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MD-83 Crew Continues Flight Operations with Suspected Engine Malfunction

The Finnish Accident Investigation Board said that the flight crew heard unusual noises from the left engine and observed abnormal left-engine instrument indications. Nevertheless, the crew did not have the engine examined properly between two flights. The crew then rejected a takeoff when the left engine failed to accelerate because of substantial compressor-section damage.

FSF Editorial Staff

On Oct. 1, 1996, the flight crew of Intersun Sunways Flight 2042, a McDonnell Douglas MD-83, rejected a takeoff at Kajaani (Finland) Airport when the left engine failed to accelerate. The crew then taxied the airplane back to the airport terminal building. No one was injured. A postincident examination of the engine revealed substantial damage in the compressor section.

The Finnish Accident Investigation Board (AIB) said, "The Finnish Ministry of Justice appointed on Oct. 3, 1996, an investigation commission in accordance with the Investigation of Accidents Act to investigate the [incident], which was suspected [of] having seriously endangered flight safety." Commission members included a retired airline captain, a retired airline maintenance-inspection supervisor and the AIB's chief air-accident investigator.

The airplane was of Turkish registry, and the airplane operator was a Turkish company. Nevertheless, the Turkish Directorate General of Civil Aviation (DGCA) elected not to participate in the commission's investigation.

The commission determined that during two flights preceding the rejected takeoff at Kajaani, the flight crew had heard

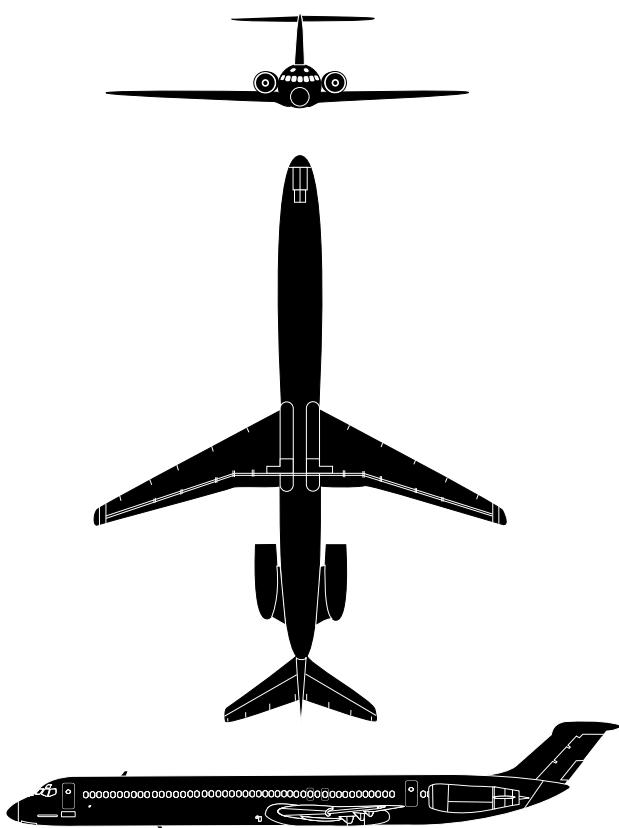


unusual noises from the left engine, including a loud bang, and had observed abnormal operating indications on the left-engine instruments.

The AIB said that the commission determined that the crew had not ensured that the engine was serviceable (airworthy) before continuing flight.

The AIB, which wrote the final report on the incident, said that the probable causes of the incident were:

- "The knowledge and skills of the cockpit crew were insufficient, and their attitudes were unprofessional in the handling of the engine malfunction. This was manifested most clearly when the pilots refused to perform [a] left-engine test run in Kajaani according to given instructions and attempted to depart without first determining the serviceability of the left engine;
- "The flight-operations management of Intersun Sunways ... failed to ensure the competency of the cockpit crews; [and,]
- "The DGCA failed to properly oversee the operations of Intersun Sunways ... as a new start-up charter operator."



McDonnell Douglas MD-83

McDonnell Douglas introduced the MD-80 series in 1979. A development of the DC-9, the MD-80 has a longer fuselage, more wing area, quieter engines, increased fuel capacity and upgraded avionics equipment and instrumentation.

The MD-83, which first flew in 1984, is the same size as the MD-81 and MD-82, and has the same passenger capacity (172 passengers, maximum). The airplane has more fuel capacity, more fuel-efficient engines and, thus, greater range than its predecessors.

The airplane has two more fuel tanks than its predecessors. The extra tanks are installed in the cargo compartment and increase fuel capacity by 1,160 gallons (4,390 liters). Total fuel capacity is 7,000 gallons (26,495 liters).

The airplane has two Pratt & Whitney JT8D-219 turbofan engines. Each engine is rated at 21,000 pounds (9,526 kilograms) thrust. The engines are two percent more fuel efficient than the MD-82's JT8D-217 engines.

Maximum takeoff weight is 160,000 pounds (72,576 kilograms). Balanced field length at maximum takeoff weight is 8,375 feet (2,554 meters). Maximum level speed is 500 knots. Maximum cruising speed is .76 Mach. Range with 155 passengers and domestic fuel reserve is 2,502 nautical miles (4,634 kilometers). Maximum landing weight is 139,500 pounds (63,277 kilograms). Landing distance at maximum landing weight is 5,200 feet (1,586 meters).

Source: Jane's All the World's Aircraft

The incident airplane was one of four MD-83s operated by Intersun Sunways, a charter airline that began operations in Turkey in 1995.

"The airline was an affiliated part of the Turkish Tursem group, which had travel agencies in several countries, [for example] Kymppimatkat in Finland," said the AIB.

The airplane was built in 1989 and had 19,961 hours in service. The airplane had Pratt & Whitney JT8D-219 turbofan engines. The left engine had 10,971 hours in service since overhaul and had 29 hours remaining before the next overhaul. The right engine had 3,916 hours in service since overhaul and had 7,084 hours remaining before the next overhaul.

The airplane had been flown from Dalaman, Turkey, to Kokkola, Finland, and then back to Dalaman on Sept. 30, 1996. A replacement flight crew was scheduled to fly the airplane to Cologne, Germany, and to Kajaani, and then back to Dalaman early the next morning.

The flight crew consisted of three pilots — two captains and a first officer. (The incident report referred to the captains as "captain A" and "captain B.") The three flight crewmembers were former Turkish air force pilots.

Captain A, 49, had 6,100 flight hours, including 3,200 hours in type. He had an airline transport pilot (ATP) certificate and an MD-83 type rating. He had approximately four years of airline flying experience.

Captain B, 56, had 9,600 flight hours, including 1,600 hours in type. He had an ATP certificate and an MD-83 type rating. He had three years of airline flying experience.

The first officer, 39, had 6,600 flight hours, including 700 hours in type. He had a commercial pilot certificate and an MD-83 type rating. He had approximately six months of airline flying experience.

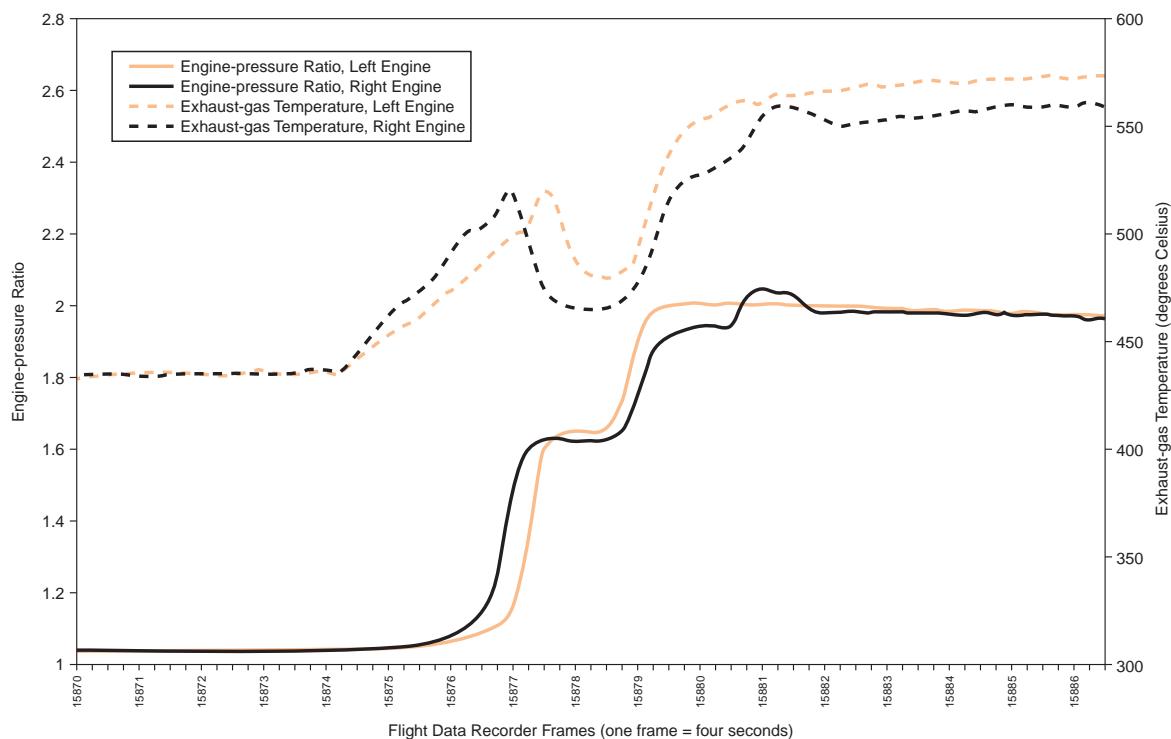
Captain B was the pilot-in-command when the airplane took off from Dalaman at 1740 local time with 129 passengers and four cabin crewmembers aboard.

Figure 1, page 3, shows the engine-pressure ratio (EPR) values and the exhaust-gas temperature (EGT) values recorded by the airplane's flight data recorder (FDR) during the takeoff from Dalaman.

The FDR showed that when the crew advanced the power levers for takeoff, the left engine accelerated to 1.4 EPR two seconds more slowly than the right engine. The AIB said that the difference between the left-engine acceleration rate and the right-engine acceleration rate was within normal tolerances.

The FDR showed that the left engine began to operate abnormally during the climb to the initial cruising altitude, Flight Level (FL) 280. The airplane was at approximately

Engine-pressure Ratios and Exhaust-gas Temperatures during Takeoff at Dalaman, Turkey, Intersun Sunways McDonnell Douglas MD-83, Sept. 30, 1996



Source: Finnish Accident Investigation Board

Figure 1

27,200 feet, in clear air, with the autopilot and autothrottle system engaged, when the FDR recorded the following left-engine abnormalities:

- EPR decreased suddenly from 2.059 to 1.891, then increased and stabilized at 2.02 within 20 seconds;
- Low-pressure compressor speed (N_1) decreased suddenly from 93 percent to 85.4 percent, then increased and stabilized at 90 percent within 10 seconds; and,
- EGT increased suddenly from 489 degrees Celsius (C) to 509 degrees C (912 degrees Fahrenheit [F] to 948 degrees F), then decreased and stabilized at 483 degrees C (901 degrees F) within 10 seconds.

The AIB said that these abnormalities showed that initial damage of the left engine had occurred.

Crew Hears a Loud Noise

The flight crew said that they heard a loud noise from the left engine approximately two minutes after the airplane entered

level flight at FL 280. One cabin crewmember said that the noise sounded like an explosion.

The AIB said that the airplane was in clear air approximately 11,000 feet to 13,000 feet above clouds.

Captain B told investigators, "There was a noise, 'bom.' We looked [at] all the engine instruments. ... The noise came from the left engine, but all the indications [were] the same."

Captain A told investigators, "After climb [and] leveled at FL 280, a 'bang' coming from [the] left engine was heard. ... Left-engine parameters were checked, and no abnormal indications [were] observed. Left-engine parameters were equal to right-engine parameters during the check."

Nevertheless, the AIB said that the crew would have had difficulty determining which of the rear-mounted engines had emitted the noise unless they had observed an associated change in engine-instrument indications.

"The left engine continued to run, but with increased EGT, N_2 [high-pressure compressor speed] and fuel flow," said the AIB.

"The abnormal-and-emergency checklist was not consulted [by the flight crew]."

The flight crew did not record the unusual engine noise in the airplane's maintenance-and-performance logbook until after the rejected takeoff in Kajaani. The first officer recorded the following entry in the logbook: "After departed from Dalaman at 28,000 feet, we heard [noise] from left engine. Instruments information was normal about left engine."

The AIB said that the crew should have recorded the engine-instrument indications immediately after hearing the unusual noise.

"The deterioration of the left-engine condition would have become obvious through data comparison," said the AIB. "The data [were] available onboard for [flights during] the previous two weeks, but [the data were] not taken advantage of." The data comprised engine-instrument indications that Intersun Sunways pilots were required to record during the first flight of each day.

"The data from Sept. 16 [through] 30, 1996, [showed that] the left mean EGT had been approximately 10 degrees C [50 degrees F] higher [than right-engine EGT], and the left fuel flow [had been] slightly higher than the [right-engine fuel flow] at the same EPR setting," said the AIB. "The N₁ and N₂ indications had been approximately equal for both engines."

The FDR showed that left-engine EGT, N₂ and fuel flow increased after the initial engine damage occurred. "The left mean EGT was 19.5 degrees Celsius [67 degrees Fahrenheit] higher [than right-engine EGT], the left mean N₂ [was] 1.4 percent higher [than right-engine N₂] and the left mean fuel flow [was] 117 [kilograms (258 pounds) per hour] higher than the [right-engine fuel flow]," said the AIB.

Crew Requested Technical Assistance

The airplane landed in Cologne at 2211 local time. The flight crew requested technical assistance from their handling agent but did not specify the nature of their problem.

The handling agent asked an aircraft technical-service-company maintenance technician to assist the crew.

The AIB said, "The mechanic told the handling agent that he was not type-rated for the MD-83 nor authorized to release the aircraft to service. He additionally stated that his company had no maintenance agreement with the carrier in question, and that he therefore saw no reason to go to the aircraft."

"After another request from the handling agent, the mechanic finally agreed to go to the aircraft and said that he would discuss the problem with the crew.

"According to captain A, the mechanic was briefed on the situation encountered at FL 280. According to the mechanic, the captain told him that they had heard a strange noise from the left engine when increasing thrust."

"The commission was unable to determine whether the mechanic was also informed about the loud bang and the associated drop in the left-engine instrument indications," said the AIB. "Technical personnel should always be provided with all available information about the observed abnormalities."

The mechanic told investigators that the airplane's logbooks showed nothing about the suspected engine problem. "According to an LBA [German Luftfahrt-Bundesamt] order, German mechanics are not allowed to carry out technical assistance on aircraft unless the crew has made an entry about technical problems into the aircraft documents," said the AIB.

The mechanic told captain A that he could not help him. "The captain, however, requested the mechanic to at least open the left-engine cowlings and to take a look, but the mechanic refused," said the AIB.

Nevertheless, the mechanic agreed to have a maintenance platform moved to the airplane so that the captain and he could visually inspect the engine-inlet area and engine-exhaust area with the aid of a flashlight.

"This was done, and the free movement of the fan was checked," said the AIB. "The captain and the mechanic [then] opened some service-access doors on the left engine and looked inside with a flashlight. Nothing abnormal was found.

"The mechanic then told the captain that this was all he could do for him, that he could not give the aircraft a release to service [either] in writing [or] verbally, and that the captain, alone, would have to take the decision and responsibility to continue the flight."

Captain A told investigators that the mechanic had determined that the left engine would operate normally and that the flight could continue.

"Captain A should have understood that the mechanic could not have given the aircraft a release to service," said the AIB.

The AIB said that the captain should have found a qualified mechanic to inspect the engine, or he should have consulted Intersun Sunways officials about the suspected engine problem, as required by the airline's flight operations manual.

"The transit check in [Cologne] was signed by the first officer," said the AIB. "Captain A signed the aircraft airworthy. The aircraft was therefore signed airworthy without assuring the serviceability of the left engine. The performed left-engine inspection was not noted in the aircraft documents."

The AIB said that after the rejected takeoff in Kajaani, the first officer recorded the following in the maintenance-and-performance logbook: "After landing [in] Cologne, a [technician examined] the left engine and said, 'Every[thing] is normal about this engine. You can fly!'"

Left Engine Accelerated Slowly

Captain A was the pilot-in-command for the flight from Cologne to Kajaani. The seven crewmembers were the only occupants of the airplane; no passengers were aboard.

The AIB said that the left engine functioned abnormally during the 2313 departure.

The FDR showed that when the airplane was taxied to the runway, left-engine N_1 and N_2 were approximately 3 percent lower than right-engine N_1 and N_2 , and left-engine EGT was 40 degrees C (104 degrees F) higher than right-engine EGT.

"In Dalaman, these values had been approximately equal for both engines," said the AIB.

The FDR showed that left-engine acceleration was slower than right-engine acceleration during the takeoff (Figure 2).

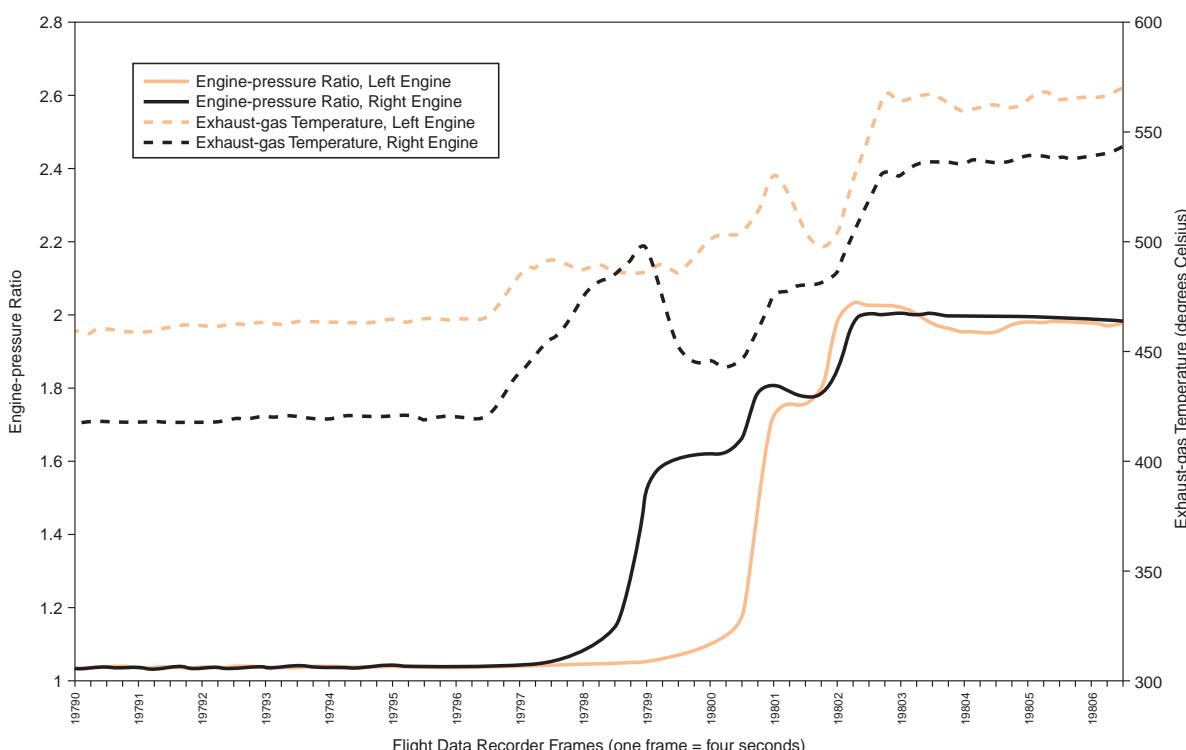
(The AIB said that for takeoff, the power levers are advanced manually to achieve a target EPR of 1.4 or approximately 80 percent N_2 . The autothrottle system then is engaged, and the power levers automatically are adjusted to achieve the selected takeoff thrust rating.)

"The left-engine acceleration rate from idle to 1.4 EPR was approximately eight seconds slower than the right-engine acceleration rate," said the AIB. "In Dalaman, the difference had been only two seconds."

The AIB said that the following guidance on engine acceleration for takeoff is provided in McDonnell Douglas all-operator letter (AOL) FO-AOL-9-035, issued Aug. 22, 1993:

"Normally, when throttles of properly trimmed engines are smoothly and simultaneously advanced to approximately 1.4 EPR, the engines should achieve a stable, spooled-up condition within three seconds of each other. Differences between engine-acceleration rates greater than three seconds are not

Engine-pressure Ratios and Exhaust-gas Temperatures during Takeoff at Cologne, Germany, Intersun Sunways McDonnell Douglas MD-83, Sept. 30, 1996



Source: Finnish Accident Investigation Board

Figure 2

normal, and should be written up [recorded in the airplane logbook] for appropriate maintenance action."

Intersun Sunways told investigators that AOLs were provided to the airline's flight crews. Nevertheless, the AIB said that one of the airline's flight instructors, who also was an operations advisor and a member of the airline's executive board, had no knowledge of the AOL about engine-acceleration rates.

The AIB said that the flight crew did not record the left engine's abnormally slow acceleration in the maintenance-and-performance logbook. The crew later told investigators that the left engine had accelerated normally during the takeoff from Cologne.

The AIB said that the left engine surged when the crew reduced power from the climb setting to the cruise setting at FL 350. The flight crew said that they heard unusual noises from the left engine.

"When the aircraft was leveling off at ... FL 350, an unusual noise was heard from the left engine (described as 'prrrt' by the cockpit crew)," said the AIB. The crew told investigators that the noise was different from the loud bang that they had heard during the flight from Dalaman to Cologne.

The crew descended to FL 310, maintained that altitude for approximately 20 minutes, then climbed to FL 330. "When the aircraft was leveling off at FL 330, the same noise was heard again," said the AIB.

The flight crew did not consult the abnormal-and-emergency checklist, and did not record the unusual noise in the maintenance-and-performance logbook.

"A new engine-performance data entry should have been made and compared with the previous data available [aboard the airplane] to find out about the nature of the abnormal left-engine behavior," said the AIB.

"The cockpit crew decided to descend to FL 290, and the flight was continued to Kajaani," said the AIB. "According to the cockpit crew, everything was normal during the rest of the flight."

Nevertheless, the FDR showed that the left-engine EGT was 22.3 degrees C [72.1 degrees F] higher than right-engine EGT, and left-engine N₂ was 1.65 percent higher than right-engine N₂.

"This indicates that the left-engine condition had deteriorated further during the flight [from Cologne] to Kajaani, most probably during the takeoff," said the AIB.

The airplane landed in Kajaani at 0032. "The observed engine abnormalities were not noted in the aircraft documents upon termination of the flight," said the AIB.

Crew Declined Engine Test Run

Intersun Sunways received ground-handling services at Kajaani from Finnair, but the services did not include maintenance.

The AIB said, "The Finnair station manager went to the aircraft upon its arrival. When [the station manager] entered the cockpit, the pilot in the left seat (captain A) requested technical assistance and stated that they had a little problem with the left engine.

"The station manager left and returned shortly with the Finnair station mechanic. The cockpit crew told them that the left-engine instrument indications had dropped momentarily in association with the loud bang at FL 280 on the flight [from] Dalaman [to] Cologne. They also demonstrated this drop by hand movement.

"One cabin attendant told the station mechanic that she had heard one very loud bang, like an explosion, on the flight [from] Dalaman [to Cologne] when she was working in the cabin. She [said] that the engine had run rough after the bang and that she had heard unusual engine noise also during the flight [from Cologne to] Kajaani."

The crew did not inform the mechanic or the station manager about the abnormally slow acceleration of the left engine during the takeoff at Cologne. "The cockpit crew should ... have provided the mechanic with all available information regarding the abnormal left-engine behavior," said the AIB.

The mechanic told the flight crew that he could not troubleshoot the problem, because Finnair had no maintenance agreement with Intersun Sunways. Nevertheless, he agreed to call the Finnair line-maintenance office in Helsinki, Finland, for further instructions.

The AIB said, "The [line maintenance] inspector-in-charge gave the following instructions: perform a visual check [of] the engine inlet and exhaust areas; perform an engine test run, including [an] acceleration test and [a] bleed-valve check ... [and] perform a [borescope] check if engine behavior during the test run is not normal." (A borescope is an optical device that is inserted into narrow openings during engine-interior examinations.)

The station mechanic told the flight crew about the instructions from the inspector-in-charge. The mechanic also told the crew that the airplane should be moved to a suitable area to conduct the engine test run.

The crew did not use a maintenance platform to conduct the recommended visual check of the left engine. "A platform ... is needed for a thorough visual inspection," said the AIB.

The crew declined the suggestion to move the airplane to a suitable area to conduct an engine test run. "The cockpit crew discussed the proposal among themselves in Turkish, [then]

refused it," said the AIB. "The abnormal left-engine behavior was not discussed thereafter with Finnair personnel."

The AIB said that the Finnair station manager became aware that oil was leaking from the airplane's left engine.

"[The station manager] relayed this information to the first officer, who was monitoring the refueling," said the AIB. "Upon request of the first officer, the station manager asked the station mechanic to add oil [to] the left engine."

"The mechanic refused because Intersun Sunways had no maintenance agreement with Finnair, but he provided the stairs needed to reach the engine. The first officer added two quarts of engine oil."

Crew Initially Declined Deicing

The flight crew declined a recommendation by the station mechanic to deice the airplane.

The AIB said, "The weather in Kajaani was favorable for overwing ice and frost formation with [a] temperature [of] four degrees C [39 degrees F], [a] dew point [of] four degrees Celsius and light rain. The amount of cold-soaked fuel remaining [in the airplane's wing tanks] after the two-hour 25-minute flight [from Cologne to] Kajaani was more than 20,000 pounds (9,072 kilograms)."

"The station mechanic observed frost on the upper and lower wing surfaces. He left stairs next to the wing for the cockpit crew [to conduct an] overwing ice check and suggested deicing to captain B."

"Captain B and the mechanic then walked inside the aircraft to the overwing emergency exits. Captain B checked the wing by looking through the cabin windows. He stated to the mechanic that they would not take deicing and demonstrated his decision by hand movement."

"According to the mechanic, it was not possible to determine the wing condition properly through the cabin windows due to darkness and poor lighting."

The AIB said that captain B believed that airframe icing does not occur when ambient temperature is above four degrees Celsius. "This is not true for ice and frost formation due to cold-soaked fuel in the wing tanks," said the AIB. "The clear-ice ... formation phenomenon has been observed to occur at [the] upper-surface wing-root area of the DC-9 series aircraft at ambient temperatures up to 14 degrees Celsius [57 degrees Fahrenheit]."

The AIB said that Intersun Sunways' transit-check procedure requires an inspection for clear-ice formation when the temperature is below 15 degrees C (59 degrees F). The AIB

said that the airline's transit-check training syllabus requires a hands-on inspection, but the transit-check checklist requires the use of a telescopic bar to confirm free movement of red tufts on the upper wing surface.

"The temperature in Kajaani was four degrees Celsius at the time of the incident, but no hands-on inspection was performed," said the AIB. "It is the opinion of the commission that the cockpit crew did not fully understand the wing-ice ... phenomenon which is caused by cold-soaked fuel in the wing tanks."

Nevertheless, the flight crew was persuaded by a Finnair station officer to deice the airplane. "[The station officer] told the cockpit crew that they should seriously consider the opinion of a professional (the station mechanic) on deicing in order to maintain smooth cooperation in the future," said the AIB. "The cockpit crew finally agreed, and the aircraft was deiced."

Intersun Sunways told investigators that the flight crew had received training in conditions conducive to airframe icing and training in airplane-deicing procedures. The AIB said, "The cockpit-crew training had not been sufficient or fully understood."

"The poor understanding among Intersun Sunways pilots of ice formation on the wings and the need for deicing had already previously compelled the Finnish Civil Aviation Administration ... to send several requests for action to the [DGCA]. The Intersun Sunways operations advisor told the [incident-investigation] commission in 1997 that Intersun Sunways had taken action ... to eliminate the deicing problems with additional training."

Left Engine Failed to Accelerate

Captain A was the pilot-in-command for the next leg of the flight, to Dalaman. A total of 137 passengers boarded the airplane. The engines were started at 0221.

The AIB said, "The first officer signed the transit check, and captain A signed the aircraft airworthy before the aircraft left the apron. This was done prior to the left-engine test run, which the cockpit crew claimed they were intending to do in the takeoff position in order to confirm the serviceability of the left engine."

"The commission considers the action taken by the cockpit crew completely wrong and dangerous for flight safety."

The AIB said that the airplane emitted a loud bang when the flight crew increased engine power at 0227 to taxi the airplane into position for takeoff on Runway 7. The noise was heard inside the airplane and inside the airport terminal building.

The transcript of radio communications (page 8) shows that at 0231, a flight crewmember told the Kajaani Aerodrome Flight

Radio Communications Transcript, Intersun Sunways Flight 2042, Oct. 1, 1996

(FSF editorial note: The following transcript is as it appears in the Finnish Accident Investigation Board incident report, except for minor column rearrangement and addition of notes defining some terms that may be unfamiliar to the reader. Local time is shown.)

Time	Source	Content
0221	SWW	Kajaani tower, good morning, Intersun 2042
	EKFI	Good morning Intersun 2042, Kajaani AFIS, go ahead
	SWW	2042, parking, ready for start-up, destination will be LTBS
	EKFI	Intersun 2042, no start-up restrictions, wind 150 degrees 7 knots, temperature 4, QNH 990, correct time 22
	SWW	All copied, QNH 990
	SWW	Tower, Intersun 202 ... 42, ready for taxi
0225	EKFI	Intersun 2042, no other traffic and your clearance ready
	SWW	Go ahead for ATC
	EKFI	Rovaniemi control clears Intersun 2042 to your destination via flight planned route, flight level 290, squawk 2013
	SWW	Rovaniemi control clears Intersun 2042 to destination at flight level 290, squawk 2013
	EKFI	Clearance correct
0226	SWW	Ready for taxi 2042
	EKFI	No other traffic and runway vacated
	SWW	Thank you, 2042
	SWW	Tower, Intersun 2042, lining up for runway 07
	EKFI	Intersun 2042, roger
0227	SWW	(unreadable) Intersun 2042
	EKFI	Intersun 2042, runway vacated, wind 150 degrees 9 knots
	SWW	We would like to check nose tire wheel and then ... aaa ... like to departure
	EKFI	Intersun 2042, roger, are you going to taxi to apron?
	SWW	We stop ... aaa in the runway ... aaa could you send me a mechanic?
0231	EKFI	You are asking mechanic to the runway?
	SWW	Okay
	EKFI	Stand by
	SWW	Standing by

Information Service (AFIS) operator that he wanted to check the airplane's nose wheel before departure. The crewmember asked the AFIS operator to send a mechanic to the airplane.

The AIB said that the AFIS operator provided the radio frequency for Finnair, but the crew did not contact Finnair. Captain B exited the airplane, then reboarded. The incident report did not explain what Captain B did during the brief period he was outside the airplane.

At 0234, a flight crewmember told Kajaani AFIS, "We checked it, everything is OK." The crewmember then requested takeoff clearance.

The AIB said that the crew's request for takeoff clearance shows that the crew did not fully understand AFIS procedures. An AFIS is not an air traffic control facility. Rather, an AFIS provides advisory services at uncontrolled airports.

The Kajaani AFIS operator told the crew that no other traffic was on the runway and that the winds were from 140 degrees at 11 knots.

The crew later told investigators that they conducted the engine test run recommended by the Finnair line maintenance inspector-in-charge. Captain A said that they conducted the test run on the runway and decided to return to the airport ramp after the left engine failed to accelerate normally during the test.

The AIB said that FDR data show that the test run was not conducted. "Both throttle levers were advanced simultaneously," said the AIB. "If the pilots had intended to perform a left-engine test run, only the left throttle lever would have been advanced."

The FDR showed that the left-engine N₁ and N₂ did not increase normally when the flight crew attempted to set takeoff power (Figure 3, page 10). The AIB said that the left engine again emitted unusual noises.

"When the throttles were advanced, the left engine did not accelerate, but the right engine operated normally," said the AIB. "The left engine EGT was fluctuating with high peaks, and the loud banging noise was heard again." Figure 4, page 11 shows the EPR and EGT values recorded by the FDR.

"The cockpit crew waited for the left engine to accelerate for approximately 40 seconds," said the AIB. "When the engine did not accelerate, [the] takeoff was aborted." The AIB said it believes that the crew would have begun the takeoff roll if the left engine had accelerated. This indicates that the airplane remained stationary on the runway while the crew waited for the left engine to accelerate.

A flight crewmember told Kajaani AFIS that they would return to the parking area.

0233	EKFI	Intersun 2042 do you have company frequency?
	SWW	Okay
	EKFI	131.50, call mechanic
	SWW	131?
	SWW	131.40
	EKFI	131.50
0234	SWW	50, thanks
	SWW	Tower, Intersun 2042, we checked it, everything is OK ... aaa ... request takeoff
	EKFI	Intersun 2042, roger and runway vacated, wind 140 degrees 11 knots
0235	SWW	(unreadable)
	SWW	SWW 2042 Kajaani, Intersun 2042, aaa ... we aborted and (unreadable) turning parking area
0236	EKFI	aaa ... you are taxiing to apron?
	EKFI	2042, confirm you are taxiing to the apron
	SWW	Affirmative
	EKFI	Roger
0246	EKFI	Intersun 2042, Kajaani AFIS
	SWW	aaa ... sir?
	EKFI	There is a telephone call in Finnair office to you
	SWW	OK

AFIS = Aerodrome flight information service
EKFI = Radio transmission from Kajaani AFIS
LTBS = International Civil Aviation Organization identification code for Dalaman (Turkey) International Airport
QNH = Corrected mean sea level pressure
SWW = Radio transmission from Intersun Sunways Flight 2042

Source: Finnish Accident Investigation Board

"The [investigation] commission considers it unprofessional that the cockpit crew did not retard the left throttle immediately after the left-engine malfunction occurred again and that they tried to apply thrust in the left engine even when they taxied back to the apron," said the AIB.

"Neither the alleged left-engine test run nor the aborted takeoff were written up in the aircraft documents after the aircraft returned to the apron," said the AIB.

Examination Showed Engine Damage

At 0500 on Oct. 1, 1996, Intersun Sunways' maintenance department asked the Finnair line-maintenance office in

Helsinki to assist in troubleshooting the abnormal functioning of the left engine. "A Finnair inspector from Helsinki arrived in Kajaani after a few hours," said the AIB.

"The first officer also arrived at the airport from [a] hotel and told the inspector that the left engine had stalled several times, but all engine instrument indications had been normal and no abnormal vibrations had occurred (the aircraft was not equipped with [an] engine vibration-monitoring system)."

The Finnair investigator ordered a borescope examination of the left engine.

"The [borescope] inspection was performed, and it was concluded that the left engine had to be changed before the next flight," said the AIB.

Further examination of the left engine showed that one rotor blade had separated from the eighth-stage compressor and had damaged the high-pressure compressor. The photo shows damage to left-engine seventh-stage compressor stators.



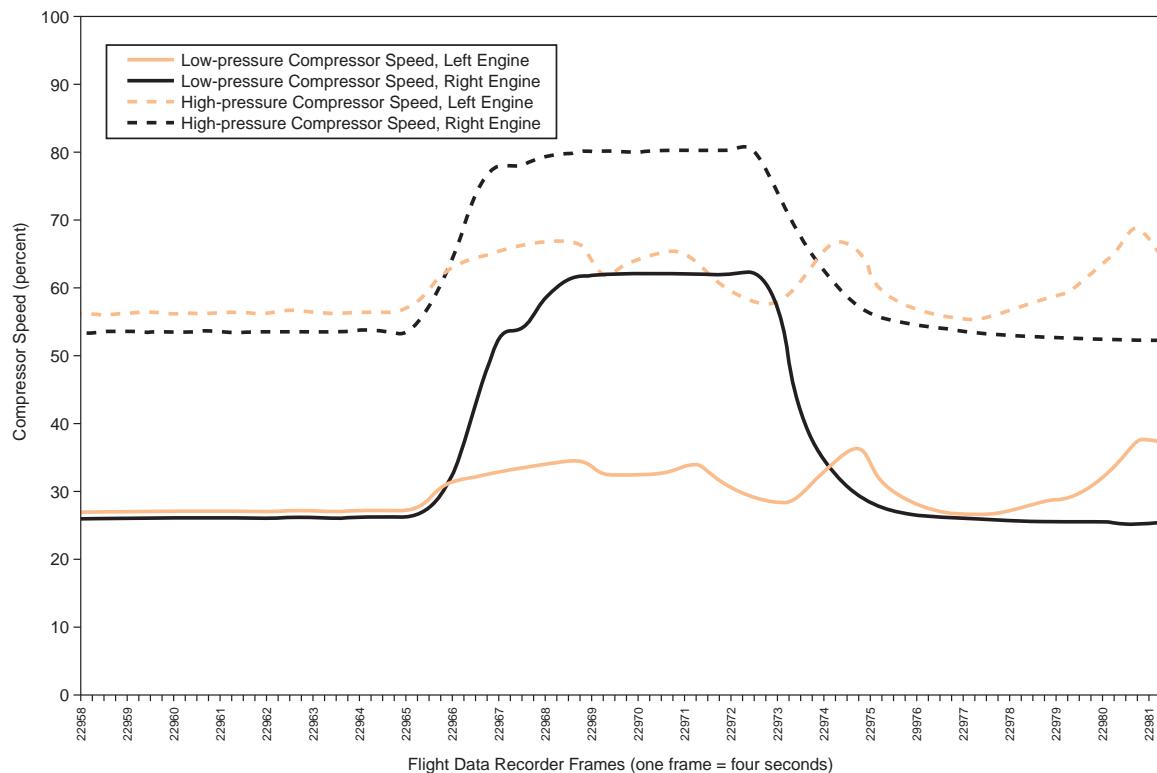
Left-engine seventh-stage-compressor stator damage. (Photo: Finnish Accident Investigation Board)

"[The] rotor blade had fractured from the root, and only the root piece was remaining in the [eighth-stage compressor] disk," said the AIB. "The liberated blade part had caused the compressor damage. The rotor blades were severely damaged in the leading and trailing edges. The blade tips had torn, and pieces were missing. Several blade roots had [a] rough surface, which looked like corrosion."

The AIB said that JT8D-200 series engines have a history of eighth-stage rotor-blade fractures, and that Pratt & Whitney had issued two service bulletins (SBs) regarding modifications of the rotor blades.

The AIB said that SB 5881, issued in 1990 after two rotor-blade failures, recommended making small "squealer" cuts in the blades to revise their natural frequency (resonance) and reduce blade-root stress.

Low-pressure Compressor Speed and High-pressure Compressor Speed During Attempted Takeoff at Kajaani, Finland, Intersun Sunways McDonnell Douglas MD-83, Sept. 30, 1996



Source: Finnish Accident Investigation Board

Figure 3

The AIB said that SB 6044, issued in 1991 after 16 rotor-blade failures, recommended making larger squealer cuts to further improve blade resonance and reduce blade-root stress.

"[SB] 5881 had been incorporated for the left engine [of the incident airplane]," said the AIB. "The recommendations of SB 6044 had not yet been incorporated."

Airline, DGCA Opposed Investigation

The AIB said that Intersun Sunways and the DGCA strongly opposed the Finnish commission's investigation.

The airline said that the incident should have been classified as an uncontained engine failure, rather than as a serious incident. The DGCA said that the incident was not serious and therefore should have been investigated by Turkish authorities.

The AIB said, "The [DGCA] stated about the investigation: 'We kindly ask you to reverse your decision to consider the

incident as serious or otherwise ... this decision shall be challenged legally in Finland or institutions elsewhere as appropriate.'

"It seems that the [DGCA's] request ... was based on incomplete information about the circumstances surrounding this incident. The commission considers it strange that the [DGCA] took the position above without first considering all available information."

The AIB also said that Intersun Sunways either delayed sending or did not send documents requested by the commission. "It was characteristic to this investigation that whenever Intersun Sunways representatives stated that they would send the commission some requested documents for investigation purposes, [the documents] were not received in reasonable time or [were] not received at all," said the AIB.

The AIB said that the investigation revealed several flight-documentation discrepancies. The flight-documentation discrepancies included the following:

- The flight from Dalaman to Cologne, the flight from Cologne to Kajaani and the intended flight from Kajaani to Dalaman were shown on the same flight-log page;
- The flight log showed both captain A and captain B as “captain-in-command” of all three flights;
- Although the flight operations manual required technical malfunctions to be recorded in the flight log, the crew used the maintenance-and-performance logbook as the technical log; and,
- The crew did not record the left-engine abnormalities after completing the flights to Cologne and to Kajaani.

“Intersun Sunways flight-operations management had failed to arrange proper operational documentation for the cockpit crews,” said the AIB. “The [DGCA] had failed to oversee the operational documentation of Intersun Sunways.”

The AIB said that the investigation also revealed flight-training discrepancies. “The transition training for airline operations

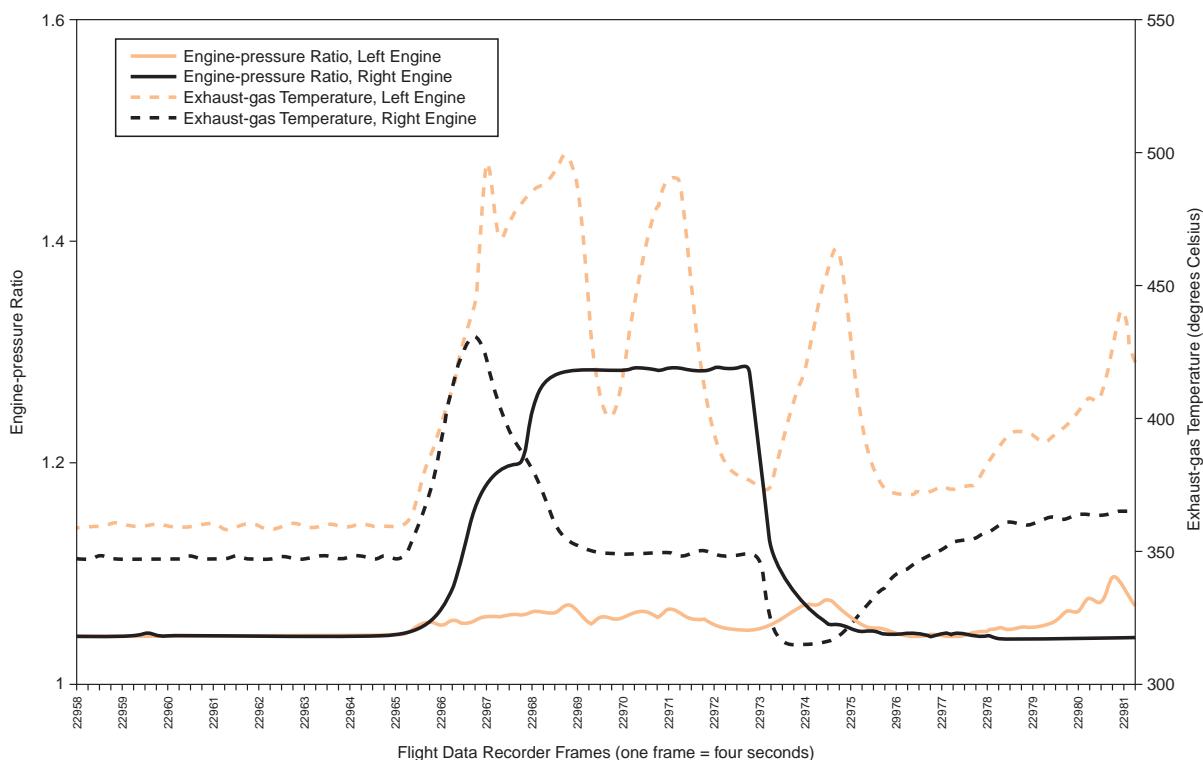
given to the pilots by Intersun Sunways was not sufficient,” said the AIB.

“The first officer had only been given four hours of introductory CRM [crew resource management] training,” said the AIB. “The commission does not consider this sufficient.

“According to the [aircraft] type-training-course syllabus, the first officer’s simulator training should have included 10 simulator sessions, but only seven were given. Each simulator session consisted of four hours of simulator time (two hours as piloting pilot and two hours as monitoring pilot) and two hours of briefing time. All simulator training was given during subsequent nights by the same instructor.”

The first officer received four hours of CRM training and four hours of emergency and safety training during a single day, between simulator sessions. “The rest periods were not sufficient,” said the AIB. “Training efficiency is usually not optimum when the training is too intensive and given at nighttime.”

Engine-pressure Ratios and Exhaust-gas Temperatures during Attempted Takeoff at Kajaani, Finland, Intersun Sunways McDonnell Douglas MD-83, Oct. 1, 1996



Source: Finnish Accident Investigation Board

Figure 4

The AIB also said, "The pilots' proficiency in the English language was rather limited. The commission had difficulties in communicating with the pilots in English. ... The company operations advisor [said] that Intersun Sunways was planning to give its pilots a course in English in the near future."

The AIB said that Intersun Sunways ceased operations in October 1997. "Therefore, there are no recommendations for the operator."

The AIB made the following recommendations to the DGCA:

- "Ensure that those cockpit crews who fly international operations and/or have manuals in English, have sufficient

language skills to manage normal and [abnormal] situations encountered during flight operations;

- "More closely monitor ... the training given to cockpit crews [to ensure that the training] is in accordance with the operator's training-manual requirements; [and,]
- "More closely monitor and direct the operations of new start-up operators."♦

Editorial note: This article was based on *Finnish Accident Investigation Board Aircraft Incident Report Aircraft Incident at Kajaani Airport, Finland*, 1 October 1996. The 48-page report contains photographs, diagrams and appendixes.

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