Office of Inspector General

Audit Report

FAA'S EFFORTS TO TRACK AND MITIGATE AIR TRAFFIC LOSSES OF SEPARATION ARE LIMITED BY DATA COLLECTION AND IMPLEMENTATION CHALLENGES

Federal Aviation Administration

Report Number: AV-2013-046
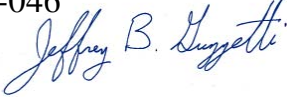*Date Issued: February 27, 2013*

Memorandum

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

Subject: <u>ACTION</u>: FAA's Efforts To Track and Mitigate Air Traffic Losses of Separation Are Limited by Data Collection and Implementation Challenges Report No. AV-2013-046

Date: February 27, 2013

From: Jeffrey B. Guzzetti
Assistant Inspector General
for Aviation and Special Program Audits

Reply to Attn. of: JA-10

To: Federal Aviation Administrator

The Nation's air traffic controllers play an important role in maintaining the world's safest air transportation system. Yet, losses of standard separation—when aircraft do not maintain the minimum distance apart—remain a significant safety concern. In January 2011, an operational error—a loss of standard separation caused by air traffic controllers[1]—led to a near mid-air collision between a commercial airliner and two military aircraft near New York City. According to the National Transportation Safety Board (NTSB), who investigated the incident, at their closest point, the aircraft came within a mile of each other. According to Federal Aviation Administration (FAA) statistics, the number of reported operational errors increased by more than 50 percent between fiscal years 2009 and 2010.

Concerned with this increase, the Senate Committee on Commerce, Science, and Transportation and the Subcommittee on Aviation Operations, Safety, and Security requested that we review FAA's ongoing efforts to assess operational errors and mitigate their risks. We also received a similar request from the House Committee on Transportation and Infrastructure. Accordingly, we (1) identified the reasons for the increase in losses of separation—specifically operational errors—from fiscal years 2009 to 2010; (2) assessed the effectiveness of FAA's policies and processes to collect, investigate, and report separation losses; and (3) evaluated the effectiveness of FAA's policies and processes to mitigate the risk of separation losses.

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[1] Most losses of separation are classified as either an operational error (if the controller's actions caused the loss) or a pilot deviation (if the pilot's actions caused the loss).

We conducted this audit in accordance with generally accepted Government auditing standards. Exhibit A details our scope and methodology. Exhibit B lists the organizations we visited or contacted.

RESULTS IN BRIEF

According to FAA, the dramatic increase in reported operational errors between fiscal years 2009 and 2010 was mostly due to increased reporting through programs such as the Air Traffic Safety Action Program (ATSAP)[2] and the Traffic Analysis and Review Program (TARP), an automated system to detect losses of separation at air traffic terminal facilities.[3] However, we found that the increase in reported errors was linked, in part, to a rise in actual errors rather than increased reporting. For example, FAA's air route traffic control centers (ARTCC)[4]—which have had an automated system in place for years to detect and investigate reported errors—had a 39 percent increase in operational errors during the same period. In addition, we identified other contributing factors to the rise in the number of operational errors. For example, almost one-quarter of the increase is due to the revocation of a separation waiver at the Southern California Terminal Radar Approach Control (TRACON) that led to the reclassification of many routine approach and landings as operational errors.[5]

FAA's new policies and procedures for collecting, investigating, and reporting separation losses have the potential to reduce losses and improve reporting, but their effectiveness is limited by incomplete data and implementation challenges. Under FAA's new policies, FAA uses TARP to detect losses, then examines the risk of these losses, and identifies corrective actions. FAA's Air Traffic Organization (ATO) has three regional air traffic Service Areas that review TARP alerts to determine whether a valid loss of separation occurred. However, FAA currently reviews only a portion of all TARP alerts. In addition, ATSAP data indicate that more operational errors might be occurring than those that FAA reports. As we reported last year,[6] approximately 50 percent of all ATSAP event reports[7] are classified as "unknown," which means that the event captured in the

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[2] ATSAP is a voluntary, non-punitive program in which controllers can self-report safety instances and concerns. In July 2012, we issued a separate report on FAA's implementation of ATSAP (OIG Report Number 2012-152, "Long-Term Success of ATSAP Will Require Improvements in Oversight, Accountability, and Transparency" July 19, 2012). OIG reports are available on our Web site at http://www.oig.dot.gov/.

[3] Terminal facilities include airport traffic control towers and Terminal Radar Approach Control (TRACON) facilities. Air traffic control towers separate aircraft on the airport surface and guide aircraft as they take off and land. TRACONs guide aircraft as they approach or leave airspace surrounding airports to about 40 miles away.

[4] ARTCC guide aircraft flying at high altitudes, generally above 17,000 feet.

[5] The waiver allowed aircraft landing simultaneously to be closer than normally allowed. Air Traffic Safety Oversight Service revoked the waiver because it considered it unsafe, and subsequently, reclassified aircraft landings that occurred under the waiver as operational errors.

[6] OIG Report Number 2012-152, "Long-Term Success of ATSAP Will Require Improvements in Oversight, Accountability, and Transparency," July 19, 2012.

[7] Event reports identify actual or potential losses of separation, including operational errors, or other situations that may degrade air traffic safety.

confidential ATSAP report was not captured in FAA's Air Traffic Quality Assurance (ATQA) database,[8] and therefore, unknown to the air traffic facility management. Any losses of separation included in these unknown reports may not be in FAA's official count. At the same time, FAA's training for controllers and managers on the new policies and procedures has been limited. Facility officials said that while FAA training on new procedures was helpful for explaining the reasons for the changes to the procedures, it failed to explain the technical aspects of how errors should be reported. For example, facility officials said they received limited training on how to use a new database to store data on losses of separation. Managers at 15 of 25 of the air traffic facilities we visited[9] also raised concerns that the three ATO Service Areas may not have enough staff or knowledge of local flight procedures and airspace to effectively investigate operational errors.

Recently, FAA developed corrective action plans to mitigate high-risk separation loss events—such as an aircraft executing an unexpected go-around[10] and aircraft arriving at the same altitude on parallel runways. However, because the Agency has not completed implementation of the action plans, it is too early to determine whether the plans will reduce the number of separation losses. In addition, FAA's corrective action plans do not include all safety risks identified by FAA and will not address all losses of separation that air traffic facility officials consider to be high risk. For example, FAA's process may not consider an instance of converging aircraft prevented from collision by Traffic Collision Avoidance Systems (TCAS)[11] to be a high-risk event if over 66 percent of the required separation was maintained. However, facility officials stated this type of event should be considered high risk regardless of the amount of separation loss because the controller introduced the risk of collision.

We are making recommendations to improve FAA's policies and processes for identifying and mitigating separation losses.

BACKGROUND

At any given time, there are roughly 7,000 aircraft occupying U.S. airspace. To help maintain safe distances between aircraft, while under the control of air traffic controllers, FAA established minimum separation standards based on the aircraft's phase of flight and size. Controllers are responsible for providing instructions to pilots.

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[8] Prior to January 30, 2012, ATQA contained reports of losses of separation. After this date, FAA began to replace ATQA with the Comprehensive Electronic Data Analysis and Reporting (CEDAR) database.

[9] These 25 facilities include: 9 ARTCCs, 11 TRACONs, 2 air traffic control towers, and 3 ATO Service Areas. Nationwide, there are a total of 21 ARTCCs (within the continental U.S), 28 TRACONS, 513 air traffic control towers, and 3 ATO Service Areas. Our selection criteria for facilities we visited are in Exhibit A. A listing of the facilities visited is in Exhibit B.

[10] A go around is an aborted landing of an aircraft on final approach to the runway.

[11] An onboard TCAS issues advisories for pilots to take evasive actions when the system detects a potential collision with another aircraft.

We have been reporting on separation losses for over a decade. Historically, FAA's oversight of operational error self-reporting has been problematic. Our previous work (see exhibit C) on operational errors has repeatedly raised concerns that nearly 300 FAA terminal facilities relied solely on controllers to self-report errors. In some cases, we found that the self-reporting process was subject to intentional manipulation.[12] More recently, in 2009, we found that inadequate guidance and insufficient staff contributed in part to control and oversight weaknesses in FAA's process for reporting and investigating losses.

In response to our reports, FAA has undertaken a number of efforts to provide better oversight of and minimize separation losses, including the following:

- **FAA implemented the Risk Analysis Process (RAP), a new risk-based approach to address losses of separation.** RAP consists of a panel of at least two controllers and a pilot. Three panels, one in each ATO Service Area, review separation losses for events in which pilots maintain less than 66 percent of required separation. For example, if aircraft are required to be separated by 3 miles, a separation of less than 2 miles (66 percent of 3 miles) would be reviewed under RAP. FAA reviews various risk factors, including the severity and repeatability of the event, and identifies the highest risk events[13] to develop a list of the top five highest risk types of separation losses, along with corrective actions to address such hazards.

- **FAA revised its process for tracking high-risk errors.** Previously, FAA tracked operational errors using a severity rating of A, B, or C—with A being the highest or most severe risk and C the lowest. The rating was based on the proximity of the aircraft to one another.[14] As a performance measure, prior to fiscal year 2011, FAA reported the rate of A and B errors per every thousand operations. However, in fiscal year 2011, FAA developed a new metric, the System Risk Event Rate (SRER), based on the high-risk events identified in RAP. This metric identifies the ratio between separation losses identified as high risk to all losses of separation. FAA's goal is to limit the rate of high risk of standard separation losses to 20 or fewer for every 1,000 standard separation losses.

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[12] For example, in both 2005 and again in 2008, our investigations at the Dallas/Fort Worth TRACON found that air traffic managers intentionally misclassified operational errors as either pilot deviations or "non-events" to reduce the number of operational errors reported at that location. Further, FAA's oversight processes failed to uncover this practice despite FAA's prior assurances that it would not allow operational errors to go unreported.
[13] Based on a risk assessment model used by the Eurocontrol, the European Organization for the Safety of Air Navigation.
[14] An "A" rating (high/severe risk) meant that less than 34 percent of separation standards were met; a "B" rating (moderate risk) at least 34 and less than 75 percent of separation standards were met; and a "C" rating (low risk) 75 percent or more of separation standards were met, but the horizontal and vertical separation is less than 90 percent. Proximity events are minor losses of separation between two aircraft where 90 percent or greater of the required separation is maintained.

- **FAA issued orders changing its process for identifying, investigating, and reporting losses of separation on January 30, 2012.** One of the fundamental differences under the new orders is FAA's decision to move the responsibility for investigating losses of separation from specific air traffic facilities (where the losses in question occurred) to three ATO Service Areas.[15]

VARIOUS FACTORS CONTRIBUTED TO THE DRAMATIC INCREASE IN REPORTED OPERATIONAL ERRORS

In the years leading up to fiscal year 2009, reported operational errors remained relatively stable (see figure 1). However, between fiscal years 2009 and 2010, reported operational errors increased 53 percent, from 1,234 to 1,887. FAA's recent numbers show a rise in the most serious Category A errors—from 37 in fiscal year 2009 to 43 in fiscal year 2010, and again to 55 in fiscal year 2011. Also, for fiscal years 2008, 2009, and 2010, FAA exceeded its target limits for the number of category A and B operational errors per million operations.[16] In addition, FAA did not meet its fiscal year 2011 goal of reducing high-risk events to no more than 20 per 1,000 separation losses; instead, the rate was 24.5 per 1,000, or 23 percent higher than its goal.

Figure 1. Operational Errors for Fiscal Years 2006 Through 2011
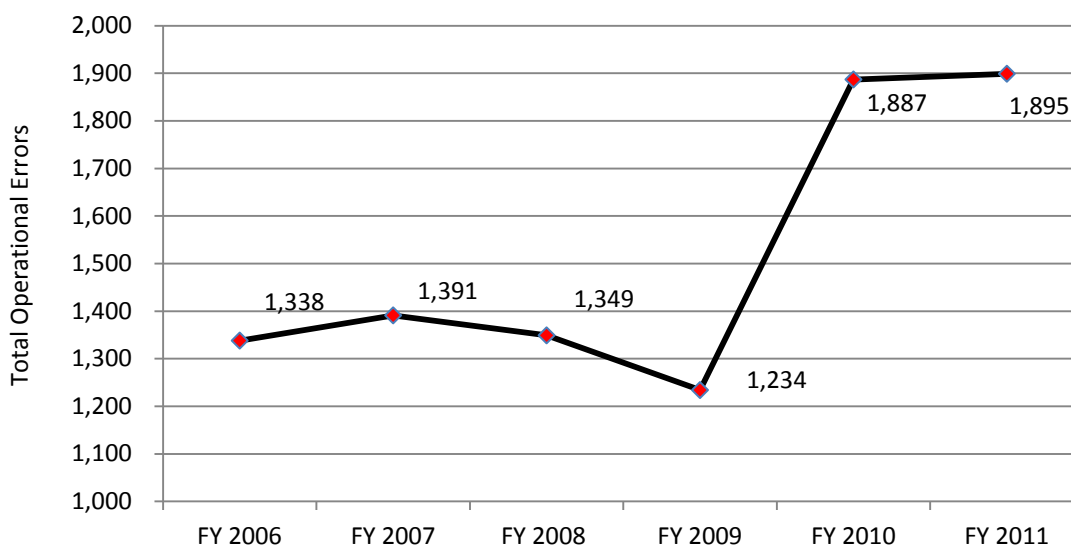
Source: OIG analysis of FAA data.

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[15] FAA was prompted in part by our April 2008 recommendation to remove the quality assurance function at all Air Traffic Control facilities from the supervision of facility management. We made this recommendation because we reported in 2005 and 2008 that Dallas/Ft. Worth TRACON intentionally misclassified operational errors. See OIG Report No. CC-2007-083, "OIG Investigation-Alleged Cover-up of Operational Errors at DFW TRACON," April 18, 2008.

[16] In fiscal year 2008, FAA goal was 2.15 A and B operational errors per million operations and the reported number was 2.25. In fiscal year 2009, the goal was 2.10 and the reported number was 2.44. In fiscal year 2010, the goal was 2.05 and the reported number was 3.32.

A large percentage of the increases in operational errors reported between fiscal years 2009 and 2010 occurred at the same 10 facilities—60 percent of the total increase of 653 errors (see table 1). TRACONs had the largest increase in reported errors—86 percent.

Table 1. Ten Air Traffic Facilities With the Largest Increase in Operational Errors From Fiscal Year 2009 to Fiscal Year 2010

Facility	FY 2009	FY 2010	Percent Increase
Southern California TRACON	33	189	473%
Central Florida TRACON	5	24	380%
Houston TRACON	11	44	300%
Miami ARTCC	15	30	100%
Potomac TRACON	21	41	95%
Dallas/Fort Worth TRACON	84	143	70%
Charlotte Douglas International Airport Air Traffic Control Tower	20	34	70%
New York TRACON	74	119	61%
New York ARTCC	25	40	60%
Atlanta ARTCC	35	50	43%
Total	**323**	**714**	**121%**

Source: OIG analysis of FAA data.

According to FAA, increased ATSAP reporting contributed to the 53 percent increase in reported operational errors between fiscal years 2009 and 2010. While non-punitive reporting may encourage more controllers to report errors, we identified other factors that contributed to the increase. Additionally, managers and controllers we spoke with at 7 of the 10 facilities attributed the increases to other factors. These factors include the following:

- **ARTCC automated reporting indicates an increase in actual errors.** The number of errors reported at FAA's ARTCCs—which have had a full-time detection tool in use for many years—also increased from fiscal year 2009 to 2010 (from 353 to 489, an increase of 39 percent). This suggests that a portion of the overall increase is due to more errors actually occurring, rather than being attributable entirely to improved reporting.

- **FAA reclassified 147 aircraft landings guided by the Southern California TRACON as operational errors.** Originally, the landings were not classified as errors because the TRACON was operating under a waiver that allowed aircraft landing simultaneously to be closer than normally allowed. In 2010, the Air Traffic Safety Oversight Service revoked the waiver, citing safety

concerns, and subsequently reclassified aircraft landings that occurred under the waiver. This accounted for 23 percent of the increase.

- **Improved radar and voice replay tools have facilitated incident reviews, allowing them to more readily determine whether an operational error occurred.** Fewer errors may have been discovered under prior incident reviews because of the difficulty obtaining data.

- **FAA has placed additional emphasis on ensuring correct phrasing when pilots read back controllers' instructions.** For example, FAA officials stated that greater emphasis has been placed on ensuring correct readbacks for visual separation procedures. If the controller fails to catch and correct inadequate readbacks, the event is reported as an operational error. Previously, these types of events were not reported as rigorously.

EFFECTIVENESS OF FAA'S POLICIES AND PROCEDURES TO COLLECT, INVESTIGATE, AND REPORT SEPARATION LOSSES IS LIMITED

FAA's policies and procedures to identify and report on losses of separation are limited by incomplete data and implementation challenges. For example, FAA lacks an accurate baseline of the actual total number of separation losses that occur. In addition, facility managers expressed concerns that FAA's training is not comprehensive in explaining how to use the new operational error reports database under the new procedures. Facility staff are also concerned about FAA's decision to move the responsibility for investigating errors to ATO Service Areas, which may not have adequate staffing levels and familiarity of each facility's operations.

Data Collection Deficiencies and Reporting Inconsistencies Limit FAA's Efforts To Track Separation Losses

FAA does not have an accurate baseline of separation losses due to gaps in TARP and ATSAP reporting and inconsistent classifications of losses. A complete picture of losses that occur is critical for FAA to track, fully address, and mitigate the risk of separation losses in the National Airspace System.

In 2009, we recommended that FAA fully implement TARP at its air traffic facilities.[17] Although TARP has been installed and running at air traffic terminal facilities,[18] FAA does not analyze and report all separation losses that are automatically flagged by TARP. TARP provides alerts when a potential loss of separation occurs. Then, FAA must investigate the TARP alerts to determine

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[17] OIG Report No. AV-2009-045, "FAA's Process for Reporting and Investigating Operational Errors", March 24, 2009.

[18] Terminal facilities are TRACONs and airport control towers.

whether an actual loss of separation happened. FAA Service Area staff only investigate losses of separation of less than 70 percent.[19]

In addition, ATSAP data indicate that more losses of separation might be occurring than those that are known to facility management. As we reported in 2012,[20] approximately 50 percent of all ATSAP event reports[21] are classified as "unknown," which means that the event captured in the confidential ATSAP report was not captured in FAA's Air Traffic Quality Assurance (ATQA) database,[22] and therefore, unknown to the air traffic facility management. Any losses of separation included in these unknown reports may not be in FAA's official count.

Inconsistencies in FAA's classification of separation losses further reduce the reliability of the Agency's count of operational errors and runway incursions. For example, in fiscal year 2011, there were a total of 1,895 reported operational errors, a negligible increase from the 1,887 reported in fiscal year 2010. However, the fiscal year 2011 count does not include 157 events classified as runway incursions[23] that occurred in August 2011 at Charlotte-Douglas International Airport. FAA reclassified the incursions as non-events due to its interpretation of the definition of a runway incursion and the judgment by senior Agency officials that safety was not compromised.[24] Runway incursions are considered to be operational errors when an air traffic controller is the cause. Therefore, had the classification to non-events not occurred, the fiscal year 2011 operational error count would have increased by 9 percent of the number of reported errors the previous year.

Staffing Challenges Undermine FAA's Efforts To Investigate Separation Losses

FAA faces significant staffing challenges with implementing its new procedures for investigating separation losses. Prior to January 30, 2012—when FAA implemented the new procedures—investigations were conducted at the Nation's more than 300 air traffic facilities. Therefore, conservatively, at least 300 staff conducted investigations on at least a part-time basis. With the implementation of

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[19] Losses of separation in which less than 70 percent of the separation was maintained.

[20] OIG Report Number 2012-152, "Long-Term Success of ATSAP Will Require Improvements in Oversight, Accountability, and Transparency," July 19, 2012.

[21] Event reports include identify actual or potential losses of separation, including operational errors, or other situations that may degrade air traffic safety.

[22] Prior to January 30, 2012, ATQA contained reports of losses of separation. After this date, FAA began to replace ATQA with the Comprehensive Electronic Data Analysis and Reporting (CEDAR) database.

[23] The definition of a runway incursion is any occurrence at an airport involving "the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing or take-off of aircraft."

[24] The errors involved the continued clearance of 157 take-offs and landings on a runway that was in close proximity to a disabled commercial airplane that had previously aborted a takeoff and was cleared off the runway onto an adjacent taxiway for maintenance. A portion of the disabled airplane intruded upon the protected area of the active runway environment.

FAA's new procedures, the number of personnel investigating losses of separation has been substantially reduced. Currently, FAA has a total of 16 staff in the three Service Areas to investigate the high numbers of separation losses that occur. However, the Agency plans to hire additional staff.

FAA faces substantial staffing challenges in several areas, including:

- **Increased workload:** Once TARP data from all facilities with TARP are reviewed by Service Areas, FAA estimates that an additional 600 to 900 reports of separation losses will need to be reviewed each day.

- **Available tools:** FAA has not fully implemented the Digital Audio Legal Recorder, which allow staff in the Service Areas to obtain air traffic audio data remotely and review audio replays of incidents. Without this automated tool, staff must request the facility to send the audio data for each incident to their Service Area, which could delay investigations of separation losses. FAA is aware of this issue and plans to address it as implementation continues.

- **Training:** Some facility officials stated that the FAA training on new procedures was helpful for explaining the reasons for the changes to the procedures, but failed to explain the technical aspects of how things should be done. For example, as part of its new procedures, FAA replaced its previous ATQA reporting database with a new database called Comprehensive Electronic Data Analysis and Reporting (CEDAR) for completing loss of separation reports. Yet facilities received limited training on how to use the new database. Additionally, FAA acknowledged that a lack of facility training on how to properly complete operational error reports contributed to incomplete or inadequate causal data in its ATQA database. In ATQA, descriptions in the causal section of these reports often provided limited information about the cause of the errors. For example, according to FAA, the causal factor called "inappropriate use of displayed data [on aircraft]" was identified as the cause in 50 percent of all ATQA reports. This description of cause did not always identify the cause of the incident such as a training deficiency, fatigue, or a lack of experience.

- **Knowledge of local facility operations:** Air Traffic facility officials questioned whether the Service Center staff have knowledge of each facility's local procedures and operations such as the expertise and technical knowledge related to aircraft routing and altitudes covered by a facility, particularly in complex areas in large cities.

FAA'S NEW CORRECTIVE ACTION PLANS DO NOT ADDRESS ALL SAFETY CONCERNS RELATED TO SEPARATION LOSSES

FAA has developed a new strategy to mitigate separation losses—including implementing corrective action plans to reduce the five highest risk events. However, FAA does not examine all losses of separation that air traffic officials considered to be high risk. Facility officials also question the effectiveness of FAA's mitigation efforts.

FAA's Corrective Action Plans Do Not Include Safety Risks and Causal Factors Identified in Previous FAA Analyses

In fiscal year 2011, FAA developed new corrective action plans to reduce the five highest risk separation loss events identified through RAP. For example, two of the top five risk categories involve loss of separation when an aircraft overshoots the turn to final approach on parallel runways and conflicts with another aircraft. FAA's plans to mitigate these risks include the following:

- limit the turn to final angle of no more than 30 degrees (see figure 2);

- require altitude separation of at least 1,000 feet prior to application of visual separation; and

- develop airport-specific speed restrictions for final approach courses.

Figure 2. Example of a Corrective Action Plan Initiative
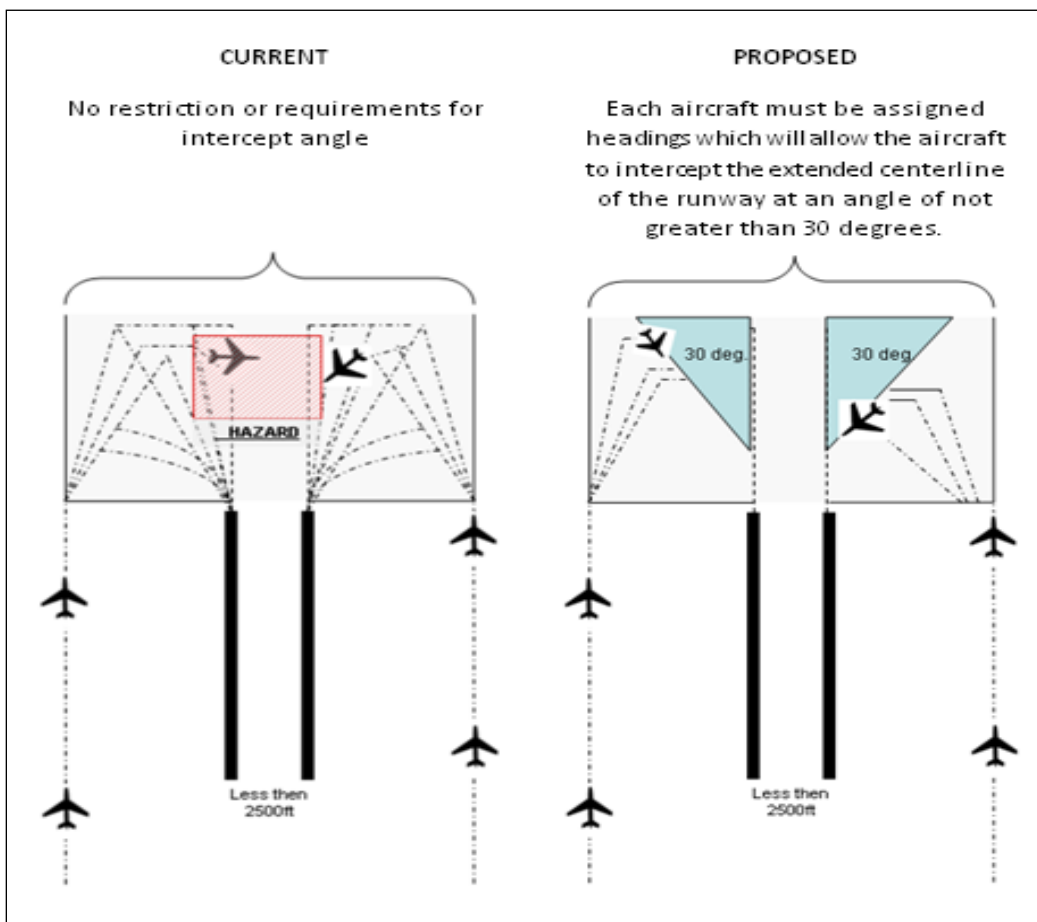
Source: FAA.

FAA also identified factors contributing to the top five high-risk events (see table 2).

Table 2. Overview of Top Five Risk Categories and Corrective Action Plans

Top Five Event Category	Causal Factors	Key Corrective Action Plan Initiatives
1. Arrival aircraft executes an unexpected go around	Lack of adequate go around procedures	Each facility must define local procedures for go arounds.
2. Arriving aircraft at the same altitude on parallel runways.	Aircraft overshoot the turn to final and conflict with parallel traffic same altitude.	Proposal to require aircraft on flight paths at right angles to the landing runway to be assigned altitudes at least 1,000 feet apart until visual separation is established.
3. Aircraft at an altitude other than expected.	(a) Breakdown of communications (b) Incorrect data block altitudes prevent conflict alert activation	Investigate the feasibility of using "Mode S" technology to allow controllers to view the altitudes pilots have entered into aircraft systems.
4. Aircraft in unexpected position resulting in a loss of separation.	Controller Coordination: Aircraft transferred to another controller on route or at different altitude than expected.	Develop training to address coordination.
5. Aircraft vectored at speed and/or angle of intercept, leading to loss of separation.	Current air traffic procedures (7110.65) allow aircraft to turn to final approach at excessive speed and excessive intercept angle.	Proposed procedure changes to: (1) require headings that allow an intercept angle to final approach of no greater than 30 degrees, and (2) require development of local speed restrictions for facilities that vector to final approach on parallel runways.

Source: FAA.

However, FAA's corrective action plans, which were finalized in July 2011, do not address previously identified causal factors, trends based on the factors, or follow-up actions to address them. In particular, in June 2011, RAP identified perception, memory, training, and experience as the top causal factors for high-risk events. Also, the RAP panel identified training and on-the job training as key corrective action areas and recommended FAA:

- **Develop specific training requirements and curriculum to address poor recovery.** Of all events analyzed through RAP, 41 percent involved poor recovery from a loss of separation. The RAP panel also found over half of the recovery efforts worsened the situation, causing the aircraft to be in closer proximity. Furthermore, RAP determined that of the 87 most severe risk analysis events, 76 (or 87 percent) involved poor air traffic control recovery.

- **Conduct root cause analyses and determine the best way to address incidents that occur during on-the-job training.** These incidents accounted for 10 percent of all analyzed events.

FAA chose to exclude these causal factors (perception, memory, training, and experience) and trends (poor recovery and on-the-job training) from the corrective action plans because it considered them to be "contextual." However, a 2005 study published by FAA[25] found that the majority (86 percent) of operational errors reviewed were "skill-based errors," which tend to be "the result of habitual actions associated with an individual's attention, memory, and/or execution technique." The study's finding is similar to causal factors identified by FAA in its 2011 RAP document. Also, the trend of poor recovery was present in the majority of the most severe risk analysis events reviewed.

Facility Officials Question the Effectiveness of Mitigation Efforts

Facility officials questioned the overall effectiveness of FAA's corrective action plans. While the new air traffic procedures proposed in the plans are reviewed for risk through the Safety Management System[26] (SMS) process, facility officials had concerns with the proposed procedures, as shown in table 3 below.

Table 3. FAA Proposals To Mitigate Losses of Separation and Facility Officials' Concerns With Them

FAA Proposals for Facilities	Facility Officials' Concerns
Determine facility-specific speed requirements to reduce the potential of an aircraft overshooting a runway	Controllers should let aircraft fly the most efficient approach, unless speed control for separation is required.
Determine the feasibility of the potential benefits from automatically relaying additional altitude information from the aircraft's autopilot to controllers	FAA must consider the impact of this information on controller workload.
Define procedures for go-arounds and missed approaches	Controllers must assess the situation and make the best decision based on established procedures and other traffic. Facilities cannot plan for every scenario, because varying traffic flows can affect the best option for controllers.

Source: FAA and OIG analysis.

Finally, air traffic facility officials are concerned that FAA's RAP, SRER, and corrective action plans do not include events they consider to be high-risk, such as those for which the loss of separation was more than 66 percent. For example, converging aircraft prevented from colliding by the Traffic Collision and

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[25] "Examining ATC Operational Errors Using the Human Factors Analysis and Classification System," DOT/FAA/AM-05/25, FAA Office of Aerospace Medicine, December 2005.

[26] FAA defines the Safety Management System as an integrated collection of processes, procedures, policies, and programs that are used to assess, define, and manage the safety risk in providing ATC and navigation services.

Avoidance System (TCAS) could be a high-risk event regardless of the degree of separation loss. TCAS, an automated cockpit avoidance system, operates independently from the ground-based Air Traffic Control system and serves as a last line of defense for preventing mid-air collisions. In other words, use of the TCAS system could indicate a high-risk event because it is an event in which the controller failed to separate aircraft and introduced the risk of collision. Yet FAA's mitigation plans do not include all of these events.

CONCLUSION

Reported losses of separation continue to be a major air safety concern, particularly in light of dramatic increases in their occurrence. While FAA recently issued new policies and processes for investigating and mitigating separation losses, a lack of a reliable baseline creates substantial challenges for FAA to ensure these new policies and processes are effective. Until FAA takes action to determine the true magnitude of operational errors, assess their potential safety impacts, identify their root causes, and align adequate staffing for oversight, the risk of separation losses will remain a safety concern.

RECOMMENDATIONS

To improve its policies and processes for collecting, investigating, and reporting separation losses, and mitigating their risks, we recommend that FAA:

1. Include all losses of separation that are reported under ATSAP, but unknown to air traffic facilities, in its official count of such events.

2. Determine the level of staff and expertise needed at the ATO Service Areas to effectively implement ATO's new Orders on investigating losses of separation, audit all TARP data, and initiate actions to fill those requirements.

3. Determine the extent to which ATO has successfully implemented its new orders (effective January 2012). This determination should include reviews of the quality of separation loss investigation reports, effectiveness of training, and additional actions or resources needed.

4. Include high-risk TCAS warning events in its Risk Analysis Process and System Risk Event Rate when the separation between two converging aircraft is maintained at 66 percent or more.

5. Develop actions to mitigate the following situations identified in the Risk Analysis Process: (1) poor recovery from loss of separation and (2) losses of separation involving on-the-job training.

6. Utilize analysis of the causal and contributory factors derived in the Risk Analysis Process—including perception, memory, and training—to identify the underlying reasons for separation losses and develop mitigation strategies to address those causes.

AGENCY COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

We provided FAA with a draft copy of this report on December 14, 2012, and received FAA's response on January 25, 2013. FAA's response is included in its entirety in the appendix to this report. In its response, FAA fully concurred with recommendations 2, 3, 5, and 6, and partially concurred with recommendations 1 and 4. FAA's planned actions for recommendations 2, 3, 4, and 5 met the intent of our recommendations and included reasonable timeframes for implementation. However, we are requesting that FAA reconsider its response or provide additional information for recommendations 1 and 6, as detailed below.

For recommendation 1, FAA stated that there would be legal and data compatibility concerns with integrating ATSAP-reported losses of separation into its baseline of total separation losses. Further, the Agency stated that TARP captures the vast majority of separation losses and has proven to be the best solution for establishing a new baseline. We agree that the process of fully implementing TARP has generated significantly more data than FAA previously had available. However, FAA is assuming that there is a virtually 100 percent overlap between ATSAP-reported losses and TARP-detected losses,[27] which we question as we are not aware of any effort by FAA to reconcile ATSAP and TARP data. Without this reconciliation, FAA cannot be assured that ATSAP data are being captured in the Agency's counts of losses of separation. FAA also did not provide a rationale for its exclusion of these data, nor has it clarified the legal impediments to integrating ATSAP-reported losses of separation into its total count of separation losses. Furthermore, there are several air traffic facilities with equipment that is not compatible with TARP, including in Honolulu, HI; San Juan, PR; Twin Falls, ID; and Helena, MT. To determine losses of separation at these locations, FAA may rely on manual reporting by controllers, which is less effective, as we have pointed out in our prior work. Therefore, in our opinion, FAA is missing an opportunity to establish a complete and accurate baseline of separation losses by not including ATSAP-reported losses in its count, and we request it reconsider its position on this recommendation.

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[27] FAA does not analyze and report all separation losses that are flagged by TARP. FAA Service Area staff investigate losses of separation identified by TARP of less than 70 percent (i.e., when less than 70 percent of the separation between aircraft was maintained).

For recommendation 6, FAA stated that it believes it has met the intent of our recommendation because its Risk Analysis Process (RAP) and yearly identification of the Top 5 hazards in the NAS use both causal and contributory factors to develop corrective actions and mitigation strategies. However, FAA did not specify how its processes have used the specific causal and contributory factors we included in our recommendation—perception, memory, and training. As we noted in our report, FAA chose to exclude these factors from its corrective action plans because it considered them to be "contextual." Therefore, to ensure that FAA's response meets the full intent of our recommendation, we request that FAA provide us with more information on how RAP uses these factors in its mitigation strategies.

ACTIONS REQUIRED

We consider recommendations 2, 3, 4, and 5 resolved but open pending the completion of the planned actions. We also consider recommendations 6 resolved but open pending receipt of supporting documentation of FAA's actions taken. For recommendation 1, we request that FAA reconsider its position. In accordance with Department of Transportation Order 8000.1C, we request that FAA provide us this additional information within 30 days.

We appreciate the courtesies and cooperation of FAA representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-0500 or Scott Macey, Program Director, at (415) 744-0434.

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cc: DOT Audit Liaison, M-1
     FAA Audit Liaison, AAE-100

EXHIBIT A. SCOPE AND METHODOLOGY

We conducted this audit in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. We conducted this performance audit from June 2011 through December 2012, which included site visits to FAA Headquarters and air traffic facilities nationwide (see exhibit B).

To evaluate the effectiveness of FAA's policies and procedures to collect, investigate, and report separation losses, we interviewed FAA Headquarters officials and analyzed FAA orders, data, and reports on losses of separation. In addition, we interviewed officials and analyzed information at the 30 facilities we contacted to evaluate these issues. We visited or contacted 9 of 21 nationwide Air Route Traffic Control Centers (ARTCC) within the continental United States, 11 of 28 stand-alone Terminal Radar Approach Control (TRACON) facilities, 2 of 513 Air Traffic Control Towers, 4 of 81 Flight Standards District Offices (FSDO),[28] 3 of 3 ATO Service Areas, and 1 of 20 Certificate Management Offices (CMO).[29] Specifically, the OIG statistician selected a stratified random sample of 11 (6 TRACON and 5 ARTCC) out of 41 TRACON and ARTCC facilities that had increases in operational errors from fiscal years 2009 to 2010. We focused on ARTCCs and TRACONs in our sample because these facilities had the largest increases in operational errors between fiscal years 2009 and 2010. Over this time period, errors at TRACONs increased 86 percent while errors at ARTCCs increased 39 percent. We visited 10 of these facilities and had a teleconference with the remaining facility.[30] We also visited 19 other facilities to obtain a broader range of information about operations nationwide including facilities located near our sample sites. A list of the sample sites and additional sites we visited in is exhibit B.

To determine various factors that contribute to increases in reported losses of separation, we interviewed FAA Headquarters officials as to why operational errors increased from fiscal year 2009 to 2010. We also interviewed officials and analyzed information at the 30 facilities we contacted to identify any other contributing factors.

To assess the effectiveness of FAA's efforts to mitigate operational errors, we analyzed mitigations and corrective action plans from FAA Headquarters.

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[28] FSDOs are part of FAA's Flight Standards Service, which promotes safe air transportation by setting the standards for certification and oversight of airmen, air operators, and air agencies.
[29] CMOs specialize in areas such as the certification, surveillance, and inspection of major air carriers.
[30] We teleconferenced with Anchorage Air Route Traffic Control Center.

Exhibit A. Scope and Methodology

Furthermore, we obtained and reviewed mitigation strategies at the 30 facilities we contacted. At both FAA headquarters and the 30 contacted facilities, we interviewed officials for their perspective on operational error mitigation strategies.

Exhibit A. Scope and Methodology

EXHIBIT B. ORGANIZATIONS VISITED OR CONTACTED

Washington Air Route Traffic Control Center (ZDC)
Seattle Air Route Traffic Control Center (ZSE)
Fort Worth Air Route Traffic Control Center (ZFW)
Atlanta Air Route Traffic Control Center (ZTL)*
New York Air Route Traffic Control Center (ZNY)*
Chicago Air Route Traffic Control Center (ZAU)
Cleveland Air Route Traffic Control Center (ZOB)*
Boston Air Route Traffic Control Center (ZBW)*
Anchorage Air Route Traffic Control Center (ZAN)*

Potomac Consolidated Terminal Radar Approach Control (PCT)
Seattle Terminal Radar Approach Control (S46) *
Northern California Terminal Radar Approach Control (NCT)
Southern California Terminal Radar Approach Control (SCT)*
Houston Terminal Radar Approach Control (190)*
Dallas/Fort Worth Terminal Radar Approach Control (DIO)*
Las Vegas Terminal Radar Approach Control (L30)*
New York Terminal Radar Approach Control (N90)*
Chicago Terminal Radar Approach Control (C90)
Cleveland Terminal Radar Approach Control (CLE)
Boston Consolidated Terminal Radar Approach (A90)

Seattle-Tacoma Air Traffic Control Tower (SEA)
Los Angeles International Air Traffic Control Tower (LAX)

Dallas Fort Worth Flight Standards District Office (DFW FSDO)
Atlanta Flight Standards District Office (ATL FSDO)
New York City Flight Standards District Office (NYC FSDO)
Chicago O'Hare Flight Standards District Office (ORD FSDO)

Delta Certificate Management Office (Delta CMO)

FAA Western Service Area
FAA Central Service Area
FAA Eastern Service Area

*This facility was part of our 11 facility sample.

Exhibit B. Organizations Visited or Contacted

EXHIBIT C. DOT OIG REPORTS ON OPERATIONAL ERRORS SINCE 2000

Issue Date and Title	Key Findings
March 24, 2009 *FAA's Process for Reporting and Investigating Operational Errors* (AV-2009-045)	Control and oversight weaknesses in FAA's process for reporting and investigating losses of separation caused by pilots and controllers. These weaknesses were due in part to inadequate FAA guidance for investigating these events and insufficient staffing in the Air Traffic Organization (ATO) Safety Office. Further, FAA's processes did not ensure that all losses of separation were accurately reported across terminal and en route facilities or consistently evaluated for severity.
April 18, 2008 OIG Investigation- Alleged Cover-up of Operational Errors at DFW TRACON (CC-2007-083),	Air traffic managers at the TRACON intentionally misclassified operational errors as either pilot deviations or "non-events" to reduce the number of operational errors reported at that location. FAA's oversight processes failed to uncover this practice despite FAA's prior assurances that it would not allow operational errors to go unreported.
February 14, 2005 Alleged Cover-up of Operational Errors at DFW TRACON (CC-2004-067)	FAA DFW TRACON managers had failed to investigate, and therefore, underreported operational errors over a seven-year period. In short, management created an atmosphere of self-reporting and other incentives that discouraged employees from identifying operational errors.
September 20, 2004 *Controls Over the Reporting of Operational Errors* (AV-2004-085)	At facilities that handle the most air traffic, FAA relies on supervisors and controllers to self-report when errors have occurred and does not have a system in place to verify that this reporting process is reliable.
April 3, 2003 *Operational Errors and Runway Incursions* (AV-2003-040)	Despite FAA progress in reducing operational errors and runway incursions, the number of incidents remained high. On average, one runway incursion and three operational errors occurred each day in fiscal year 2002. High-risk incursions and errors occurred, on average, once every 10 days and 8 days, respectively.
December 15, 2000 *Actions To Reduce Operational Errors and Deviations Have Not Been Effective* (AV-2001-11)	FAA does not determine the severity of operational errors, and controllers and managers have different perceptions of actions taken when operational errors occur. According to the National Air Traffic Controllers Association, controllers face serious disciplinary actions for committing operational errors. Facilities with the most reported operational errors over the previous 5 fiscal years lacked adequate plans to reduce operational errors. Further FAA has not provided provide strong national oversight to effectively reverse the upward trend in operational errors.

Exhibit C. DOT OIG Reports on Operational Errors Since 2000

EXHIBIT D. MAJOR CONTRIBUTORS TO THIS REPORT

Name	Title
Scott Macey	Program Director
Stephen Jones	Project Manager
Kevin Montgomery	Senior Analyst
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Karen Sloan	Communications Officer
Andrea Nossaman	Senior Writer
Audre Azuolas	Writer-Editor
Petra Swartzlander	Senior Statistician
Megha Joshipura	Statistician

Federal Aviation Administration

Memorandum

Date: January 25, 2013

To: Jeffrey B. Guzzetti, Director, Assistant Inspector General for Aviation and
                 Special Program Audits

From: H. Clayton Foushee, Director, Office of Audit and Evaluation, AAE-1

Subject: Response to Office of the Inspector General (OIG) Review of FAA's Efforts to
                 Track and Mitigate Air Traffic Losses of Separation

The Federal Aviation Administration (FAA) through its Air Traffic Organization (ATO) is committed to conducting safe operations throughout the Nation Airspace System (NAS). Tracking data relating to aircraft operations that do not maintain standard separation distances is an important component of risk assessment in the NAS and is used to develop appropriate corrective actions when significant risks are identified.

In January of 2012, the ATO implemented a significant change in the way safety data, including losses of separation, are reported, analyzed, and acted upon. These changes improve utilization of the Air Traffic Safety Action Program (ATSAP), which is a non-punitive reporting system, as well as the Traffic Analysis and Review Program (TARP), which electronically identifies losses of separation. As a result, the ATO has seen a dramatic increase in reporting and now has available unprecedented amounts of both qualitative safety data, through ATSAP, and quantitative data from TARP. The validation and analysis processes that have been implemented have greatly enhanced the agency's ability to identify and prioritize high risk hazards, which are addressed through the ATO's Top 5 program. This program provides a forum for a coordinated and collaborative approach to identify and mitigate risks through the most effective means available, including training, procedures, and technological improvements.

The ATO continues to implement enhancements in training, procedures, and technology based on its use of a dramatically improved reporting, with many new initiatives planned throughout 2013, which offer the potential to further enhance the safety of operations in the NAS.

RECOMMENDATIONS AND RESPONSES

OIG Recommendation 1: Include all losses of separation that are reported under ATSAP, but unknown to air traffic facilities, in its official count of such events.

FAA Response: Partially-concur. The FAA agrees that knowledge of operational incidents is crucial to its ability to identify and address safety trends. In order to achieve that goal FAA

successfully developed and is in the process of fully implementing the TARP system that captures quantitative data relating to the vast majority of occurrences that involve loss of separation. TARP was fully implemented at all terminal radar facilities in September 2012. FAA is now developing TARP for En Route facilities, and with implementation targeted for May 2013. TARP has already demonstrated its capability to operate effectively in the terminal environment, and is generating ten times the amount of data FAA previously had available relating to loss of separation. Further, the system increases the utility of the data captured by consolidating the information into a single database available to all facilities. Increased reporting is a key strategy to improve air traffic safety and TARP has already proven to be the best solution for the FAA to establish a new baseline of reporting losses of separation. Incorporating ATSAP data, as recommended would bring about significant legal issues with regard to the use of this information and introduce considerable data compatibility problems. As a result, FAA is focused on fully implementing and utilizing the vast amount of new data made available by TARP, which provides the most accurate available metric for these occurrences.

OIG Recommendation 2: Determine the level of staff and expertise needed at the ATO Service Areas to effectively implement ATO's new Orders on investigating losses of separation, audit all TARP data, and initiate actions to fill those requirements.

FAA Response: Concur. The FAA Air Traffic Organization (ATO) has just completed the largest and most significant improvements in the last 30 years to the way air traffic control risk and safety performance are managed in the United States. From the implementation of voluntary reporting, to electronic detection, the development of standardized risk assessment processes and the establishment of a proactive safety management system, the ATO is now able to identify precursors to risk rather than just react to single incidents. Our processes and metrics need to mature before a proper baseline can be established. We have made commitments to the Office of the Secretary and the Office of Management and Budget that at the end of FY14 we will have established sound baseline for metrics based upon about two years' worth of data. With the experience developed over that period, FAA will be better able to understand the staffing requirements for making full and appropriate use of this newly available data. While FAA will continue to evaluate informally resource requirements over the implementation period, it intends to conduct a formal staffing study for TARP management and analysis by October 1, 2015.

OIG Recommendation 3: Determine the extent to which ATO has successfully implemented its new orders (effective January 2012). This determination should include reviews of the quality of separation loss investigation reports, effectiveness of training, and additional actions or resources needed.

FAA Response: Concur. The ATO combined its Safety and Technical Training offices into one service unit in 2012 under the leadership of the Vice President, Safety and Technical Training. This combination was initiated for the specific purpose of identifying safety issues, evaluating the effectiveness of training, and collaboratively identifying necessary resources (e.g. training, staffing, procedures, technological improvements) to improve overall safety in the delivery of air traffic control services.

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The Safety directorate's QA Group is in the final stage of developing a Standard Operating Procedure (SOP) to address the validation and processing of MORs and EORs for each of the QA Service Area offices. The QA SOP will be completed in early 2013 and subsequent training of these procedures will be conducted throughout 2013.

The Safety directorate has initiated the development of a revised QA and Quality Control (QC) Training Course for ATO personnel to be taught at the FAA Academy. Coordination is currently ongoing between the Safety and Technical Training directorates to fully define requirements. This course will include lessons on how to utilize Comprehensive Electronic Data Analysis Reporting (CEDAR) and provide an overall understanding of the QA and QC processes that have been implemented.

Additionally, QA staff has conducted visits to the QC Groups in each of the ATO Service Areas to provide clarification and familiarization with the new Orders, CEDAR and TARP. In support of these visits, the ATO is in the process of publishing Safety Guidance reflecting best practices on how to implement the new orders. This guidance is expected to be published by February 2013. In addition, the Air Traffic Oversight Service is planning to audit the implementation of the new Orders in fiscal year (FY) 2013.

FAA will use the results of these incremental compliance and effectiveness evaluations of the individual components of its new approach to continue fine tuning its operation of individual elements of its new safety scheme. It intends to conduct an overall evaluation of the overall scheme by October 1, 2015, once sufficient data is available to meaningfully evaluate its performance.

OIG Recommendation 4: Include high-risk TCAS warning events in its Risk Analysis Process and System Risk Event Rate when the separation between two converging aircraft is maintained at 66 percent or more.

FAA Response: Partially-concur. The ATO has a well-developed risk analysis process that reviews events on a prioritized basis in accordance with the risk factors present during an event. TCAS is one of several safety countermeasures, and its effectiveness or lack thereof is already part of the analysis process used by the ATO. The ATO will clarify and produce written criteria for determining which TCAS events represent a high-risk and should be included in the risk assessment process. It intends to complete these criteria by December 30, 2013.

OIG Recommendation 5: Develop actions to mitigate the following situations identified in the Risk Analysis Process: (1) poor recovery from loss of separation and (2) losses of separation involving on-the-job training.

FAA Response: Concur. The ATO is already addressing these issues. The number one hazard identified in the FY 2013 Top 5 hazards in the NAS was poor recovery after a loss of separation. As a result, FAA-wide corrective action and monitoring plans have been developed. Hazard Risk Mitigation is a high priority DOT goal that tracks how well the FAA is doing in implementing corrective actions on a yearly basis. To meet this goal the FAA has to complete a

Appendix. Agency Comments

minimum of 80% of approved mitigations to address the top five contributing hazards to high risk events every year.

The ATO does not have data that directly ties the on-the-job training (OJT) program to a specific increase in risk for losses of separation. However, the ATO plans to gather more information about such incidents in order to determine whether there is sufficient support provided to OJT instructors in the current training methodology. The ATO will be amending CEDAR to require identification of OJT in progress when operational incidents occur. ATO intends to implement this upgrade by June 2013.

OIG Recommendation 6: Utilize analysis of the causal and contributory factors derived in the Risk Analysis Process—including perception, memory, and training–to identify the underlying reasons for separation losses and develop mitigation strategies to address those causes.

FAA Response: Concur. RAP and the yearly identification of the Top 5 hazards in the NAS utilize both causal and contributory factors to develop corrective actions and mitigation strategies to address causes for losses of separation in the NAS. Following our Safety Management System which requires continuous improvement of our processes, the ATO is making improvements to RAP and other safety programs, such as Search and Rescue and QC, as well as sharing the ATO's safety data with Aviation Safety Information Analysis and Sharing for analysis of air traffic control and aircraft data. Combining air traffic and aircraft data offers numerous opportunities to improve aviation safety. The FAA believes it has met the intent of this recommendation and requests that it be closed.

Appendix. Agency Comments