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Improperly Installed Electrical Wiring Causes In-flight Fire and Leads to Loss of Control by Learjet Crew During Attempted Emergency Landing

The operator of the accident aircraft failed to provide adequate quality control and oversight of the installation of special-mission power wiring for military use of the aircraft, the official U.S. report said.

FSF Editorial Staff

The crew of the Learjet 35A were returning to the Fresno Air Terminal (FAT), Fresno, California, U.S., on an instrument flight rules (IFR) flight plan after completing a support mission with the California Air National Guard (ANG). Moments after establishing contact with the Fresno U.S Federal Aviation Administration (FAA) terminal radar approach control (TRACON), the crew declared an emergency, reported an engine fire and requested immediate vectors to the airport. Visual meteorological conditions (VMC) prevailed.

The Fresno approach controller vectored the aircraft to a right base to Runway 29R at FAT. Unable to control the aircraft, the crew flew past the airport and crashed on a city street. The aircraft exploded and burned. The two pilots (the only aircraft occupants) were killed, and 21 persons on the ground were injured in the Dec. 14, 1994, accident.

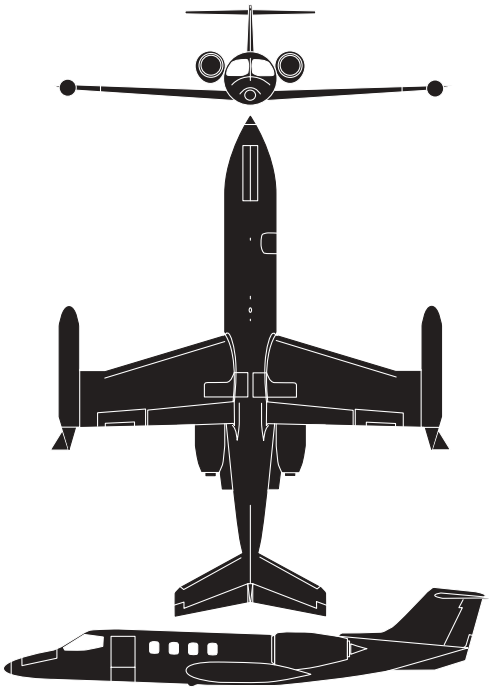
The U.S. National Transportation Safety Board (NTSB) determined that the probable causes of the accident were: "1) improperly installed electrical wiring for special-mission operations that led to an in-flight fire that caused airplane systems and structural damage and subsequent airplane control difficulties; 2) improper maintenance and inspection procedures followed by the operator; and 3) inadequate oversight and approval of the maintenance and inspection practice by the operator in the installation of the special-mission systems."

The accident aircraft was owned by Phoenix Air Group Inc., and was based and maintained at the Klamath Falls International Airport, Klamath Falls, Oregon, U.S., the report said. It was operated as a public-use aircraft under contract to the U.S. Air Force to provide training for ANG fighter aircraft. The aircraft had been modified with electronic equipment to support ANG mission requirements, the report said.

On the day of the accident, the crew checked out of their hotel at 0846 hours Pacific Standard Time, the report said. They departed FAT on an IFR flight plan and flew to a restricted-airspace area east of the Sierra Nevada mountains.

After completing an operational exercise with two California ANG General Dynamics F-16s, the accident flight crew contacted Fresno approach control. At 1141:36, the first officer reported that the flight was descending out of 11,500 feet (3,507 meters) mean sea level (MSL) for 11,000 feet (3,355 meters) MSL, and that the crew had received the current automatic terminal information service (ATIS) broadcast for FAT, the report said.

"At 1143:10, the flight was instructed to fly a heading of 290 degrees and to descend [to] and maintain 4,000 feet [1,220 meters]," the report said. The first officer responded, "Declare an emergency, engine fire, immediate vectors." At this point, the flight was descending through 9,200 feet (2,806 meters) and was 10 nautical miles (11.5 statute miles/18.5 kilometers) northeast of FAT, the report said.



Learjet 35A

The Learjet 35A is powered by two AlliedSignal TFE731-2-2B turbofan engines. The 35A can accommodate eight passengers and two flight crew members. It has a maximum takeoff weight of 18,300 pounds (8,300 kilograms); a maximum cruising speed at 41,000 feet (12,500 meters) of 460 knots (529 miles per hour/852 kilometers per hour); and a service ceiling of 41,000 feet. With four passengers, maximum fuel and 45-minute reserves, the 35A has a range of 2,196 nautical miles (2,527 statute miles/4,067 kilometers).

Source: *Jane's All the World's Aircraft*

The controller asked the crew if they wanted Runway 11 or Runway 29 for landing, and the first officer responded that they wanted Runway 29, the report said. The flight was then issued a vector heading and cleared for a visual landing approach to Runway 29R. "At 1144:01, the approach controller informed the pilots that they were six miles [9.6 kilometers] from the airport, and at 1144:25, that the airport was four miles [6.4 kilometers] at 12 o'clock," the report said.

When the first officer reported that they had the airport in sight, the crew were instructed to switch to the Fresno FAA air traffic control (ATC) tower frequency.

After the crew contacted the Fresno ATC tower, "the flight's intracockpit communications began to be carried on [the] tower frequency," the report said. "The communications between the captain and first officer (the only persons on board), as well as cockpit background sounds, were carried continuously on [the] tower frequency from that time until the airplane crashed. Static, sometimes loud enough to make it difficult to discern the pilots' voices, was heard during approximately the last one minute of flight," the report said.

At 1145:01, the flight was about three miles (4.8 kilometers) east-northeast of the approach end of Runway 29R, on a southwest track. The first officer said, "I think you're gonna need to do a two-seventy [270-degree turn]," the report said. Shortly thereafter, the captain said, "We got an engine fire on the right side too, it shows." At this point, the airplane had a ground speed of 280 knots (322 miles per hour/518 kilometers per hour) and was at an altitude of 1,600 feet (488 meters) MSL. The FAT field elevation is 333 feet (101 meters) MSL, the report said.

ATC radar data and witnesses on the ground indicated that "the flight turned to the south, as if beginning a 270-degree turn to the left, but the flight then turned back to a southwesterly track and crossed the extended centerline about two miles [3.2 kilometers] from the approach end of [Runway] 29R," the report said. "Radar contact was lost [at] about 1145:38 as the airplane descended below 1,000 feet [305 meters] MSL at 250 knots [288 miles per hour/463 kilometers per hour]."

The accident flight was observed by two ANG pilots at the airport, "who heard the fire/rescue equipment warning horn go off and rushed outside of the [ANG] squadron building, [and] saw the airplane about 1.5 miles [2.4 kilometers] from the approach end of [Runway] 29R, about 200 feet [610 meters] above ground level (AGL) in a steep right bank of about 60 degrees or more, overshooting final and not turning," the report said. "They said 'the nose [was] not tracking at all.'"

Fresno tower controllers reported that "after the airplane passed to the southwest of the extended centerline [of the runway], it appeared ... to gradually descend very low," the report said. "The tower supervisor stated that the landing gear appeared to be down about that time. The airplane then climbed back up gradually from what appeared by line of sight to tower controllers to be above the tree tops. It then again gradually descended in an apparent westerly heading. The airplane climbed or 'porpoised' up a second time, more severely. It then descended sharply until view was obstructed by trees. A fireball and smoke were then observed," the report said.

The airplane crashed on a city street in Fresno, approximately two miles (3.2 kilometers) west-southwest of the approach end of Runway 29R, the report said.

A review of the wreckage path (Figure 1, page 3) revealed that the right wing tip/fuel tank of the airplane struck a lamp pole and a traffic-signal pole on the north side of a street that was east-west oriented. The airplane then traveled west down the street for about 1,300 feet (396 meters). "Immediately after the right wing impacted the lamp pole, the left wing, all three landing gear and the fuselage of the airplane impacted on [the street]," the report said. "The left wing tip and its attached fuel tank impacted near the centerline of the [street]. Impact

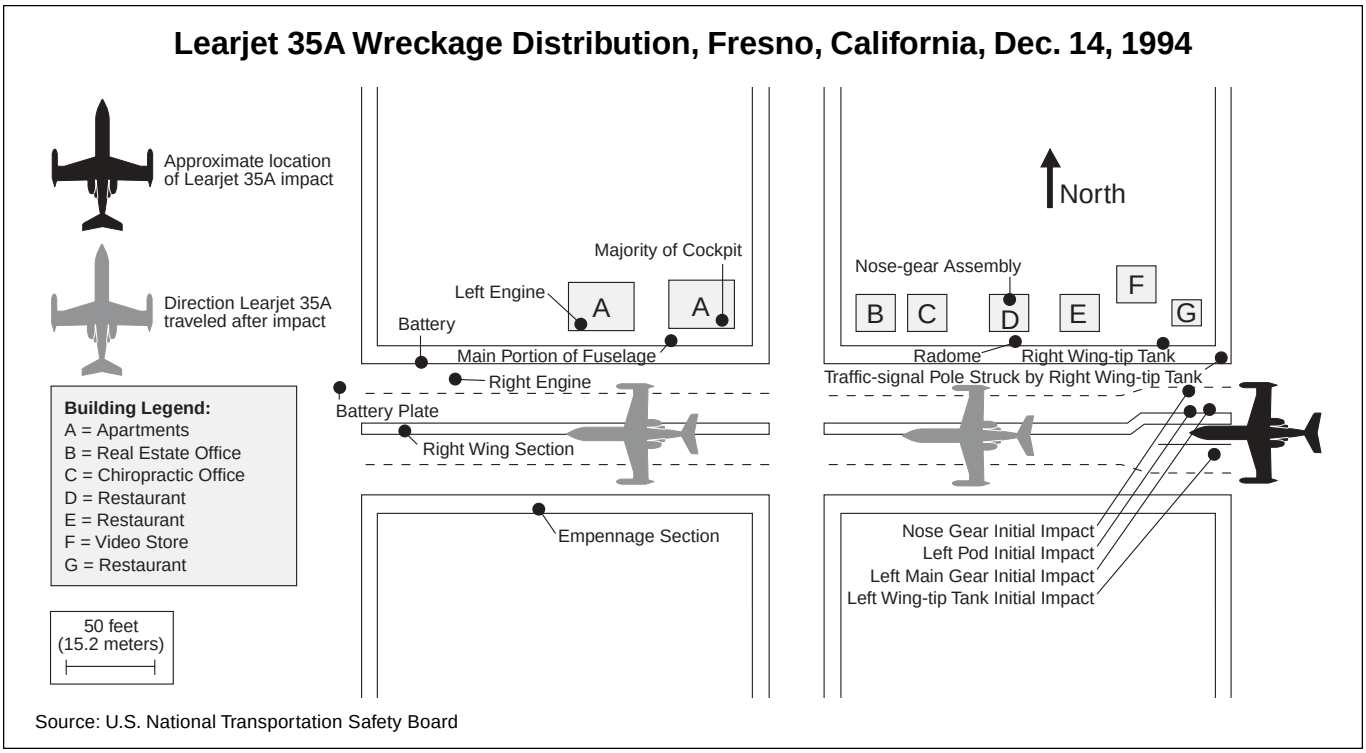


Figure 1

marks from the nose and main landing gear penetrated approximately two inches [five centimeters] into the asphalt, heading in a westerly direction," the report said.

The report continued: "The main fuselage, as evidenced by ground and asphalt scars and a blackened fire trail, continued to travel along the sidewalk on the north side of [the street]. The witnesses to the accident sequence stated that there was a continuous fireball after the initial impact with the street until parts visibly broke free after more than a block of travel. [Then,] the airplane began to veer across the sidewalk and impacted and moved two large decorative boulders that were immediately north of the sidewalk, in front of an office building ... ."

The airplane continued disintegrating as it traveled on the street and through an intersection. The majority of the cockpit was found in an apartment building on the north side of the street. The pilots' bodies were recovered in front of the apartment building.

The left engine was in the living room of a first floor apartment in a second apartment building, immediately west of the building where the cockpit was found. "There was no evidence of fire damage to the engine or the inside of the room in the apartment," the report said.

The main portion of the fuselage, combined with the remains of the left wing, was inverted in debris in front of the two apartment buildings. "Most of the aluminum structure was melted, and the left wing was barely recognizable, except for the remaining steel components," the report said.

The empennage separated from the main fuselage and came to rest on the south side of the street. "It was not on fire," the report said. Further down the street, "the right wing and right engine came to rest, on fire ... about 1,200 feet [366 meters] west of the initial impact marks," the report said.

The two apartment buildings sustained the most severe damage of all the buildings on the street. "Most of the 21 persons who were injured on the ground lived in units in the two damaged apartment buildings. One female resident sustained severe burn injuries," the report said.

The airplane was destroyed by the impact and fire, the report said. It was valued at US$1.3 million. Damage to public property was estimated at $10,000. Private property damage was about $2 million, the report said.

Autopsies were performed on, and toxicological specimens taken from, both pilots, the report said. The specimens tested negative for drugs and alcohol.

When the airplane wreckage was analyzed, investigators found that "the cockpit was extensively damaged by impact forces," the report said. "Most of the cockpit wreckage was recovered, but not all of the cockpit indicators were recovered. Recovered cockpit engine instruments were examined at the facility of the subsystem manufacturer. None of the engine indicators could be functionally tested due to impact damage. All power-warning flags were broken loose and all instrument indications were found to be unreliable," the report said.

Investigators recovered "the left-engine fire-detection T-handle ... from the cockpit wreckage in the stowed or normal position," the report said. "The hydraulic and fuel valves for the left engine were each found in the open or normal positions. By design, pulling a T-handle would actuate the respective engine's fuel and hydraulic valves to the closed position. The right [engine] T-handle was not found," the report said.

When the throttle quadrant was examined, the guarded spoilers-deployment switch (trigger guard) was found in the spoilers-deployed position. "The electrically powered actuator for the elevator trim was found about one degree from a full nose-down trim position," the report said. "According to Learjet, the actuator would remain in its impact position and would provide a reliable indication of elevator trim at impact."

The fire bottles for both engines were recovered. " ... The cartridge that opens the plumbing from the right fire bottle to the left engine was found to have been electrically fired," the report said. This explosive cartridge is fired from the cockpit by pushing a light labeled "ARMED" above the fire detection T-handle for the corresponding engine. When the explosive cartridge fires, it "discharges the contents of one fire extinguisher bottle and allows it to flow into the affected engine nacelle," the report said.

Examination of the left engine revealed that it was "in a windmilling condition (not under power) at the time of impact," the report said. "There was no evidence of internal or external fire damage." Examination of the right engine "found no evidence of internal or external preimpact fire damage," the report said. The right engine was producing power above flight idle at impact.

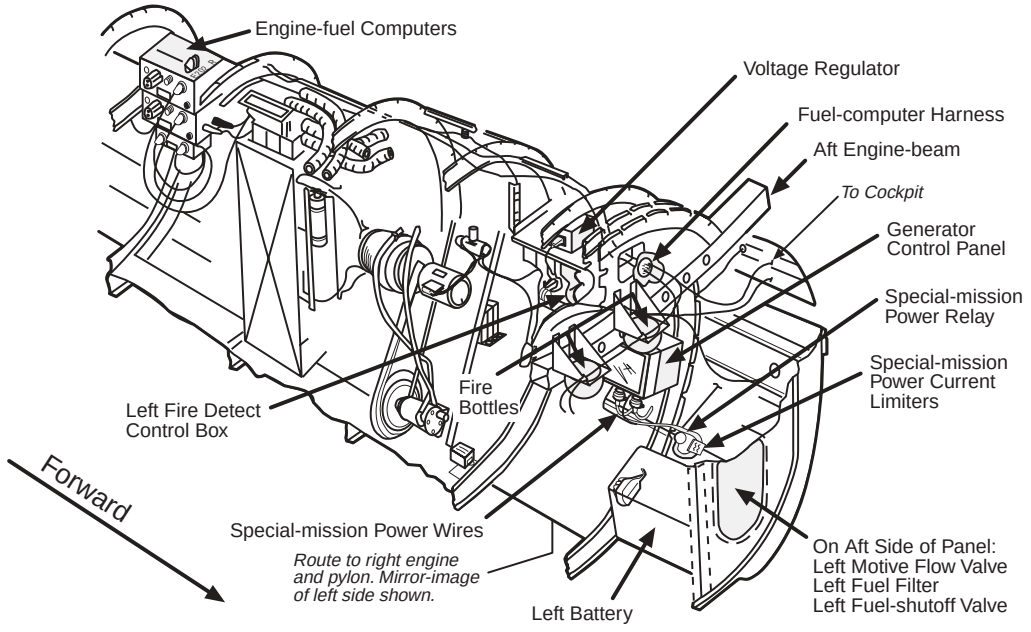
When the remaining wreckage was examined, "there was evidence of in-flight fire damage in the aft fuselage area of the electronics bay," the report said. "Soot deposits were found around lightening holes in the vertical stabilizer. These holes were at the interface between the aft tailcone [Figure 2] and the interior of the forward portion of the vertical stabilizer."

Approximately 27 inches (69 centimeters) of the aft engine-support beam was recovered and examined. "The material had experienced high temperatures in the area where it passed through the aft fuselage between the engines," the report said. "The analysis found that portions of the beam that had traversed through the aft fuselage had been near the melting point of aluminum (at about 1,200 degrees F [649 degrees C])."

The aircraft was not equipped with, nor was it required to have, a flight data recorder (FDR) or a cockpit voice recorder (CVR). A review of the maintenance records revealed that the aircraft had at one time been equipped with both an FDR and a CVR, the report said. Both recorders were removed in 1992, when the special-mission wiring was installed.

After examining the wreckage, investigators found that "the electrical power cables for the special-mission equipment had not been installed in accordance with specifications," the report said (Figure 3). "The improper installation left portions of the wires unprotected by current limiters. The two large-diameter

Learjet 35A Aft Tailcone, Special-mission Power Wiring



Source: U.S. National Transportation Safety Board

Figure 2

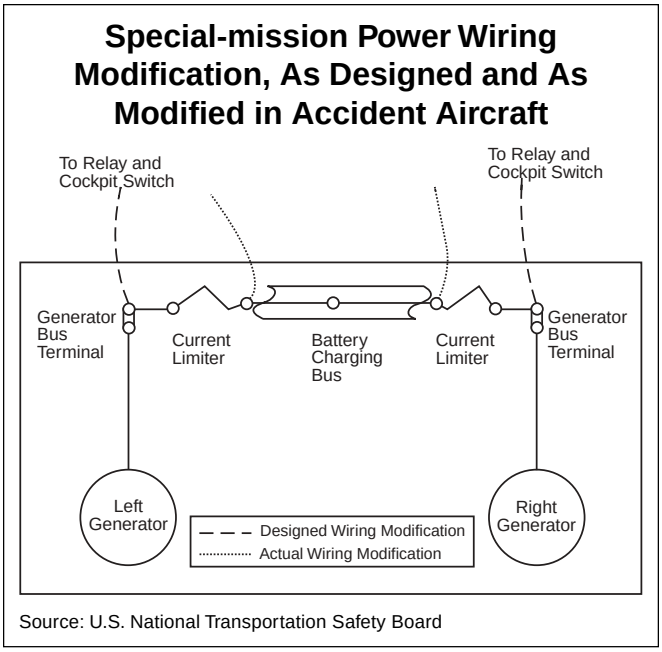


Figure 3

DC [direct current] power wires that were retrieved from the wreckage showed evidence of arcing and they were 'welded' together in the area unprotected by current limiters. This evidence indicates shorting [short circuiting] and unlimited current flow for an extended period of time while the airplane was airborne. ...

"The evidence suggests that the arcing probably ignited wiring insulation and other combustible materials on the left side of the electronics bay. This caused damage to adjacent components. However, melting of the aft engine-beam, the loss of Teflon electrical insulation on the engine fuel computer harness and holes burned in the steel shield on the cabin air conditioning hose required an intense fire directed at these items that was farther to the left side of the airplane. ... A 'torchlike' flame from a pressurized fuel leak would be consistent with the fire damage noted ... ."

The report concluded: "The fact that these heavily fire-damaged components were in the same general location in the electronics bay of the airplane is also consistent with a burning fuel leak from a pressurized system. It is possible that the arcing or [direct] short drew excessive current, causing a battery to explode; this is supported by the conditions of the batteries and tie-downs. Two of the battery tie-down bolts were nearly straight, indicating the likelihood that they were not restraining substantial battery mass at the time of impact. Battery explosion, specifically the left battery, could have compromised a fuel line."

The accident aircraft was one of 18 Learjets operated by Phoenix Air with the special-mission wiring, the report said. Three of these aircraft had been purchased from another operator and were correctly wired. The remaining 15 aircraft had been modified by Phoenix Air. In reviewing the modification of the 15 aircraft, it was discovered that confusion had begun with one mechanic's misinterpretation of another's instructions. "The [Phoenix Air] director of maintenance stated that after the first airplane was miswired, the incorrect wiring alteration was copied on 14 subsequent Learjets and that a drawing was not referenced," the report said.

Six days after the accident, "the Phoenix Air director of maintenance issued an 'Immediate Airworthiness Action' to Phoenix Air's seven maintenance sites to immediately stop flying the remaining 17 mission-equipped Learjets until the wiring was inspected for chafing, then 'disconnect the special-mission power wire from the generator control panel to the current limiter and remove this entire section of wire,'" the report said. Nine days after the accident, "Learjet sent a letter to its operators, worldwide, stating that, 'It is strongly recommended that [an inspection] take place prior to the next flight,'" the report said.

In reviewing the oversight of Phoenix Air's maintenance operations, the report commented: "Although the [U.S. Air Force] had specified that [Phoenix Air] must use an FAA-approved maintenance program, this did not diminish the fact that the airplane was being operated as a public-use aircraft requiring [U.S. Air Force] oversight. The [NTSB] believes that the DOD [U.S. Department of Defense] should have provided audits of contractor maintenance actions on specific aircraft."

The report noted: "Because the operation was considered public use, technically, [Phoenix Air] did not have to comply with FAA regulations; however, [Phoenix Air] did maintain the airplane in accordance with such regulations. Consequently, when the special-mission equipment was installed, it was supposed to be installed in accordance with the provisions of the [FAA] Form 337 [*Major Repair or Alteration*]."

The report continued: "The use of the FAA Form 337 for approval of the installation of the special-mission equipment, and the fact that a Phoenix Air mechanic holding IA [inspection authorization] privileges signed off on the installation procedures, placed the responsibility for quality and oversight of the installation on the operator. The operator failed in these responsibilities."

The NTSB concluded that "a qualified mechanic should not have overlooked basic electrical-power wire installation practices, such as ensuring proper current-overload protection for the entire system," the report said. "Similarly, the failure of the FAA-certified avionics inspector to compare the actual installation with the specified installation instructions is inexcusable. ... These failures, coupled with the fact that 14 additional airplanes had been modified incorrectly, reflect on the competence of the individuals involved and a lack of adequate oversight by the operator's maintenance management personnel," the report said.

Investigators computed the weight and balance for the accident flight, and found both to be within approved limits for the aircraft, the report said.

The background and qualifications of the flight crew were reviewed. The captain, 36, held a U.S. airline transport pilot (ATP) certificate for multiengine land airplanes, with type ratings for the Beech 300, Beech 1900 and Learjet, the report said. He had 7,109 total flying hours, with 2,746 hours in Learjets (1,954 hours as pilot-in-command). He also held a commercial certificate for single-engine land and rotorcraft-helicopter, and a flight instructor certificate for airplane single-engine land and instrument airplane.

"In the preceding 30, 60 and 90 days, he logged 56.4, 96.5 and 152.9 flight hours, respectively," the report said. "His total instrument time was 261.7 hours, and his total night time was 843.2 hours." The captain held an FAA first-class medical certificate with no restrictions, which had been issued on April 27, 1994, the report said.

A review of FAA accident/incident records indicated that he had been cited with a violation of U.S. Federal Aviation Regulations (FARs) Part 91.9 ("Careless or Reckless Operation") in 1988, the report said. "The report indicated that he attempted to take off in a Cessna 402C with the parking brake partially engaged," the report said. "His airman's certificate was suspended for 14 days."

The captain was hired by Phoenix Air as a Learjet first officer in 1990 and was upgraded to captain in 1991, the report said. He received annual Learjet 35 recurrent training at FlightSafety International (FSI) in October 1994, and completed a proficiency check ride.

FSI training records indicated that "the captain had problems with altitude control during the first three flights of the recurrent training," the report said. The following remarks, about a flight on the second day of training, were entered in his records: "Periodically loses concentration on [aircraft] control," the report said. During a flight on the third day of training, "overall improvement was noted in the record, but the captain was noted as occasionally allowing the airspeed to wander, and there were occasional altitude deviations noted of more than 200 feet [61 meters]," the report said. "The remarks pertaining to the proficiency check indicated that the flight was good."

The first officer, 34, held a U.S. ATP certificate for multiengine land airplanes, with a type rating for the Learjet, the report said. He also held a commercial certificate for single-engine land airplanes. He had 5,268 total flying hours, with approximately 3,000 hours in the Learjet (2,000 hours as pilot-in-command).

"In the last 30, 60 and 90 days prior to the accident, he logged 50.2, 95.2 and 145.4 flight hours, respectively," the report said. "His total instrument time was 266.8 hours, and his total night time was 492.3 hours." The first officer held a current FAA first-class medical certificate with no limitations, the report said.

A review of FAA accident/incident records revealed that, in 1988, the first officer made a forced landing in a Cessna 152 following an engine failure, the report said. No violations resulted from this incident.

The first officer was hired by Phoenix Air as a Learjet first officer in 1991 and was upgraded to captain in 1992, the report said. He received annual recurrent training at FSI, and completed a proficiency check ride at the same time as the captain. His FSI training records contained the following comments: "Very good in all areas," "Strong performer throughout" and "Continued good work," the report said.

Investigators reviewed the flight crew's ability to evaluate the emergency, considering the information available to the crew at the time of the emergency. "The evidence strongly suggests that the flight crew was first alerted to a problem by an engine-fire warning light, which was probably on the left side because they later discussed 'engine fire on the right side too, it shows,'" the report said. "Adjacent to the [special-] mission power wires [Figure 2, page 4] was the left-engine fire-warning control box. The input/output wiring harness for the fuel-control computer for both engines was also routed just above this area."

The report continued: "The fire-warning circuits for the left engine above the ignition area probably became involved early in the fire. This would have triggered the left-engine fire-warning system and the subsequent shutdown of the engine by the pilots. Examination of the engine revealed no in-flight fire damage and no indication of power at impact. Evidence indicated that the right-engine fire bottle was electrically fired to the left engine, which also supports the scenario."

The investigation also found that the flight crew "may also have received a fire warning later in the flight as the fire continued to cause damage in the aft fuselage area," the report said. "Their comment about 'fire on the right side too, it shows' supports this possibility. There was no reasonable means for the flight crew to observe fire in the aft fuselage from the cockpit. Consequently, their remarks about the location of the fire probably came from the cockpit engine T-handle fire warnings."

Because of the extensive damage in the crash, cockpit instrumentation revealed no information useful to the investigation.

In evaluating the flight crew's ability to control the airplane before impact, the report said: "Although the airplane appeared to be in a controlled, gradual, high-speed descent until just before it crashed, the tower recording of the pilots' voices indicated that they were having difficulties controlling the airplane during the last portion of the flight, as well as in diagnosing [increasing] problems with the airplane. The airplane crossed the extended centerline of the runway, did not turn to final approach, and subsequently crashed in a nose-low, left wing-down attitude."

Investigators were unable to determine for certain why the flight crew could not successfully land the airplane. "The two

Learjet 35A N521PA Final Moments from ATC Transcript

1144:54	**FO:**	Base for emergency.
1144:58	**TWR:**	Dart two one, runway two nine right, cleared to land. Wind's one one zero at five.
1145:01	**FO:**	*, I think you're gonna need to do a two-seventy.
1145:04	**TWR:**	'K Dart, one approved. Cleared to land runway two nine right.
1145:07	**FO:**	Tower, Dart two one.
1145:09	**Capt.:**	Ya ...
1145:11	**Capt.:**	We got an engine fire on the right side too, it shows.
1145:15	**FO:**	## ... Do we have any power?
1145:17	**Capt.:**	I'm not getting any response, man.
1145:19	**FO:**	Gear's coming down. Pull it in.
1145:22	**Capt.:**	I'm coming, I'm coming. I'm not gonna ...
1145:29	**FO:**	##.
1145:34	**FO:**	Full power, full power ... pull up.
1145:38	**Capt.:**	I, dammit ... [sound of static] pull up dude.
1145:48	**FO:**	(I've got) full right rudder in.
1145:50	**FO:**	Oh, Christ.
1145:52		[Sound of static.]
1145:54	**Capt.:**	Get ...
1145:57	**Capt.:**	C'mon baby, don't crash on me now.
1146:03		***It ... that's all she wrote. [Twenty seconds of garbled transmissions.]
1146:21	**Capt.:**	Oh, God.
1146:22	**Capt.:**	Oh, God.
1146:23	**FO:**	No, no.

TWR = Fresno air traffic control tower # = Expletive
* = Unintelligible word ( ) = Questionable insertion
ATC = Air traffic control Capt. = Captain
FO = First officer

Source: U.S. National Transportation Safety Board.

minutes of tower-recorded intracockpit communications between the pilots prior to impact failed to provide sufficient data to determine the controllability of the airplane," the report said. "The installation of a CVR and/or FDR would have facilitated the determination of the events that led to the unsuccessful attempt to land the airplane."

As part of the investigation, 12 flights were made in a Learjet 35 simulator, using the accident aircraft's flight track and profile information obtained from recorded radar data. "Two significant variables that were used in some of the simulated flights were: 1) the possibility that the spoilers were extended during the descent and that they remained extended until impact, and 2) that elevator trim was at nearly full nose-down position throughout the emergency," the report said.

During the simulator flights, "a variety of emergencies were used, including single- and no-engine power, deployed spoilers and/or full nose-down trim," the report said. "Although control forces were heavy (with an estimated 60 to 70 pounds [27 to 31 kilograms] of back pressure on [the] yoke required at some speeds to overcome full nose-down trim), the airplane was controllable. Turns could be made with sufficient back pressure."

The report continued: "There was sufficient speed for the flight to land on the approach end of [Runway] 29R, from the time of the call from Fresno [approach control] that the field was at 12 o'clock and four miles, with no engine power, spoilers deployed and full nose-down trim. It should be noted that the flight simulator is used primarily for pilot training, proficiency and flight checks, and is not designed to be an emergency simulator to test airplane capabilities, especially near the edge of the operational envelope."

The report noted: "It is possible that the in-flight fire caused sufficient damage to the [accident] airplane structures and systems to render the airplane only partially controllable. Although examination of the wreckage did not reveal a definitive reason for the loss of control, there is evidence that severe fire damage in the aft fuselage area occurred while the airplane was airborne."

The NTSB concluded that the flight crew were "unable to control the airplane during the final moments of the flight because of fire damage to structures and/or systems, and that they were possibly diverted by conflicting input resulting from the in-flight fire," the report said.

The survival factors associated with the crash were reviewed. "The accident was not survivable for the two pilots because of the severe impact forces and destruction of the airplane during the crash sequence," the report said. "Additional loss of life was avoided because the airplane crashed into a street that was not crowded with other persons. Although a severe ground fire occurred after the impact and several vehicles and residences were destroyed as a result, no persons on the ground lost their lives."

The NTSB concluded that the flight crew "was unable to land the airplane successfully on the intended runway because of in-flight fire-induced damage," the report said. "However, it is very possible that they had control of some axes (roll and yaw) and partial control of pitch during the final descent and that they were able to avoid buildings during the crash landing," the report said.

As a result of its investigation, the NTSB developed the following findings:

- "Weather was not a factor in the accident;
- "Air traffic services were proper and did not contribute to the causes of the accident;

- "The flight crew experienced an in-flight fire leading to a request for an emergency landing;
- "The special-mission wiring was not installed properly, leading to a lack of overload-current protection;
- "The FAA Form 337s provided instructions for the correct installation, and the mission power modifications made by another operator on three of the 18 special-mission Learjets were correct;
- "Neither the mechanic(s) who installed the wiring nor the mechanic(s) holding the inspection authorization, who approved the installation, noted the nonconformity with the FAA Form 337 in the installation on [the accident aircraft] and 14 other Learjets modified by the operator;
- "The in-flight fire most likely originated with a short [circuit] of the special-mission power-supply wires in an area unprotected by current limiters;
- "The fire resulted in false engine-fire warning indications to the pilots that led them to a shutdown of the left engine;
- "The intense fire, which burned through the aft engine-support beam in flight, can be explained by a compromised fuel line resulting from a battery explosion;
- "The in-flight fire caused substantial damage to the airplane structure and systems in the aft fuselage, and may have precluded a successful emergency landing; [and,]
- "At the time of the impact, the left engine was not producing power, and the right engine was producing at least flight-idle power."

As a result of its findings, the NTSB made the following recommendation to the FAA: "Publish an FAA Special Airworthiness Information Bulletin that describes the consequences of improper installation of the special-mission wiring, where electrical power wires were unprotected by current limiters. In addition, emphasize that all major aircraft repairs and alterations requiring an FAA Form 337 must be performed in strict accordance with the technical data contained in the FAA Form 337, and that it is unacceptable to use similar work done on other aircraft as a technical guide in lieu of the FAA Form 337."

The NTSB also recommended that the DOD "centralize contractual oversight for safety for all [DOD] components using contracted aircraft services."

The NTSB recommended that Phoenix Air Group Inc. "conduct an in-depth audit of your maintenance program to ensure that all work is being done in accordance with applicable [FARs], and particularly to ensure that mechanics and others involved in aircraft maintenance are consulting proper technical data when performing [maintenance] and inspecting aircraft."♦

Editorial note: This article was adapted from *Crash During Emergency Landing, Phoenix Air, Learjet 35A, N521PA, Fresno, California, December 14, 1994*. Report no. NTSB/AAR-95/04, prepared by the U.S. National Transportation Safety Board. The 68-page report contains photographs, figures and appendices.

ACCIDENT PREVENTION

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