FLIGHT SAFETY FOUNDATION
Accident Prevention
Vol. 57 No. 10 *For Everyone Concerned With the Safety of Flight* October 2000

ATR 42 Strikes Mountain on Approach In Poor Visibility to Pristina, Kosovo

Deficiencies in the performance of the flight crew and the air traffic controller were among the causes cited by the report on the controlled-flight-into-terrain (CFIT) accident. Crew fatigue and an inoperative ground-proximity warning system were factors.

FSF Editorial Staff

At 1114 on Nov. 12, 1999, an Avions de Transport Regional ATR 42-300 chartered by the United Nations (U.N.) World Food Program struck a mountain during an approach to Pristina, Kosovo, in instrument meteorological conditions. The aircraft was being flown at 4,600 feet on an air traffic control (ATC) radar vector when it entered an area where the minimum safe altitude (MSA) was 6,900 feet. The flight crew was conducting a turn toward the airport when the aircraft struck a 4,650-foot mountain. All 24 occupants were killed.

The French Bureau Enquêtes-Accidents (BEA), in its final report, said that the accident was caused by:

- "[Flight crew] teamwork which lacked procedural discipline and vigilance during maneuvers in a mountainous region with poor visibility;
- "The aircraft being kept on its track and then forgotten by a military controller unused to the mountainous environment of the [airport] and to preventing the risk of collisions with high ground, within the framework of the radar service he was providing;
- "The operator's critical situation as a new company highly dependent on the lease contract, favoring a failure to respect procedures; [and,]
- "The opening of the [airport] to civil traffic without an advance evaluation of the operating conditions or of the conditions for distribution of aeronautical information."

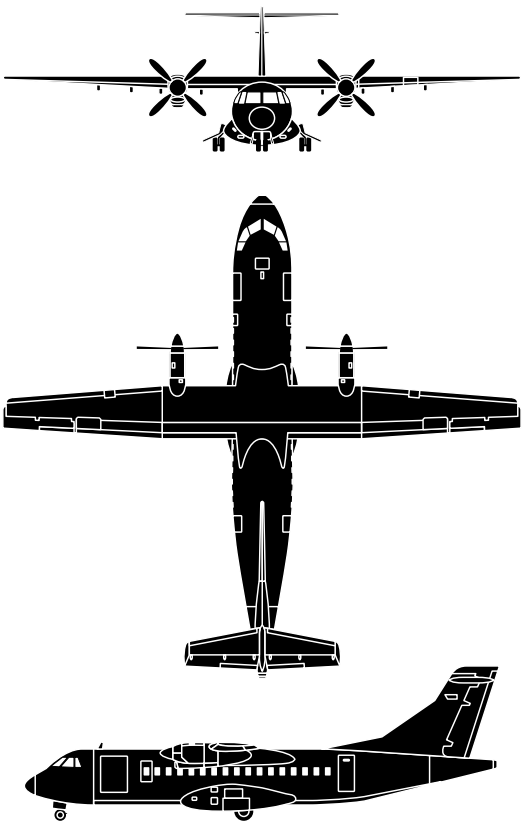
The report said that the following factors contributed to the accident:

- "Crew fatigue, favoring a lowering of vigilance; [and,]
- "Undertaking the flight with an unserviceable or disconnected GPWS [ground-proximity warning system]."

The accident aircraft was owned by ATR, registered in France and operated by Si Fly, an Italian airline that began operations in August 1999. At the time of the accident, Si Fly had two ATR 42s and 24 employees, including eight pilots.

Both accident flight crewmembers began their flying careers as pilots in the Italian air force.

The captain, 59, had an airline transport pilot (ATP) license and type ratings in the ATR 42, Fokker F27 and Douglas DC-9/McDonnell Douglas MD-80. He had 18,000 flight hours, including 5,000 flight hours in ATR 42s. He was employed by Si Fly as an ATR 42 captain on Sept. 1, 1999.



Avions de Transport Regional ATR 42-300

Aerospatiale and Aeritalia (now Alenia) agreed in 1981 to develop the ATR series of twin-turboprop regional transports. The ATR 42-300 — the first aircraft in the series — was produced from 1984 to 1996.

The aircraft has a two-pilot flight deck and cabin configurations for 46, 48 or 50 passengers. The pressurization system provides a 6,695-foot cabin altitude at the aircraft's maximum operating altitude — 25,000 feet.

Maximum takeoff weight is 16,700 kilograms (36,817 pounds). Maximum landing weight is 16,400 kilograms (36,155 pounds).

Each Pratt & Whitney Canada PW120 engine is flat-rated at 1,342 kilowatts (1,800 shaft horsepower) and drives a four-blade Hamilton Standard propeller. Maximum fuel capacity is 5,700 liters (1,506 gallons).

Maximum rate of climb is 2,100 feet per minute, and maximum single-engine rate of climb is 625 feet per minute, at sea level and a gross weight of 15,000 kilograms (33,069 pounds). Maximum cruise speed at 17,000 feet and 16,200 kilograms (35,715 pounds) is 265 knots. Maximum range with 46 passengers and fuel reserves is 1,050 nautical miles.

Stall speed with flaps up is 104 knots. Stall speed with flaps extended fully is 81 knots. Landing field length at sea level and maximum landing weight is 1,034 meters (3,393 feet).

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

"The captain had undergone satisfactory checks on a simulator on 26 February 1999 and in flight on 14 October 1999," the report said.

The first officer, 49, had an ATP license, a commercial helicopter pilot's license and type ratings in the ATR 42 and Dassault Falcon 50. He had 5,000 flight hours, including 2,100 flight hours in helicopters and 1,500 flight hours in ATR 42s. He was employed by Si Fly as an ATR 42 first officer on Oct. 20, 1999.

"The [first officer] had undertaken three flights with the Si Fly chief pilot as line-oriented flight training (LOFT)," the report said. "On 30 October 1999, he had been checked satisfactorily in flight. He was in the course of upgrading to captain status."

The captain and first officer had conducted 13 previous flights to Pristina as a crew.

"No evidence of the flight crew's participation in a specific crew resource management (CRM) course was found, nor of any airline internal training course," the report said. "Italian regulations do not require such training."

The report said that at the time of the accident, Italian regulations did not require compliance with Joint Aviation Requirements – Operations (JAR-OPS).

The aircraft had accumulated 24,930 flight hours and 32,810 cycles since it began service in 1986. The aircraft had an AlliedSignal Mark II GPWS.

The report said that the GPWS had not received maintenance recommended by three service bulletins (SBs). ATR issued SBs in 1986 and 1998, recommending replacement of connecting cables and a modification of the radio-altimeter antenna. AlliedSignal issued an SB in 1993, recommending a modification to eliminate false alarms generated during operation of aircraft in the clean configuration (i.e., with landing gear and flaps/slats retracted).

"Since the beginning of operations by Si Fly, the aircraft logbook showed no GPWS breakdowns," the report said.

Nevertheless, a check flight conducted when the aircraft was delivered to Si Fly showed that the GPWS generated false warnings during landing. A power supply card connection problem caused intermittent activation of the GPWS "FAULT" annunciator light in the cockpit. The GPWS computer was replaced.

"Si Fly informed ATR that despite the replacement of the computer, the GPWS was still not working properly and the 'FAULT' indication was still on," the report said. "Suspecting that the failure might originate in the radio altimeter, Si Fly requested that ATR send them a new radio altimeter."

Si Fly also ordered the equipment required to comply with the SB regarding replacement of the radio altimeter connecting cables and modification of the antenna. The report said that the airline planned to perform this work during a maintenance check scheduled to begin when the aircraft returned from the flight to Pristina.

The aircraft, being operated as Flight KSV (Kosovo) 3275, departed from Rome, Italy, at 0911. The first officer was the pilot flying.

Pristina airport has one runway (17-35), which is 2,500 meters (8,202 feet) long and 45 meters (148 feet) wide. The report said that the airport was closed in March 1999 because of damage during warfare, including destruction of the control tower by bombardment. The airport previously had been managed by the Federal Republic of Yugoslavia.

In June 1999, the U.N. delegated airport management to the Russian army and airport ATC services to the U.K. Royal Air Force (RAF). The RAF installed a temporary control tower and a mobile radar system. The airport was reopened July 6, 1999, to military flights and to authorized civilian humanitarian flights.

"Special procedures, relating in particular to [ATC] and to distribution of regulatory information, were put in place without any detailed checks as to their conformity to international civil norms and practices," the report said.

The report said that information on flight operations at Pristina was available from six different sources, and that some of the information was contradictory.

Only daytime visual flight rules (VFR) operations could be conducted at the airport because of frequent electrical power disruptions and because the Pristina nondirectional beacon (NDB) — which is colocated with the outer marker for the instrument landing system (ILS) approach to Runway 17 — was out of service.

A notice to airmen (NOTAM) said that "limited" radar service was available at the airport. The NOTAM said that the mobile radar system did not include secondary radar [which processes information received from aircraft transponders] and had several blind spots.

On Oct. 10, 1999, Si Fly issued special instructions for operations at Pristina, which included the statement: "Information supplied by the radar, possible [ATC] vectors and instructions, must always be cross-checked with onboard indications and the MSA [minimum safe altitude] rigidly adhered to."

Airport weather conditions reported at 1050 on the day of the accident included surface winds from 340 degrees at seven knots, 4,000 meters (2.5 statute miles) visibility in haze, few clouds at 1,000 meters (3,281 feet), broken clouds at 2,000 meters (6,562 feet) and an overcast at 3,000 meters (9,843 feet).

"A helicopter pilot who was flying in the accident area at around 1400 noticed a compact layer of clouds towards 1,000 meters, all of the peaks being covered," the report said.

The cockpit voice recorder (CVR) showed that, at 1047, the ATR 42 captain told the first officer, "We're going to do an ILS on runway seventeen."

The crew then conducted an approach briefing, during which the first officer said, "So many obstacles."

The report said, "The [crew's] preparation for the arrival at Pristina was rapid and incomplete. No safety altitudes were called out by the [first officer] in the arrival briefing. No questions were asked by the captain.

Only daytime visual flight rules (VFR) operations could be conducted at the airport because of frequent electrical power disruptions and because the Pristina nondirectional beacon was out of service.

"The large number of flights which these two pilots had made to Pristina could have created a certain sense of routine, more so in that they knew they were, as usual, going to get assistance from ATC. They may have believed that the [ATC] instructions they received ensured that they would clear any obstacles."

The Pristina approach controller, 40, was an RAF noncommissioned officer. He entered service with the RAF in 1982. The report said that before his assignment to Pristina in September 1999, the controller conducted military ATC services at airports located in nonmountainous areas.

"[The controller] was not familiar with civil procedures," the report said. "He had received about five hours training on the Pristina approach radar."

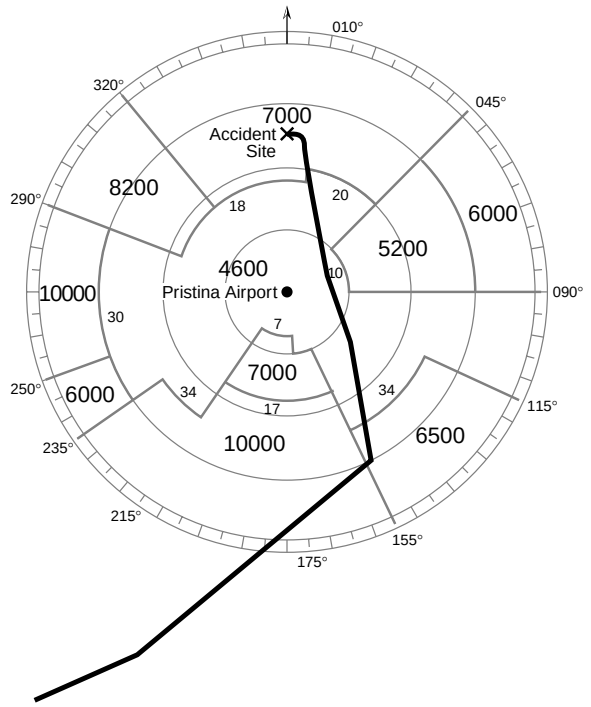
At 1057, the captain told the Pristina approach controller that the aircraft was at 14,000 feet and 0.4 nautical mile (0.7 kilometer) from XAXAN, a navigational fix at one end of a military flight corridor in Kosovo. [XAXAN is about 29 nautical miles (54 kilometers) southeast of Pristina.]

The controller said, "Kosovo three two seven five, what are your flight conditions?"

The captain said, "Flight condition now is VFR."

The controller confirmed that the flight crew wanted vectors for the ILS approach and then said, "Three two seven five,

Aircraft Ground Track in Relation to Air Traffic Control Radar Vector Chart, ATR 42, Pristina, Kosovo, Nov. 12, 1999



Source: French Bureau Enquêtes–Accidents

Figure 1

roger. Radar information service limited due to poor radar performance. Turn left heading three five zero."

Figure 1 shows the aircraft's ground track in relation to the ATC radar vector chart.

At 1103, the controller told the flight crew to descend to 4,600 feet. At 1110, the controller told the flight crew that they were following a "much faster aircraft" five miles ahead and to maintain their heading.

The report said that the accident aircraft's groundspeed was about 160 knots; the faster aircraft's groundspeed was about 250 knots. The crew of the faster aircraft, which was not identified by the report, had reported crossing XAXAN about seven minutes after the ATR 42 crossed XAXAN.

"[The ATR 42] was initially informed that it was number one for landing; then the controller reversed the landing order," the report said.

The report said that the controller momentarily might have confused the aircraft radar returns; radar data from an AWACS (airborne warning and control system) aircraft showed that the accident aircraft was in front of the faster aircraft at the time.

The controller issued vectors to the crew of the faster aircraft to intercept the localizer.

About this time, the accident aircraft flew from an area where the minimum radar vectoring altitude was 4,600 feet to an area where the minimum radar vectoring altitude was 7,000 feet.

"Having changed [the accident aircraft's] position to number two for the approach, [the controller] had to extend its track away to the north a little more than he had planned," the report said. "This maneuver probably led to the loss [of the ATR's radar signal] or clutter of the ATR's radar signal because of poor detection in this mountainous region.

"This loss, along with the fact that the controller was probably focused on the track of the aircraft which was now number one, apparently caused him to forget Flight KSV 3275."

The flight crew was using an ILS approach chart that showed an MSA of 6,900 feet in the area.

"The [crew's] conduct of the approach shows a clear lack of procedural discipline," the report said. "They failed to check the aircraft's track, and the altitudes given by ATC caused no comments although they were lower than the MSA on the approach chart."

At 1112, the captain told the first officer, "They've got military traffic, and they're letting it pass in front."

At 1113, the captain told the controller, "I want to land."

"Roger, turn left heading two seven zero," the controller said. The controller then asked the crew for their estimated position from the Pristina NDB.

"Fifteen nautical miles [28 kilometers], now heading two seven zero," the captain said. (The report said that Pristina NDB was the active waypoint in the aircraft's global positioning system receiver.)

"Kosovo three two seven five, roger. Turn left heading one eight zero," the controller said. "Apologies for the delay, sir."

The report said, "The altitude at which the aircraft was flying relative to its estimated position did not provoke any reaction from the controller," the report said. "He may have thought that the aircraft was still in visual meteorological conditions. The crew had not, in fact, advised him of a change in their flight conditions.

"A study of meteorological conditions at the [airport] and examination of the FDR TAT [flight data recorder total air temperature] parameter … shows that Flight KSV 3275 was probably flying in a layer of compact cloud from an altitude of 6,000 feet down to the point of impact."

A "continuous repetitive chime" occurred during the last six seconds of the CVR recording. The report said that the chime was a landing gear warning that began when the crew set the power levers to the idle position while the landing gear was still retracted.

Two seconds before the end of the recording, the first officer told the captain, "Two hundred and forty on the radar altimeter."

Two seconds later, the left propeller struck the top of a tree. The aircraft then struck a ridge 50 meters (164 feet) from the top.

"The debris was spread over a length of about 250 meters [820 feet] on a line at 250 degrees on either side of a pass," the report said. "The lower part of the fuselage had disintegrated on the rocks on a slope. … At the end of the track, at about 150 meters [492 feet] after the ridge, the main part of the fuselage was found … showing signs of fire … and upside down."

The aircraft's emergency locator transmitter (ELT) did not activate.

"This delayed discovery of the wreckage and … obliged the search and rescue helicopters to undertake night searches in conditions which were particularly dangerous for the crews," the report said. "It is not the first time that failure of [an ELT] has been noted following an aircraft accident. These failures and the delays they generate could cause the possible death of survivors or prolong their suffering."

A ground search began at 1145. An air search began at 1430. At 2141, a helicopter crew found the wreckage 25 nautical miles (46 kilometers) north of the airport. U.N. troops and a medical team were sent to the accident site.

"The crew should have been autopsied, and the passengers' injuries noted," the report said. "For humanitarian reasons, the investigators accepted that this [would] be done in Rome. No results have been communicated to [the investigators]."

An analysis of flight crew fatigue was conducted by the University of Paris Applied Anthropology Laboratory. The laboratory primarily studied the duration of duty periods in the five days preceding the accident and the number of duty periods that began early in the morning.

In the five days preceding the accident, the captain had flown 32 hours, and the first officer had flown 28 hours.

"The crew of the ATR had been faced with a heavy workload in the five days before the accident," the report said. "On the days of the 10th and 11th November, their duty periods started at about 0530."

Based on a numerical scale that rates fatigue level as "very slight" (0–20), "slight" (21–40), "average" (41–60), "high" (61–80) and "very high" (81–100), the laboratory said that the fatigue levels of both pilots were high. The estimated value for the captain was 69.5; the estimated value for the first officer was 65.

"This state of fatigue promoted [decreased vigilance by] the crew, [who were] lulled by what appeared to be radar vectoring and made confident by the success of their previous approaches [to Pristina]," the report said.

The report said that the accident might have been avoided if the GPWS had functioned.

"Simulations undertaken during the investigation both by the aircraft manufacturer and the equipment maker showed that [GPWS warnings] should have been set off during the last 30 seconds of flight … ," the report said. "The aircraft was flying with an inoperative or disconnected GPWS, and the crew must have been aware of this situation."

Si Fly began conducting flights for the U.N. World Food Program in late October 1999 under a 30-day renewable lease contract with Balmoral Central Contracts of the Republic of South Africa. The flights comprised two-thirds of the airline's activity.

"Contact was only established between Si Fly and Balmoral a few days before the beginning of the flights," the report said. "Considering the urgency of operating flights into Pristina, it is unlikely that Balmoral carried out a detailed check of Si Fly's organization; the fact that the latter was in possession of an air operator certificate seems to have sufficed."

The report said that Si Fly was "a recently created airline undergoing rapid development, thus in a financially weak position, having had no time to stabilize itself or to acquire collective experience in its structures and procedures.

"A strict follow-up on Si Fly's activities by the agency responsible for oversight … could have quickly brought to light certain anomalies, such as the low aircraft/crew ratio or the overwhelming part played by the lease [contract with Balmoral] in the airline's activity, or some failings such as those concerning the keeping of the logbook."

Based on the accident investigation, BEA recommended that:

- "An evaluation of the conditions for the operation of Pristina [airport] be carried out and procedures be put into effect which are compatible with the rules laid down by ICAO [International Civil Aviation Organization], and that civil flights serving Pristina be immediately suspended while these measures are put into effect. Particular attention should be paid to the following points:

– "The reliability of the radio-navigation aids used, both in terms of their power supply and the quality of the information supplied;

– "Approach, go-around and departure procedures;

– "Control procedures and terminology; [and,]

– "Documentation published and distributed to crews;

- "The opening to international civil traffic of an [airport] which is not under the effective authority of a contracting state be subject, henceforth, to a complete audit by ICAO;

- "The Italian civil aviation authorities, along with those of any other member states of the JAA [Joint Aviation Authorities] in the same situation, apply the JAR-OPS regulations in the shortest possible time;

- "Civil aviation authorities exercise reinforced surveillance of companies with a recently acquired air transport certificate or where there is significant change in an operator's structure or activity;

- "The airworthiness authorities make any modifications mandatory which are designed to improve the operation of equipment of last resort, such as GPWS;

- "A complete test of the GPWS system be included in the preflight checklist;

- "Where there is a GPWS mode failure, the JAR-OPS 1 amendment make the takeoff of a public transport aircraft subject to establishing and following alternate procedures according to the type of operation and environment;

- "ICAO take the initiative in the near future to re-examine the standards applicable to [ELTs] so as to ensure that they correspond to the objective of operating correctly after an accident in order that the aircraft's location be established rapidly; and,

- "In parallel, the study of supplementary or replacement systems which permit rapid and precise identification of the location of an accident aircraft be considered as a priority."♦

[This article, except where specifically noted, was based on the French Bureau Enquêtes-Accidents' *Report Translation the accident on 12 November 1999 North of Pristina (Kosovo) to the ATR 42-300 registered F-OHFV operated by SI FLY*, F-FV991112A. The 101-page report contains photographs, diagrams and appendixes.]

Accident Prevention

Staff: Roger Rozelle, director of publications; Mark Lacagnina, senior editor; Wayne Rosenkrans, senior editor; Linda Werfelman, senior editor; Karen K. Ehrlich, 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.