# 'CLASH *of* MOTIVES'

**The Tu-154 pilot knew that the approach was unsafe but was strongly motivated to land.**

BY MARK LACAGNINA

The flight crew's failure to proceed to an alternate airport after being told repeatedly that the weather conditions at Smolensk (Russia) Severny Airdrome were significantly lower than the nonprecision approach minimums was the "immediate cause" of the controlled flight into terrain accident that killed all 96 people aboard a Tupolev 154M the morning of April 10, 2010, according to the final report by the Russian Interstate Aviation Committee (IAC).

The IAC also faulted the crew's continued descent below the decision height without visual contact with ground references and their failure to respond to numerous terrain awareness and warning system (TAWS) warnings.

The aircraft, operated by the Polish Ministry of Defense, was transporting Polish President Lech Kaczynski and other government officials, as well as parliament members, clergy and others to attend an event marking the 70th anniversary of the massacre of Polish intellectuals, politicians and military officers in Katyn, according to media reports.

The IAC report said that the presence on the flight deck of the commander-in-chief of the Polish air force during the approach exerted "psychological pressure on the PIC's [pilot-in-command's] decision to continue descent in the conditions of unjustified risk with a dominating aim of landing at any means."

The four flight crewmembers were Polish air force pilots assigned to a special regiment conducting VIP flights. The PIC, 36, had more than 3,400 flight hours, including 530 hours as a Tu-154 PIC and 1,663 hours as a copilot in type. The report noted that he was authorized to conduct nondirectional beacon (NDB) approaches with visibility no lower than 1,200 m (3/4 mi) and with ceilings no lower than 100 m (328 ft).

The copilot, 36, had more than 1,700 flight hours, including 198 hours as a Tu-154 copilot and 277 hours as a navigator in type. The navigator, 32, had more than 1,060 flight hours, including 59 hours as a Tu-154 navigator and 389 hours as a Yakovlev 40 copilot. The flight engineer, 37, had more than 320 flight hours.

"It is impossible to assess the professional level of the PIC and the other crewmembers completely, as the Polish representatives [to the investigation] did not provide relative documentation to confirm their

## Tupolev Tu-154M

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The Tu-154 medium-range airliner initially was designed to replace the first-generation turboprop and jet transports in the Aeroflot fleet. The three-engine airplane entered passenger service in 1972. Refinements that included upgrades of the rear-fuselage-mounted Kuznetsov NK-8-2 turbofan engines marked the successive introductions of the A, B and B-2 models. The next model, the Tu-154M, debuted in 1984 with a redesigned empennage and more modern Soloviev D-30KU engines, each rated at 104 kN (23,386 lb) thrust.

The airplane accommodates three flight crewmembers and up to 180 passengers, and was designed to operate on unpaved and relatively short runways. Maximum weights for the Tu-154M are 100,000 kg (220,460 lb) for takeoff and 80,000 kg (176,368 lb) for landing. Maximum payload is 18,000 kg (39,683 lb). Maximum cruise speed is 513 kt, and maximum cruise height is 11,900 m (39,000 ft). Ranges are 2,100 nm (3,889 km) with maximum payload and 3,563 nm (6,599 km) with maximum fuel and 5,450 kg (12,015 lb) payload. The avionics equipment meets International Civil Aviation Organization standards for Category II landings.

The accident airplane, shown above, was built in 1990. Nearly 900 Tu-154s were built before the airplane was replaced in 1995 by the Tu-204, which has two engines mounted under the wings.

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

qualification," the report said. However, it noted that "the PIC had comparatively insignificant experience of unsupervised flight in his position (a little over 500 hours), and he was appointed along with a crew who had even less experience of unsupervised flights on type."

The report said that the formation of the crew for the flight to Smolensk "was done without considering the actual professional level of each person and the nature of the task." Of the four crewmembers, only the PIC had previously flown to Smolensk, serving as a copilot on three flights to the airport.

The report also said that the Tu-154 crew "did not have complete air navigation and other data on Smolensk Severny Airdrome when preparing for the flight," and that a notice to airmen about inoperative navigation aids at the airport was not provided to the crew. The crew also was not aware that one of the alternate airports on their flight plan — Vibebsk, Belarus — was not open. (The other filed alternate was Minsk, also in Belarus.)

### Fog and Low Clouds

The aircraft was 27 minutes behind schedule when it departed from Warsaw at 0927 Smolensk time (0727 Warsaw time). The estimated flight time was 1 hour and 15 minutes.

About 40 minutes after departure, Minsk Control cleared the crew to descend from 10,000 m (32,810 ft) to 3,900 m (12,796 ft) and advised them that the visibility at the Smolensk airport was 400 m (1/4 mi) in fog. "However, the crew did not show any concern and did not request recommendations as to the alternate airdromes," the report said.

Smolensk Severny (North) Airdrome is a joint-use airport served only by NDB approaches. It has one runway, which is 2,500 m (8,203 ft) long and 49 m (161 ft) wide. The report noted that the airport is not certified for international flights.

Visibilities of 3 to 4 km (2 to 2 1/2 mi) had been forecast, but the weather conditions at Smolensk had worsened during the morning as fog and low clouds drifted in from the southeast. Visibility had decreased from 4 km to 2 km (1 1/4 mi) during the approach of a Yakovlev 40 that had landed at 0915. (The Yak-40 also was carrying Polish delegates to the Katyn commemoration.) About 25 minutes later, the crew of a Russian Ilyushin 76 diverted to Moscow after conducting two radar-assisted NDB approaches and missed approaches at Smolensk.

"The weather measurements taken at 0940 showed that the weather conditions — visibility

800 m [1/2 mi], cloud base 80 m [262 ft] — got below the airdrome minima — 100 [m ceiling] x 1,000 [m; 5/8 mi visibility] — for landing on Runway 26 using the radar and NDB landing system," the report said.

At 1023, the Tu-154 crew established radio communication with the chief air traffic controller at Smolensk, who advised that "it is foggy, visibility 400 m" and warned that the weather conditions were not appropriate for landing, the report said.

## 'Trial Approach'

The crew discussed this information among themselves and with passengers who had entered the cockpit. "The crew did not take the correct decision to go to an alternate airdrome," the report said. "The PIC realized that it was difficult to approach in such conditions but, considering the importance of the task and the possible negative reaction of the main passenger in case of leaving for an alternate airdrome without a trial approach, took a decision to make a trial approach."

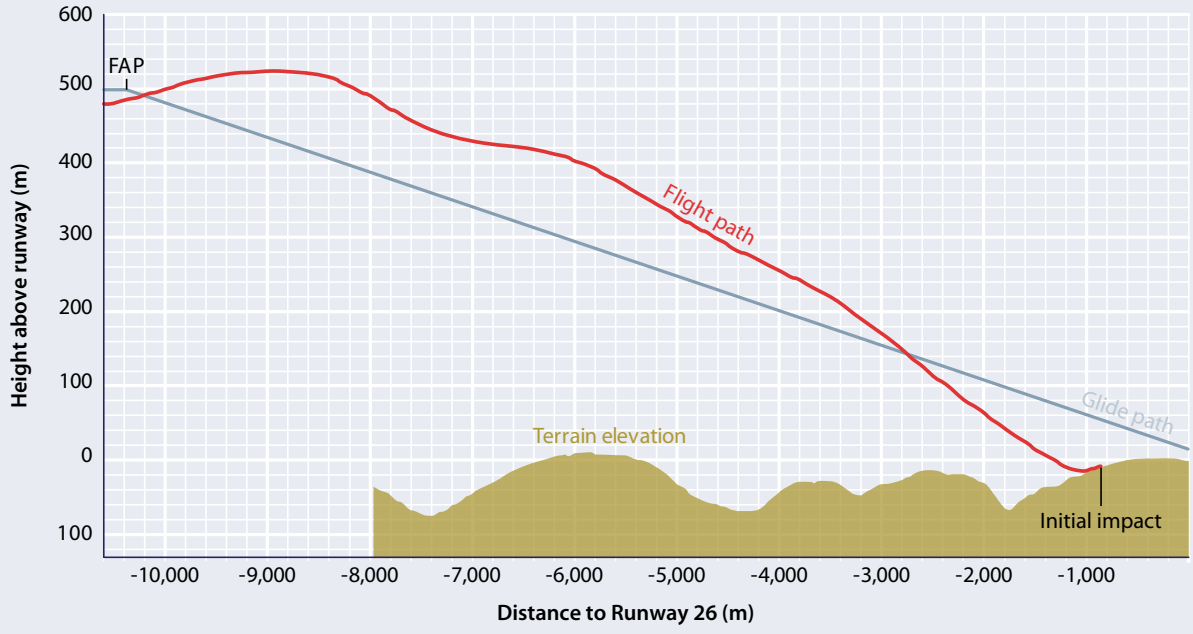
The presence of the other people in the cockpit "obviously intensified stress and distracted the crew from their duties," the report said. "It can most probably be assumed that the PIC experienced a psychological clash of motives. On the one hand, he realized that landing in these conditions was unsafe … on the other hand, he had strong motivation to land at that airdrome. … When a person experiences a clash of motives, his attention gets narrower and the probability of inadequate decisions increases."

The crew requested clearance to conduct a trial approach but did not ask for radar assistance, according to the report. The controller approved the request but later, when the aircraft was turning toward the final approach course, told the crew not to descend below 100 m and to be ready to conduct a missed approach from that altitude, the report said.

The PIC, who was communicating with the controller in Russian as well as flying the aircraft with the autopilot and autothrottle engaged, acknowledged the instruction by saying, emphatically, "Yes, sir."

The crew of the Yak-40 that had landed earlier established radio contact with the Tu-154 crew and told them several times that the weather conditions were unfavorable for a landing, the report said. "The last warning [was] given before the latter approached the final turn. The Yak-40 crew transmitted that the visibility at the airdrome was 200 m [1/8 mi]."

**Tu-154 Flight Path**




FAP = final approach point

Source: Russian Interstate Aviation Committee

**Figure 1**

## 'Passive Behavior'

The report said that the crew demonstrated "passive behavior" during the approach. They did not conduct a full briefing or establish reference speeds. The Tu-154 crossed the outer marker at 420 m (1,378 ft), or 120 m (394 ft) higher than the published crossing altitude, and at 300 kph (162 kt), or about 35 kph (19 kt) higher than the appropriate airspeed.

The crew increased the descent rate to 8 m/sec (26 ft/sec) in an attempt to establish the aircraft on the proper glide path. This descent rate, which resulted in a glide path of 5 degrees, was maintained almost until impact.

The report said that the PIC did not monitor the aircraft's rate of descent during the final stage of the approach: "No attempts were made to decrease the vertical speed, even when reaching the decision height of 100 m. It should be noted that, even when approaching in simple meteorological conditions (when the pilot can clearly see the runway and visually monitor the height), the vertical speed of descent should be reduced to the standard speed of 4-5 m/sec [13-16 ft/sec] before reaching a height of 40-50 m [131-164 ft] to conduct a safe landing."

The PIC became distracted, "turning his eyes and attention to the space outside the cockpit in order to search for the runway or ground references," the report said. The copilot and the other crewmembers likely were not monitoring the instruments, either.

The report said that crew resource management was absent. The copilot did not call out "steep descent," as required when the descent rate exceeded 5 m/sec, or "high airspeed" when required. He did call for a go-around when the aircraft reached the decision height but took no decisive action when the PIC did not respond to the call.

"The FDR [flight data recorder] analysis revealed that at 1040:51, when the 'go around' callout sounded, the [control column] was slightly pulled up, but not enough to disengage the autopilot [or] to go around," the report said. "Most probably, this action was instinctive of the copilot, who realized the critical nature of the situation better than the other crewmembers."

The report said that the presence of the air force commander-in-chief likely impelled the PIC to continue the approach. "There was evidence that the crew were expecting possible negative reaction in case they did not land at Smolensk Severny Airdrome. The expectation of punishment in case of proceeding to an alternate airdrome formed the dominant idea of landing by any means and drove them to take unjustified risks."

Two flight crewmembers, the PIC and the copilot, had been aboard an aircraft whose commander had refused for safety reasons to land in Tblisi, Georgia, in August 2008, despite direct orders by the Polish president and the air force deputy commander-in-chief. The report said that "strict measures" were taken against the commander after that flight, on which the Tu-154 PIC had served as copilot and the copilot had served as the navigator.

## Misset Altimeter

Investigators found that the Tu-154 navigator had set the PIC's pressure altimeter incorrectly, causing it to read about 160 m (525 ft) high. "This could have misinformed the PIC if he was monitoring altitude," the report said, noting, however, that there was "a lot of other information" indicating that the aircraft was too low.

Among this information were four TAWS warnings. One of the warnings — "TERRAIN AHEAD, PULL UP, PULL UP" — was generated when the aircraft reached a radio altimeter height of 105 m (345 ft) and continued for 12 seconds. Although the crew should have responded immediately by initiating a climb, no action was taken, the report said.

The initial impact occurred near the middle marker. The aircraft was about 11 m (36 ft) above ground level and slightly left of the extended runway centerline when it struck the top of a tree about 1,100 m (3,609 ft) from — and 15 m (49 ft) below — the runway threshold.

The report said that analysis of recorded flight data and examination of the accident site indicated that the PIC attempted to initiate a go-around by pulling the control column all the way back. Angle-of-attack was near the stall value, and the aircraft was climbing when it clipped several more trees on rising terrain. The left wing then struck a large birch tree and separated from the fuselage. The aircraft rolled inverted and crashed in a swampy area.

Based on the findings of the investigation, the IAC issued several recommendations, including calls for improved training and procedures for pilots in Poland's special air regiment, and for civil aviation authorities to consider prohibiting the presence of nonessential personnel in cockpits and requiring technical checks before international flights to airports that are not certified for such operations.

*This article is based on the English translation of the final report by the IAC Air Accident Investigation Commission. The final report in Russian and English, comments by the Polish government in Polish and other information about the accident are available at <www.mak.ru/english/info/tu-154m_101.html>.*