

# INTO THE BLACK SEA

A go-around goes awry in Sochi, Russia.

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BY MARK LACAGNINA

Spatial disorientation, inadequate control inputs by the captain, lack of monitoring by the copilot and the failure of both pilots to respond to a terrain awareness and warning system (TAWS) warning were among the factors that led to the crash of an Airbus A320 during a missed approach to Sochi (Russia) Airport, according to the final report by the Russian Air Accident Investigation Commission (AAIC).

The accident occurred in nighttime instrument meteorological conditions on May 3, 2006. The aircraft was destroyed, and all 105 passengers and eight crewmembers were killed.

The aircraft, operated as Flight RNV-967 by Armavia Airlines, was en route to Sochi from Yerevan, Armenia. Sochi is a resort city on the Black Sea, about 560 km (302 nm) northwest of Yerevan. Estimated flight time was one hour.

The captain, 40, had 5,458 flight hours, including 1,436 flight hours in A320s. He began his aviation career as a copilot in Antonov An-2s and Yakovlev Yak-40s. He served as a Yak-40 captain for Ararat Airline for about six years before being hired by Armavia as an A320 copilot in May 2004. He transitioned to A320 captain in September 2005.

The copilot, 29, had 2,185 flight hours, including 1,022 flight hours in A320s. After receiving primary training at a civilian flight school, he served as an ATR 42 and Tupolev

Tu-154 copilot for Armenian Airlines. He was hired by Armavia in October 2004.

Both pilots were based in Yerevan and had a rest period of more than 24 hours before the accident flight. "It should be noted that it was difficult for the crew to take adequate rest during the day before the night flight due to impairment of biorhythms," the report said. "That is most likely why, in their cockpit conversations, the crewmembers mentioned that they had not [had] enough sleep."

The flight crew's preflight documents indicated that weather conditions at Sochi included calm surface winds, visibility of 2,700 m (1.7 mi) and a broken ceiling at 1,200 m (3,937 ft); temperature and dew point both were 11 degrees C (52 degrees F). Forecast conditions included visibility greater than 10 km (6 mi) in light rain showers and mist, and a broken ceiling at 450 m (1,476 ft), with visibility occasionally 800 m (0.5 mi) and vertical visibility occasionally 60 m (197 ft) in fog.

The aircraft departed from Yerevan at 0047 local time with 10,000 kg (22,046 lb) of fuel, which the report said was sufficient to fly to Sochi and then either divert to the alternate airport in Rostov, Russia, or return to Yerevan.

The cruise portion of the flight was conducted initially at Flight Level (FL) 300 (approximately 30,000 ft) and later at FL 340. The aircraft remained above the clouds during

cruise, and icing conditions were not encountered during the flight.

### Unstable Weather

The report said that a cold front was nearing Sochi, and weather conditions at the airport were unstable.

At 0104, a Tbilisi (Georgia) Regional Centre controller told the crew that Sochi Airport was reporting 2,000 m (1.2 mi) visibility and a 170-m (558-ft) ceiling. “This weather was below the established minimums for the landing aerodrome,” the report said.

The published minimum visibility and ceiling for the instrument landing system (ILS) approach to Runway 06 at Sochi were 2,500 m (1.6 mi) and 170 m; the published minimums for the ILS approach to Runway 02 were 3,000 m (1.9 mi) and 220 m (722 ft).<sup>1</sup>

While under Tbilisi’s control, the crew established radio communication with a Sochi approach controller and asked if the weather conditions at the airport were expected to improve. The controller said that the forecast for the next two hours was for a visibility of 1,500 m (0.9 mi) and a ceiling at 150 m (492 ft). However, the controller failed to note that these were forecast as occasional conditions.

Based on this information, the crew told the Tbilisi controller that they wanted to return to Yerevan. At the time, the aircraft was 180 km (97 nm) from Sochi. The Tbilisi controller cleared the crew to turn back toward Yerevan.

### ‘Around the Limit’

About 10 minutes after turning back toward Yerevan, the crew again contacted the Sochi controller and asked for the current weather conditions. “While waiting for the results, the crew told the Sochi controller that they had deputies aboard,” the report said. “This information was not true. Analysis of the crew conversations ... shows that the crew intentionally misinformed the controller in order to obtain a positive weather forecast.”

The Sochi controller said that visibility was 3,600 m (2.2 mi) and the ceiling was at 170 m

(558 ft). “The weather is around the limit but OK so far,” the controller noted.

The crew requested and received clearance from the Tbilisi controller to resume the flight to Sochi. The cockpit voice recorder (CVR) then recorded discussion about the Runway 06 ILS approach procedure and missed approach procedure.

“Analysis of internal communications ... shows that the situation in the cockpit was getting complicated,” the report said. “The crew (especially the captain) appeared to be eager to land in Sochi and nowhere else. Further conversations show that the crew did not even wish to bother the Sochi approach controller once more, so as not to get an unfavorable weather forecast from him.”

The crew began the descent at 0152. The report said that statements by the captain, who was flying the aircraft with the autopilot and autothrust systems engaged, indicated that he was annoyed that the descent rate — about 1,000 fpm — was not as high as he expected. “This fact shows that either the captain did not fully understand the autopilot work algorithm in the ‘DESCENT’ mode or was in a state of high psycho-emotional strain with an imperative to land at Sochi as soon as possible,” the report said.

While discussing autopilot operation during the initial descent, the copilot voiced an expletive and said, “Who operates such flights with the jitters and not enough sleep?” After the crew changed the autopilot and autothrust modes, the descent rate increased to 2,000 fpm.

At 0200, the Tbilisi controller told the crew to establish radio communication with Sochi approach control. The crew reported that they were descending to 3,600 m (11,812 ft). The Sochi controller told the crew that they were “flying too high” and to continue the descent to 1,800 m (5,906 ft).

“During descent and approach, the crew of Flight RNV-967 was kept informed of the observed weather conditions,” the report said. At about 0202, the controller advised that visibility was 4 km (2.5 mi) and the ceiling was overcast at 800 m (2,625 ft).

The approach to Runway 06 is conducted over the sea. The aircraft was at 3,120 m (10,237

ft) and about 45 km (24 nm) from the runway when the crew began the turn to final. The aircraft overshot the turn, and the crew turned right to a heading of 090 degrees to intercept the extended centerline.

### 'Negative Overreaction'

At 0207, the controller told the crew that the cloud base was at 160 m (525 ft) and visibility was 4,000 m (2.5 mi), and to descend no lower than 600 m (1,969 ft).

"The information about the deteriorated weather conditions caused a negative overreaction, with the use of expletives," the report said. "The crew [discussed] the issue for *three* minutes, swearing about the controller's action even between [conducting] the items of the checklist. Such behavior by the crew inevitably must have resulted in an increase of their psycho-emotional strain."

During this time, the autopilot captured the localizer and the selected altitude, 600 m. The crew reduced airspeed and began extending the flaps and slats.

At 0209, the approach controller advised that weather conditions were "4,000 by 190" and told the crew to establish radio communication with the tower controller. The aircraft was about 10 km (5 nm) from the airport when the crew reported that the landing gear was extended and told the tower controller that they were ready to land.

The tower controller said that visibility was 4,000 m (2.5 mi) in light rain showers and the ceiling was at 190 m (623 ft), and cleared the crew to land.

During this time, the autopilot captured the glideslope, and the aircraft began to descend at about 800 fpm; indicated airspeed was 140 kt. The aircraft was descending through 465 m (1,526 ft) at 0211, when the crew selected full flaps. "The aircraft was stabilized on the glideslope, in the landing configuration and was completely ready for landing," the report said.

### 'Abort Descent'

The report said that the ceiling dropped abruptly as the aircraft neared the runway. Soon

## Airbus A320



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Development of the A320 began in 1984, and deliveries began in 1988. It is the first subsonic commercial airplane with major primary structures manufactured from composite materials, a "fly-by-wire" control system and sidestick manual controls.

The A320 accommodates two flight crewmembers and up to 180 passengers. The engines are either CFM International CFM56s or IAE V2500s. Fuel capacities are 23,859 liters (6,304 gal), standard, and 29,659 liters (7,836 gal), maximum optional.

Maximum standard takeoff weight is 73,500 kg (162,038 lb).

Maximum standard landing weight is 64,500 kg (142,197 lb).

Maximum operating speed is Mach 0.82. Optimum cruising speed is Mach 0.78. Service ceiling is 39,000 ft. Range in standard configuration is 4,807 km (2,596 nm).

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

after the controller cleared the crew to land, he was told by a weather observer that the ceiling was at 100 m (328 ft).

The A320 was 7 nm (13 km) from the runway and descending through 390 m (1,280 ft) when the controller said, "Flight RNV-967, abort descent, clouds at 100 meters, right-hand climbing turn to 600 meters."

Among the initial go-around actions prescribed by the A320 flight crew operating manual are to move the thrust levers to the "TOGA" — takeoff/go-around — position, retract the flaps and slats to the go-around setting, and retract the landing gear after a positive rate of climb is achieved.

"Not a single action of those required in the go-around procedure ... was performed by the crew, [indicating] that they were unable to

evaluate the current situation adequately,” the report said.

Instead, the crew used the push-to-level-off button on the flight control unit to stop the descent and selected a heading of 172 degrees. “As a result, the aircraft entered a turn to the right with a roll angle up to 25 degrees, maintaining an altitude of 1,114 ft (340 m),” the report said. Figure 1 shows the aircraft’s flight path.

The crew then set 3,200 ft in the altitude selector and engaged the autopilot’s open-climb mode. As a result, the aircraft pitched nose-up and began to climb at about 2,400 fpm.

The aircraft was in a climbing turn, in landing configuration, at 1,150 ft when an aural low-energy warning was generated at 0212:04. The report said that the crew responded by moving the thrust levers to the TOGA position. This resulted in deactivation of the autothrust system and engagement of the autopilot go-around modes.

A few seconds later, however, the autopilot was disengaged. The report said that the crew likely had been surprised by the aircraft’s maneuvering behavior and the low-energy

warning, and disengaged the autopilot because they doubted that it was functioning properly.

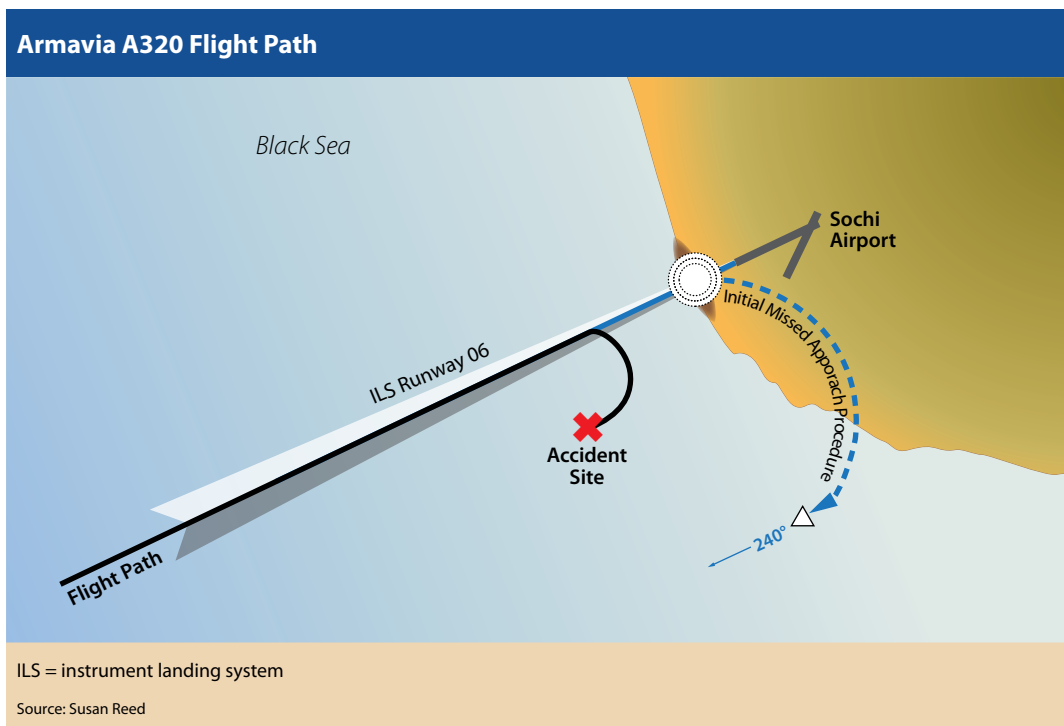
Using his sidestick, the captain reduced the pitch angle from 21 degrees to 4 degrees and the bank angle from 25 degrees to about 20 degrees. Indicated airspeed increased from 129 kt to 140 kt, and the rate of climb decreased to about 400 fpm.

The rudder pedals in an A320 do not have to be used to make a coordinated turn, but recorded flight data showed that forces up to 15 kg (33 lb) were applied to the right pedal. “The pedal inputs ... might have been caused by transfer [of the captain’s] knowledge of flying another previous aircraft type, while under stress,” the report said.

At 0212:20, the altitude-selector setting was changed to 1,969 ft (600 m), and the captain began to move his sidestick forward. The report said that the captain might have overreacted to the downward movement of the flight director pitch-command bars in his primary flight display (PFD) when the selected altitude was reduced. The sensation of acceleration and the absence of external visual cues might have caused

the somatogravic illusion that the aircraft was pitching nose-up. Another possibility was that the captain moved the sidestick forward in reaction to an indication on the PFD that airspeed was nearing the limit for the aircraft’s configuration — landing gear extended and flaps/slats in the landing configuration.

“The actual reason for such actions by the captain could not be determined,” the report said. “However, it can be stated that such inadequate piloting



**Figure 1**

was caused by a lack of monitoring of flight parameters — in particular, pitch and roll angles.”

### Crossed Controls

The aircraft was descending through 1,626 ft in a steep right turn when the captain told the copilot to retract the flaps and slats. Indicated airspeed was 186 kt and increasing.

At 0212:45, the captain made sidestick inputs that increased the aircraft’s nose-down pitch attitude and right bank angle. Two seconds later, a TAWS “pull up” warning was generated, and the copilot said, “Level off.” The aircraft was descending at about 4,300 fpm, and bank angle had increased to 39 degrees.

“At this moment, the copilot intervened and moved [his] sidestick to the left stop position to counter the increasing right bank, while the captain continued making control inputs to increase the right bank,” the report said. “Apparently, the copilot was trying to counter the bank, only. However, while moving the sidestick sideways to the stop position, he had made forward control inputs on it as well.”

The copilot had not called out his control intervention or engaged the take-over pushbutton on his sidestick, which would have deactivated the captain’s sidestick. The captain apparently was not aware of the copilot’s sidestick inputs. As a result, the A320’s autoflight system “added and averaged” the captain’s and copilot’s uncoordinated control inputs, the report said. A “DUAL CONTROL” warning usually is generated in this situation; however, because of the higher-priority TAWS warning that was being generated, the dual-control-input warning was not generated, the report said.

“The captain twice moved the sidestick half-way backward, possibly reacting to the [TAWS warning],” the report said. “But, at the same time, the copilot was inadvertently making nose-down inputs, which might have led the captain to believe that the aircraft’s response to the control inputs in the pitch channel was not adequate.”

In the final seconds of the flight, both pilots made nose-up control inputs. The bank angle was about 10 degrees, and pitch attitude was

about 5 degrees nose-down when the A320 struck the sea at 0213, at an indicated airspeed of 285 kt. (The accident occurred less than 80 seconds after the crew received the “abort descent” instruction.)

The aircraft sank in 1,540 ft of water. “Only a small portion of the wreckage, less than 5 percent, was found and recovered from the water surface,” the report said. Examination of the 52 bodies and numerous body parts that were recovered led to the conclusion that the cause of death of the occupants was “severe trauma incompatible with life,” the report said.

Based on the findings of the investigation, the AAIC made several recommendations. Among them were that the aviation administrations in the Commonwealth of Independent States should “draw the attention of A320 crews to the necessity of immediate response to activation of [a TAWS] warning (even if other warnings are on at the same time) in the case of instrument flight or flight in difficult weather conditions or in the mountains, [and] introduce relevant exercises in simulator training programs to practice these actions.”

The report included comments and recommendations by the French Bureau d’Enquêtes et d’Analyses pour la Sécurité de l’Aviation Civile (BEA). One comment noted that the tower controller was authorized by Russian aviation regulations to refuse the landing. “This flight was, however, an international flight governed by different regulations, which specifically allow the captain to descend to [the ILS decision height] before deciding on a go-around,” the BEA said. “Thus, it would be desirable for the Russian Civil Aviation Authority to clarify its doctrine on interventions by ATC in relation to the responsibilities that normally fall on the captain.” ●

*This article is based on the English translation by the BEA of the AAIC’s “Final Report on the Investigation Into the Accident Involving the Armavia A320 Near Sochi Airport on 3 May 2006.” The 57-page report contains appendixes.*

### Note

1. Russia measures altitude in meters. The A320 can display altitude in meters as well as in feet.