.2 degrees nose right trim. The designed trim range is +/- 15 degrees.

The accident aircraft was reexamined to document the installation of the control columns, the condition of the bob weight system, and to verify the type of control columns installed. The assessment of the bob weight system was precluded due to impact damage. No pre-impact anomalies were found with the installation of the control columns to the floor structure. The control columns were a one-piece casting type.

#### MEDICAL AND PATHOLOGICAL INFORMATION

Both pilots received serious injuries during the accident and were treated at a local area hospital.

#### FIRE

There was no evidence of an in-flight or post impact fire.

#### EMERGENCY RESPONSE

According to a SLN ARFF incident report and personnel interviews, the Alert II (Klaxon)

sounded at 1241 followed by a description of the emergency. The emergency was listed as, "Pilot reported elevator trouble." At the time of the initial alert the accident airplane was approximately 30 nm north and was preparing for a landing on runway 17. The incident report indicated there were two individuals and 3,800 pounds of fuel on-board the airplane.

Two ARFF vehicles (ARFF-1 & ARFF-2) responded to the Alert II call. ARFF-1, consisting of a driver and two personnel, positioned themselves near the approach end of runway 17. ARFF-2, consisting of a driver and two personnel, positioned themselves at the intersection of taxiways alpha and foxtrot. The Salina Fire Department had one crash vehicle and four personnel positioned on the ramp. The incident report states emergency vehicles were in position for about 5 minutes prior to making visual contact with the accident airplane. The SLN ARFF manager reported no difficulties gaining access to the accident site.

At 1300 (time of accident) SLN Tower called local 911. ARFF-1 responded first to the accident site and was on scene within 60 seconds of the accident. Subsequently, ARFF-2 arrived at the accident site and provided support to ARFF-1. Upon arrival at the accident scene no fire or sparks were noted and the decision was made to enter the aircraft through the main cabin door. The incident report states that both pilots were "alert and verbal." The Salina Fire Department unit arrived and performed the extraction of both pilots. At 1332 SLN ARFF resumed Index A coverage. At 1333 both pilots had been removed from the wreckage and were transported to a local area hospital. According to the ARFF report, both pilots were conscious during transport.

## TEST AND RESEARCH

### Elevator System Description:

The elevators provide longitudinal control of the aircraft. Each elevator is connected to the horizontal stabilizer at three hinge points. The mechanical control system consists of control column torque tube, bellcranks, sectors, cables, and push-pull tubes. A bellcrank is mounted on the control column torque tube that provides rotary motion to the forward elevator sector through a push-pull tube. The forward elevator sector is connected to the aft elevator sector by a series of cables and pulleys. The aft sector operates the elevators through bellcranks, push-pull tubes, and an idler assembly.

Elevator control motion is transferred from the interconnected control columns through a push-pull tube, bellcrank assembly, and closed loop cable assembly to the aft sector assembly in the tailcone. From the aft sector assembly, motion is transferred through push-pull tubes to elevator horns. A bob weight, linked to the right control column, extends forward into the nose compartment to provide an adjustable static balance device in the elevator control system.

### NTSB Metallurgy Examinations:

The aft elevator sector (p/n 2315147-2), the fractured clevis rod end fitting (p/n 2331510-32), and the end portions of push-pull tube (p/n 2331510-33) were removed from the airplane and sent to the NTSB Materials Laboratory in Washington, D.C., for additional examination. A Materials Laboratory Factual Report is included with the docket material associated with this accident investigation.

According to the Materials Laboratory Factual Report, the clevis rod end fitting was fractured in the threaded region of the fitting. The fracture intersected the thread root adjacent to the

lowermost thread engaged by the lock nut. The forward and aft sides of the fracture surface were relatively smooth with smooth curving boundaries, features consistent with fatigue. There were multiple fatigue origins observed around the circumference of the fitting. The origins were roughly diametrically opposite each other, a feature consistent with reverse-bending fatigue. The center of the fracture surface was matte gray and was relatively rough, features consistent with overstress fracture. The mating fracture surface had multiple fatigue origins around most of the outer diameter, as is typical of fatigue with high bending stresses and a severe stress concentration. However, the relative size and shape of the final fracture area is more typical of fatigue with low bending stresses and a severe stress concentration. The average hardness of the clevis measured 28.2 HRC. The minimum specified hardness for the clevis fitting is 26 HRC.

The aft elevator sector center bearing had a limited range of motion. At the accident site, the bearing moved through less than 10 degrees before binding. The bearing moved through about 45 degrees at the NTSB Materials Laboratory. The bearing shields were removed and the grease had a dried appearance. The bearing was worked back and forth by hand, resulting in full rotation around 360 degrees being achieved. The center attachment bolt had circumferential scoring around the shaft. The scoring was located within 0.27 inches of the underside of the head and within 0.38 inches of the innermost thread.

The upper spherical rod end bearing was self-aligned with 12 balls. The bearing shield was dented inward at the aft side of the bearing. Circumferential rubbing marks were observed on the forward side of the rod end. The bearing would rotate through 360 degrees but movement was rough and jerky. The bearing was cut open and examined. The inner ring contained a yellow-green deposit and multiple impressions were observed on the inner ring raceway. There were twelve impressions, evenly spaced around the circumference, which appeared deeper and shinier than the rest. The outer ring raceway ball paths appeared relatively dark. Pitting was observed in the ball path, with heavier pitting observed on the upper aft portion of the raceway. Areas of shiny impressions were observed around the forward, upper, and aft portions of the outer raceway outside the normal ball path. Hardness averages were taken for four balls, the inner ring, and outer ring. The average hardness values were 61.1 HRC, 63.2 HRC, and 60.5 HRC, respectively. The approved range for the balls, inner ring, and outer ring was 62 to 66 HRC.

#### Aft Elevator Clevis Testing:

Learjet Incorporated examined 7 elevator clevis rod end fittings (p/n 2331510-32). The in-service times of the 7 fittings varied between 2,002.6 and 16,988.1 hours. The fittings were examined for any existing corrosion or cracking, using bench microscopy and magnetic particle inspection. No signs of corrosion or cracking were found with the fittings examined.

#### Sound Spectrum Study:

According to the CVR Group Chairman Factual Report, at approximately 1233:31 a "sound of unidentified chattering noise" starts and continues for a period of 17 seconds. This portion of the CVR was examined to document the characteristics of the unidentified noise. According to the NTSB specialist's report, the recording was examined on a computerized spectrum analyzer that produces a color visual/graphical presentation of the frequency and energy content of the signals. Selections, approximately 1 second in duration, were taken from the start, middle, and end of the original 17 second sample. The numbers of peaks observed on the individual

waveforms were divided by the elapsed time of the samples, yielding an average frequency in Hertz (Hz). The first, middle, and last samples had an average frequency of 28.2 Hz, 28.4 Hz, and 28.2 Hz, respectively. Spectral energy diagrams for each sample indicated a fundamental frequency of 28.4 Hz, 28.4 Hz, and 28.1 Hz, respectively.

#### Airspeed and Altimeter Examinations:

The left, right, and flight engineer station airspeed indicators were removed from the accident aircraft for bench testing. The left airspeed indicator (p/n 739BK-3-018, s/n AF44-4323) tested within tolerances. The right airspeed indicator (p/n S225-8, s/n 177) tested within tolerances. The flight test engineer station airspeed indicator was not tested due to damage.

The left and right altimeters were damaged and were not removed from the airplane. The flight engineer altimeter appeared undamaged and was removed for testing. Further examination of the flight engineer altimeter revealed a case fracture and a calibration test could not be performed. According to Avcon documentation, the three altimeters (left, right, and flight engineer) were calibrated prior the start of the flight test program and all were in a serviceable condition.

#### ADDITIONAL INFORMATION

The main wreckage was released to a representative of Avcon Industries on June 14, 2001. All elevator system components were returned to a representative of the insurance company on January 17, 2002. The CVR was returned to a representative of the insurance company on November 8, 2001.

The FAA, Learjet Incorporated, and Avcon Industries were parties to the investigation.

#### Pilot Information

<b>Certificate:</b>	Commercial	<b>Age:</b>	69, Male
<b>Airplane Rating(s):</b>	Multi-engine Land; Single-engine Land; Single-engine Sea	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	Seatbelt, Shoulder harness
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 2 Valid Medical--w/ waivers/lim.	<b>Last Medical Exam:</b>	01/25/2001
<b>Occupational Pilot:</b>		<b>Last Flight Review or Equivalent:</b>	05/03/2001
<b>Flight Time:</b>	19000 hours (Total, all aircraft), 1500 hours (Total, this make and model), 16500 hours (Pilot In Command, all aircraft), 19 hours (Last 90 days, all aircraft), 8 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		



## Co-Pilot Information

<b>Certificate:</b>	Commercial	<b>Age:</b>	57, Male
<b>Airplane Rating(s):</b>	Multi-engine Land; Single-engine Land	<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	Seatbelt, Shoulder harness
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 2 Valid Medical--w/ waivers/lim.	<b>Last Medical Exam:</b>	08/06/1999
<b>Occupational Pilot:</b>		<b>Last Flight Review or Equivalent:</b>	05/03/2001
<b>Flight Time:</b>	5168 hours (Total, all aircraft), 470 hours (Total, this make and model), 4500 hours (Pilot In Command, all aircraft), 40 hours (Last 90 days, all aircraft), 20 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Manufacturer:</b>	Learjet	<b>Registration:</b>	N333CG
<b>Model/Series:</b>	25D	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>		<b>Amateur Built:</b>	No
<b>Airworthiness Certificate:</b>	Experimental	<b>Serial Number:</b>	262
<b>Landing Gear Type:</b>	Retractable - Tricycle	<b>Seats:</b>	3
<b>Date/Type of Last Inspection:</b>	06/08/2001, Continuous Airworthiness	<b>Certified Max Gross Wt.:</b>	15000 lbs
<b>Time Since Last Inspection:</b>	2.8 Hours	<b>Engines:</b>	2 Turbo Jet
<b>Airframe Total Time:</b>	8419.5 Hours	<b>Engine Manufacturer:</b>	General Electric
<b>ELT:</b>	Not installed	<b>Engine Model/Series:</b>	CJ610-8A
<b>Registered Owner:</b>	Butler National, Inc.	<b>Rated Power:</b>	2950 lbs
<b>Operator:</b>	Avcon Industries, Inc.	<b>Air Carrier Operating Certificate:</b>	None

## Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	SLN, 1273 ft msl	Observation Time:	1253 CDT
Distance from Accident Site:	0 Nautical Miles	Direction from Accident Site:	0°
Lowest Cloud Condition:	Clear	Temperature/Dew Point:	33° C / 20° C
Lowest Ceiling:	None	Visibility	10 Miles
Wind Speed/Gusts, Direction:	23 knots/ 28 knots, 180°	Visibility (RVR):	
Altimeter Setting:	29.61 inches Hg	Visibility (RVV):	
Precipitation and Obscuration:			
Departure Point:	Newton, KS (EWK)	Type of Flight Plan Filed:	IFR
Destination:	Salina, KS (SLN)	Type of Clearance:	IFR
Departure Time:	1155 CDT	Type of Airspace:	Class D

## Airport Information

Airport:	Salina Municipal Airport (SLN)	Runway Surface Type:	Asphalt
Airport Elevation:	1273 ft	Runway Surface Condition:	Dry
Runway Used:	17	IFR Approach:	Visual
Runway Length/Width:	13337 ft / 200 ft	VFR Approach/Landing:	Straight-in

## Wreckage and Impact Information

Crew Injuries:	2 Serious	Aircraft Damage:	Destroyed
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 Serious	Latitude, Longitude:	38.816944, -97.646389

## Administrative Information

Investigator In Charge (IIC):	Andrew T Fox	Adopted Date:	11/25/2003
Additional Participating Persons:	Henry (Hank) A Rochon; Federal Aviation Administration - Wichita FSDO; Wichita, KS James B Tidball; Bombardier Aerospace (Learjet); Wichita, KS Marcus L Abendroth; Avcon Industries, Inc.; Newton, KS		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at <a href="mailto:pubinq@ntsb.gov">pubinq@ntsb.gov</a> , or at 800-877-6799. Dockets released after this date are available at <a href="http://dms.nts.gov/pubdms/">http://dms.nts.gov/pubdms/</a> .		

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

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