



# Memorandum

**U.S. Department of  
Transportation**

Office of the Secretary  
of Transportation

Office of Inspector General

Subject: **ACTION:** Report on Oversight of Aircraft Maintenance,  
Continuing Analysis and Surveillance Systems  
Report No. AV-2002-066

Date: December 12, 2001

From: Alexis M. Stefani   
Assistant Inspector General for Auditing

Reply To: JA-10:x60500  
Attn. Of:

To: Federal Aviation Administrator

This report presents the results of our audit of the Federal Aviation Administration's (FAA) Oversight of Aircraft Maintenance, Continuing Analysis and Surveillance Systems. This report is in response to requests by the Senate Committee on Commerce, Science, and Transportation and the House Committee on Transportation and Infrastructure. An executive summary of the report follows this memorandum.

The objective of this audit was to determine the effectiveness of FAA's oversight of air carriers' continuing analysis and surveillance systems (CASS). CASS is the system air carriers use to monitor the effectiveness of their aircraft maintenance and inspection programs. To complete our review, we visited selected FAA Flight Standards Service offices. In addition, we accompanied FAA inspection teams on eight of the nine National Program Reviews of major air carriers. In preparing the report, we considered FAA's October 4, 2001 comments to our August 23, 2001 discussion draft report.

This report focuses on one element of FAA's inspection program, namely how FAA monitors the way air carriers execute their internal maintenance inspection and oversight programs, or their CASS. In this regard, it is important to note that FAA and the aviation industry rely on a series of overlapping controls to ensure aircraft maintenance is performed properly. In addition to CASS, air carriers rely on FAA-approved maintenance procedures, qualified mechanics, and their own inspector workforce to inspect and approve the repairs performed. Early next year we will be reporting on the results of a separate review of FAA's implementation of its Air Transportation Oversight System (ATOS). ATOS is FAA's new overall approach to air carrier safety oversight. It was designed to go beyond monitoring

air carrier operations for just compliance with regulations to evaluating all aspects of their operations and maintenance systems for indicators of safety risks. ATOS currently covers only 10 of the Nation's largest air carriers.

FAA concurred with our recommendations for enhancing its oversight of air carriers' CASS and has indicated that corrective actions are already underway. In comments on the draft report, FAA agreed to develop a follow-up system to monitor inspector findings of deficiencies in an air carrier's maintenance practices; require inspectors to better document inspections; expedite the development and completion of CASS-specific training for inspectors who oversee CASS; and enhance CASS guidance. These corrective actions, when properly implemented, will satisfy the intent of our recommendations. Therefore, we consider these four recommendations resolved, subject to the audit follow-up requirements of Department of Transportation Order 8000.1C.

FAA also concurred with our recommendation to require comprehensive annual CASS inspections at all air carriers; however, FAA needs to provide a planned implementation date for completing changes to its CASS surveillance process before we consider this recommendation resolved. FAA partially concurred with our recommendation to require aviation safety inspectors to analyze maintenance-related inspection results to identify trends that could link deficiencies to the overall effectiveness of air carriers' CASS. FAA stated that this type of analysis is already being performed; however, while performing our audit, we did not see any evidence that FAA's analysis links maintenance-related deficiencies to the effectiveness of the CASS. FAA stated it will investigate enhancing the analysis process; therefore, this recommendation will remain open until FAA has performed its investigation and expanded its procedures to fully address our recommendation. We request that you provide a target date as to when you expect to complete this action.

We appreciate the courtesies and cooperation provided by your staff during the review. If you have any questions concerning this report, 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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cc: Chris Bertram, ABA-1  
Ron Page, ABU-100

# EXECUTIVE SUMMARY

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## *Oversight of Aircraft Maintenance, Continuing Analysis and Surveillance Systems*

### *Federal Aviation Administration*

*Report No. AV-2002-066*

*December 12, 2001*

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### ***Background and Objective***

On January 31, 2000, Alaska Airlines Flight 261 crashed into the Pacific Ocean just outside Los Angeles, killing all 88 people on-board. Preliminary investigation results disclosed that the cause of the crash could be related to the air carrier's improper maintenance practices. Following the crash, the Federal Aviation Administration (FAA) conducted a special safety inspection, which revealed that Alaska Airlines improperly deferred maintenance, did not have adequate controls in place to ensure aircraft parts were tested to proper standards, and lacked effective quality control and quality assurance programs. According to FAA, these problems indicated a breakdown in the effectiveness of Alaska Airlines' Continuing Analysis and Surveillance System (CASS). If the CASS had been operating effectively, Alaska Airlines' own internal monitoring process should have identified the deficiencies in its maintenance program. In addition, the findings from the special inspection raised questions as to *why FAA's routine surveillance had not identified the deficiencies in Alaska Airlines' CASS and ensured they were corrected.*

Since 1964, FAA has required air carriers to establish and maintain a CASS to provide a structured process for carriers to use in identifying maintenance factors that could ultimately lead to an accident or incident. CASS is the system air carriers use to monitor the effectiveness of their aircraft maintenance and inspection programs. As part of FAA's routine surveillance, aviation safety inspectors should determine whether air carriers have a CASS in place and whether it is working effectively. Routine surveillance is FAA's process of continuous periodic safety inspections of air carriers and aviation-related activities to ensure compliance with safety regulations.<sup>1</sup>

While each carrier designs its CASS so that it best fits the carrier's unique operation, a properly functioning CASS should minimally include an internal audit function and a process to monitor the mechanical performance of the aircraft fleet.

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<sup>1</sup> See Exhibit A for a more detailed description of FAA surveillance of air carriers' CASS.

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As part of the audit function, each carrier should review the actual work performed within its maintenance program to ensure that all maintenance, including work completed by outside maintenance providers, meets the carrier's approved maintenance procedures and FAA airworthiness requirements. For example, through this audit process, the carrier can verify that maintenance on its aircraft is performed at the required intervals and using the correct procedures. Incidents of noncompliance within the carrier's maintenance processes identified during these audits should be considered an indicator or symptom of a systemic failure that the carrier should evaluate and correct.

To further evaluate its maintenance program, the carrier should have procedures in its CASS to assess aircraft mechanical performance. For example, the carrier should review data such as engine removal rates and pilot reports of mechanical disruptions to identify negative trends or premature failures. Mechanical monitoring programs can help carriers maintain reliable aircraft operating rates by identifying causes of maintenance-related delays and cancellations. More importantly, a properly designed and utilized CASS establishes a culture of safety within an airline's operations.

The objective of this audit was to determine the effectiveness of FAA's oversight of air carriers' continuing analysis and surveillance systems.<sup>2</sup> Audit fieldwork was conducted from July 2000 to September 2001 at FAA Headquarters, five Certificate Management Offices, and five Flight Standards District Offices throughout the country. We accompanied FAA inspection teams on eight of the nine National Program Reviews of major air carriers. In addition, we visited five air carriers to obtain information on their maintenance and inspection programs and the oversight provided by FAA.

## ***Results-in-Brief***

The crash of Alaska Airlines Flight 261, and FAA's subsequent findings on Alaska Airlines' maintenance program, heightened concerns about whether FAA was providing adequate oversight of air carriers' maintenance operations. Even though FAA has had a long-standing CASS requirement that provides it with a way to hold carriers accountable for monitoring their own maintenance, FAA has placed limited emphasis on CASS in its oversight of carriers' maintenance programs. While FAA inspectors conducted reviews of air carriers' ongoing aircraft maintenance, CASS reviews were not routinely conducted or were not conducted in a comprehensive manner. For example, some CASS inspections consisted only of inspectors' attendance at carriers' maintenance meetings. In

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<sup>2</sup> See Exhibit B for a more detailed description of our audit objective, scope, and methodology.

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other instances when CASS inspections were performed and CASS-related deficiencies were identified, FAA did not ensure the problems were corrected in a timely manner. In addition, FAA maintained little documentation on inspections, precluding effective trend analysis of inspection findings.

To its credit, in July 2000, FAA initiated a series of special inspections, called the National Program Review (NPR), to evaluate safety programs and CASS procedures at 9 of the 10 major air carriers.<sup>3</sup> FAA wanted to determine whether problems like those found at Alaska Airlines existed at other carriers. However, this review was hastily planned and not as effective as it could have been because of flaws in the review procedures. Air carrier representatives questioned the review procedures and strongly objected to the review conclusions; however, FAA has worked with carriers to address their concerns and obtain action plans for resolving the NPR findings. Although the NPR provided useful information about the carriers' programs, it did not provide information on why FAA's routine oversight had not identified the deficiencies found.

Six months after the NPR was initiated, and almost a year after the Alaska Airlines crash, FAA performed another comprehensive review at a large air carrier not covered by the NPR. This FAA special inspection found problems with four of the five aircraft inspected, the carrier's maintenance program, and its CASS. In addition, we identified significant weaknesses in the CASS procedures at another air carrier we visited. For example, the carrier did not conduct audits of aircraft repair work performed within its facilities and used "mail-out surveys" to conduct audits of maintenance work performed by outside vendors. FAA's routine surveillance had not previously identified the CASS deficiencies at these carriers.

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<sup>3</sup> These are the Nation's 10 largest air carriers that are covered by FAA's Air Transportation Oversight System. Alaska Airlines was not included in the NPR because FAA had already conducted a special inspection at this carrier.

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## *Principal Finding and Recommendations*

### *FAA Needs to Place Greater Emphasis on CASS Oversight*

- ***FAA inspectors should perform annual comprehensive CASS reviews.*** For major air carriers, FAA inspectors are required to perform a yearly risk analysis at each carrier to determine whether CASS inspections should be performed. Therefore, annual CASS inspections are not required for all air carriers. Because CASS reviews were not always conducted or were not conducted in a comprehensive manner, FAA was unaware of deficiencies in some carriers' CASS. During an April 2000 special inspection at Alaska Airlines, FAA determined that the carrier's CASS was ineffective in identifying deficiencies in the carrier's maintenance program. Until this special inspection, FAA had not performed any CASS reviews at Alaska Airlines since August 1998. At two other major carriers, inspectors had reviewed the CASS procedures in fiscal year 1999, but did not perform any inspections to verify that these procedures were working effectively until fiscal year 2000. For one of these two carriers, FAA determined during its July 2000 special inspection that the carrier did not have a functioning CASS.

For non-major carriers, inspectors are required to perform annual inspections and often perform more than one CASS inspection in a year. However, we found that, for three of five carriers we visited, these inspections sometimes consisted of nothing more than attendance at monthly maintenance meetings. For 1 of the 3 carriers, 9 of 12 CASS inspections performed were completed by inspectors' attendance at these meetings. While valuable information can be obtained from these meetings, in our view, attending monthly maintenance meetings does not constitute effective oversight of air carriers' CASS.

- ***FAA must ensure CASS deficiencies identified through its oversight inspections are corrected.*** In some instances, inspectors identified CASS problems through routine oversight inspections, but the deficiencies were not corrected. At one air carrier, significant CASS problems identified by one inspector as far back as 1996 had not been corrected when FAA performed the NPR at this carrier in September 2000. At another carrier, inspectors identified maintenance deficiencies in July 1998 that were substantial enough for FAA to take enforcement action against the carrier. Despite this action, many of these problems were not corrected and were identified again during FAA's July 2000 NPR at this carrier.

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- ***FAA inspectors need to better document their CASS inspections to allow for trend analysis and resource targeting.*** FAA maintained no files that showed what inspectors reviewed during CASS inspections. When problems are recorded, there is no requirement for the inspector to document what action was taken to correct the problem, or whether the problem was actually corrected. Additionally, inspectors advised us that, in some cases, inspection findings are handled informally between the carrier and the inspector. Therefore, there is no record that deficiencies were found or corrected. These practices prevent inspectors from reviewing inspection results for trends and targeting areas for future CASS inspections.
- ***FAA must better train its inspectors to evaluate carriers' CASS for systemic weaknesses.*** Aviation safety inspectors are not provided training on how to evaluate the effectiveness of a carrier's CASS program and procedures. Current inspector training primarily focuses on how to *approve* a carrier's CASS, which principally entails reviewing a carrier's manual to determine if there are written procedures in place to comply with the requirement to have a CASS. Inspectors are not receiving critical training on how to test the implementation of the CASS to determine whether it is functioning effectively.
- ***FAA guidance on CASS needs to be updated and expanded.*** The existing guidance and CASS regulation do not provide a model for what an effective CASS should include. As a result, both inspectors and air carriers lacked specific information on how a CASS should be structured. We found instances where inspectors seemed unclear about what a CASS should include and even more confused on how to evaluate a CASS. Some air carrier representatives suggested that FAA criticisms of their CASS constituted creation of "de facto regulations" in that FAA had not previously defined what it expected to see in a CASS. Inspectors cited this ambiguity as a reason for limited actions against carriers for CASS violations.

Revisions to an FAA advisory circular that provides CASS guidance were started in 1995, but have not been completed. In addition, after the NPR, FAA developed a model for what an effective CASS should include, but this model has not been incorporated into existing guidance or into the proposed revision to this guidance.

- ***FAA inspectors need to link maintenance-related deficiencies found in carriers' operations to the overall effectiveness of the carriers' CASS.*** Generally, inspectors did not use valuable available information to make their CASS oversight more effective. Inspectors routinely conducted reviews of various aspects of carriers' maintenance programs, but did not use these

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findings to assess whether they were “red flags” or precursors of deficiencies in carriers’ CASS. For example, results of inspections of aircraft during in-service operations were documented only as an aircraft inspection and were not evaluated as part of CASS oversight. Consequently, FAA relied more on its own aircraft inspections to ensure aircraft were properly maintained rather than ensuring carriers had internal monitoring systems to meet this objective.

### ***FAA’s National Program Review Identified Weaknesses in CASS Oversight, but the Agency Has Not Moved Aggressively to Correct the Problems***

Although the NPR could have been better planned and executed, it generated valuable information on the nine air carriers’ safety management programs. Problems to some degree were found in CASS procedures at all nine carriers and, in at least three cases, the problems were significant. For example, an NPR team found that one carrier maintained an inadequate inventory of aircraft parts, had poor maintenance recordkeeping practices, and allowed insufficient time for maintenance technicians to perform maintenance functions. As a result, the inspection team determined that the carrier did not have a functional CASS.

Because the NPR was a reaction to events surrounding the Alaska Airlines crash, FAA quickly developed the inspection plans for this review. As a result, the review process was flawed. Air carrier representatives questioned the review procedures and strongly objected to some of the NPR results. Specifically, the air carriers were concerned that some of the FAA inspectors lacked the experience and qualifications to do the reviews, the inspections were subjective and judgmental, the audit teams were inconsistent in the way they performed the reviews, and the accuracy of the information in the NPR reports was suspect. To address these concerns, NPR team members made return visits to the carriers and modified their final reports on the NPR inspections.

In accompanying FAA on the NPR reviews, we found that the inspection teams did not review each carrier in the same manner. For example, the teams physically inspected aircraft at only one of the nine carrier locations. The teams focused more on whether procedures were in place and did not have a consistent and detailed process for validating that these procedures were operating effectively. Finally, the review checklists were shared with carriers in advance of the reviews. At least six of the nine carriers made last-minute changes to their written procedures in preparation for the inspections. In our view, this hindered the effectiveness of the NPR in assessing the quality of the air carriers’ programs.

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***FAA's Oversight of CASS for All Carriers Needs to Be Improved.*** Since the initiation of the NPR in July 2000, FAA teams and our office have identified CASS problems at air carriers that were not included in the NPR. These CASS weaknesses were also not documented and corrected through FAA's routine oversight. For example, one carrier we visited did not conduct audits of repair work performed within its own facility and conducted some audits of maintenance work completed by outside vendors through "mail-out surveys." The carrier did not routinely validate these surveys with on-site visits, leaving the appearance that the carrier relies on the maintenance vendor to evaluate the quality of its own work. FAA's routine surveillance had not identified any problems with this carrier's CASS procedures.

In January 2001, we accompanied an FAA team that identified problems with another large air carrier's CASS that had not been identified by FAA inspectors who were assigned oversight responsibilities for this carrier. During this inspection, the team inspected a sample of aircraft about to be put into service. The results of these inspections demonstrated a potential effect of a carrier having a deficient CASS system.

<b>Aircraft Inspection Results at One Air Carrier</b>		
	<b><i>Problem Found</i></b>	<b><i>Status of Aircraft</i></b>
<b><i>Aircraft 1:</i></b>	Engine Cowling Latch Broken	Delayed 3 hours
<b><i>Aircraft 2:</i></b>	Fuel Leak Under Right Wing	Grounded
<b><i>Aircraft 3:</i></b>	Sewage Leak	Repaired on the Spot
<b><i>Aircraft 4:</i></b>	Fuel Leak Under Right Wing	Grounded
<b><i>Aircraft 5:</i></b>	None	In Service

The team found maintenance problems on four of the five aircraft inspected. The problems identified on two of the aircraft were significant enough that the carrier canceled the flights for which these aircraft were scheduled.

The FAA inspection team documented significant problems with the air carrier's maintenance program and its CASS. *The problems with the carrier's maintenance program should have been detected by the carrier's CASS. In turn, problems with the carrier's CASS should have been detected by FAA's routine surveillance. One month prior to FAA's independent inspection, the local FAA office responsible for oversight of this air carrier conducted a CASS inspection and found *no* deficiencies. The findings resulting from FAA's independent inspection reiterated that FAA's oversight continues to be ineffective in identifying deficiencies in carriers' CASS and ensuring that these deficiencies are corrected.*

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## ***FAA Has Proposed Improvements to Its CASS Oversight but Must Follow Through***

In May 2001, FAA named a new Flight Standards Service (AFS) Director. The new Director has initiated or planned changes in FAA's oversight of major air carriers and of air carriers' CASS. In June 2001, changes were made in inspection data collection tools to allow inspectors to record more thorough information on inspection results. However, there is no *requirement* that inspectors use these tools. The AFS Director stated FAA plans to implement new data analysis procedures for 10 major carriers by April 2002 so that collected data can be analyzed for trends. In addition, FAA has not established timeframes for implementing these same data documentation and analysis changes in its oversight process for other carriers.

The AFS Director stated FAA is making progress on revisions to a new CASS advisory circular to provide better guidance to both FAA inspectors and the aviation industry. While the advisory circular is nearing completion, development of this circular has been underway for over 5 years. Also, FAA is planning to develop CASS-specific training, but has not identified specific timeframes for development of this training. Finally, FAA has not proposed any changes to the frequency or quality of its CASS inspections so that comprehensive reviews will be regularly performed.

## ***Summary***

The lack of effective oversight of air carriers' CASS perpetuates a system where FAA is relying on its own inspections to ensure carriers maintain their aircraft in an airworthy condition. *This system is ineffective because FAA does not have sufficient resources to physically inspect every aircraft.* It has become increasingly important that FAA have an effective maintenance oversight process because a National Transportation Safety Board (NTSB) member has reported that aircraft maintenance is becoming a more prevalent concern in aviation accidents. In fact, the NTSB member found that 5 of 16 recent aviation accidents can be attributed to maintenance-related factors.

*While it is clearly the responsibility of air carriers to ensure the day-to-day safe operation and maintenance of their aircraft, FAA must be more proactive in identifying deficiencies in air carriers' CASS and ensuring those problems are corrected.* It is important to note that an effective CASS is not the *only* mechanism carriers have to ensure maintenance is performed properly. For example, an air carrier's maintenance system consists of many checks and

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balances, such as FAA-approved maintenance procedures, qualified mechanics to perform the work, and an inspector workforce to inspect and approve the repairs performed. However, a properly functioning CASS provides carriers with a systematic means of evaluating how well maintenance processes are functioning within the carrier's operation.

## ***Recommendations***

We are recommending that FAA:

- conduct annual CASS inspections at all air carriers to evaluate the overall effectiveness of their CASS and establish minimum review criteria for the inspections.
- develop a follow-up system to monitor inspector findings to ensure identified deficiencies are corrected.
- require inspectors to document, at a minimum, the scope and results of *each* CASS inspection to facilitate trend analysis of CASS findings.
- establish milestones for development of CASS-specific training; ensure the training includes techniques for conducting effective surveillance and validating CASS procedures; and, within 2 years, provide this training to all inspectors who oversee CASS.
- complete proposed revisions to CASS guidance within 90 days of the date of this report.
- require that inspectors and analysts periodically analyze maintenance-related inspection results to identify deficiencies or trends in carriers' aircraft maintenance programs that could be considered indicators of problems in the carriers' CASS.

## ***Agency Comments and Office of Inspector General Response***

On October 4, 2001, FAA provided comments to our August 23, 2001 discussion draft report. FAA concurred with our first five recommendations and partially concurred with one recommendation. Specifically, FAA agreed to require comprehensive annual CASS inspections at all air carriers, develop a follow-up system to monitor inspector findings, require inspectors to better document inspections, expedite the development and completion of CASS-specific training

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for inspectors who oversee CASS, and enhance CASS guidance. FAA's planned corrective actions for the first five recommendations will enhance FAA's surveillance of air carriers' CASS. FAA provided target dates for four of these recommendations. However, FAA needs to establish implementation dates for its planned changes in annual CASS inspections.

FAA partially concurred with our recommendation to require aviation safety inspectors to analyze maintenance-related inspection results to identify trends that could link deficiencies to the overall effectiveness of air carriers' CASS. FAA stated that this type of analysis is already being performed; however, while performing our audit, we did not see any evidence that FAA's analysis links maintenance-related deficiencies identified during inspections to CASS. FAA has promised to investigate enhancing the analysis process. This recommendation will remain open until FAA has performed its investigation and expanded its procedures to fully address our recommendation.

Finally, FAA suggested in its response that our report leaves the perception that the CASS at the major air carriers were inadequate, when in fact FAA determined during its NPR that the carriers' programs met regulatory requirements. We agree that the NPR reports contained overall conclusions that the carriers met regulatory requirements; however, it is important to note that the regulation only requires carriers to have a CASS. Despite FAA's overall conclusion that the carriers complied with this requirement, the NPR reports also outlined CASS deficiencies at the carriers reviewed. As we point out in our report, these deficiencies varied in severity; however, in some cases, the problems found impacted the effectiveness of the carriers' CASS. Given the fact that FAA required the carriers to provide corrective action plans to remedy the deficiencies identified during its inspections, we can only conclude that FAA officials also believed that the systems needed to be improved.

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# ***Introduction***

## ***Background***

On January 31, 2000, Alaska Airlines Flight 261 crashed into the Pacific Ocean just outside Los Angeles, killing all 88 people on-board. Preliminary investigation results disclosed that the cause of the crash could be related to the air carrier's improper maintenance practices. Following the crash, the Federal Aviation Administration (FAA) conducted a special safety inspection, which revealed that Alaska Airlines improperly deferred maintenance, did not have adequate controls in place to ensure aircraft parts were tested to proper standards, and lacked effective quality control and quality assurance programs. According to FAA, these problems indicated a breakdown in the effectiveness of Alaska Airlines' Continuing Analysis and Surveillance System (CASS). If the CASS had been operating effectively, Alaska Airlines' own internal monitoring process should have identified the deficiencies in its maintenance program. In addition, the findings from the special inspection raised questions as to *why FAA's routine surveillance had not identified the deficiencies in Alaska Airlines' CASS and ensured they were corrected.*

Since 1964, FAA has required air carriers to establish and maintain a CASS to provide a structured process for carriers to use in identifying maintenance factors that could ultimately lead to an accident or incident. CASS is the system air carriers use to monitor the effectiveness of their aircraft maintenance and inspection programs. As part of FAA's routine surveillance process, aviation safety inspectors should determine whether air carriers have a CASS in place and whether it is working effectively. Routine surveillance is FAA's process of continuous periodic safety inspections of air carriers and aviation-related activities to ensure compliance with safety regulations.<sup>1</sup>

While each carrier designs its CASS so that it best fits the carrier's unique operation, a properly functioning CASS should minimally include an internal audit function and a process to monitor the mechanical performance of the aircraft fleet. As part of the audit function, each carrier should review the actual work performed within its maintenance program to ensure that all maintenance, including work completed by outside maintenance providers, meets the carrier's approved maintenance procedures and FAA airworthiness requirements. For example, through this audit process, the carrier can verify that maintenance on its aircraft is performed at the required intervals and using the correct procedures. Incidents of noncompliance within the carrier's maintenance processes identified during these

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<sup>1</sup> See Exhibit A for a more detailed description of FAA surveillance of air carriers' CASS.

audits should be considered an indicator or symptom of a systemic failure that the carrier should evaluate and correct.

To further evaluate its maintenance programs, the carrier should have procedures in its CASS to assess aircraft mechanical performance. For example, the carrier should review data such as engine removal rates and pilot reports of mechanical disruptions to identify negative trends or premature failures. Mechanical monitoring programs can help carriers maintain reliable aircraft operating rates by identifying causes of maintenance-related delays and cancellations. More importantly, a properly designed and utilized CASS establishes a culture of safety within an airline's operations.

### ***Objective, Scope, and Methodology***

The objective of this audit was to determine the effectiveness of FAA's oversight of air carriers' CASS. The audit fieldwork was conducted from July 2000 to September 2001 at FAA Headquarters, five Certificate Management Offices, and five Flight Standards District Offices throughout the country. In addition, we visited five air carriers to obtain information on their maintenance and inspection programs and the oversight provided by FAA. We performed the audit in accordance with Government Auditing Standards prescribed by the Comptroller General of the United States and included such tests of procedures and records as we considered necessary.<sup>2</sup>

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<sup>2</sup> See Exhibit B for a more detailed description of our audit objective, scope, and methodology.

## ***Finding and Recommendations***

### ***FAA's Surveillance Should Be Improved to Better Identify and Ensure Correction of Problems in Air Carriers' CASS***

FAA does not have sufficient resources to physically inspect and ensure the safe operation of every aircraft. This responsibility rests with the air carriers. The requirement for air carriers to maintain an effective CASS allows FAA to rely on a systems approach to oversight of aircraft maintenance. Carriers are required to develop and maintain a CASS, and FAA inspectors should verify that the system is operating effectively. However, recent inspections by both FAA and our office have shown that problems exist in carriers' CASS and that FAA's routine surveillance has not been effective in identifying and obtaining correction of these problems.

For example, during the special inspection performed at Alaska Airlines after the January 31, 2000 crash, FAA found extensive problems in the carrier's maintenance and safety programs, which indicated a breakdown in the effectiveness of the CASS. After these findings, in July 2000, FAA initiated a National Program Review (NPR) to determine if similar problems existed at other carriers. The NPR found problems to some degree in CASS procedures at all nine carriers reviewed.

Six months later, and almost a year after the Alaska Airlines crash, FAA performed another comprehensive review at a large air carrier not covered by the NPR. This independent FAA inspection found problems with four of the five aircraft inspected, the carrier's maintenance program, and its CASS. In addition, we identified significant weaknesses in the CASS procedures at another air carrier we visited. For example, the carrier did not conduct audits of aircraft repair work performed within its facilities and used "mail-out surveys" to conduct audits of maintenance work performed by outside vendors. FAA's routine surveillance had not previously identified the CASS deficiencies at these carriers.

We concluded that, until the Alaska Airlines crash, FAA placed limited emphasis on the importance of CASS in its oversight of carriers' maintenance programs, and since that time, FAA has not moved aggressively to correct this deficiency. Annual CASS inspections are neither required nor performed for every air carrier, and in some cases, the reviews that have been performed were not comprehensive. When CASS-related deficiencies were identified, FAA did not always ensure they were corrected in a timely manner. In addition, FAA maintained little documentation on inspections, precluding effective trend analysis of inspection findings. CASS training and guidance were also incomplete. As a result,

inspectors and air carriers were confused on how an effective CASS should be structured. FAA inspectors did not evaluate findings from maintenance inspections to assess whether there were deficiencies in air carriers' CASS. FAA needs to promptly correct deficiencies in its CASS surveillance process.

### ***FAA's CASS Oversight Needs to Be Improved***

***FAA Should Place More Emphasis on Inspecting Air Carriers' CASS.*** FAA's inspection planning process is not designed to emphasize CASS reviews. For major air carriers (i.e., carriers covered under FAA's Air Transportation Oversight System - ATOS<sup>3</sup>), FAA oversight offices determine which areas should be reviewed based on a yearly risk analysis of the carriers' operations. The inspection planning process does not require a yearly CASS inspection.

We reviewed FAA's inspection database and found that at Alaska Airlines, prior to the January 2000 crash and FAA's April 2000 special inspection, FAA had not performed any CASS inspections since August 1998. This occurred because the ATOS planning process resulted in the CASS inspection having a lower priority than other individual inspection categories such as aircraft airworthiness, deferred maintenance, and major aircraft repairs and alterations. These elements are important; however, by focusing on FAA reviews of these activities, rather than reviews of the air carrier's CASS, FAA perpetuates a system where it relies on its own efforts to ensure carriers maintain their aircraft in an airworthy condition. This is ineffective because of FAA's limited resources. In addition, it is the carrier's responsibility to ensure aircraft are maintained in an airworthy condition.

For non-major carriers, one CASS inspection per year is required; however, FAA does not specify what the inspections should minimally include. We determined that, in some cases, CASS "inspections" consisted of attendance at the carriers' monthly maintenance meetings. For example, at 1 carrier we visited, FAA records showed there had been 12 CASS inspections from January 2000 to January 2001. However, 9 of the 12 inspections were recorded in the inspection database as being fulfilled by the inspector's attendance at a monthly maintenance meeting. While valuable information can be obtained from the monthly maintenance meetings, in our view, attending these meetings does not constitute effective oversight of air carriers' CASS. According to the documentation provided, the inspector did not evaluate the overall effectiveness of the carrier's CASS during any of these 12 "inspections." When an FAA team performed an independent inspection of this carrier in January 2001, the team identified weaknesses in the carrier's maintenance procedures, its CASS, and the physical condition of its

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<sup>3</sup> ATOS is a proactive means of evaluating an air carrier's entire operation, assessing safety risks, and monitoring how the carrier's systems interact to maintain safety.

aircraft. The FAA office responsible for routine oversight of this carrier was not aware of these deficiencies.

FAA should reevaluate its approach to CASS oversight. Annual inspections of the effectiveness of CASS systems at *all* air carriers would verify that carriers are meeting their responsibility to maintain an effective CASS. Further, FAA should establish parameters for these reviews to preclude inspectors from using attendance at meetings as the sole method of evaluating carriers' CASS.

***FAA Needs to Ensure CASS Deficiencies Identified Through Its Oversight Inspections Are Corrected.*** We found instances where inspectors did identify CASS problems through their routine surveillance inspections, but these problems were not corrected. At one major air carrier, an FAA inspector had identified deficiencies in the carrier's CASS as far back as July 1996. The inspection database showed that the inspector concluded the carrier's CASS policies and procedures were very weak. For example, the carrier was not effectively analyzing data from routine inspections or critical aircraft data such as service difficulty reports. The same inspector found and documented similar problems during another CASS inspection in 1998. The inspector stated that, in his opinion, his managers did not support his efforts to correct the deficiencies. Instead, his managers suggested that the carrier had procedures, but they were not documented. These problems had not been corrected when FAA performed the NPR at this carrier in September 2000.

In another instance, a major air carrier was assessed a sizable civil penalty in July 1998 for violating aircraft maintenance and operating rules, problems that are related to the effectiveness of the air carrier's CASS. FAA entered into an agreement with the carrier to reduce the penalty by half if the carrier made improvements to its maintenance program. However, FAA Flight Standards Service Headquarters officials made a decision in August 1999 to absolve the carrier of the remainder of the penalty because, in their view, the carrier had complied with the agreement. The local FAA office did not agree that the carrier had made sufficient progress in correcting the deficiencies. Local inspectors had identified 33 of 71 deficiencies relating to performance of maintenance procedures that the carrier had not addressed. For example, the local office had found that the carrier failed to comply with an airworthiness directive on 12 aircraft. The carrier continued to operate these aircraft even after recognizing that it had not complied with the directive.

The local inspectors believed that FAA's agreement to reduce the penalty amount left little incentive for the carrier to correct systemic problems in its maintenance program. FAA's July 2000 NPR substantiated this concern when inspectors identified many of the same maintenance problems that the local office brought to

Headquarters' attention prior to the settlement. This special inspection determined that the carrier's CASS continued to operate ineffectively. FAA needs to review existing CASS-related or maintenance-related deficiencies and determine whether carriers are making sufficient progress in making corrections.

***FAA Inspectors Need to Better Document Their Safety Inspections to Allow for Trend Analysis and Resource Targeting.*** Inspectors do not maintain enough documentation on what is reviewed and what is found during routine oversight inspections to perform trend analysis of inspection results. CASS inspection documentation primarily showed the results of inspections as “yes,” “no,” “satisfactory,” or “information” answers in FAA’s inspection databases. Inspectors are only required to record comments when the inspection results are unsatisfactory or when the inspections are recorded as “information.” Although the “information” category could be used to establish an audit trail, or to record other pertinent inspection results, we found that inspectors typically used this category to record general information such as when inspections consisted of attendance at meetings.

In addition, in some instances, discrepancies identified during surveillance at air carrier facilities are handled informally (i.e., the carriers verbally agree to correct the findings). Because the inspector does not document these findings, these discrepancies would not be captured in the inspection history for that air carrier and thus could not be used for trend analysis of findings or for targeting areas for future inspections.

FAA’s documentation process is particularly inadequate for inspections of carriers’ maintenance facilities located outside the geographic area of the FAA office responsible for the carriers’ oversight. A key component of an effective CASS is the assurance that primary maintenance facilities conduct maintenance procedures in accordance with the methods and standards specified in the air carrier’s manuals. FAA is required to determine that carriers, as part of their CASS, perform adequate oversight of these maintenance facilities. However, these facilities may be located in a different state than the FAA offices responsible for oversight of that carrier, requiring inspectors to travel to those facilities. Because FAA surveillance at these facilities is not as frequent as the surveillance provided at facilities located locally, it is particularly important for inspectors to maintain thorough documentation of the inspections conducted.

Of the FAA offices we reviewed that were responsible for oversight of five air carriers, only one office maintained any documentation to describe what was reviewed and deficiencies that were found during the inspections performed at off-site facilities. Through travel records or enroute inspection records, FAA could determine the number of times inspectors visited these primary maintenance

facilities, but FAA could not determine the scope or results of the inspections at these facilities. These poor documentation practices make it very difficult to pass on important safety information to new inspectors in the event of changes in inspector staffing assignments. Without knowledge of prior CASS inspections, a new inspector has to start from scratch in the oversight of the air carrier's CASS.

We also found instances where the information recorded in FAA's inspection database was incorrectly coded. For example, an inspector in one FAA oversight office entered his review of an air carrier's internal maintenance audits under "Inspections" rather than "CASS." Internal audits are a key component of a carrier's CASS, and this carrier's internal audits were identified by FAA's NPR team as deficient. The miscoding of these inspection results would have made it difficult for inspectors to include deficiencies in the audit process in an analysis of CASS findings. As a result, valuable information that could have led to identification of negative trends in the carrier's CASS system was unavailable. Thorough documentation and accurate data entry of FAA safety inspections is essential for inspection trend analysis and for providing historical inspection information on the carrier's internal maintenance monitoring system.

***FAA Must Better Train Its Inspectors to Evaluate Carriers' CASS for Systemic Weaknesses.*** While FAA provides limited training for newly hired inspectors on how to **certify** an air carrier's CASS program, FAA does not currently train inspectors, either formally or as part of on-the-job training, to conduct **ongoing oversight** of the effectiveness of a CASS.

Formal Training. Prior to October 1998, FAA provided newly hired aviation safety inspectors with formal training on CASS that included how to certify an air carrier's CASS program and how to conduct ongoing surveillance of that program to ensure it was operating effectively. While FAA still provides training on how to certify a CASS program, the training module for ongoing surveillance was eliminated from the formal training curriculum in 1998. However, approving a new CASS program is far different from assessing the effectiveness of the program after it becomes operational. CASS program certification involves evaluating the program as it is presented in manuals (i.e., how the program will *theoretically* function), whereas ongoing surveillance of a carrier's CASS involves on-site inspections to test the implementation of the program to determine how it *actually* functions.

On-the-Job Training. FAA's on-the-job training program also does not focus on surveillance of carriers' CASS or inspection procedures for validating that carriers' written procedures have been implemented and are working effectively. FAA Headquarters has developed a list of minimum on-the-job training requirements for aviation safety inspectors. However, this list only covers training

requirements for certifying CASS programs at air carriers. Each FAA district office develops its own on-the-job training program for its inspectors based on these minimum requirements. The lack of CASS training limits an inspector's ability to develop practical application skills for determining whether a carrier's CASS is operating effectively.

***FAA Guidance on CASS Is Incomplete and Needs to Be Updated.*** FAA has not provided adequate guidance on CASS to either its aviation safety inspectors or the industry. Title 14, Code of Federal Regulations, Part 121.373 requires air carriers to establish and maintain a system for the continuing analysis and surveillance of their maintenance programs and for the correction of any deficiencies in those programs. The regulation also states that whenever the carrier's program does not contain the appropriate procedures or standards to meet the requirements of the regulation, the air carrier should make changes to the program. However, the regulation does not provide any guidance on what these appropriate procedures and standards should include.

FAA inspectors informed us that, because the regulation is so vague, it is difficult to use as a basis for enforcement actions, even in cases where inspectors identify deficiencies in carriers' maintenance programs. As a result, for 5 air carriers we reviewed, the CASS regulation was cited as the basis for the violation in only 5 of 533 maintenance-related enforcement cases initiated since October 1997.

The Airworthiness Inspector's Handbook (FAA Order 8300.10, dated December 1996) provides guidance to FAA inspectors on evaluating and monitoring an air carrier's CASS. In addition, in August 1980, FAA issued Advisory Circular 120-16C to provide industry and inspectors additional information and guidance on CASS; however, the guidance needs to be updated. Neither the advisory circular nor the Inspector's Handbook includes details on what should be included in an effectively operating CASS.

According to FAA, Advisory Circular 120-16C is currently being revised, but this revision has been underway since 1995. The lack of comprehensive and current CASS guidance has resulted in confusion by the air carriers regarding FAA's requirements for a CASS, since one inspector's perception of a good CASS might be different from another's perception. One air carrier representative reported to us that, for routine oversight, the carrier has had three principal maintenance inspectors in 5 years. According to the air carrier's representative, each inspector had his own view of what constituted an effective CASS and required the carrier to change its program accordingly.

After the NPR, another air carrier representative described FAA's findings as the creation of "de facto regulations," since FAA had not previously communicated to

carriers the expectations carriers were held to during the review. Following the special inspections, FAA developed a “model program,” which illustrates what FAA considers to be a good CASS. This model program was, however, only issued as a part of the NPR Summary Report. FAA has not initiated steps to incorporate this model program into any of its CASS guidance materials. *Air carriers are not required to follow either the advisory circular or the Inspector’s Handbook, because these documents are not mandatory or regulatory in nature.* However, the inclusion of the model program in FAA guidance would be beneficial to air carriers in establishing an effective CASS and to FAA inspectors in performing oversight of air carriers’ CASS. Because sound guidance is necessary for FAA inspectors to use in oversight of CASS and for air carriers to use in developing and maintaining an effective CASS, FAA must expedite completion of revisions to Advisory Circular 120-16C and to its Inspector’s Handbook.

***FAA Inspectors Need to Link Maintenance-Related Deficiencies Found in a Carrier’s Operations to the Overall Effectiveness of the Carrier’s CASS.***

Although air carriers have been required to maintain a CASS to determine the effectiveness of their aircraft maintenance and inspection programs since 1964, FAA did not place emphasis on CASS inspections until it evaluated carriers’ CASS during the NPR. Prior to this time, inspectors primarily reviewed individual parts of carriers’ maintenance programs, but did not evaluate the effectiveness of air carriers’ CASS in a systematic manner.

FAA routinely conducted inspections of individual aircraft during in-service operations. For example, at one air carrier, even though 24 percent of FAA’s inspection activities detected problems with aircraft airworthiness, aircraft record-keeping practices, and maintenance program procedures, inspectors did not assess what these findings suggested about the carrier’s maintenance oversight system. Therefore, even if the carrier addressed these individual deficiencies, the potential for new problems to develop remained. If FAA had evaluated the carrier’s ability to detect these problems and find solutions for them, the carrier’s maintenance program and the safety of its aircraft would be improved.

We found similar conditions in our review of other carriers. For example, at 1 carrier, FAA’s routine surveillance disclosed 23 air returns<sup>4</sup> between January 1 and December 1, 2000, that were attributed to maintenance deficiencies in 3 aircraft systems. FAA required the air carrier to take corrective action; however, FAA did not connect these problems to potential systemic weaknesses in the air carrier’s CASS. One primary focus of a CASS should be the analysis and

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<sup>4</sup> An air return is the return of an aircraft to the airport of origin as a result of the malfunction or suspected malfunction of any item on the aircraft.

correction of portions of a maintenance program that allow maintenance discrepancies to occur. If the air carrier's CASS had been operating as intended (i.e., identifying and correcting negative trends in the air carrier's maintenance programs), these maintenance deficiencies would have been detected and resolved before an entire year had elapsed.

Given the limited number of inspectors, it is impossible for FAA to monitor the maintenance and safe operation of every aircraft. A properly functioning CASS within an air carrier's operation provides FAA an opportunity to place greater reliance on the carrier to detect and correct its own maintenance problems. To determine that a carrier's CASS is operating effectively, FAA should periodically review available information from its oversight of individual components of the carrier's maintenance operations for trends. Identification of negative trends can provide beneficial information about the effectiveness of the carrier's ability to identify and correct problems in its maintenance operations.

### ***FAA Must Move Aggressively to Identify and Correct Problems Within Its Oversight Process***

Because of the weaknesses in FAA's routine surveillance of CASS, FAA had little assurance that maintenance discrepancies identified at Alaska Airlines did not exist at other air carriers. Therefore, FAA initiated the NPR at the nine other major commercial air carriers. The inspections were conducted by three different FAA inspection teams from July to September 2000. The NPR identified problems of varying degrees in the CASS and/or maintenance programs at all nine carriers. FAA concluded that, overall, there were no regulatory violations found because all the carriers had a CASS. However, the fact that problems were identified to some extent at all nine carriers reviewed indicates FAA's CASS surveillance was not effective.

In addition, while the NPR has prompted the carriers that were reviewed to improve their CASS programs, the manner in which the review was conducted left questions as to whether the review could have identified more problems. The FAA teams focused their reviews on a determination of whether procedures were in place, but the reviews lacked consistency and depth in validating that these procedures were operating effectively. For example, the checklist used for CASS inspections did not require teams to inspect aircraft or maintenance facilities. Since the actual condition of the aircraft is the best indicator of the effectiveness of the carrier's maintenance program, aircraft inspections at each carrier could have yielded beneficial information. Instead, this valuable tool was only used at one of the nine air carriers included in the NPR.

For the one carrier where aircraft were inspected, the team went beyond the checklist to inspect six in-service aircraft because of deficiencies found in the carrier's CASS. The following chart shows that maintenance deficiencies were found on five of the six aircraft that had been scheduled to go into service prior to the inspection.

<b>Aircraft Inspection Results at One Air Carrier</b>	
<b><i>Problem Found</i></b>	
<b><i>Aircraft 1:</i></b>	No. 2 Engine Thrust Reverser Inoperative.
<b><i>Aircraft 2:</i></b>	No. 1 Engine Blade Nicked; Flap Rubbing Engine Pylon.
<b><i>Aircraft 3:</i></b>	No. 1 Engine Shows Evidence of Metal Shavings in Tailpipe.
<b><i>Aircraft 4:</i></b>	Right Engine Oil Leak; Left Aileron Trim Tab Deteriorating.
<b><i>Aircraft 5:</i></b>	Hydraulic Leaks at: Flap Actuator Motor, Landing Gear Module, and Nose Landing Gear Actuator.
<b><i>Aircraft 6:</i></b>	No Problems Identified.

The results from this special inspection indicated a deficient CASS. *These maintenance problems should have been detected by the carrier's CASS, and the problems with the carrier's CASS should have been detected by FAA's oversight.*

***Questions Remain on the Effectiveness of the NPR.*** FAA did not fully utilize the NPR as a process to evaluate the effectiveness of FAA's routine oversight of air carriers' CASS. FAA released the four checklists used in the NPR to the Air Transport Association (ATA) prior to the inspections. The ATA, in turn, provided the checklists to the air carriers being reviewed. At least six of the nine air carriers then made last-minute changes to their manuals for the programs under review in FAA's inspections. For example, the NPR began at one carrier on July 19, 2000. As part of its inspection process, the inspection team reviewed the carrier's manuals and determined that the manuals were last revised on July 15, 2000 (the Saturday before the inspection began). Because changes to those programs were so new and were not in place long enough to be fully implemented, FAA was unable to determine the true effectiveness of those programs.

Air carrier representatives also questioned the review procedures and strongly objected to some of the NPR results. Specifically, the air carriers were concerned that some of the FAA inspectors lacked the experience and qualifications to do the reviews, the inspections were subjective and judgmental, the audit teams were inconsistent in the way they performed the reviews, and the accuracy of the information in the NPR reports was suspect. For example, one air carrier found five pages of errors and inaccuracies in its individual NPR report. The air carriers

also claimed that, because of the inconsistencies among the three NPR teams, two different teams would not get the same results if they performed reviews at the same carrier.

To respond to the carriers' concerns, FAA inspection teams revisited the carriers to further discuss their concerns and consider whether changes should be made to the reports. According to FAA, all carriers have now submitted action plans to address the final NPR conclusions. Local FAA oversight offices are monitoring the implementation of these action plans.

***Recent FAA Progress.*** In May 2001, FAA named a new Flight Standards Service (AFS) Director. The new Director has initiated or planned changes in FAA's oversight of major air carriers and of air carriers' CASS. AFS recognized that it is not possible to analyze "yes" and "no" responses. As a result, in June 2001, FAA changed its inspection data collection tools to allow inspectors to record more thorough information on inspection results. However, there is no *requirement* that inspectors use these tools. The AFS Director stated FAA plans to implement new data analysis procedures for major carriers by April 2002 so that the data collected can be analyzed for trends. FAA has not established timeframes for implementing these types of data documentation and analysis changes for the oversight of non-ATOS carriers.

The AFS Director stated FAA is making progress on revisions to Advisory Circular 120-16C to provide better CASS guidance to both FAA inspectors and industry. While the advisory circular is nearing completion, development of this circular has been underway for over 5 years. Currently, the circular is being reviewed internally by FAA. FAA plans to issue the revised advisory circular in January 2002. Also, FAA is planning to develop CASS-specific training but has not identified specific timeframes for development of the training.

FAA has proposed some positive changes; however, specific timeframes need to be developed, and planned changes need to be applied to oversight of *all* air carriers. Also, FAA has not proposed changes to the frequency or quality of CASS inspections so that comprehensive CASS reviews will be regularly performed. The planned changes also do not specifically address the need for inspectors to document what was reviewed during CASS inspections. FAA needs to quickly complete this important work to advance safety in the area of aircraft maintenance in order to make an already safe aviation system safer.

## ***Summary***

The lack of effective oversight of air carriers' CASS perpetuates a system where FAA is relying on its own inspections to ensure carriers maintain their aircraft in

an airworthy condition. *This system is ineffective because FAA does not have sufficient resources to physically inspect every aircraft.* It has become increasingly important that FAA have an effective maintenance oversight process because a National Transportation Safety Board (NTSB) member has reported that aircraft maintenance is becoming a more prevalent concern in aviation accidents. In fact, the NTSB member found that 5 of 16 recent aviation accidents can be attributed to maintenance-related factors.

*While it is clearly the responsibility of air carriers to ensure the day-to-day safe operation and maintenance of their aircraft, FAA must be more proactive in identifying deficiencies in air carriers' CASS and ensuring those problems are corrected.* It is important to note that an effective CASS is not the *only* mechanism carriers have to ensure maintenance is performed properly. For example, an air carrier's maintenance system consists of many checks and balances, such as FAA-approved maintenance procedures, qualified mechanics to perform the work, and an inspector workforce to inspect and approve the repairs performed. However, a properly functioning CASS provides a carrier with a systematic means of evaluating how well other maintenance processes are functioning within the carrier's operation.

### ***Recommendations***

FAA needs to place more emphasis on routine surveillance and validation of the effectiveness of air carriers' maintenance oversight systems, or CASS. We recommend FAA:

1. Require aviation safety inspectors to conduct annual CASS inspections to evaluate the overall effectiveness of the air carriers' CASS at all air carriers, and establish minimum review criteria for these inspections.
2. Develop a follow-up system to monitor inspector findings to ensure identified deficiencies are corrected.
3. Require inspectors to document, at a minimum, the scope and results of each inspection performed.
4. Establish milestones for and expedite the development of a CASS-specific training course; require all inspectors who oversee CASS to be trained within 2 years; and ensure that CASS training includes both certification *and surveillance* of CASS as part of the inspectors' formal and on-the-job training.
5. Enhance CASS guidance for aviation safety inspectors and the aviation industry by including the model programs developed from the National Program Review and any future changes to these programs in FAA Order

8300.10 (Airworthiness Inspector's Handbook) and/or revised Advisory Circular 120-16C. Complete revisions to the guidance within 90 days of the date of this report.

6. Require aviation safety inspectors and analysts to analyze maintenance-related inspection results for assigned carriers at the end of each year to identify trends that could link deficiencies to the overall effectiveness of the carriers' CASS.

### ***Agency Comments and Office of Inspector General Response***

On October 4, 2001, FAA provided comments to our August 23, 2001 discussion draft report. FAA concurred with five recommendations and partially concurred with one recommendation, as follows.

- FAA agreed to require aviation safety inspectors to conduct annual CASS inspections that evaluate the effectiveness of air carriers' CASS and to establish minimum review criteria for these inspections. To improve the quality of these inspections, FAA plans to use the CASS checklist that was developed as part of the NPR. This checklist will be used in CASS inspections for both ATOS and non-ATOS carriers. While this action is responsive to our recommendations, FAA will need to provide a target date for when these changes will be implemented.
- FAA agreed to develop a follow-up system, by April 2002, to monitor inspector findings to ensure identified deficiencies are corrected for ATOS carriers. For non-ATOS carriers, FAA agreed to require inspectors to use the existing follow-up system. It is key that FAA take steps to ensure inspectors fully utilize the follow-up system to ensure identified deficiencies are corrected.
- FAA agreed to use the checklist developed for the NPR to enhance CASS surveillance and documentation for both ATOS and non-ATOS carriers. For ATOS carriers, FAA will investigate the potential of additional modifications to existing inspection checklists. FAA expects to complete these activities by March 2002.
- FAA agreed to expedite the development of CASS-specific training, require inspectors to be trained within 2 years, and ensure CASS training includes certification and surveillance of CASS as part of formal and on-the-job training. In the short term, FAA agreed to train inspectors on the use of the CASS checklist by March 2002. In the long term, by January 2004, FAA agreed to develop and deploy a training program to inspectors having CASS oversight responsibility.

→ FAA agreed to publish Advisory Circular 120-16D by January 31, 2002, and develop a model CASS program by January 2003. FAA agreed to deploy the model program to inspectors by March 2004 and to issue a CASS-specific advisory circular concurrent with the model program.

FAA's planned corrective actions for the first five recommendations will enhance FAA's surveillance of air carriers' CASS. FAA provided target dates for four of these recommendations; therefore, these recommendations are resolved. We will require information on planned implementation dates on FAA's planned changes in annual CASS inspections before we consider the first recommendation resolved.

FAA partially concurred with recommendation 6, to require inspectors to analyze maintenance-related inspection results to identify trends that could link deficiencies to the overall effectiveness of the air carriers' CASS. FAA stated that this type of analysis is already being performed; however, FAA will investigate enhancing the analysis process. This recommendation will remain open until FAA has performed its investigation and enhanced its system so that it more fully addresses our recommendation.

Finally, FAA suggested in its response that our report leaves the perception that the CASS at the major air carriers were inadequate, when in fact, FAA determined during its NPR that the carriers' programs met regulatory requirements. We agree that the NPR reports contained overall conclusions that the carriers met regulatory requirements; however, it is important to note that the regulation only requires carriers to have a CASS. Despite FAA's overall conclusion that the carriers complied with this requirement, the NPR reports also outlined multiple CASS deficiencies at the carriers reviewed. As we point out in our report, these deficiencies varied in severity; however, in some cases, the problems found affected the effectiveness of the carriers' CASS. Given the fact that FAA required the carriers to provide corrective action plans to remedy the deficiencies identified during its inspections, we can only conclude that FAA officials also believed that the systems needed to be improved.

## FAA SURVEILLANCE OF CASS

The FAA requirement for air carriers to establish and maintain a CASS was initiated in December 1964, when Part 121.373 was added to Title 14 of the Code of Federal Regulations. This requirement resulted from a joint FAA/National Transportation Safety Board (NTSB) study of a series of maintenance-related accidents that occurred in the 1950s. This study found that, in some cases, the primary causal factor of the accident was the air carrier's maintenance program itself, in that it was either incapable of or ineffective in preventing the equipment failure that led to the accident. Recently, an NTSB member found that maintenance errors contributed to 5 of 16 accidents that have occurred since 1995.

Although the investigations have not been completed, maintenance-related issues have surfaced in at least three major accidents occurring since 1996 (i.e., TWA Flight 800, Swissair Flight 111, and Alaska Airlines Flight 261). These accidents resulted in 547 fatalities. Because two of these accidents involved U.S. air carriers, concerns have been raised regarding how FAA oversees and inspects air carriers' maintenance and operations.

Currently, FAA conducts surveillance of air carriers under two separate programs, depending on the size of the air carrier. In October 1998, FAA began conducting surveillance of the Nation's 10 major air carriers under the Air Transportation Oversight System (ATOS). ATOS is a structured process designed to analyze interactions within and among air carrier systems to identify and assess threats to safety. ATOS shifts FAA's surveillance beyond simply checking an air carrier's compliance with regulations to proactively evaluating an air carrier's entire operation, assessing safety risks, and monitoring how the carrier's systems interact to maintain safety. FAA monitors all other carriers using a less structured system commonly referred to as the national work program. Under this program, inspectors are required to complete a minimum number of inspections at all air carriers each year, rather than targeting surveillance based on an assessment of safety risks.

FAA plans and conducts CASS inspections for ATOS and non-ATOS air carriers differently, as described below.

**ATOS Carriers**

- Annual CASS inspections may or may not be performed, depending on the results of FAA's yearly risk analysis of each air carrier.
- CASS inspections are performed using checklists.

**Non-ATOS Carriers**

- At least one CASS inspection is required annually.
- Guidance is provided to inspectors for CASS inspections, but no checklists are used.

## OBJECTIVE, SCOPE, AND METHODOLOGY

In a February 2000 letter to the Inspector General, the Ranking Member of the Senate Committee on Commerce, Science, and Transportation questioned why it took a crash for FAA to determine that significant maintenance problems existed at Alaska Airlines. The Senator expressed concern as to whether FAA has been proactive on the safety front and whether its efforts are meeting with success. At the Senator's request, the Office of Inspector General initiated a review of FAA's oversight of aircraft maintenance, focusing on FAA's oversight of air carriers' CASS.

In a February 2001 letter to the Inspector General, the Chairman and the Ranking Democratic Member of the House Committee on Transportation and Infrastructure requested that our office review FAA's current approach for providing oversight of airline operations and maintenance, as well as agency efforts to target its inspector workforce to the most pressing concerns. This audit addresses concerns presented in both letters.

The objective of the audit was to determine the effectiveness of FAA's oversight of air carriers' Continuing Analysis and Surveillance Systems. Audit fieldwork was conducted from July 2000 to September 2001 at FAA Headquarters, five Certificate Management Offices, and five Flight Standards District Offices throughout the country. To evaluate FAA's inspection procedures, we reviewed maintenance inspection records and interviewed maintenance inspectors. In addition, we visited five air carriers to obtain information on their maintenance and inspection programs and the oversight provided by FAA.

From July to September 2000, we also accompanied FAA on eight of the nine special inspections to evaluate the carriers' safety programs. We observed the process used and determined the results of the inspections. After the inspections were completed, we revisited five inspection locations to determine why problems identified during the special inspections were not identified during FAA's routine oversight. We performed the audit in accordance with Government Auditing Standards prescribed by the Comptroller General of the United States and included such tests of procedures and records as we considered necessary. During our audit, we reviewed procedures and records from fiscal year 1996 to present.

## ENTITIES VISITED

### FAA

*Flight Standards Service (AFS):* Washington, D.C.

Continuous Airworthiness Maintenance Division

Systems Process Audit Program Staff

*AFS District Offices:*

Atlanta Flight Standards District Office Atlanta, GA

Denver Flight Standards District Office Denver, CO

Indianapolis Flight Standards District Office Indianapolis, IN

Las Vegas Flight Standards District Office Las Vegas, NV

Orlando Flight Standards District Office Orlando, FL

*AFS Certificate Management Offices*

American Airlines Certificate Management Office Dallas, TX

America West Certificate Management Office Phoenix, AZ

Delta Airlines Certificate Management Office Atlanta, GA

Trans World Airlines Certificate Management Office Kansas City, MO

US Airways Certificate Management Office Coraopolis, PA

**Air Carriers**

***Accompanied FAA on National Program Review:***

America West Airlines	Phoenix, AZ
American Airlines	Dallas, TX
Continental Airlines	Houston, TX
Delta Airlines	Atlanta, GA
Northwest Airlines	Minneapolis, MN
Southwest Airlines	Dallas, TX
Trans World Airlines	Kansas City, MO
US Airways	Pittsburgh, PA

***Others:***

Air Tran Airways	Orlando, FL
American Trans Air	Indianapolis, IN
Atlantic Southeast Airlines	Macon, GA
Frontier Airlines	Denver, CO
National Airlines	Las Vegas, NV

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U.S. Department  
of Transportation

**Federal Aviation  
Administration**

# Memorandum

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Subject: **INFORMATION:** Comments on OIG  
Discussion Draft Report on Oversight of  
Aircraft Maintenance, Continuing Analysis and  
Surveillance Systems

From: Assistant Administrator for Financial Services  
and Chief Financial Officer

Date: OCT - 4 2001

Reply to  
Attn. of:

To: Assistant Inspector General for Auditing

As stated and agreed upon in the August 23 exit conference on the subject audit, we have reviewed your Discussion Draft Report. Attached is our response to each recommendation followed by additional comments.

If you have questions or need further information, please contact Anthony Williams, Budget Policy Division, ABU-100. He can be reached at (202) 267-9000.

  
for Chris Bertram

Attachment

**Federal Aviation Administration (FAA) Response to the  
Office of Inspector General Discussion Draft on  
Oversight of Aircraft Maintenance,  
Continuing Analysis and Surveillance Systems**

Many of the recommendations contained in this report were already noted in the National Program Review (NPR) and are currently underway. Although this report does not make it clear, it must be noted that the Continuing Analysis and Surveillance System (CASS) programs reviewed met regulatory compliance, and the actions taken by the carriers were those necessary to achieve the highest level of a model program. The Federal Aviation Administration (FAA) and industry learned that by working in collaboration in going above and beyond mere regulatory compliance, a higher level of safety is attainable.

**OIG Recommendation 1: Require aviation safety inspectors to conduct annual CASS inspections to evaluate the overall effectiveness of the air carriers' CASS at all air carriers, and establish minimum review criteria for these inspections.**

**FAA Response: Concur. The requirement to conduct annual CASS inspections is contained in FAA Order 1800.56B. FAA aviation safety inspectors (ASI) understand that under the National Program Guidelines (NPG) at least one CASS review must be accomplished for non-Air Transportation Oversight**

**System (ATOS) carriers. For ATOS air carriers, one CASS inspection will be accomplished using the safety attribute inspection (SAI), or the Dynamic Observation Report. This requirement will be implemented through the Comprehensive Surveillance Plan (CSP). To improve the quality of our surveillance, these mandatory inspections will be accomplished using the new CASS job aid that was developed as part of the NPR.**

**OIG Recommendation 2: Develop a follow-up system to monitor inspector findings to ensure identified deficiencies are corrected.**

**FAA Response: Concur. A follow-up system to monitor ASI findings to ensure deficiencies are corrected already exists in Program**

**Tracking and Reporting Subsystem (PTRS). A method to link follow-up records in ATOS is in final development and should be in place by April 2002.**

**OIG Recommendation 3: Require inspectors to document, at a minimum, the scope and results of each inspection performed.**

**FAA Response: Concur. The PTRS user's manual details the requirements for proper documentation in the existing system. The FAA will use the existing NPR job aid as a tool to enhance CASS surveillance and documentation. In ATOS, we will investigate the potential of modifications to the existing SAI/element performance inspection (EPI). This activity will be completed by March 2002.**

**OIG Recommendation 4: Establish milestones and expedite the development of a CASS-specific training course; require inspectors to be trained within 2 years; and ensure CASS training includes both certification and surveillance of CASS as part of the inspectors' indoctrination, post-indoctrination, and on-the-job training.**

**FAA Response: Concur. The NPR contains a recommendation to establish a CASS-specific training course. In the short-term, inspectors will be trained on the use of the CASS job aid by March 2002. In the long-term, the training program will be developed and deployed to the ASIs having CASS oversight responsibility by January 2004.**

**OIG Recommendation 5: Enhance CASS guidance for aviation safety inspectors and the aviation industry by including the model programs developed from the NPR and any future changes to these programs in FAA Order 8300.10 (Airworthiness Inspector's Handbook) and/or revised Advisory Circular (AC) 120-16C. Complete revisions to the guidance within 90 days of the date of this report.**

**FAA Response: Concur. The concept of enhancing CASS guidance for ASIs was proposed by the NPR. The guidance will be updated through the development of AC 120-16D, Air Carrier Maintenance**

**Programs; a CASS-specific AC; and a detailed model CASS program. AC 120-16D will be published by January 31, 2002. The model program will be developed by January 2003, with deployment to ASIs having CASS oversight responsibility by March 2004. The associated CASS-specific AC will be issued concurrently with the model program.**

**OIG Recommendation 6: Require aviation safety inspectors to analyze maintenance-related inspection results for assigned carriers at the end of each year to identify trends that should link deficiencies to the overall effectiveness of the carriers' CASS.**

**FAA Response: Partially concur. For ATOS carriers, the CSP and a dedicated data analyst are used to provide analysis of maintenance-related inspection results. For non-ATOS air carriers, this type of analysis is conducted using the Surveillance Evaluation Program (SEP) process. However, the FAA will investigate enhancing the analysis process through the use of the Flight Standards Safety Analysis Information Center organization.**

**Additional Comments:**

**BACKGROUND:** The authority for all of the Federal Aviation Regulations (FAR) for air carrier maintenance is 49 USC section 44701 (formerly Federal Aviation Act of 1958, section 604). This section establishes a statutory requirement that obliges the FAA Administrator to promote the safe flight of civil aircraft by prescribing regulations and standards in the interest of safety. Section 44701 further obliges the Administrator, when prescribing these regulations and standards, to consider: 1) the duty of an air carrier to provide service with the highest possible degree of safety in the public interest; and 2) differences between air transportation and other air commerce. The Administrator shall also classify a regulation or standard appropriate to the differences between air transportation and other air commerce.

In May 1964, as part of this statutory responsibility, the FAA introduced a regulatory requirement for an air carrier maintenance program quality assurance system, which includes provisions for correcting maintenance program deficiencies. This system is identified as a CASS. CASS and its

functions are described in 14 CFR section 121.373. The CASS is the only management system that is mandated by regulation. Each air carrier is required to establish and maintain a system for the continuing analysis and surveillance of the performance and effectiveness of its maintenance programs. Additionally, the regulation requires a CASS to include provisions for the correction of any deficiencies that are found. Consistent with the regulatory function described in section 44701, a CASS is crucial in the attainment of major objectives of an air carrier maintenance program; i.e., the highest possible degree of safety. An additional benefit of a properly designed and utilized CASS is the establishment of a positive safety culture within the air carrier.

A CASS has two distinct primary functional areas: 1) monitoring maintenance program effectiveness; and 2) monitoring maintenance program performance. The two distinct sub-functions within the primary functional areas are:

1) scheduled (proactive) investigations and analysis; and 2) unscheduled (reactive) investigations and analysis.

A third functional area encompasses the development and implementation of corrective action for deficiencies identified as a result of activities in the two primary functional areas. The two primary functions monitor: 1) the degree that the maintenance program is effective in reaching its goals and objectives; and 2) the degree that the program is being accomplished according to maintenance program requirements.

On a continuous basis, an air carrier's CASS should continuously validate the performance and effectiveness of elements of its maintenance program, including, but not limited to, maintenance tasks and intervals, maintenance procedures, maintenance methods, techniques, and practices. The validation should occur through a closed loop, continuous cycle of surveillance, investigations, data collection and analysis, corrective action, corrective action monitoring, and back to surveillance.

The NPR is in keeping with the FAA's "Safer Skies" agenda and served as a special initiative undertaken in light of the weaknesses revealed by the inspection of Alaska Airlines in January 2000. While routine FAA surveillance is designed to uncover specific areas of noncompliance, the NPRs aim was to look at the broader perspective of air carrier management systems. As stated in a FAA letter from the Director, Flight Standards Service, in December 2000, "the review teams took an unprecedented look at the air carriers' overall management oversight

systems.” The team focused on individual air carrier initiatives and innovations. Additionally, the aim was to identify and share the attributes of a well-run CASS or “best practices” with the aviation community in a proactive approach to raising the safety bar. The NPR Report, dated December 8, 2000, made recommendations for several positive enhancements that are in varying stages of implementation.

The implications in this report that the CASS at the major carriers is inadequate are simply not accurate. At the time of these safety reviews, the carriers’ programs were found to meet FAA requirements. As a result of these reviews, enhancements have been made that now exceed regulatory requirements. Collaborative efforts between the carriers and FAA since these reviews have succeeded in raising the safety bar.

**NPR CONTRIBUTIONS TO THE CASS PROGRAM:** Important outcomes of the NPR effort include an improved FAA and industry understanding of CASS that was reached through a collaborative effort. NPR contributions to the CASS program include:

- A standardized job aid for use by FAA inspectors in assessing CASS was established at the start of the NPR. A criteria development group was convened to develop the job aid appropriate to the areas to be reviewed. The development group consisted of individuals from the System Process Audit Program, the Continuous Airworthiness Maintenance Division, Certification, Standardization and Evaluation Team (CSET), Flight Standards Safety Analysis Information Center (FSAIC), and principal inspectors. The group reviewed all available guidance materials, including the surveillance tools, applicable ACs; FAA Order 8300.10, Airworthiness Inspector’s Handbook; FAA Order 8400.10, Air Transportation Operations Inspector’s Handbook; Flight Standards Handbook Bulletins for Air Transportation and Airworthiness; training course materials; and industry information. The job aid was then prototyped at an air carrier to ascertain its effectiveness prior to being used by the review team.
- Action Plans for resolving deficiencies identified at various airlines were in place, in most cases, before the NPR teams departed. As stated in the executive summary of the NPR Summary Report, “As a result of the daily outbriefings, most of the air carriers had corrective action plans in place for any deficiencies noted before the teams departed.”
- A prototype or shell CASS program was developed and is contained in the FAA NPR Summary Report. We intend to further develop this shell

into a robust model program that will provide the necessary guidance to industry and FAA. Ultimately, this model, once fully developed, will answer the fundamental question “What does a model program look like, and what should it contain?” This program will be released by January 2003.

- CASS “best practices” were identified and shared with the other 121 air carriers and responsible FAA offices. The FAA NPR Summary Report listed best practices in six of the nine attributes areas. Following are samples of some of the identified best practices:
- The duties and responsibilities of air carrier CASS personnel are clearly defined in manuals;
- Automated systems were developed to plan audits, which allows the air carriers to track overdue audits;
- Formal systems were developed to ensure audits were not closed until all findings were answered in an acceptable manner;
- Air carriers have documented procedures for the identification of root causes, and the root causes of discrepancies are identified and corrected to prevent reoccurrence.