Memorandum

U.S. Department of Transportation
Office of the Secretary of Transportation
Office of Inspector General

Subject: ACTION: Actions to Reduce Operational Errors and Deviations Have Not Been Effective
AV-2001-011

Date: December 15, 2000

From: Alexis M. Stefani
Assistant Inspector General for Auditing

Reply to Attn of: JA-10:x60500

To: Federal Aviation Administrator

This final report presents the results of our review of the Federal Aviation Administration's (FAA) efforts to reduce air traffic control operational errors and deviations. We are providing this report for your information and use.

FAA must approach reducing operational errors with a sense of urgency. FAA has been ineffective in reducing operational errors, which have increased by 51 percent from 764 to 1,154 from Fiscal Year (FY) 1996 to FY 2000. While operational errors, which occur mostly in midair, can pose a serious safety risk, the true extent of the safety risk remains unknown because FAA does not determine the severity of every incident. For example, the severity of operational errors can vary from an incident that does not pose an immediate safety threat, such as when two airplanes are headed in the same direction with 4 miles of separation, to an incident that is only seconds away from a head-on collision.

Also, controllers and managers must resolve a dispute regarding their different perceptions of actions taken when operational errors occur. According to the National Air Traffic Controllers Association (NATCA), controllers face serious disciplinary actions for committing operational errors. For instance, after an operational error occurs, controllers are relieved from air traffic duties and re-trained before returning to duty, which can take from 2 days to 3 weeks. However, FAA managers do not view this process as punitive and indicated that disciplinary action, such as loss of pay, is taken only in extreme cases.

Currently, FAA is working with NATCA to come to an agreement regarding the actions to be taken when operational errors occur, based on the severity of the incident. This dialogue must include an explicit discussion between controllers and FAA managers of their perceptions of actions taken when controllers make an operational error. We encourage FAA and NATCA to promptly resolve their differences. In our opinion, this dispute has diverted attention away from identifying the true extent of the safety risk posed by operational errors and hindered actions needed to reduce these incidents and improve safety.

Further, facilities with the most reported operational errors over the past 5 fiscal years have shown little progress at reducing operational errors. We attribute the lack of progress to inadequate regional plans to reduce operational errors because the plans were not based on assessments at facilities or focused on specific actions to correct weaknesses identified.

FAA's Air Traffic Services Evaluations and Investigations Staff needs to provide strong national oversight to ensure that efforts to reduce operational errors are effective in reversing the upward trend in operational errors. This is especially important given the growth in flight volume and the need to develop capacity benchmarks for determining what traffic load the air traffic control system can reasonably be expected to safely and efficiently process.

On November 9, 2000, we discussed the results of our audit with officials from the Air Traffic Services Evaluations and Investigations Staff and considered their verbal comments in preparing this report. These officials agreed that reducing operational errors must be approached with a sense of urgency. They agreed that the severity of operational errors needs to be identified and are in the process of developing a method to do this. Officials from the Air Traffic Services Evaluations and Investigations Staff also agreed with our recommendations to improve regional operational error prevention plans and to increase national oversight of regional efforts to reduce operational errors.

FAA did not agree to extend its retention period of voice communication and radar tapes from 15 days to 45 days as recommended by the National Transportation Safety Board (NTSB) to ensure that documentation is available to investigate air traffic incidents. Officials from the Air Traffic Services Evaluations and Investigations Staff told us that FAA could not implement NTSB's recommendation because retaining tapes for 45 days would create a storage problem for facilities. However, FAA did not provide any support for its position. In our opinion, extending the retention period to 45 days will not only aid in NTSB's investigation of air traffic incidents, but should also aid in FAA's investigation of unreported operational errors.

In accordance with Department of Transportation Order 8000.1C, we would appreciate receiving your written comments within 30 days. Please indicate for each recommendation the specific action taken or planned and the target dates for completion. If you do not concur with a specific recommendation, please provide your rationale. Furthermore, you may provide an alternative course of action that you believe would resolve the issues.

We appreciate the cooperation and assistance provided by your staff during the audit. If you have questions or need further information, please contact me at (202) 366-1992, or David A. Dobbs, Deputy Assistant Inspector General for Aviation, at (202) 366-0500.

Attachment

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EXECUTIVE SUMMARY

Actions to Reduce Operational Errors and Deviations Have Not Been Effective

Federal Aviation Administration

Background and Objectives

Operational errors, one of the Department's primary safety indicators reported to Congress, occur when an air traffic controller does not ensure that Federal Aviation Administration (FAA) separation standards are maintained between airplanes.[1] *Operational deviations* occur when an air traffic controller allows an airplane to enter airspace managed by another controller without prior coordination and approval. Operational deviations can cause operational errors if an airplane unknowingly enters another controller's airspace in direct conflict with another airplane without proper planning or knowledge of the receiving controller.

Operational errors, which mostly occur in the air,[2] can pose a very serious safety risk, as described in the following incidents.

- In July 1999, an operational error occurred at the Atlanta en route center when a commercial airliner at an altitude of 23,400 feet came within an estimated 1,200 feet laterally and 400 feet vertically of a general aviation airplane. A collision was avoided when the crew of the airliner took evasive action as a result of an alarm from an on-board Traffic Alert Collision and Avoidance System (TCAS).

- In April 2000, an operational error occurred at the Denver en route center when a controller allowed two jet airliners to lose separation as they were approaching ***head on*** at an altitude of 39,000 feet. At about 6 miles apart, less than 20 seconds from a midair collision, TCAS sounded an alert and prompted the pilots to take evasive action averting an accident. The two airplanes came within 1,100 feet vertically and 1 mile laterally.

[1] Standard separation is 5 miles laterally and 1,000 feet vertically up to 29,000 feet and 2,000 feet vertically above 29,000 feet in the en route environment. Lateral separation in the terminal environment is generally between 3 and 5 miles depending on the type of airplane. See Exhibit A for a description of FAA en route and terminal facilities.

[2] Historically, about 90 percent of the reported operational errors occurred in the air. Operational errors that occur on the surface and create a collision hazard are considered runway incursions.

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- In May 2000, an operational error occurred at the Philadelphia Terminal Radar Approach Control (TRACON) when a military cargo airplane at an altitude of 6,000 feet came within 1 mile laterally and 100 feet vertically of a general aviation airplane.

- In September 2000, an operational error occurred at the Los Angeles air traffic control tower when a commercial cargo airplane at an altitude of about 3,000 feet flew over a general aviation airplane and came within 200 feet vertically.

As more airplanes enter the air traffic control system, increased system capacity will be obtained by decreasing the spacing between airplanes. At the same time, the risk of operational errors and midair collisions also increases.

The objectives of our review were to: (1) determine the appropriateness of goals and measures relating to operational errors and deviations, (2) verify and validate the associated performance data, and (3) evaluate FAA's progress and effectiveness in accomplishing its goals for reducing operational errors and deviations.

Results

FAA has been ineffective and has not shown a sense of urgency in reducing operational errors. Operational errors have increased by 51 percent from 764 to 1,154 from Fiscal Year (FY) 1996 to FY 2000. While operational errors can pose a serious safety risk, the true extent of the safety risk remains unknown because FAA does not determine the severity of every incident. The safety risk of operational errors can vary from an incident that does not pose an immediate safety threat, such as when two airplanes are 4 miles apart but headed in the same direction, to an incident that is only seconds away from a head-on collision.

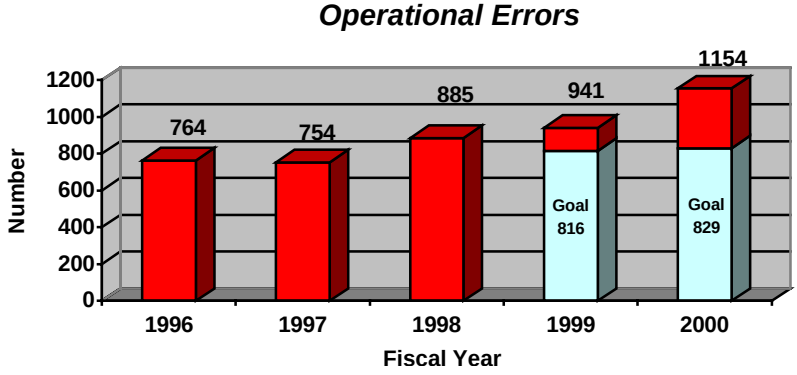
Operational errors are at risk of increasing further because of projected growth in air traffic. From FY 1996 to FY 2000, the total number of operations at all air traffic control facilities increased 12 percent, from approximately 149.5 million to 167.5 million. Operational errors have risen over four times as fast with a 51 percent increase over FY 1996 levels. In addition, FAA projects air traffic operations will increase another 30 percent by 2011, which may further increase the risk of operational errors and midair collisions.

Further, facilities with the most reported operational errors over the past 5 fiscal years have shown little progress at reducing operational errors. For example, four

of the five facilities with the most operational errors have had no reduction in operational errors. We attribute the lack of progress in reducing operational errors to inadequate regional plans that were not based on assessments at facilities and did not include specific actions to reduce operational errors. Also, operational errors are at risk of being underreported because only en route centers have an automated system that documents when operational errors occur.

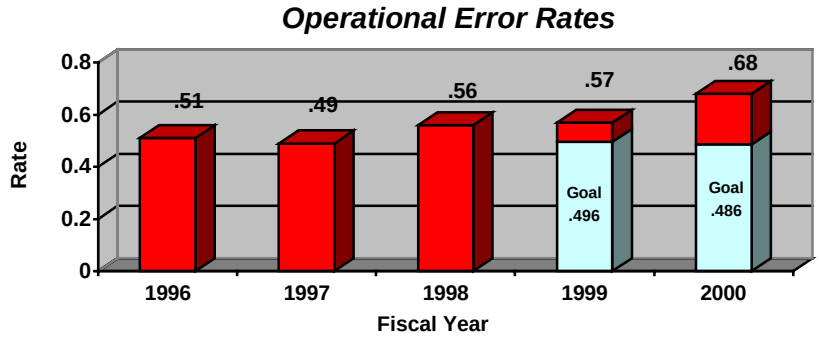
FAA must approach reducing operational errors with a sense of urgency. FAA's Air Traffic Services Evaluations and Investigations Staff needs to provide strong national oversight to ensure that efforts to reduce operational errors are effective in reversing the upward trend. For example, as part of FAA's Free Flight initiative, FAA will be implementing new technologies, which will allow controllers to land more aircraft during peak hours and provide for closer spacing of aircraft. In addition, there is uncertainty over what traffic load the air traffic control system can reasonably be expected to handle because capacity benchmarks have not been established. Therefore, it is imperative that FAA take aggressive action to reduce operational errors.

Operational Errors Continue to Rise and FAA Did Not Meet its Goals to Reduce Them. To date, FAA has not been effective in reducing operational errors and did not meet its goals.[3] FAA's goals and measures for reducing operational errors in FYs 1999 and 2000 were appropriate, but these goals were not met. Operational errors increased by 51 percent from 764 to 1,154 from FY 1996 to FY 2000 as shown on the following chart.[4]



[3] FAA was also not successful at reducing operational deviations. Operational deviations are discussed in the body of this report.
[4] FY 2000 rates and numbers are preliminary.

Further, the rate of operational errors per 100,000 operations[5] also increased, not just the absolute number, as shown on the following chart.



FAA attributes some of the increases in the number and rate of operational errors to better data reporting. For example, in 1997, FAA established regional quality assurance offices, which are responsible for improving awareness and investigating such incidents. Also, in August 1998, FAA discovered and corrected a procedural misunderstanding at the en route facilities that caused some operational errors involving 4.0 to 4.9 miles of separation between airplanes to go unreported. While this contributed to the increases in operational errors between FY 1998 and FY 1999, operational errors at en route facilities in FY 2000 have increased 29 percent over FY 1999, even after this correction was made in August 1998. Further, regardless of the reasons for the increases, the fact that the number of operational errors has continued to rise is a negative safety trend.

FAA is pursuing several new technologies to improve the controllers' ability to handle the increase in traffic activity and reduce operational errors, but such technologies are several years away. For example, controller-pilot data link[6] is not scheduled to *begin* implementation until 2003 and conflict probe[7] will have a *limited* deployment at only 7 of the 21 en route facilities by the end of 2002.

FAA Has Not Determined Which Operational Errors Pose a Safety Risk. Although the number of operational errors has increased by 51 percent over the

[5] Air traffic operations, as reported by FAA, include arrivals, departures, and overflights that occur within an air traffic control facility's airspace.

[6] Controller-pilot data link will allow controllers to communicate clearances and instructions to pilots and to receive pilot requests via electronic mail. The expected benefits include increased controller efficiency, reduced voice congestion, and reduced communication errors. It will also reduce the number of radio transmissions and allow controllers more time to focus on the traffic situation.

[7] Conflict probe checks for potential conflicts and, after detection, provides controllers with advance notice of potential problems such as the loss of separation. It allows controllers to foresee potential conflicts in a more timely manner and gives controllers more time to react.

past 5 fiscal years, the true safety risk of these incidents remains unknown. The National Air Traffic Controllers Association (NATCA) has indicated that most operational errors do not present an unsafe condition. However, there is no basis to conclude this because FAA has not established a system to identify which operational errors occurring in the air pose a safety risk. For example, FAA cannot identify which of the 1,154 operational errors that occurred in FY 2000 resulted in potential near-midair collisions.

In contrast to operational errors that occur in midair, FAA has established a system to identify serious surface incidents:[8] each incident that occurs on the surface is reviewed to determine if it created a potential collision hazard. If so, it is classified as a runway incursion. FAA must develop a method, like it has for runway incursions, to identify those operational errors occurring in the air that pose a safety risk and focus its resources and actions on reducing those incidents.

Also, controllers and managers must resolve a dispute regarding their different perceptions of actions taken when operational errors occur. According to NATCA, controllers face serious disciplinary actions for committing operational errors. For instance, after an operational errors occurs, controllers are relieved from air traffic duties and are re-trained before returning to duty, which can take 2 days to 3 weeks. However, FAA managers do not view this process as punitive and stated that disciplinary action, such as loss of pay, is taken only in extreme cases.

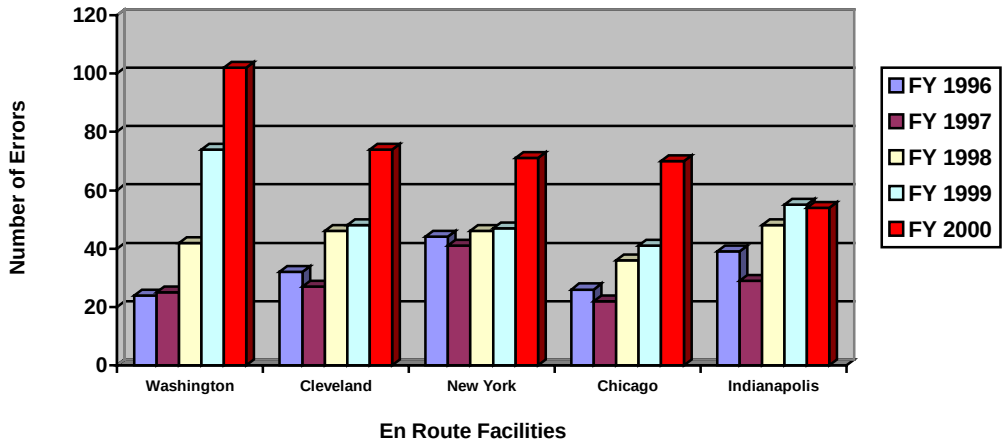
Currently, FAA is working with NATCA to come to an agreement regarding the actions to be taken when operational errors occur, based on the severity of the incident. This dialogue must include an explicit discussion between controllers and FAA managers of their perceptions of actions taken when controllers make an operational error. We encourage FAA and NATCA to promptly resolve their differences so that controllers and managers can focus on identifying the true extent of the safety risk posed by operational errors and implementing actions needed to reduce these incidents and improve safety.

Four of the Five Facilities With the Most Operational Errors Have Not Improved Over the Past 5 Years. As shown in the following chart, operational errors at the top five facilities (all en route facilities) have been increasing since FY 1996, and four of the top five facilities continued this trend from FY 1999 to FY 2000. The Indianapolis en route facility had one less operational error in FY 2000 than in FY 1999. Although the improvement is minor, it is the only

[8] Surface incidents occur on the airport surface and can be caused by operational errors or deviations, pilot deviations, or vehicle/pedestrian deviations.

facility of the five that did not have an increase. FAA officials attribute this to improved quality assurance and training efforts that were implemented after it conducted a national review of the Indianapolis facility in February 2000.

Facilities With Most Operational Errors in FY 2000 and Increases From FYs 1996 to 2000



FAA considers the increasing air traffic operations, which add to traffic complexities, a significant external factor influencing operational errors. As shown on the following chart, five en route facilities with the most operational errors in FY 2000 were also within the six facilities with the most air traffic operations.

Facility	*Air Traffic Operations (in thousands)*	*Rank in Air Traffic Operations*[9]
Cleveland En Route Center	3,215	1
Chicago En Route Center	2,922	3
New York En route Center	2,910	4
Washington En Route Center	2,758	5
Indianapolis En Route Center	2,696	6

The following chart compares the growth in operational errors to the growth in air traffic operations at these five facilities.

[9] Atlanta en route center is ranked number 2 with 2,952,000 operations in FY 2000.

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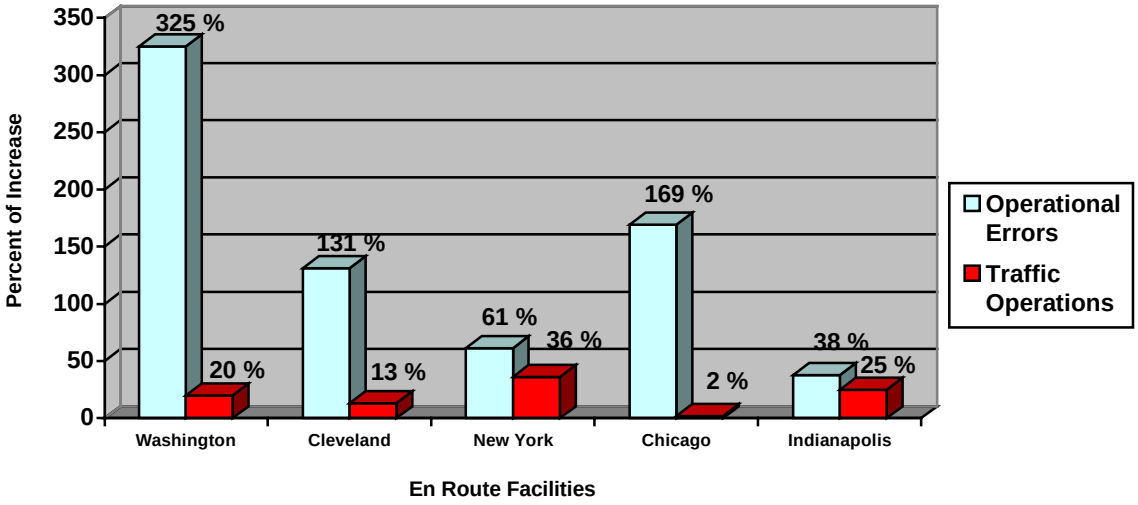
Growth in Operational Errors and Air Traffic Operations
FYs 1996 to 2000



In our opinion, the fact that the growth in operational errors is far outpacing the growth in air traffic operations at certain facilities may be due to several reasons. One reason may be the capacity and complexity of the airspace. For example, the New York en route facility had a 36 percent growth in air traffic operations since FY 1996, but had a 61 percent growth in operational errors. In FY 2000, this facility handled 2.6 million operations in 35,000 square miles of airspace, excluding oceanic airspace. Further, New York's airspace is complex: it has 3 major airports within a 15 mile radius and includes, or is impacted by, 6 of the 7 choke points, or bottlenecks identified by FAA.

In contrast to the New York en route facility, the Albuquerque en route facility had a much lower growth in operational errors (19 percent) over the past 5 fiscal years even though it had the highest growth in traffic operations in the Nation since FY 1996 (42 percent). However, Albuquerque has over 5 times as much airspace (179,500 square miles) and fewer operations (2.1 million operations in FY 2000), and its airspace is much less complex.

Besides external factors such as traffic growth and the complexity of airspace, there are other reasons why certain facilities may have experienced significant increases in operational errors over the past 5 fiscal years. For example, operational errors at the Washington en route facility grew 325 percent from FY 1996 to FY 2000. Although air traffic operations at this en route facility grew 20 percent during this same period, a regional assessment at that facility identified several operational deficiencies that may have caused operational errors. The

region found that operational managers and supervisors were not providing adequate oversight of control room operations, controllers were not adequately briefing controllers coming on duty, controllers were not provided adequate training, and control room distractions contributed to errors. These issues need to be addressed at the local and regional levels in their operational error and deviation prevention plans.

Regional Operational Error and Deviation Prevention Plans Have Not Been Effective at Reducing These Incidents at Problem Facilities. In FY 2000, about 70 percent of operational errors occurred at just 25 facilities. Twenty-two of these facilities showed no progress at reducing operational errors over FY 1996 levels including the five facilities with the most operational errors in FY 2000. Regional initiatives to reduce incidents at facilities with the most operational errors and deviations have not been effective.

We attribute the lack of progress in reducing operational errors to inadequate regional plans that were not based on assessments at facilities or focused on specific actions to reduce operational errors. For example, we reviewed operational error and deviation prevention plans from seven regions and found that the plans did not contain specific actions to reduce operational errors and deviations at problem facilities. The plans primarily focused on improving awareness through general initiatives such as training, personal accounts of lessons learned, and quality assurance briefings of recent trends in operational errors/deviations. Instead, the plans should be prepared and updated after reviewing problem facilities and identifying what the problems are, and contain actions needed to correct these problems.

Further, we found that in FY 1999, the Eastern Region conducted special assessments at two of its problem facilities (New York and Washington en route facilities) and identified several operating deficiencies, such as inadequate briefings to controllers relieving other controllers and control room distractions, that may have contributed to operational errors. However, there was little evidence the Region followed up to ensure corrective actions were taken or to determine why operational errors continued to rise. Since this time, operational errors have risen 51 percent at New York and 38 percent at Washington. In addition, we found that the Region did not update its plans to focus on correcting deficiencies identified nor did Headquarters require it to do so.

Stronger National Oversight Is Needed of Those Facilities With the Most Operational Errors. In February 2000, FAA began conducting national reviews of the top five en route, terminal, and stand-alone TRACON facilities with the

most operational errors and those facilities with significant increases over the previous year. However, due to other priorities, FAA did not complete 7 of the 15 reviews that were to be completed by the end of FY 2000, including the Washington, New York, and Cleveland en route centers. These reviews were to focus on the facility's quality assurance and training efforts to reduce or prevent operational errors. FAA needs to complete these reviews in a timely manner so it can be more effective at reducing operational errors.

Even though it is too early to determine how effective the national reviews will be at reducing operational errors at the reviewed facilities, these reviews are a step in the right direction. As currently structured, however, FAA is relying on the regions to ensure corrective actions are taken. In our opinion, stronger national oversight is needed, and FAA Headquarters should be responsible for ensuring that recommendations contained in these national reviews are implemented and effective at reducing operational errors.

Stronger national oversight of facilities that continue to experience high numbers of operational errors is especially important, as the risk of operational errors will most likely increase as upcoming workforce changes come about. For example, in January 2001, FAA will begin reducing approximately one-third of its operational supervisors through attrition. However, before an air traffic control facility can begin the reduction, the facility manager must certify that controllers have been trained under the new Controller-in-Charge Program, the facility's operational health has been evaluated, and the reduction of operational supervisors will not have an adverse impact on air traffic operations. As part of the evaluation, the facility manager must review safety data, including operational errors.

The occurrence of operational errors is, *and should remain,* a significant factor in the facility manager's consideration as to whether or not the facility should be certified to implement the reduction of operational supervisors. FAA must, through its national reviews, monitor the facilities that have reduced the number of operational supervisors to ensure that the reduction has not had a negative impact on operational errors.

Operational Errors Are at Risk of Being Underreported. While en route facilities have an automated system that documents when operational errors occur, no such system exists at terminal air traffic control facilities. At these facilities, FAA relies on controllers to self-report when these incidents occur. Although FAA actively encourages reporting and has taken adverse action against personnel

who intentionally cover up operational errors, it still cannot be sure that all operational errors are reported.

Further, adequate documentation is not always available to confirm whether an operational error has occurred. Since FAA only requires air traffic radar and voice recording tapes to be retained for 15 days, some incidents cannot be investigated to confirm whether an operational error has occurred. The National Transportation Safety Board (NTSB) has recommended that FAA extend its retention period of voice communication and radar data from 15 to 45 days to aid in NTSB's investigation of air traffic incidents. In the past, valuable information was not available during some of NTSB's investigations because the 15 days had elapsed. Our review of nine FAA hotline complaints concerning unreported operational errors disclosed that three of the reviews were also hampered by lack of available radar and voice data.

FAA did not agree to extend its retention period of voice communication and radar tapes from 15 days to 45 days as recommended by NTSB to ensure that documentation is available to investigate air traffic incidents. Officials from the Air Traffic Services Evaluations and Investigations Staff told us that FAA could not implement NTSB's recommendation because retaining tapes for 45 days would create a storage problem for facilities. However, FAA did not provide any support for its position. In our opinion, extending the retention period to 45 days will not only aid in NTSB's investigation of air traffic incidents, but should also aid in FAA's investigation of unreported operational errors.

Recommendations

FAA needs to address reducing operational errors with a sense of urgency and improve its efforts to reduce operational errors. We recommend FAA implement a series of actions which include:

- Developing a method to determine the severity, or collision hazard, of operational errors that occur in the air so it can focus its resources and take action based on the severity of these incidents.

- Requiring regions to (1) prepare and periodically update operational error prevention plans based on facility assessments which identify specific actions needed to reduce operational errors, and (2) follow up to ensure deficiencies identified during regional reviews are corrected.

- Requiring the Air Traffic Services Evaluations and Investigations Staff to review and approve regional operational error prevention plans, complete the national reviews of facilities with increasing trends in operational errors, and ensure that recommendations resulting from the national reviews are implemented and effective at reducing operational errors.

- Implementing NTSB's recommendation to extend the retention period for voice communication and radar tapes from 15 to 45 days.

Agency Comments and Office of Inspector General Response

Officials from FAA's Air Traffic Services Evaluations and Investigations Staff agreed that reducing operational errors must be approached with a sense of urgency. They agreed that the severity of operational errors needs to be identified and stated that FAA is in the process of developing a method to do this. These officials also agreed with our recommendations to improve the regional operational error prevention plans and to increase national oversight of regional efforts to reduce operational errors.

However, FAA's Air Traffic Services Evaluations and Investigations Staff did not agree to reconsider NTSB's recommendation to extend its retention period of voice communication and radar tapes from 15 days to 45 days. FAA officials believe it would create a storage problem for facilities without updated technology to extend their tape retention period. However, FAA has not substantiated that a storage problem does exist. FAA needs to reconsider its position on this recommendation.

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Introduction

Background

Operational errors, one of the Department of Transportation's primary safety indicators reported to Congress, occur when an air traffic controller does not ensure that Federal Aviation Administration (FAA) separation standards are maintained between airplanes.[1] *Operational deviations* occur when an air traffic controller allows an airplane to enter airspace managed by another controller without prior coordination and approval. Operational deviations can cause operational errors if an airplane unknowingly enters another controller's airspace in direct conflict with another airplane without proper planning or knowledge of the receiving controller.

Operational errors, which mostly occur in the air,[2] can pose a very serious safety risk, as described in the following incidents.

- In October 1998, an operational error occurred at the New York Terminal Radar Approach Control (TRACON) when a controller, in an attempt to prevent a midair collision of two airliners, inadvertently directed one of the airliners to descend into the path of a general aviation airplane. The airplanes came within 900 feet vertically and 1,580 feet laterally before action was taken to avoid a collision.

- In July 1999, an operational error occurred at the Atlanta en route center when a commercial airliner at an altitude of 23,400 feet came within an estimated 1,200 feet laterally and 400 feet vertically of a general aviation airplane. A collision was avoided when the crew of the airliner took evasive action as a result of an alarm from an on-board Traffic Alert Collision and Avoidance System (TCAS).

- In April 2000, an operational error occurred at the Denver en route center when a controller allowed two jet airliners to lose separation as they were approaching ***head on*** at an altitude of 39,000 feet. At about 6 miles apart, less than 20 seconds from a midair collision, TCAS sounded an alert and prompted

[1] Standard separation is 5 miles laterally and 1,000 feet vertically up to 29,000 feet and 2,000 feet vertically above 29,000 feet in the en route environment. Lateral separation in the terminal environment is generally between 3 and 5 miles depending on the type of airplane. See Exhibit A for a description of FAA en route and terminal facilities.

[2] Historically, about 90 percent of the reported operational errors occurred in the air. Operational errors that occur on the surface and create a collision hazard are considered runway incursions.

the pilots to take evasive action averting an accident. The two airplanes came within 1,100 feet vertically and 1 mile laterally.

- In May 2000, an operational error occurred at the Philadelphia TRACON when a military cargo airplane at an altitude of 6,000 feet came within 1 mile laterally and 100 feet vertically of a general aviation airplane.

- In September 2000, an operational error occurred at the Los Angeles air traffic control tower when a commercial cargo airplane at an altitude of about 3,000 feet flew over a general aviation airplane and came within 200 feet vertically.

As more airplanes enter the air traffic control system, increased system capacity will be obtained by decreasing the spacing between airplanes. At the same time, the risk of operational errors and midair collisions also increases.

At the Headquarters level, FAA's Air Traffic Services Evaluations and Investigations Staff is responsible for identifying and monitoring national initiatives to reduce operational errors and deviations, and reviewing operational error and deviation reports to identify system-wide deficiencies and recommend corrective action. This staff also prepares a daily performance report that shows the increases in operational errors and deviations on a national and regional basis. Regional air traffic divisions and facilities are required to establish quality assurance programs that include operational error and deviation prevention.

Objectives, Scope and Methodology

The objectives of our review were to: (1) determine the appropriateness of goals and measures relating to operational errors and deviations, (2) verify and validate the associated performance data, and (3) evaluate FAA's progress and effectiveness in accomplishing its goals for reducing operational errors and deviations. We performed our review between June 1999 and November 2000.

We conducted site visits at FAA Headquarters in Washington, D.C., five FAA regional offices, and eight air traffic control facilities. Details regarding the methodology and scope of our review are described in Exhibit B. The review was conducted in accordance with the Government Auditing Standards prescribed by the Comptroller General of the United States.

Finding and Recommendations

FAA has been ineffective and has not shown a sense of urgency in reducing operational errors. Operational errors, which occur mostly in midair, have increased by 51 percent from 764 to 1,154 from Fiscal Year (FY) 1996 to FY 2000. While operational errors can pose a serious safety risk, the true extent of the safety risk remains unknown because FAA does not determine the severity of every incident. Further, facilities with the most reported operational errors over the past 5 fiscal years have shown little progress at reducing operational errors. For example, four of the five facilities with the most operational errors have had no reduction in operational errors. We attribute the lack of progress in reducing operational errors to inadequate regional plans that were not based on assessments at facilities or focused on specific actions to reduce operational errors. Also, operational errors are at risk of being underreported because only en route centers have an automated system that documents when operational errors occur.

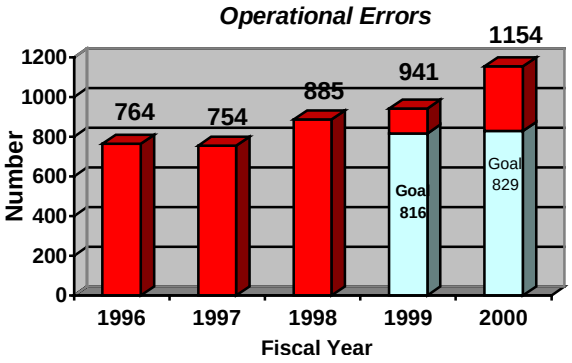
FAA must approach reducing operational errors with a sense of urgency. FAA's Air Traffic Services Evaluations and Investigations Staff needs to provide strong national oversight to ensure that efforts to reduce operational errors are effective in reversing the upward trend in operational errors. This is especially important because of the growing number of flight delays that occurred during 1999 and 2000 and initiatives to increase capacity to handle expected traffic growth. For example, as part of FAA's Free Flight initiative, FAA will be implementing new technologies, which will allow controllers to land more aircraft during peak hours and provide for closer spacing of aircraft. In addition, there is uncertainty over what traffic load the air traffic control system can reasonably be expected to handle because capacity benchmarks have not been established. Therefore, it is imperative that FAA takes aggressive action to reduce operational errors.

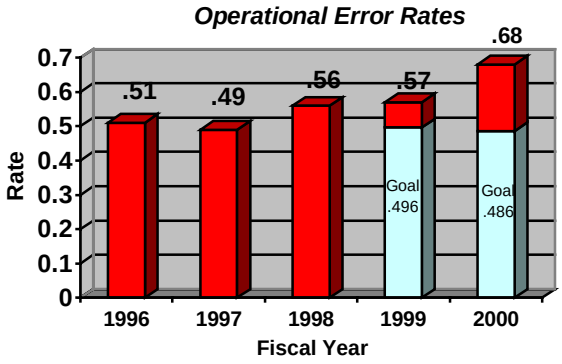
Operational Errors and Deviations Continue to Rise and FAA Did Not Meet Its Goals to Reduce Them

FAA has not been effective in reducing operational errors and deviations and did not meet its goals. FAA's goals and measures for reducing operational errors and deviations in FYs 1999 and 2000 were appropriate,[3] but these goals were not met. As shown in the following charts, operational errors have risen 51 percent, from

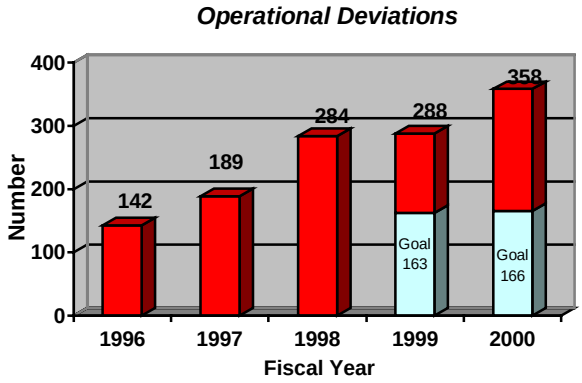
[3] The goals, if met, would have resulted in a reduction of operational error and deviation rates. Also, these goals are consistent with FAA's and Department of Transportation's (DOT) overall strategic goals to reduce the aviation fatal accident rate for U.S. commercial air carriers by 80 percent by 2007.

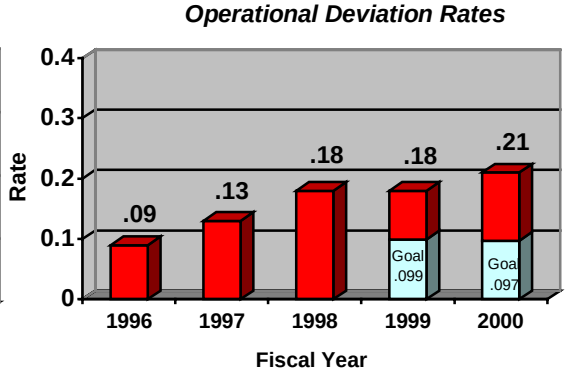
764 to 1,154 from FY 1996 to FY 2000.[4] Further, the rate of operational errors per 100,000 operations[5] also increased, not just the absolute number.





In addition, operational deviations have risen 152 percent, from 142 to 358 during this same time period, and the rate of operational deviations per 100,000 operations also increased, as shown below.





FAA attributes some of the increases in the number and rate of errors and deviations to better data reporting. For example, in 1997, FAA established regional quality assurance offices, which are responsible for improving awareness and investigating such incidents. Also, in August 1998, FAA discovered and corrected a procedural misunderstanding at the en route facilities that caused some operational errors involving 4.0 to 4.9 miles of separation between airplanes to go unreported. For this reason, FAA air traffic management has concluded that some

[4] FY 2000 rates and numbers are preliminary. There is a time lag in reporting operations; therefore, the last 1 to 2 months of traffic are estimated. In addition, the number of operational errors and deviations may decrease slightly because the investigations of some incidents are not finalized. After the incidents are fully investigated, some may be reclassified as another type of incident.

[5] Air traffic operations, as reported by FAA, include arrivals, departures, and overflights that occur within an air traffic control facility's airspace.

of the increases in FY 1999 are attributed to correcting this misunderstanding. Operational errors from FY 1998 to FY 1999 increased by 56 overall (885 to 941) with an increase of 88 at en route facilities and a decrease of 32 at terminal facilities. FAA estimates that between 5 and 38 of these additional errors were the result of clarifying reporting procedures.

While this may have contributed to the increases in operational errors between FY 1998 and FY 1999, operational errors at en route facilities in FY 2000 have increased 29 percent over FY 1999, even after this correction was made in August 1998. Further, regardless of the reasons for the increases, the fact that the number of operational errors and deviations has continued to rise is a negative safety trend.

FAA is pursuing several new technologies to improve the controllers' ability to handle the increase in traffic activity and reduce operational errors, but such technologies are several years away. For example, controller-pilot data link[6] is not scheduled to *begin* implementation until 2003 and conflict probe[7] will have a *limited* deployment at only 7 of the 21 en route facilities by the end of 2002. In addition, tools such as the Airport Surface Detection Equipment (ASDE-X), which FAA plans to acquire to assist controllers in preventing runway accidents at 25 smaller airports, may actually result in an increase in the number of operational errors reported because of increased awareness in the air traffic control tower of incidents on the runway.

FAA Has Not Determined Which Operational Errors Pose a Safety Risk

Although the number of operational errors has increased by 51 percent over the past 5 fiscal years, the true extent of the safety risk presented by these incidents remains unknown. The safety risk of operational errors varies from an incident that does not pose an immediate safety threat, to incidents that are only seconds away from a near-midair collision. For example, an operational error can occur when one airplane is 4.9 miles behind another airplane at the same altitude, but no collision hazard exists. On the other hand, if the same two airplanes were flying head on, this would pose a significant safety risk. At a cruising speed of 600 miles per hour, it takes only 15 seconds for two jet airplanes 5 miles apart, approaching head on, to collide.

[6] Controller-pilot data link will allow controllers to communicate clearances and instructions to pilots and to receive pilot requests via electronic mail. The expected benefits include increased controller efficiency, reduced voice congestion, and reduced communication errors. It will also reduce the number of radio transmissions and allow controllers more time to focus on the traffic situation.

[7] Conflict probe checks for potential conflicts and, after detection, provides controllers with advance notice of potential problems such as the loss of separation. It allows controllers to foresee potential conflicts in a more timely manner and will give controllers more time to react.

The National Air Traffic Controllers Association (NATCA) has indicated that most operational errors do not present an unsafe condition. However, there are no data to support this conclusion because FAA has not established a system to identify operational errors *occurring in the air* that pose a serious safety risk. For example, FAA cannot identify which of the 1,154 operational errors that occurred in FY 2000 resulted in potential midair collisions.

In contrast, FAA has established a system to identify serious surface incidents:[8] each incident that occurs on the surface is reviewed to determine if it created a potential collision hazard. If so, it is classified as a runway incursion. FAA must develop a method, like it has for runway incursions, to identify and focus its resources on reducing those operational errors occurring in the air that pose a safety risk.

Also, controllers and managers must resolve a dispute regarding their different perceptions of actions taken when controllers make operational errors. According to NATCA, controllers face serious disciplinary actions for committing operational errors. After operational errors occur, controllers are relieved from air traffic duties and are re-trained before returning to duty, which can take 2 days to 3 weeks. In fact, according to NATCA, controllers may add a buffer to the standard separation requirements to avoid any possibility of incurring an operational error. For example, a controller may increase the actual separation from a required 5 miles laterally to 7 miles laterally. In an already overtaxed system, NATCA officials indicated that such changes have a direct impact on delays and system capacity.

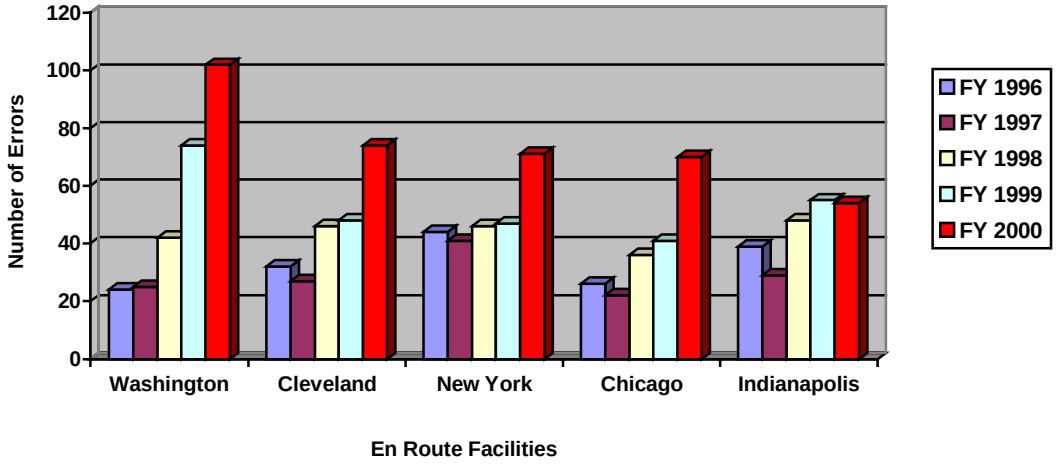
FAA managers do not view this process as punitive and stated that disciplinary action, such as loss of pay, is taken only in extreme cases. Currently, FAA is working with NATCA to come to an agreement regarding the actions to be taken when operational errors occur, based on the severity of the incident. This dialogue must include an explicit discussion between controllers and FAA managers of their perceptions of actions taken when controllers make an operational error. We encourage FAA and NATCA to promptly resolve their differences so that controllers and managers can focus on identifying the true extent of the safety risk posed by operational errors and implementing actions needed to reduce these incidents and improve safety.

[8] Surface incidents occur on the airport surface as a result of operational errors or deviations, pilot deviations, or vehicle/pedestrian deviations.

Four of the Five Facilities With the Most Operational Errors Have Not Improved Over the Past 5 Years

As shown in the following chart, operational errors at the top five facilities (all en route facilities) have been increasing since FY 1996 and four of the top five facilities continued this trend from FYs 1999 to 2000. Not only has the number of errors increased, but the rate per 100,000 operations has also increased at all five of these facilities. See Exhibit C for details.

Facilities With the Most Operational Errors in FY 2000 and Increases From FYs 1996 to 2000



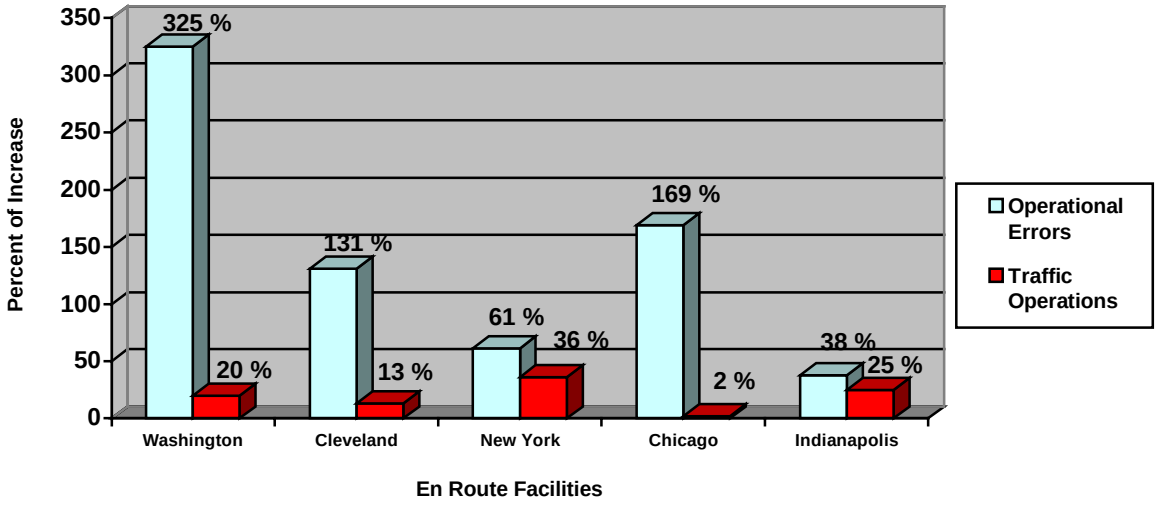
The Indianapolis en route facility had one less operational error in FY 2000 than in FY 1999. Although the improvement is minor, it is the only facility of these five that did not have an increase. FAA officials attribute this improvement to improved quality assurance and training efforts that were implemented after a national review of the Indianapolis facility in February 2000.

FAA has reported that a significant external factor impacting operational errors is air traffic operations. We found that the five en route facilities with the most operational errors in FY 2000 were also within the six facilities with the most air traffic operations. Atlanta en route center is ranked number 2 with 2,952,000 operations in FY 2000.

Facility	*Air Traffic Operations (in thousands)*	*Rank in Air Traffic Operations*
Cleveland En Route Center	3,215	1
Chicago En Route Center	2,922	3
New York En route Center	2,910	4
Washington En Route Center	2,758	5
Indianapolis En Route Center	2,696	6

The following chart compares the growth in operational errors to the growth in air traffic operations at these five facilities.

Growth in Operational Errors and Traffic Operations
FYs 1996 to 2000



In our opinion, the fact that the growth in operational errors is far outpacing the growth in air traffic operations at certain facilities may be due to several reasons. One reason may be the capacity and complexity of the airspace. For example, the New York en route facility had a 36 percent growth in air traffic operations since FY 1996, but had a 61 percent growth in operational errors. In FY 2000, this facility handled 2.6 million operations in 35,000 square miles of airspace, excluding oceanic airspace. Further, New York's airspace is complex: it includes 3 major airports within a 15 mile radius and includes, or is impacted by, 6 of the 7 choke points, or bottlenecks identified by FAA. Choke points generate unusually high levels of delays in the system caused by increased spacing, holding aircraft both on the ground and/or in the air, and reduced flexibility in moving aircraft from point to point.

In contrast to the New York en route facility, the Albuquerque en route facility had a much lower growth in operational errors (19 percent) over the past 5 fiscal years even though it had the highest growth in traffic operations in the Nation since FY 1996 (42 percent). However, Albuquerque has over 5 times as much airspace (179,500 square miles) and fewer operations (2.1 million operations in FY 2000), and its airspace is much less complex than New York's. Increases in air traffic operations in New York airspace have a much greater effect on operational errors than in Albuquerque airspace. As recommended in our September 14, 2000 testimony before Congress on flight delays and cancellations, capacity benchmarks are needed to measure the relationship between capacity and scheduling to help understand the true impact of increased traffic operations on safety.

Besides external factors such as traffic growth and the complexity of airspace, there are other reasons why certain facilities may have experienced significant increases in operational errors over the past 5 fiscal years. For example, operational errors at the Washington en route facility grew 325 percent from FY 1996 to FY 2000. Although air traffic operations at this en route facility grew only 20 percent during this same period, a regional assessment at the facility identified several operational deficiencies that may have caused operational errors. The region found that operational managers and supervisors were not providing adequate oversight of control room operations, controllers were not adequately briefing relief controllers, controllers were not provided adequate training, and control room distractions contributed to errors. These issues need to be addressed at the local and regional levels in their operational error and deviation prevention plans.

Regional Operational Error and Deviation Prevention Plans Have Not Been Effective at Reducing These Incidents at Problem Facilities

Regional attempts to reduce operational errors and deviations at those facilities with the most operational errors and deviations were not effective. About 70 percent of operational errors and 67 percent of operational deviations occurred at just 25 facilities (see Exhibits C and D). However, 22 of the 25 facilities with the most operational errors in FY 2000 showed no reduction in the number of operational errors over FY 1996 levels despite regional oversight. Also, 18 of the 25 facilities showed no progress based on the rate of operational errors.

We found that FAA was not effective at holding the regions accountable for reducing these operational errors and deviations at problem facilities. FAA Order 7210.56A, Air Traffic Quality Assurance, contains guidance for operational error and deviation prevention plans. However, we found the following weaknesses in FAA's guidance.

- The guidance did not require the regions to include specific operational error reduction actions for problem facilities in their plans.[9] Instead, the guidance provides a list of 12 generic initiatives that the regions could select from in developing their plans. These initiatives primarily focused on quality assurance, awareness, and training, such as conducting quality assurance briefings and developing personal accounts of lessons learned.

- The guidance did not require Headquarters review and approval of regional operational error and deviation prevention plans to ensure the plans contained effective actions to reduce operational errors and deviations.

- Finally, FAA's guidance did not address the regions' responsibilities for ensuring that deficiencies cited in regional assessments were corrected or that the regions' prevention plans were prepared and updated based on the results of these assessments.

Our review of seven regional operational error and deviation prevention plans disclosed that none of the plans contained specific actions to reduce operational errors and deviations at problem facilities. The plans did not indicate (1) the primary reasons for the increase in operational errors; (2) actions needed to fix the problems leading to the increases; or (3) how often the region planned to follow up to ensure the problems were corrected.

The regional plans mainly focused on improving awareness through general initiatives such as training, personal accounts of lessons learned, and quality assurance briefings of recent trends in operational errors/deviations. Two of the plans (Eastern and Southwest Regions) specifically addressed re-certification requirements for controllers who had made more than one operational error. However, none of the regional plans addressed problem facilities and how to reduce errors at those facilities. The plans should be prepared after reviewing problem facilities and identifying what the problems are, and contain actions needed to correct these problems.

For example, FAA's Eastern Region had 217 operational errors in FY 1999, and 77 percent of these errors occurred in just 4 facilities (the Washington and New York en route centers, the New York stand-alone TRACON, and the Washington-Dulles Airport). The Region's prevention plan did not address these facilities even though 3 of these facilities have been within the top 10 since FY 1996. The Region's plan should identify the deficiencies that caused operational errors,

[9] FAA first required regional plans in its new quality assurance order that was issued in 1998. It requires the regions to identify which facilities must prepare plans.

indicate how the Region is going to hold the facility accountable for correcting these deficiencies, and what course of action will be taken if the facility's operational errors continue to rise. By requiring the regions to include specific actions they plan to take to reduce these incidents at problem facilities, FAA then can hold the regions accountable for taking needed actions.

Further, we found that in FY 1999, the Eastern Region conducted special assessments at two of its problem facilities (New York and Washington en route facilities) and identified several operating deficiencies, such as inadequate briefings to relief controllers and control room distractions, that may have contributed to operational errors. However, there was little evidence the Region followed up to ensure corrective actions were taken or to determine why operational errors continued to rise. Since this time, operational errors have risen 51 percent at New York and 38 percent at Washington. In addition, we found that the Eastern Region did not update its plan to focus on correcting deficiencies identified nor did Headquarters require it to do so.

Stronger National Oversight Is Needed of Those Facilities With the Most Operational Errors

In February 2000, FAA began conducting national reviews of the top five en route, terminal and stand-alone TRACON facilities with the most operational errors or those facilities that have significant increases over the previous year. These reviews focus on the facility's quality assurance and training efforts to reduce or prevent operational errors and deviations. For example, the national reviews include evaluations of re-certification plans for controllers who have had operational errors and the effectiveness of the facility's quality assurance program to reduce operational errors.

FAA scheduled 15 facilities for review during FY 2000. However, due to other priorities, FAA did not complete seven of these reviews. Three of the facilities not reviewed (Washington, New York and Cleveland en route facilities) were in the top five facilities with the most operational errors for FY 1999 and FY 2000. FAA officials indicated that the reviews were originally scheduled for August 2000, but were delayed due to a high priority investigation. FAA needs to complete these reviews in a timely manner so it can be more effective at reducing operational errors.

Although it is too early to determine how effective the reviews will be at reducing operational errors at these facilities, these reviews are a step in the right direction. However, FAA plans to rely on the regions to ensure corrective actions are taken. In our opinion, stronger national oversight is needed, and FAA's Air Traffic Services Evaluations and Investigations Staff at Headquarters should be

responsible for ensuring that recommendations contained in these national reviews are implemented and effective at reducing operational errors.

Stronger national oversight of these facilities is especially important as operational errors and deviations will most likely continue their upward trend as air traffic operations continue to increase and upcoming workforce changes come about. Specifically:

- NATCA projects that by 2010, 50 percent of the current workforce will be retired. This will significantly reduce the experience level of the controller workforce and may increase the risk of operational errors. We found that, historically, about 70 percent of operational errors were committed by controllers with less than 10 years experience.

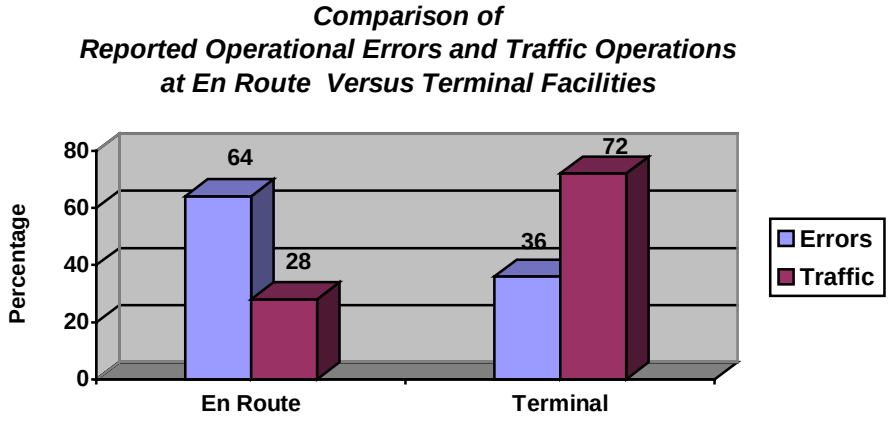
- In January 2001, FAA will begin reducing approximately one-third of its operational supervisors through attrition. However, before an air traffic control facility can begin the reduction, the facility manager must certify that controllers have been trained under the new Controller-in-Charge (CIC) Program, the facility's operational health has been evaluated, and the reduction of operational supervisors will not have an adverse impact on air traffic operations. The CIC Program allows FAA to replace operational supervisors with bargaining unit members who have been trained under the new CIC guidelines. In the role of watch supervisor, a CIC will have the same authority, responsibility, and accountability as an operational supervisor.

  As part of the evaluation of the facility's operational health, the facility manager must review safety data, including operational errors. The occurrence of operational errors is, *and should remain,* a significant factor in the facility manager's consideration as to whether or not the facility should be certified to implement the reduction of operational supervisors. It will be imperative that FAA, through its national reviews, monitor the facilities that have reduced the number of operational supervisors to ensure that the reduction has not had a negative impact on operational errors.

Operational Errors Are at Risk of Being Underreported

Operational errors are at risk of being understated. While en route facilities have an automated system that documents when operational errors occur, no such system exists at terminal air traffic control facilities. At these facilities FAA relies on controllers to self-report when these incidents occur. As shown on the following chart, about 64 percent of reported operational errors occurred at the 23 en route centers even though they represent only about 30 percent of the

operations. The remaining 36 percent of reported operational errors occurred at 361 terminal facilities, which rely on self-reporting.[10]



Although FAA actively encourages reporting and has taken adverse action against personnel who intentionally cover up operational errors, it still cannot be sure that all operational errors are reported. For example, at the request of a Member of Congress concerning allegations of unreported operational errors at a terminal facility, we confirmed that one of the four incidents reviewed was an operational error but was not reported.[11] The incident was reported to the facility by another controller and the facility classified it as a pilot deviation because it believed the pilot failed to follow the controller's instructions. The FAA Flight Standards office investigating the incident determined that the pilot had followed the controller's instructions, and the Flight Standards office closed the referral without action. We found, however, that this incident was in fact an operational error because the controller gave the pilot inadequate instructions, which caused the aircraft to lose the minimum required separation with another aircraft. We referred the unreported operational error to FAA regional and Headquarters officials for detailed analyses. As a result of our review, FAA reported the incident as an operational error.

Further, adequate documentation is not always available to confirm whether operational errors have occurred. FAA does not retain air traffic radar and voice recording tapes past the 15 days required by FAA regulations. As a result, some incidents cannot be investigated to confirm whether an operational error has occurred. The National Transportation Safety Board (NTSB) has recommended[12] that FAA extend its retention period of voice communication and radar data from 15 to 45 days to aid in NTSB's investigation of air traffic incidents. In the past,

[10] In FY 2000, 215 of the 361 terminal facilities did not report any operational errors.
[11] This terminal facility was not one of the eight facilities visited during our audit.
[12] NTSB Safety Recommendation Letter dated June 16, 2000, Recommendation Number A-00-39.

valuable information was not available during some of NTSB's investigations because the 15 days had elapsed. Our review of nine FAA hotline complaints concerning unreported operational errors disclosed that three of the reviews were also hampered by a lack of available radar and voice data.

FAA did not agree with NTSB's recommendation to extend its retention period of voice communication and radar tapes to 45 days. Officials from the Air Traffic Services Evaluations and Investigations Staff told us that it could not implement NTSB's recommendation because retaining tapes for 45 days would create a storage problem for facilities. However, FAA did not provide any support for its position. In our opinion, extending the retention period to 45 days will not only aid in NTSB's investigation of air traffic incidents, but should also aid in FAA's investigation of unreported operational errors.

Recommendations

To reverse the increasing trend in operational errors and deviations, FAA needs to address reducing operational errors and deviations with a sense of urgency. FAA should:

1. Develop a method to determine the severity, or collision hazard, of operational errors that occur in the air so it can focus its resources and take action based on the severity of these incidents.

2. Require regions to (a) prepare and periodically update operational error prevention plans based on facility assessments which identify specific actions needed to reduce operational errors, and (b) follow up to ensure deficiencies identified during regional reviews are corrected.

3. Require the Air Traffic Services Evaluations and Investigations Staff to review and approve regional operational error prevention plans, complete the national reviews of facilities with increasing trends in operational errors, and ensure that recommendations resulting from the national reviews are implemented and effective at reducing operational errors.

4. Implement NTSB's recommendation to extend the retention period for voice communication and radar tapes from 15 to 45 days.

Agency Comments and Office of Inspector General Response

Officials from FAA's Air Traffic Services Evaluations and Investigations Staff agreed that reducing operational errors must be approached with a sense of urgency. They agreed that the severity of operational errors needs to be identified

and are in the process of developing a method to do this. These officials also agreed with our recommendations to improve the regional operational error prevention plans and to increase national oversight of regional efforts to reduce operational errors.

However, FAA's Air Traffic Services Evaluations and Investigations Staff did not agree to reconsider NTSB's recommendation to extend its retention period of voice communication and radar tapes from 15 days to 45 days. FAA officials believe extending the tape retention period would create a storage problem for facilities. However, FAA has not substantiated that a storage problem does exist. FAA needs to reconsider its position on this recommendation.

Action Required

In accordance with Department of Transportation Order 8000.1C, we would appreciate receiving your written comments within 30 days. If you concur with our recommendations, please indicate for each recommendation the specific actions taken or planned along with target dates for completing planned actions. If you do not concur, please provide your rationale. Furthermore, you may provide alternate courses of action that you believe would resolve the issues presented in this report.

We appreciate the courtesies and cooperation extended by your staff. If I can answer any questions or provide additional information, please contact me on (202) 366-1992 or David A. Dobbs, Deputy Assistant Inspector General for Aviation, on (202) 366-0500.

EXHIBIT A

Description of FAA's Air Traffic Control Facilities

Air Traffic Control (ATC) is provided primarily by the following three types of facilities where operational errors or deviations can occur.

- *Air Route Traffic Control Centers (en route facilities)* provide ATC services for the en route phase of flights, generally above 10,000 feet.

- *Terminal Radar Approach Control (TRACON)* facilities provide ATC approach control services within about 5 to 40 miles of an airport.

- *Control towers (towers)* provide ATC services within about 5 miles of an airport (including take-offs, landings, and ground control).

TRACON and tower facilities are commonly referred to as *terminals.* Some TRACON and tower facilities are combined into one facility while others are separate facilities. Therefore, it is important to know whether or not an airport has both a TRACON and a tower or only a tower when comparing the number of operational errors and deviations with those of other airports.

EXHIBIT B

Methodology and Scope

In determining whether goals and measures for reducing operational errors and deviations were appropriate, we reviewed FAA's basis for establishing the goals and measures. To verify and validate the performance data, we reviewed operational error and deviation reporting procedures at each of the sites visited and tested the data recorded in the national database. To evaluate FAA's progress and effectiveness in reducing operational errors and deviations, we reviewed FAA's actions taken or planned from October 1998 through September 2000.

We conducted site visits at FAA Headquarters in Washington, D.C., the five FAA regional offices, and eight air traffic control facilities listed below.

FAA Regional Offices

Eastern
Southern
Southwest
Western Pacific
Great Lakes

FAA Facilities

Atlanta en route center
Dallas-Fort Worth en route center
New York en route center
Salt Lake City en route center
Southern California stand-alone TRACON
Atlanta Airport TRACON/tower
Chicago O'Hare Airport tower
Washington-Dulles Airport TRACON/tower

We also interviewed representatives from NATCA, FAA Conference for Federal Managers Association, Air Line Pilots Association, Aircraft Owners and Pilots Association, and NTSB. We performed our review between June 1999 and November 2000. The review was conducted in accordance with the Government Auditing Standards prescribed by the Comptroller General of the United States.

EXHIBIT C

FY 2000 Top 25 Facilities for Operational Errors and Changes From FY 1996

	Facility	Number of Errors FY 1996	Number of Errors FY 2000	Percent Increase/ Decrease	Rate of Errors FY 1996	Rate of Errors FY 2000	Percent Increase/ Decrease
1.	Washington Air Route Traffic Control Center (ARTCC)	24	102	325%	1.04	3.70	255%
2.	Cleveland ARTCC	32	74	131%	1.13	2.30	105%
3.	New York ARTCC	44	71	61%	2.05	2.44	19%
4.	Chicago ARTCC	26	70	169%	0.90	2.40	165%
5.	Indianapolis ARTCC	39	54	38%	1.80	2.00	11%
6.	Atlanta ARTCC	36	40	11%	1.47	1.36	-8%
7.	Memphis ARTCC	21	38	81%	1.06	1.70	61%
8.	Dallas-Fort Worth ARTCC	23	34	48%	1.08	1.52	41%
9.	Los Angeles ARTCC	19	33	74%	0.96	1.53	60%
10.	Denver ARTCC	11	33	200%	0.73	1.93	163%
11	Jacksonville ARTCC	27	30	11%	1.44	1.32	-8%
12.	Kansas City ARTCC	20	28	40%	1.01	1.27	25%
13.	New York TRACON*	33	27	-18%	1.76	1.29	-27%
14.	Albuquerque ARTCC	21	25	19%	1.40	1.17	-16%
15.	Miami ARTCC	15	21	40%	0.76	0.96	26%
16.	Boston ARTCC	13	21	62%	0.76	1.11	46%
17.	Southern California TRACON*	30	18	-40%	1.29	0.73	-44%
18.	Houston ARTCC	7	18	157%	0.37	0.87	134%
19.	Oakland ARTCC	20	17	-15%	1.28	1.02	-20%
20	Minneapolis ARTCC	13	15	15%	0.64	0.70	9%
21.	Chicago TRACON*	13	14	8%	1.04	1.00	-4%
22.	Salt Lake City ARTCC	8	12	50%	0.54	0.78	45%
23.	Oakland Bay TRACON*	6	8	33%	0.57	0.74	29%
24.	Miami Airport TRACON/Tower**	2	8	300%	0.14	0.53	284%
25.	Washington-Dulles Airport TRACON/Tower**	2	7	250%	0.21	0.56	159%
	Total Top 25	505	818	62%	1.07	1.52	42%
	Nationwide Total	764	1,154	51%	0.51	0.68	33%

Notes:

***** These TRACON facilities are stand-alone facilities and provide TRACON services only.

** Miami and Washington-Dulles Airports' operational errors include both the TRACON and control tower as these services are combined into one facility.

EXHIBIT D

FY 2000 Top 25 Facilities for Operational Deviations and Changes From FY 1996

	Facility	Number of Deviations FY 1996	Number of Deviations FY 2000	Percent Increase/ Decrease	Rate of Deviations FY 1996	Rate of Deviations FY 2000	Percent Increase/ Decrease
1.	**Dallas-Fort Worth ARTCC**	**7**	**26**	**271%**	**0.33**	**1.16**	**253%**
2.	**Cleveland ARTCC**	**4**	**25**	**525%**	**0.14**	**0.78**	**453%**
3.	**Memphis ARTCC**	**1**	**19**	**1800%**	**0.05**	**0.85**	**1586%**
4.	**Houston ARTCC**	**1**	**17**	**1600%**	**0.05**	**0.82**	**1450%**
5.	**New York ARTCC**	**8**	**15**	**88%**	**0.37**	**0.52**	**38%**
6.	**Atlanta ARTCC**	**8**	**12**	**50%**	**0.33**	**0.41**	**25%**
7.	**Washington ARTCC**	**3**	**11**	**267%**	**0.13**	**0.40**	**206%**
8.	**Kansas City ARTCC**	**1**	**11**	**1000%**	**0.05**	**0.50**	**885%**
9.	**Jacksonville ARTCC**	**5**	**11**	**120%**	**0.27**	**0.48**	**81%**
10.	**Southern California TRACON***	**4**	**10**	**150%**	**0.17**	**0.40**	**134%**
11	**Indianapolis ARTCC**	**1**	**9**	**800%**	**0.05**	**0.33**	**623%**
12.	San Juan CERAP***	6	8	33%	1.18	1.28	8%
13.	Anchorage ARTCC	3	8	167%	0.56	1.43	155%
14.	**Chicago ARTCC**	**1**	**7**	**600%**	**0.03**	**0.24**	**589%**
15.	Indianapolis Airport TRACON/Tower**	0	7	700%	0.00	1.10	110%
16.	**Minneapolis ARTCC**	**1**	**6**	**500%**	**0.05**	**0.28**	**507%**
17.	**Oakland ARTCC**	**2**	**5**	**150%**	**0.13**	**0.30**	**134%**
18.	Seattle ARTCC	3	5	67%	0.22	0.34	60%
19.	**Denver ARTCC**	**4**	**5**	**25%**	**0.27**	**0.29**	**9%**
20	Nashville Airport TRACON/Tower	0	5	500%	0.00	0.88	88%
21.	Washington Reagan National Airport TRACON/Tower	0	4	400%	0.00	0.41	41%
22.	Philadelphia Airport TRACON/Tower	0	4	400%	0.00	0.34	34%
23.	**New York TRACON***	**5**	**4**	**-20%**	**0.27**	**0.19**	**-28%**
24.	Daytona Beach Airport TRACON/Tower	0	4	400%	0.00	0.41	41%
25.	**Washington-Dulles Airport TRACON/Tower**	**0**	**3**	**300%**	**0.00**	**0.24**	**24%**
	Total Top 25	68	241	254%	0.17	0.51	200%
	Nationwide Total	142	358	152%	.09	0.21	133%

Notes:

***** These TRACONs are stand-alone facilities and provide TRACON services only.

** These airports' operational errors include both the TRACON and control tower as these services are combined into one facility.

*** CERAP = Center/Radar Approach Control and is a combined en route and approach control facility.

Bolded Facilities (17) are also within the top 25 for operational errors