



Audit of ATC Operational Errors Prompts Call for Mandatory Remedial Training

The U.S. Department of Transportation investigated whether optional training has been effective in reducing operational errors by air traffic controllers. Auditors recommended a policy of mandatory training — without connotations of punishment — when relatively serious operational errors occur.

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FSF Editorial Staff

The U.S. Federal Aviation Administration (FAA) made progress from fiscal year 2001 to fiscal year 2002 in reducing operational errors by air traffic controllers and in reducing runway incursions, said an audit report by the Office of Inspector General of the U.S. Department of Transportation. Operational errors¹ — which occur primarily while aircraft are in flight — are reported when an air traffic controller does not maintain FAA standards for separation of airplanes. Runway incursions² create a collision hazard on a runway.

“In fiscal year 2002, operational errors decreased 11 percent to 1,061 and runway incursions decreased 17 percent to 339 from fiscal year 2001 levels,” the report said. “FAA’s success was due in part to the implementation of FAA and industry initiatives.³ However, the number of operational errors is still 20 percent higher than the number of operational errors that occurred in fiscal year 1998, when air traffic operations were about the same as fiscal year 2002 levels. In the first five months of fiscal year 2003, operational errors have decreased 4 percent, from 414 to 398, compared to the same period in fiscal year 2002. However, during this same five-month period, operational errors rated as high risk have increased from 21 to 24 compared to the same period in fiscal year 2002.”⁴



The auditors recommended mandatory training for controllers who commit multiple operational errors or who commit moderate-severity operational errors or high-severity operational errors; re-examining and expanding the severity classification for the most serious operational errors; evaluating the influence of FAA’s controller-in-charge program on trends in operational errors; implementing a program of cognitive-performance training for controllers; implementing recommendations from technological reviews of airports where the largest numbers of operational errors and runway incursions have occurred; and improving FAA administrative oversight and accountability. (The controller-in-charge program,

which was expanded by a 1998 agreement between FAA and the National Air Traffic Controllers Association [NATCA, the controllers union], uses designated controllers for oversight of air traffic operations during the absence of supervisors.)

Regional inconsistencies were found in documentation of efforts to identify and to correct operational errors; some regions met regional goals for fiscal year 2002, and others failed to show progress or to meet goals.

“Despite an 11 percent decrease in total operational errors in fiscal year 2002, we found that 13 of the top 27 facilities with

the most operational errors made no progress in reducing their errors from fiscal year 2001 levels,” the report said. “Seventy-eight percent of the 1,103 operational errors that FAA rated during the 13-month period from May 1, 2001, to May 31, 2002, posed a moderate or high safety risk ... [and] FAA rated 61 [5.5 percent] as high-severity [operational errors].”

FAA changed one goal for fiscal year 2002 from reducing the total number of operational errors to reducing the number of operational errors involving less than 80 percent of required separation between aircraft, the report said. Records showed 617 such errors compared with a goal of no more than 568, the report said. Further reductions in operational errors will depend, in part, on how FAA trains individual air traffic controllers when they commit an operational error.

Auditors said that the current FAA–NATCA memorandum of understanding limits actions that ATC managers/supervisors can take when controllers commit multiple operational errors, commit operational errors that pose a moderate safety risk or a high safety risk, or demonstrate other performance deficiencies. Among these limitations, “the procedures do not allow managers to revoke or suspend control tower operator licenses and facility ratings of controllers who have performance deficiencies,” the report said.

“One reason for the change in these procedures [effective August 2002] was that controllers believed that actions taken as a result of an operational error were punitive,” the report said. “In the past, supervisors could decertify a controller and provide remedial training even if the error was the controller’s first operational error and did not pose a safety risk.”

Records for controllers who committed multiple operational errors showed that training after the first operational error sometimes could have helped to prevent subsequent operational errors, the report said. Auditors also found an increase in the number of controllers who had more than one operational error in the most recent 2.5-year period.⁵

“In fiscal year 2001, less than 2 percent of the controller work force (only 191 controllers in a work force of about 15,000) had more than one operational error,” the report said.

Review of 85 moderate-severity operational errors and high-severity operational errors showed that the air traffic controllers involved did not receive training related to 18 (21 percent) of the operational errors. One example involved the absence of formal training after one controller committed multiple operational errors in a brief period.

“[The] controller’s failure to properly sequence air traffic on arrival into an airport resulted in four operational errors within

a six-minute period,” the report said. “Two errors were rated as high, and two were rated as moderate. The supervisor reviewed the voice [tapes] and radar tapes with the controller and made suggestions to improve performance, but the controller received no formal training.”

The auditors found that FAA required no training when a low-severity operational error occurred and the controller was aware that the error was about to occur (called a “controlled error”) and that training “may be provided” (i.e., was not mandatory) when a low-severity operational error occurred and the controller was not aware the error was about to occur (called an “uncontrolled error”).

“[FAA should] require that controllers who are involved in multiple operational errors receive training regardless of the severity rating of the errors, and mandate that training be provided for controllers who have had moderate[-rated operational errors] and high-rated operational errors,” the report said.

The report said that FAA has developed appropriate plans to address various issues identified by the fiscal year 2002 audit and previous audits regarding operational errors.

“FAA, in conjunction with NATCA, issued a three-year plan in August 2002 to prevent operational errors,” the report said. The plan encompasses improvements to controller training and the creation of a national safety board to review at-risk ATC facilities.⁶ Related initiatives include human factors studies to improve controller performance and to identify the causal factors of operational errors.

The auditors also concluded that FAA’s severity-rating system understated the number of serious operational errors by only

considering the high-risk errors. They disagreed with the rating of “moderate” assigned by FAA to 78 percent of operational errors because of the underlying methodology.

“In our view, categorizing errors such as [some of those compared by auditors] as ‘moderate’ is misleading,” the report said. “We found that 95 percent of operational errors that scored between 70 [points] and 89 points were considered ‘uncontrolled.’ ... Also, on average, these errors had only 50 percent of the required separation. ... We found that 65 [66 percent] of the 98 operational errors that were [determined by auditors to have involved aircraft] 30 seconds or less from a midair collision were scored between 70 [points] and 89 points.”

In response to the audit, FAA said, in part, that monitoring of the controller-in-charge program would be conducted to determine why some audit data showed increases in operational errors during periods when a controller-in-charge was on duty. The auditors said that designating 100 percent of controllers as

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qualified to be a controller-in-charge at larger facilities was not reasonable, although they agreed that this practice was necessary at small ATC facilities. "If actions taken do not reverse the upward trend in operational errors while controllers-in-charge are on duty, then FAA should limit the use of controllers-in-charge to only the most qualified candidates," the report said.

The report said that human factors techniques that have been studied by FAA should be implemented to reduce operational errors. The techniques use a cognitive method to identify causal factors leading to operational errors (i.e., what the controller was thinking when the error occurred), including the environment, task, memory and equipment factors.

"In March 2002, FAA completed a prototype memory-enhancement training program to evaluate a skills-based approach to develop controller mental skills (e.g., visual processing, concentration and scanning ability)," the report said. "According to FAA air traffic officials, the study was a success and improved controller mental skills by 16.5 percent in a six-week period. In a post-[training] evaluation of the pilot training program, participants found the experience made a significant positive impact on their personal performance."

In its response, FAA said, "National Air Traffic Professionalism (NATPRO) is a new training [method] designed to exercise the mind to improve concentration rather than relying solely on knowledge-based intervention. This project will utilize an interactive computer-based cognitive skills program that facilitates skill building and increases controller awareness of mental skills affecting performance. ... Some of the functions this type of training will address are awareness, memory improvement, performance management and coaching."

Among efforts to identify technologies to prevent runway incursions, FAA has reviewed technology in use at airports that had runway incursions, reviewed low-cost emerging technologies⁷ and worked to expedite introduction of flight deck moving-map displays (i.e., electronic maps for pilots that show in real time the aircraft position relative to runways, taxiways, gates, etc. — including data that traditionally have required reference to paper charts — and other traffic).

Based on its assessments of 16 airports (including 13 that were identified in 2001 as problem airports for runway incursions), FAA has focused in 2003 on the following primary areas:

- "Lack of perimeter security, which results in unrestricted vehicle access to the airport movement area;
- "Complex and confusing airport layouts;

- "Inadequate surface markings and signs; and,
- "Opportunities for low-cost technology enhancements."

FAA is working on the following three low-cost emerging technologies (among six proposed originally) as possible methods to help pilots reduce runway incursions:

- Flashing precision approach path indicator (PAPI) lights, which would aid in automatically alerting pilots whenever a runway is occupied. In its response to the audit, FAA said that efforts were underway in 2003 to develop a reliable and affordable sensor for flashing PAPI lights;
- Ground markers, which transmit audible messages to the pilot regarding the runway status (i.e., alerting the pilot whenever a runway is occupied). In its response to the audit, FAA said that a contractor would install a prototype ground-marker system at one airport in late 2003; and,
- Smart boards, which are electronic bulletin boards that would be placed at taxiway/runway intersections to provide pilots with advisory messages. In its response to the audit, FAA said that it expects to resolve issues of compatibility with the airport environment and issues of system performance through simulations in late 2003.

FAA said that even if these low-cost technologies pass functional tests, their effectiveness in preventing runway incursions must be evaluated, they must be proven to be cost-effective solutions, and they must pass large-scale operational evaluations.

To prepare for future implementation of flight deck moving-map technology for airport surface operations, FAA is developing airport-surface moving maps (map data), the report said.

In its response to the audit, FAA said that data for 40 airfield surface maps had been published in early 2003 and that plans call for data for a total of 78 maps by the end of 2003 and data for 80 additional maps by the end of 2004.

In summary, FAA agreed to review training provisions for operational errors in memorandums of understanding between FAA and NATCA; revalidate scientifically the point system for rating high-severity operational errors; include data from the controller-in-charge program in FAA causative analysis for operational errors; implement cognitive-enhancement training for controllers; and improve national oversight of the FAA regions and facilities that do not show progress in reducing operational errors.◆

The auditors said that designating 100 percent of controllers as qualified to be a controller-in-charge at larger facilities was not reasonable, although they agreed that this practice was necessary at small ATC facilities.

[FSF editorial note: This article, except where specifically noted, is based on the U.S. Federal Aviation Administration (FAA) report *Operational Errors and Runway Incursions: Progress Made, But The Number of Incidents Is Still High and Presents Serious Safety Risks*, FAA Report no. AV-2003-040, April 3, 2003. The 46-page report contains tables.]

Notes

1. The report said, "Standard separation in the en route environment is 5.0 nautical miles [9.3 kilometers] horizontally and 1,000 feet vertically up to 29,000 feet, and 2,000 feet vertically above 29,000 feet. Horizontal separation in the terminal environment is generally between 3.0 nautical miles [5.6 kilometers] and 5.0 nautical miles, depending on the type of airplane. Historically, about 90 percent of reported operational errors affect aircraft in the air. Operational errors that affect aircraft on the runway and create a collision hazard are considered runway incursions."
2. The U.S. Federal Aviation Administration (FAA) defines a runway incursion as any occurrence at an airport involving an aircraft, vehicle, person or object on the ground, that creates a collision hazard or results in a loss of separation with an aircraft taking off, intending to take off, landing, or intending to land. FAA's definition applies only to airports with operating air traffic control towers.
3. Auditors analyzed the 11 percent decrease in operational errors from fiscal year 2001 to fiscal year 2002 (1,194 to 1,061) and found that the decrease was caused in part by the 3 percent reduction in air traffic operations (about 4.2 million operations) during fiscal year 2002. The report said, "Sixty-five percent of the total decrease in operational errors nationwide (86 out of a total decrease of 133 errors from fiscal year 2001 to fiscal year 2002) occurred at Washington [Air Route Traffic Control] Center, Los Angeles [Air Route Traffic Control] Center, and New York [Terminal Radar Control Facility]. FAA air traffic officials attributed the decrease at these three facilities to an increase in headquarters [oversight] and regional oversight."
4. FAA's rating system was designed to help focus and prioritize improvements. The rating system comprises a 100-point scale with three risk categories: low (39 points and below), moderate (40-89 points) and high (90 points and above). Points are assigned based on vertical separation distances and horizontal separation distances, flight paths, closure rate, and level of awareness of the air traffic controllers involved.
5. In accordance with provisions of union agreements, FAA keeps individual records of operational errors for air traffic controllers for a 2.5-year period, then removes these records from the employee's files, the report said.
6. Facilities with significant increases in operational errors or with significant numbers of high-severity errors are considered to be "at-risk facilities," the report said.
7. The report said that FAA reviewed low-cost emerging technologies while implementing the Airport Movement Area Safety System (AMASS), which alerts air traffic controllers about potential surface collisions at the 34 largest U.S. airports. As of December 31, 2002, FAA had commissioned 25 AMASS systems at 24 airports, and planned to commission systems at the remaining 10 airports by the end of 2003. "AMASS will not prevent runway incursions in all situations and does not directly alert pilots of potential collisions; therefore, other technological solutions are still needed," the report said.

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