FLIGHT SAFETY FOUNDATION
Accident Prevention
Vol. 59 No. 8 *For Everyone Concerned With the Safety of Flight* August 2002

Engine Flameouts in Sabreliner and MU-2 Linked to Nonuse of Continuous Ignition

The flameouts occurred when the Rockwell Sabreliner encountered turbulence while being flown to cruise altitude and after the Mitsubishi MU-2 was flown through icing conditions on approach. Both aircraft struck terrain, killing the pilots.

—

FSF Editorial Staff

The U.S. National Transportation Safety Board (NTSB) said that failures of the pilots to adhere to published procedures for the use of the continuous-ignition systems in their aircraft were among the factors that led to two fatal accidents in the United States in 2000.

Most turbine engines have *igniters* that normally are activated automatically by the starting circuit to help start the engines. The igniters produce heat (e.g., a flame or sparks) that ignites the fuel-air mixture during starting. After the engines are started, combustion is self-sustaining and the igniters are deactivated. *Continuous ignition* (i.e., continuous activation of the igniters) typically is manually or automatically selected during takeoff and landing — and before/during flight in certain conditions, such as heavy precipitation, icing or turbulence — to help prevent engine flameout (i.e., cessation of combustion).

One accident involved a Rockwell NA-265-80 Sabreliner that was at about 30,800 feet, being flown to cruise altitude in an area of severe thunderstorms, when both turbofan engines flamed out the afternoon of Aug. 14, 2000. The crew's attempts to restart the engines were unsuccessful, and the aircraft struck terrain in Ironwood, Michigan, near an airport that the crew had chosen for an emergency landing. The pilots were killed, and the two passengers received serious injuries.

NTSB said, in its final report, that the probable causes of the Sabreliner accident were the pilot-in-command's "improper in-flight decision, the pilot's continued flight into known adverse weather, the pilot's failure to turn on the continuous ignition in turbulence and the pilot's failure to follow the procedures for an airstart."

The other accident involved a Mitsubishi MU-2B-60 that was about 400 feet above ground level after being flown through icing conditions during descent when both turboprop engines flamed out the morning of Feb. 11, 2000. Seconds later, the aircraft struck a ridge about 1.5 nautical miles (2.8 kilometers) from the Lewiston (Idaho)–Nez Perce County Airport. The pilot was killed.

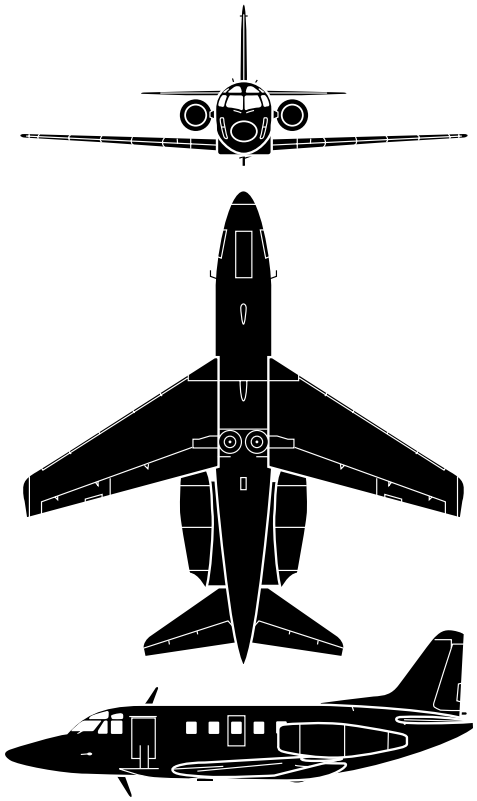
NTSB said, in its final report, that the probable cause of the MU-2 accident was that "the pilot failed to follow the flight manual procedures and did not engage the continuous-ignition system, resulting in both engines flaming out when the air-induction system was blocked with ice."

The Sabreliner captain obtained weather information from a flight service specialist about an hour and 20 minutes before the aircraft departed from Brainerd, Minnesota, at 1747 local time for a business flight to Flint, Michigan. The specialist told the captain about an area of severe thunderstorms east of Brainerd.

The 60-year-old captain, who held an airline transport pilot (ATP) certificate and had about 13,037 flight hours, including

2,560 flight hours in type, said, "How far south would I have to go to get around it?"

The specialist said that the area of severe thunderstorms was northeast of Brainerd.



Rockwell NA-265-80 Sabreliner

North American Aviation began designing a military jet trainer and utility airplane in 1956. Production of the airplane, designated the T-39 by the U.S. Air Force, began in 1958. A civilian version, the NA-265-40 Sabreliner, was introduced in 1964. The company merged with Rockwell-Standard Corp. in 1967 to form North American Rockwell, which was renamed Rockwell International in 1973.

The NA-265-60 Sabreliner was introduced in 1967 with a fuselage lengthened by 38 inches (97 centimeters) to accommodate 10 passengers (compared with eight passengers in earlier models). The NA-265-70 was introduced in 1971 with Pratt & Whitney JT12A-8 turbojet engines rated at 3,300 pounds (7,275 kilograms) thrust. Refinements included more cabin headroom and square cabin windows, rather than the previously triangular windows. In 1973, the NA-265-80 was introduced with General Electric CF700-2D-2 turbofan engines rated at 4,500 pounds (2,041 kilograms) thrust.

Maximum takeoff weight is 23,300 pounds (10,569 kilograms). Maximum rate of climb is 4,500 feet per minute (fpm); maximum single-engine rate of climb is 1,050 fpm. Maximum operating altitude is 45,000 feet. Maximum cruise speed is 0.8 Mach. Stall speed in landing configuration is 89 knots. Maximum landing weight is 22,000 pounds (998 kilograms).

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

"So, if I'm going southeast, I might just skirt the edge of this whole thing," the captain said.

"If you go to the southeast, you can avoid practically all this stuff," the specialist said. "Anywhere east of Brainerd is where you're going to get clobbered."

The captain filed an instrument flight rules flight plan that included a direct route to Flint, which is 490 nautical miles (908 kilometers) from Brainerd on a course of 108 degrees. Before takeoff, air traffic control (ATC) cleared the crew to fly directly to Flint.

Recorded ATC radar data indicated that for about six minutes after takeoff, the aircraft's ground track was 110 degrees. The first officer — who held a commercial pilot certificate and had about 5,600 flight hours, including 135 flight hours in type — then requested a heading of 090 degrees "for weather." The request was approved by the controller.

The captain then told the first officer, "Hey, tell them I need 080 for weather." The first officer requested a heading of 080 degrees. The controller approved the request.

The captain then asked the controller if ATC radar showed any areas of significant precipitation ahead of the aircraft. "We don't have any cells, but it's looking pretty grim up there," the captain said. At the time, the Sabreliner was being flown through 17,000 feet.

"You can deviate as necessary for weather north or south," the controller said. "Just keep me advised."

"OK, how's it looking to the north, northeast?" the captain said.

"I'm not showing anything towards the north," the controller said. "Well, I'm showing just moderate precip[itation] toward the northeast. I don't think there's any significant cells. I think most of them have dissipated, but there is a significant one at your one o'clock [position] to your three o'clock [position], about thirty miles [56 kilometers] in diameter, that you're skirting the edge of right now."

The report said that the Sabreliner was five nautical miles (nine kilometers) north of a "large, organized multicellular-type" storm system with Level 6 precipitation, which is characterized by the U.S. National Weather Service (NWS) as "extreme" and corresponds to a rainfall rate of more than 5.7 inches (14.5 centimeters) per hour. [U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 00-24B, *Thunderstorms*, says that Level 6 precipitation is associated with severe turbulence, lightning, large hail and extensive surface-wind gusts.]

The captain told the controller that they would fly a heading of 040 degrees to "get around this."

The controller approved the heading and then told the crew to establish radio contact with Minneapolis Center on a different radio frequency.

The first officer changed radio frequencies and told the controller that the aircraft was at 19,700 feet, climbing to Flight Level (FL) 230 (approximately 23,000 feet) on a heading of 040 degrees. The controller asked how long the crew expected to fly that heading. The first officer said, "Well, until we're around the weather. We'll let you know." The controller told the crew to fly directly to Flint when they were able to do so and to climb to and maintain FL 330.

The report said that the Sabreliner was flown into the northern edge of the storm system, into an area of Level 2 precipitation, which is characterized by NWS as "light to moderate." [AC 00-24B says that Level 2 precipitation is associated with light-to-moderate turbulence and lightning.]

At 1759, the controller broadcast to all crews monitoring the frequency that information about a convective SIGMET (significant meteorological information) affecting the area was available on a HIWAS (hazardous in-flight weather advisory service) frequency or from a flight service station.

The pilots did not discuss the controller's message or obtain information about the convective SIGMET, which was issued by NWS at 1757 and advised of severe thunderstorms with tops above 45,000 feet moving southeast at 35 knots in an area that included parts of Wisconsin and Michigan.

The report said, "The advisory warned [that] tornadoes, hail to two inches [five centimeters in diameter] and wind gusts to 70 knots were possible. The issuance of a convective SIGMET also implied a potential for severe [turbulence] or greater turbulence, severe icing and low-level wind shear."

At 1800, the captain told the first officer that he observed "visible moisture."

The controller told the crew to change to a different center radio frequency. The first officer changed frequencies and told the controller that the aircraft was climbing through 24,300 feet and "deviating for weather."

The controller said, "Roger, just let me know when you're able [to fly] direct Flint."

The captain asked the controller if ATC radar showed any areas of significant precipitation on a bearing of 090 degrees from the aircraft.

The controller said, "I don't know what kind of equipment you have on board, but [if you maintain your present] heading for about another thirty miles and then … start heading east, it looks like you're going to stay probably north of some of the heavier weather. I just had a Learjet come through at [FL 410]. He went over the Ironwood area and then southbound. … It looks to me [that] if you … head over toward the Ironwood area and then start working your way back southeast toward Flint, that would be the best way."

"OK, we'll do," the captain said. "Thank you, sir."

The captain then told the first officer, "We got visible moisture, and we got negative five [degrees]; so, we got icing conditions. And we're not climbing. We're down to two twenty [220 knots], and I can't do anything about it. So, we're going to have to nurse it up to twenty-nine [thousand feet]. … I don't see anything out there. Tell them we'll take zero six zero right now. See what happens."

The first officer told the controller that they were turning right to a heading of 060 degrees.

"Roger, and when able, just proceed direct Flint," the controller said. "Let me know."

At 1809, the first officer told the captain, "Seems like the climb should be better, but I guess we are kind of heavy."

"Well, we're warm," the captain said. "We're heavy and we're warm. … Everything's up. I checked that."

The crew then discussed the landing-gear-position-indicating lights.

"Something happened here, because we had four red lights," the captain said. "Those lights were red. You remember seeing that or no? Those were not green lights."

"I don't remember," the first officer said. "I'm trying to think back, and I really can't formulate a picture."

"Well, I saw three red lights," the captain said. "I don't know how you get red lights. Maybe I saw green lights, and the handle — that was red."

"I was thinking the handle was red, but I don't want to be too quick to answer," the first officer said.

"Well, that means the gear doors didn't, that means it didn't lock up," the captain said.

The cockpit voice recorder (CVR) then recorded the sound of a thud, followed by a sound similar to a decrease in engine speed. The time was 1811.

"That wasn't good," the first officer said.

Another sound similar to a decrease in engine speed was recorded by the CVR.

"We lost them all?" the first officer said.

"Yeah," the captain said.

The captain then told the controller, "Mayday, mayday, mayday. Eight five delta whiskey [the aircraft's registration number was N85DW] lost both engines."

The controller told the crew that the Ashland, Wisconsin, airport was at their one o'clock position and about 10 nautical miles (19 kilometers) distant. The captain asked for the runway length, and the controller told him to stand by while he checked.

"Try a relight," the captain told the first officer.

The controller said that the longest runway at Ashland was 5,199 feet (1,586 meters) long.

The captain said, "OK, request a vector. We got hit by lightning." He then told the first officer, "OK, you fly."

"Me fly?" said the first officer. The captain said yes.

The report said that the CVR transcript indicated that the crew did not discuss airplane flight manual (AFM) procedures for engine restart and did not use emergency-procedures checklists.

"Neither the AFM [nor] the Sabreliner Pilot's Checklist discuss[es] dual engine failures or procedures for load-shedding of electrical equipment in the event of a dual engine failure," the report said.

The emergency-procedures checklist for failure of both engine-driven generators said that the aircraft's batteries will power the essential bus for about 30 minutes.

The first officer told the captain that he would maintain an indicated airspeed of 170 knots for best-glide performance. The captain concurred.

Twice within two minutes (beginning at 1812), the CVR recorded sounds similar to engine ignition beginning and ending. The report said the Sabreliner was at 30,300 feet when the crew made the first attempt to restart an engine and at 29,200 feet when the crew made the second attempt to restart an engine.

The emergency-procedures section of the Sabreliner AFM said that the maximum altitude for attempting an engine restart at an airspeed of 170 knots is approximately 25,500 feet.

The controller told the crew to fly a heading of 180 degrees and provided information about the Ashland airport, including the airport identification code and the frequency for the very-high-frequency omnidirectional radio (VOR) on the airport.

The captain said, "OK, we're going to need a visual [approach]. What's the weather there?"

The controller said that the Ashland airport had 2.5 statute miles (4.0 kilometers) visibility, a broken ceiling at 100 feet and an overcast ceiling at 900 feet. The controller also told the crew that the airport had a VOR GPS (global positioning system) instrument-approach procedure.

"The weather at Ironwood is better, and that would be about thirty-five [nautical] miles [65 kilometers] east of you," the controller said. "Would you rather try that?"

At the time, the Sabreliner was descending through 26,000 feet. The first officer told the captain that they were "right over" the Ashland airport. The captain told the first officer to tell the controller that they would fly the airplane to Ironwood.

The controller told the crew to fly a heading of 060 degrees and said, "The Ironwood weather is clear, visibility ten [statute miles (16 kilometers)]. The wind's zero six zero at nine."

The first officer selected the Ironwood VOR radio frequency and told the captain that the course to the VOR was 108 degrees. "But he's giving us vectors," the first officer said. "Take them."

"I know," the captain said.

The report said that the Sabreliner was flown into an area of Level 5 precipitation, which is characterized by NWS as "intense" and corresponds to a rainfall rate of 2.5 inches (6.4 centimeters) per hour. [AC 00-24B says that Level 5 precipitation is associated with severe turbulence, lightning, hail and organized surface wind gusts.] At 1816, the CVR began to record sounds similar to heavy precipitation.

The controller told the crew that Runway 09-27 at Ironwood was 6,500 feet (1,983 meters) long and that there was an ILS (instrument landing system) approach and a VOR DME (distance-measuring equipment) GPS approach to Runway 27, and a VOR GPS approach to Runway 09. "We show you right on the approach course for [the] VOR GPS runway nine [approach] right now," the controller said.

"All right, talk us down," the first officer said. "Keep us on the approach course for [Runway] zero nine."

The aircraft was at about 19,600 feet at 1818 when the CVR recorded a sound similar to engine ignition beginning; the sound lasted for two minutes. The CVR also recorded sounds similar to increasing precipitation.

The first officer told the controller, "We show ourselves fifteen miles [28 kilometers] out. Give us vectors. We're going to need vectors all the way in."

"All right," the controller said. "Fifteen miles from the VOR. That is correct. [The] VOR is collocated on the field."

"OK, and we're going to need you to keep us on course, right on the centerline of the runway," the first officer said. "Are you doing that, sir?"

"Right," the controller said. "We show you right on the approach course, ten miles from the four-mile [7.4-kilometer] DME fix, fourteen miles [26 kilometers] from the airport."

The first officer thanked the controller and, a few seconds later, said, "We're losing the radios. … Give me the frequency for the VOR again."

The controller read the VOR frequency and said, "Eight five delta whiskey, show you a little bit to the right of the final approach radial, zero seven nine inbound. Turn five degrees left."

The first officer read back the instruction and said, "We've lost [radio navigation] ability up here, so … we're relying on your vectors." At the time, the Sabreliner was at about 17,500 feet and 12 nautical miles (22 kilometers) west of Ironwood.

"Eight five delta whiskey, when able, report the airport in sight," the controller said.

"We're solid," the captain told the controller, indicating that the aircraft was in instrument meteorological conditions.

"And eight five delta whiskey, would you like the equipment available at the Ironwood airport?"

"Absolutely," the first officer said. "Affirmative. Keep giving us vectors down, because we don't have any nav ability at all. We've lost it all. … What's the weather at Ironwood?"

"The Ironwood weather, showing wind three two zero and zero six, visibility nine [statute miles (15 kilometers)] with a thunderstorm," the controller said. "Sky clear, though."

"Thank you," the first officer said. "Any ceilings?"

The CVR recorded two unintelligible words spoken by the controller and "three."

The captain told the controller, "Give us a vector for the airport now."

"Five delta whiskey, we've lost the [secondary radar target from your] transponder," the controller said. "We've lost the transponder, and from the last position, five degrees left to the airport, should have been about eleven-thirty and eight miles [15 kilometers]."

The first officer told the captain, "We're losing everything. I have no nav." He then told the controller, "You get a primary [radar target] on us, let us know."

"The primary radar is, I believe, the airport's about twelve o'clock and seven miles [13 kilometers]," the controller said. "You're going right at the airport. … And, when able, could you give the number of people on board and fuel remaining?"

The captain told the controller, "We have four people on board and really don't know how much fuel [is] remaining."

The Sabreliner was at about 13,200 feet at 1821 when the CVR recorded a sound similar to engine ignition beginning. The sound of engine ignition stopped 15 seconds after it began.

The captain told the first officer, "OK, we're done. We got nothing."

The report said that the last primary radar target observed by the controller indicated that the Sabreliner was about 1.4 nautical miles (2.6 kilometers) north of the airport. The controller asked the crew if they had the airport in sight.

The first officer said, "Negative, negative, negative."

The controller made several radio transmissions to the crew, but there was no response.

The first officer told the captain, "We're losing electrical."

"OK, we're going to dead-stick it here," the captain said. "We're seven miles. When we come out of this, you want to look behind us for the airport. … I'll take an airport. I'll take a freeway. We got the gear down, three green."

"Got a good descent," the first officer said. "Get below before we lose our gyros, or maybe turn back. I don't know."

"There's the ground," the captain said. "Suggest a left turn."

"Left turn," the first officer said. "Left turn. Standard left turn."

As electrical power diminished, the operating speed of the CVR decreased. The sources of the following statements were not identified by the report.

"There's [unintelligible word] over there. Left turn ninety degrees. Left turn."

"Is that a clearing? Are you sure?"

"Seat belts on? Put your seat belt on."

"I have mine on."

The CVR recorded three unintelligible words before the recording ended.

The report said that there was a broken ceiling at 4,500 feet and five statute miles (eight kilometers) visibility in the area at 1822 when the Sabreliner struck heavily wooded terrain about three nautical miles (six kilometers) northeast of the airport.

Search-and-rescue operations were begun at 1839. Rescue personnel arrived at the accident site at 0830 the next morning.

Investigators found the Sabreliner's emergency locator transmitter (ELT) switch in the "OFF" position. When the

"ON" position was selected, the ELT activated; when the "ARMED" position was selected and a jolting force was applied to the ELT, the ELT activated.

One passenger told investigators that after takeoff, the aircraft entered gray clouds and the flight was "bumpy." The aircraft then entered blue sky with "big, puffy cumulonimbus clouds" and "black clouds" in the distance. The aircraft later entered gray clouds, and the flight became bumpy again. "All of a sudden there was an explosion. I thought I saw a brilliant white circle around the [left] engine." Before impact, the pilot told the passengers to "put your head between your legs and brace yourself for a crash landing."

The passenger said that he did not remember the impact: "Must have blacked out." He heard the other passenger calling his name and observed that the aircraft was upside down. "Pulled seat belts. Stupid. Fell down." Both passengers were "hurt pretty bad" and required 20 minutes to 30 minutes to exit the aircraft.

Notes made by an investigator during an interview with the passenger read: "We couldn't sit. We couldn't stand. Prepared for nightfall. Stayed awake during night. Writhing in pain. Bleeding from ear and nose. Ruptured vertebrae."

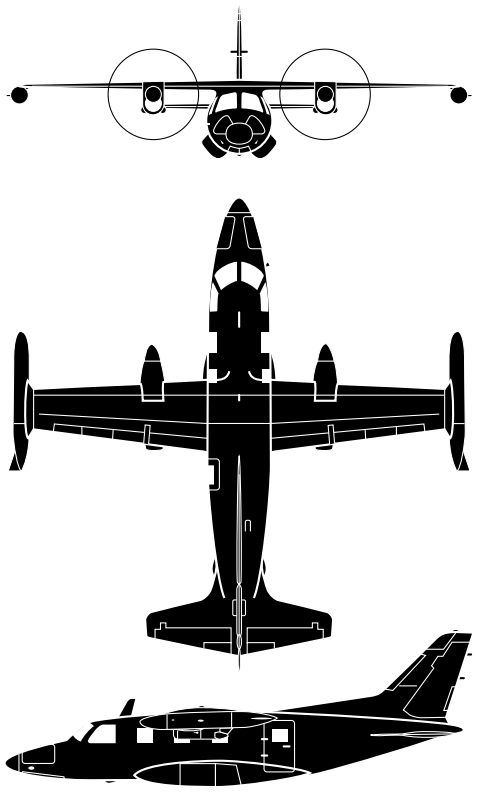
The passenger said that in the morning, he returned to the aircraft and found his jacket, which contained a cellular telephone. The investigator's notes read: "Called wife first. Called 911 [an emergency telephone number]. Got deputy sheriff. He was amazed [that] I was calling from crash site. Devised a system for search. Heard [helicopter] and directed it overhead. A ground crew found us."

The report said that lightning strikes to aircraft with fuselage-mounted turbine engines have caused flameouts, compressor stalls and roll-backs (i.e., reductions in turbine rotational speed); these effects are believed to be caused by disruption of inlet airflow by the shock wave associated with the lightning strike. Although the Sabreliner captain reported a lightning strike to ATC, investigators found no signs that the accident aircraft received a lightning strike.

"Inspection of the engines revealed no preexisting anomalies that would preclude normal engine operation," the report said. "[The] engine-starter drive shafts were found intact. The igniter plugs were bench-tested and showed continuous rapid sparking."

The Sabreliner AFM and the Sabreliner Pilot's Checklist recommend use of continuous ignition during takeoff, landing and flight in turbulent air.

"The CVR recording indicated that neither pilot called for the ignition switch to be placed in the 'CONTINUOUS' position," the report said. "The CVR did not record any … sound similar to engine ignition at any time prior to the reported lightning strike or [prior to] the dual engine flameouts."



Mitsubishi MU-2B-60

Mitsubishi Heavy Industries began designing the MU-2 twin-turboprop utility transport in 1960. The MU-2A prototype first flew in 1963 with Turboméca Astazou IIK engines and three-blade propellers. Three MU-2As were built before the company changed to Garrett AiResearch (now Honeywell) TPE331-25AB engines and added three feet (one meter) to the wingspan; the revised model, the MU-2B-10, first flew in 1965. The MU-2B-20 was introduced in 1969 with 705-shaft-horsepower (526-kilowatt) TPE331-1-151A engines.

A "long-body" model — the MU-2B-30 — was introduced in 1970 with the same powerplants as the MU-2B-20 but with a 6.2-foot (1.9-meter) longer fuselage and exterior pods to house the main landing gear. In 1978, the powerplants on the long-body model were changed to 778-shaft-horsepower (580-kilowatt) TPE331-10-501M engines and four-blade Hartzell propellers; the airplane was named the MU-2B-60 "Marquise." Production of both the long-body model and the short-body model (the "Solitaire") ended in 1986.

The MU-2B-60 accommodates a pilot and up to 10 passengers. Maximum takeoff weight is 11,575 pounds (5,250 kilograms). Maximum rate of climb at sea level is 2,200 feet per minute (fpm); maximum single-engine rate of climb is 410 fpm. Service ceiling is 29,750 feet. Maximum cruise speed is 308 knots. Stall speed in landing configuration is 76 knots. Maximum landing weight is 11,025 pounds (5,000 kilograms).

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

The MU-2B accident occurred during the second leg of a cargo flight. The pilot, 67, held an ATP certificate and had 21,100 flight hours, including 1,100 flight hours in type.

The report said that the pilot had conducted the cargo flight regularly for 12 months. The flight involved the transport of canceled bank checks in the morning between Salt Lake City, Utah, and three cities in Idaho: Boise, Lewiston and Coeur d'Alene. The flight also included a return to Salt Lake City, via Lewiston and Boise, in the afternoon. The entire flight typically required about 5.2 flight hours.

The aircraft departed from Boise at 0723 the morning of the accident. The pilot began the descent from cruise altitude, 16,000 feet, at 0756 and flew a holding pattern at 6,000 feet while the crew of another aircraft conducted an instrument approach to the Lewiston airport, elevation 1,438 feet. The pilot then was cleared by ATC to conduct the ILS approach to Runway 26.

Weather conditions at the airport included a 3,200-foot broken ceiling, a 4,000-foot overcast and 10 statute miles visibility. Surface temperature was two degrees Celsius (36 degrees Fahrenheit).

At 0810, the pilot told the Lewiston tower controller that the MU-2 was inbound on the ILS approach.

The aircraft was about four nautical miles (seven kilometers) from the airport when the controller told the pilot that the aircraft was in sight. The controller said that the pilot could land on Runway 26 or on Runway 29. The surface winds were from 300 degrees at 13 knots, gusting to 21 knots. The pilot said that he would land on Runway 29.

The controller observed the MU-2 turn left and then turn right toward Runway 29. The aircraft was about two nautical miles [four kilometers] east of the airport at 0815 when the pilot reported that both engines had flamed out.

"I just had two flameouts," the pilot said. "I'm going in. I'm going to pick out … I'll go as far as I … ."

The controller said that the aircraft was about 400 feet above a residential area. She observed the aircraft descend below a ridge, heard an ELT signal and told aircraft rescue and fire fighting (ARFF) personnel that an aircraft had struck terrain south of the approach lights for Runway 26.

The aircraft struck terrain about 20 feet (six meters) below the top of a ridge and came to rest in a plowed field on top of the ridge. ARFF personnel arrived at the accident site about 0826.

"Examination of the pilot's seat belt and shoulder harness revealed that the seat-belt buckle was still engaged and the seat belt was fastened around the pilot," the report said. "But the two shoulder-harness straps were hanging loose and [were] not attached to the seat-belt buckle."

The report said that toxicological tests detected "extremely high levels" of dihydrocodeine in the pilot's blood; hydrocodone and diphenhydramine were detected in the pilot's urine.

"Dihydrocodeine is a prescription narcotic painkiller used for the control of moderate-to-severe pain," the report said. "Hydrocodone is a prescription narcotic painkiller that can also be produced by the metabolism of dihydrocodeine. Diphenhydramine is an over-the-counter sedating antihistamine."

The pilot's medical records indicated that in December 1994, while employed as an airline flight engineer, he told airline medical personnel that he had become a habitual user of dihydrocodeine. The pilot initially used the drug periodically for two years in the early 1970s for back pain. He began using the drug again in the summer of 1994 after injuring his back during a fall on an airport ramp.

"The toxicologist for the laboratory that performed the drug screen for the airline reported that the laboratory's routine drug screen would not have detected [dihydrocodeine] or reported dihydrocodeine," the report said. "The laboratory performed testing under DOT [U.S. Department of Transportation] guidelines that required [testing for opiates] only for the presence of codeine and morphine."

In August 1995, after receiving psychiatric treatment and counseling for drug abuse, the pilot obtained a "special-issuance" second-class medical certificate from FAA. Subsequent routine and random drug tests were negative for dihydrocodeine.

The report said that dihydrocodeine was not among the drugs screened during a routine drug test administered to the pilot before he was employed by the cargo company.

"The medical director of the toxicology laboratory which performed the drug testing reported that the laboratory's routine screen would not have detected dihydrocodeine," the report said.

NTSB listed "impairment (drugs) — pilot-in-command" as a finding of the accident investigation but did not cite this as a cause or factor.

The MU-2's fuel tanks and fuel lines ruptured during impact. Investigators found no fuel remaining in the tanks.

"Fuel was leaking from the [fuel] lines when the wreckage was removed from the site," the report said. "Rescue personnel reported that they smelled fuel when they arrived at the accident [site]. The main fuel gauge read approximately 1,040 pounds [472 kilograms]."

The report said that an AIRMET (airman's meteorological information) issued by NWS at 0645 and valid until 1300 advised of occasional moderate mixed icing and/or occasional moderate rime icing in clouds and in precipitation below 15,000 feet.

"The area covered by this AIRMET included the route from Boise to Lewiston," the report said.

A pilot report (PIREP) at 0644 indicated moderate mixed icing between 10,000 feet and 12,000 feet near Lewiston. A PIREP at 0849 indicated light mixed icing at 7,000 feet near Lewiston.

The MU-2B-60 AFM says that the continuous-ignition system should be selected in the following situations:

- "During takeoff and climb-out in actual or potential icing conditions;
- "When ice is visible on, or shedding from, propeller(s), spinner(s) or leading edge(s);
- "Before selecting 'ANTI-ICE,' when ice has accumulated;
- "Immediately any time engine flameout occurs as a possible result of ice ingestion; [and,]
- "During approach and landing while in or shortly following flight in actual [icing conditions] or potential icing conditions, or where there is water, slush or snow on the runway."

The "Approach" checklist for the MU-2B says that the continuous-ignition switches should be selected "as required" and includes the following note: "Caution. Continuous ignition shall be selected to 'ON' during approach and landing while in or shortly following flight in actual or potential icing conditions."

In November 1995, the aircraft manufacturer, Mitsubishi Heavy Industries, issued Service Bulletin 086/74-002, which recommended installation of an auto-ignition system to supplement the existing manually activated continuous-ignition system and to "reduce the possibility of engine flameout when icing conditions are encountered and the continuous-ignition [system] is not selected."

The auto-ignition system is activated automatically when engine torque pressure decreases rapidly below a certain value.

The report said that the operator of the accident aircraft was not required to comply with the service bulletin. Nevertheless, NTSB said that the operator's noncompliance with the service bulletin was a factor in the accident.

In June 1997, FAA published the findings of a special certification review of the MU-2B. Among the review team's recommendations was mandatory installation of auto-ignition systems in the aircraft.

In May 1998, FAA proposed a regulation that would require installation of auto-ignition systems in all MU-2B airplanes. In May 2000 — three months after the Lewiston accident — FAA issued Airworthiness Directive 2000-09-15, which required installation of auto-ignition systems in MU-2Bs.♦

[FSF editorial note: This article, except where specifically noted, is based on U.S. National Transportation Safety Board (NTSB) report no. CHI00MA256, which comprises 1,110 pages and includes illustrations, and on NTSB report no. CHI00FA070, which comprises 269 pages and includes illustrations.]

Accident Prevention

Staff: Roger Rozelle, director of publications; Mark Lacagnina, senior editor; Wayne Rosenkrans, senior editor; Linda Werfelman, senior editor; Karen K. Ehrlich, web and print production coordinator; Ann L. Mullikin, production designer; Susan D. Reed, production specialist; and Patricia Setze, librarian, Jerry Lederer Aviation Safety Library

Subscriptions: One year subscription for twelve issues includes postage and handling: US$240. Include old and new addresses when requesting address change. • Attention: Ahlam Wahdan, membership services coordinator, Flight Safety Foundation, Suite 300, 601 Madison Street, Alexandria, VA 22314 U.S. • Telephone: +1 (703) 739-6700 • Fax: +1 (703) 739-6708.