





## FAA Lacks Effective Oversight Controls To Determine Whether American Airlines Appropriately Identifies, Assesses, and Mitigates Aircraft Maintenance Risks

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*Requested by the Ranking Members of the House Committee on Transportation and Infrastructure and its Aviation Subcommittee*

Federal Aviation Administration | AV2022004 | October 20, 2021

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### What We Looked At

American Airlines, one of the world's largest commercial air carriers, has not experienced a fatal accident in nearly two decades. Despite this safety record, reports of potentially unsafe maintenance practices have raised concerns about the Federal Aviation Administration's (FAA) oversight of the carrier's maintenance programs. At the request of then-ranking members of the House Committee on Transportation and Infrastructure and its Aviation Subcommittee, we initiated this review. Specifically, we examined whether FAA ensures that American Airlines implemented effective corrective actions to address the root causes of maintenance problems and FAA's oversight of American Airlines' safety management systems (SMS).

### What We Found

FAA lacks effective oversight controls to ensure American Airlines' corrective actions for maintenance non-compliances addressed root causes. According to FAA guidance, FAA inspectors should collaborate with the air carrier to correctly identify and fix the root cause(s) of deviations or non-compliances. However, in 171 of 185 (92 percent) of cases we sampled, FAA inspectors accepted root cause analyses by the air carrier that did not identify the true root cause of the problem. Furthermore, FAA closed compliance actions before the air carrier implemented its corrective actions. FAA's oversight controls are also not effective for evaluating if American Airlines' SMS sufficiently assesses and mitigates risk. FAA requires American Airlines to use its SMS to determine the level of risk associated with maintenance non-compliances. However, we found that FAA inspectors did not routinely or consistently evaluate whether the carrier adequately and effectively assessed and rated risks. This is in part because FAA did not provide its inspectors with comprehensive training and tools for overseeing and evaluating the carrier's SMS.

### Our Recommendations

FAA concurred with five and partially concurred with two of our seven recommendations to improve FAA's oversight of American Airlines maintenance programs. We consider recommendations 1, 2, 4, and 6 resolved but open, pending completion of planned actions. However, we are asking FAA for additional information and to reconsider its actions for recommendations 3, 5, and 7.

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## Memorandum

Date: October 20, 2021

Subject: ACTION: FAA Lacks Effective Oversight Controls To Determine Whether American Airlines Appropriately Identifies, Assesses, and Mitigates Aircraft Maintenance Risks | Report No. AV2022004

From: Matthew E. Hampton  
Assistant Inspector General for Aviation Audits 

To: Federal Aviation Administrator

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American Airlines, one of the world’s largest commercial air carriers, has not experienced a fatal accident in nearly two decades. Despite this safety record, reports of potentially unsafe maintenance practices—such as congressional allegations that mechanics have been forced to shortcut repairs to keep aircraft in service—have raised concerns about the Federal Aviation Administration’s (FAA) oversight of maintenance programs at American Airlines. FAA shares the responsibility to ensure the safety of air carrier maintenance programs along with aircraft manufacturers and air carriers.

Safety is FAA’s top priority. In March 2015, the Agency developed a formal, top-down approach to manage safety risks, known as Safety Management Systems (SMS), and required air carriers to implement it in March 2018. SMS uses the safety risk management process to identify hazards and address unacceptable risk. FAA established the Compliance Program in October 2015, which helped to address safety risk management. This program outlines a process for inspectors to address non-compliances by correctly identifying root causes and recommending appropriate corrective actions to adequately mitigate the risks involved. Nearly 6 years after FAA implemented its Compliance Program, the Agency is still refining its inspector guidance<sup>1</sup> for identifying and addressing root causes of identified non-compliances.

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<sup>1</sup> Federal Aviation Administration Order 8900.1, Volume 14, *Compliance and Enforcement*, November 4, 2016, and October 14, 2020. Federal Aviation Administration Order 2150.3C, *FAA Compliance and Enforcement Program*, September 18, 2018. For the purpose of this report, we refer to FAA Order 8900.1 as “inspector guidance.”

At the request of then-ranking members of the House Committee on Transportation and Infrastructure and its Aviation Subcommittee,<sup>2</sup> we initiated a review of FAA's oversight of air carrier maintenance programs at two air carriers in May 2018. This report presents the results of our review of FAA's oversight of American Airlines' maintenance programs. Specifically, we examined whether FAA ensures that American Airlines implemented effective corrective actions to address the root causes of maintenance problems and FAA's oversight of American Airlines' safety management systems.

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, and exhibit C lists the acronyms used in this report.

We appreciate the courtesies and cooperation of Department of Transportation representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-0500 or Tina Nysted, Program Director, at (404) 562-3770.

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

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<sup>2</sup> Letter from Congressmen Peter DeFazio and Rick Larsen to DOT Inspector General Calvin Scovel III, dated June 7, 2016.

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## Results in Brief

### **FAA lacks effective oversight controls to ensure American Airlines' corrective actions for maintenance non-compliances addressed root causes.**

According to FAA guidance,<sup>3</sup> FAA inspectors should conduct an investigation and collaborate with the air carrier to correctly identify and fix the root cause(s) of deviations or non-compliances. However, we found that FAA inspectors accepted root cause analyses by the air carrier that did not identify the true root cause of the problem. In 171 of 185 (92 percent) maintenance compliance cases we sampled from fiscal years (FY) 2016 to 2020, American Airlines did not identify the root cause at all, or the root cause was determined to be related to human factors issues—which, according to FAA guidance and industry best practices, are not considered true root causes. FAA accepted insufficient root causes in part because FAA inspectors were not adequately trained on root cause analysis. Furthermore, we found that FAA closed compliance actions before the air carrier implemented its corrective actions. Of the 394 corrective actions proposed by the carrier that we reviewed, FAA inspectors accepted all of the corrective actions—including 20 actions that were closed out *before* American Airlines could actually implement them. This occurred because, at the time of our review, FAA's Compliance Program did not require inspectors to verify that the carrier had taken its planned corrective actions. Without conducting comprehensive root cause analysis and verifying corrective actions, FAA cannot reasonably ensure that American Airlines is sufficiently identifying root causes and mitigating future maintenance non-compliances.

### **FAA's oversight controls are not effective for evaluating if American Airlines' SMS sufficiently assesses and mitigates risk.**

FAA requires American Airlines to use its SMS to determine the level of risk (e.g., "risk rating") associated with maintenance non-compliances and report to FAA what controls failed and what consequences would occur had safety controls failed. However, our review found that FAA inspectors did not routinely or consistently evaluate whether the carrier adequately and effectively assessed and rated risks. This is because inspectors do not conduct comprehensive team inspections of the carrier's risk rating process on a regular basis. For example, from October 2020 to March 2021, a team inspection of SMS yielded 27 findings where an individual inspector using the same inspection checklist identified only one. Further, FAA does not provide its inspectors with comprehensive training on how to assess an air carrier's risk assessment process, and FAA inspectors stated

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<sup>3</sup> Federal Aviation Administration Order 8900.1, Volume 14, *Compliance and Enforcement*, October 14, 2020.

that their data collection tool is insufficient for comprehensively evaluating the effectiveness of the carrier's SMS. As a result, FAA is limited in its ability to reasonably ensure that American Airlines is assigning risk levels that are commensurate to the identified non-compliance and that the carrier's corresponding corrective actions and controls are appropriate to address the problem.

We are making recommendations to improve FAA's oversight of American Airlines maintenance programs. We made similar recommendations in our previous report on FAA's oversight of Allegiant Air's maintenance programs.<sup>4</sup> In that report, we recommended that FAA review the quality of its root cause analysis training and revise inspector guidance to ensure corrective actions are implemented before closing compliance action cases. According to FAA officials, the Agency has made progress in addressing recommendations from our previous report; however, until FAA has completed these actions, these recommendations will remain open. The recommendations in this report further refine the actions FAA needs to take to address our findings related to American Airlines.

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## Background

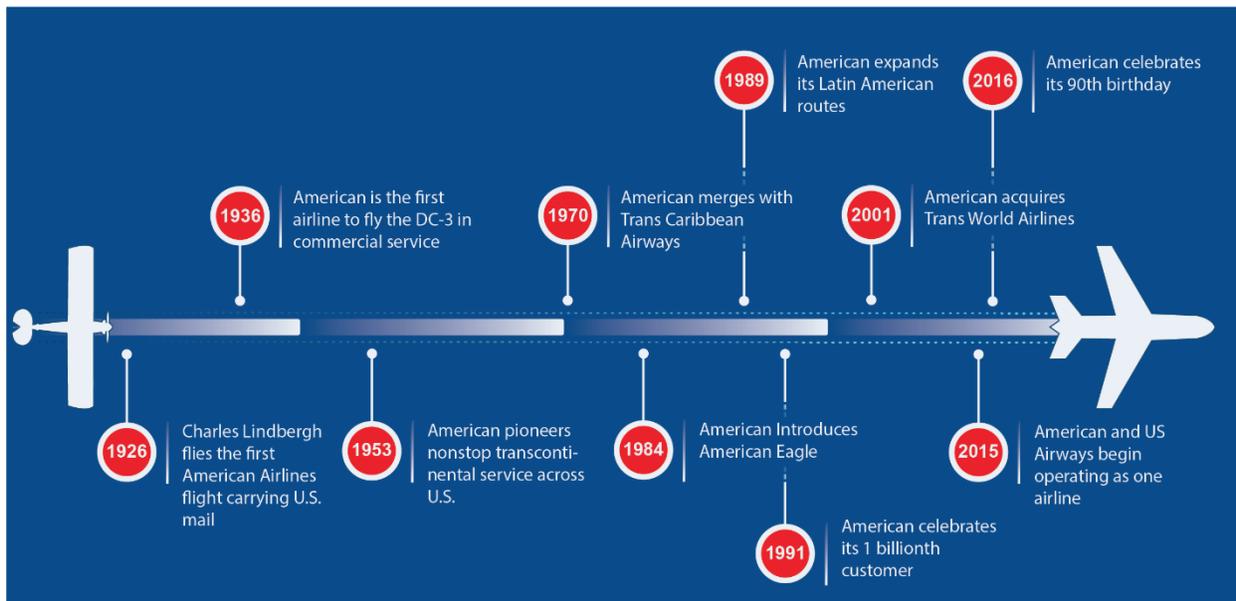
Since its first mail carrier flight in 1926, American Airlines has grown into one of the world's largest air carriers, operating nearly 900 Boeing and Airbus aircraft. As shown in figure 1 below, much of American's growth was likely due to mergers with other major airlines such as Trans World Airlines and US Airways. As a result of the worldwide coronavirus pandemic in 2020 and the sudden drop in demand for air travel, American decommissioned more than 150 aircraft and retired five aircraft types: Embraer 190, Boeing 757, Boeing 767, Airbus A330, and Bombardier CRJ200. American replaced many of these aircraft with newer aircraft, such as the Boeing 737 MAX and the Airbus 321 Neo. As a result, American currently has one of the youngest fleets in the world. Together with regional partner American Eagle, the American Airlines Group averages nearly 6,000 flights per day to 318 destinations in 42 countries.<sup>5</sup>

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<sup>4</sup> *FAA Needs To Improve Its Oversight To Address Maintenance Issues Impacting Safety at Allegiant Air* (OIG Report No. AV2020013), December 17, 2019. We made nine recommendations, of which two remain open. OIG reports are available on our website: <https://www.oig.dot.gov/>.

<sup>5</sup> This data is based on American's projected flight activity for July 2021 (July 2020 flight data is skewed by the drop in demand for air travel as a result of the coronavirus pandemic of 2020). According to American, July is its peak travel month.

Figure 1. History of American Airlines



American Airlines employs approximately 9,000 certificated mechanics and aircraft inspectors at maintenance facilities in the United States and around the world, and operates one of the world's largest and most sophisticated aviation maintenance facilities in Tulsa, OK. This facility employs over 2,700 mechanics, all whom are licensed aircraft and jet engine mechanics.

To oversee a large air carrier such as American Airlines, FAA inspectors based in Irving, TX, and Coraopolis, PA, are responsible for overseeing American's maintenance programs. Approximately 60 inspectors manage the air carrier's operating certificate by performing inspections to ensure the carrier is meeting Federal safety standards. To conduct its oversight, FAA relies on its Safety Assurance System (SAS), a risk-based oversight system, which is intended to evaluate an air carrier's ability to manage risk and ensure safe operations, as well as focus on air carriers' safety systems and controls. In addition, it provides a risk-assessment tool for FAA inspectors to identify and document potential risks. SAS is also part of FAA's broader SMS, which is focused on enhancing safety through data analysis to better respond to changes in industry business models (i.e., growth and fleet changes).

SMS has been adopted worldwide as a standardized approach to managing risk. FAA requires air carriers to implement SMS to identify and analyze potential hazards and mitigate risk to an acceptable level based on each carrier's operating environment. Under this approach, FAA and air carriers develop systems to

identify hazards and implement corrective actions. Specifically, air carriers must identify root causes for hazards and proactively manage risk to prevent accidents.

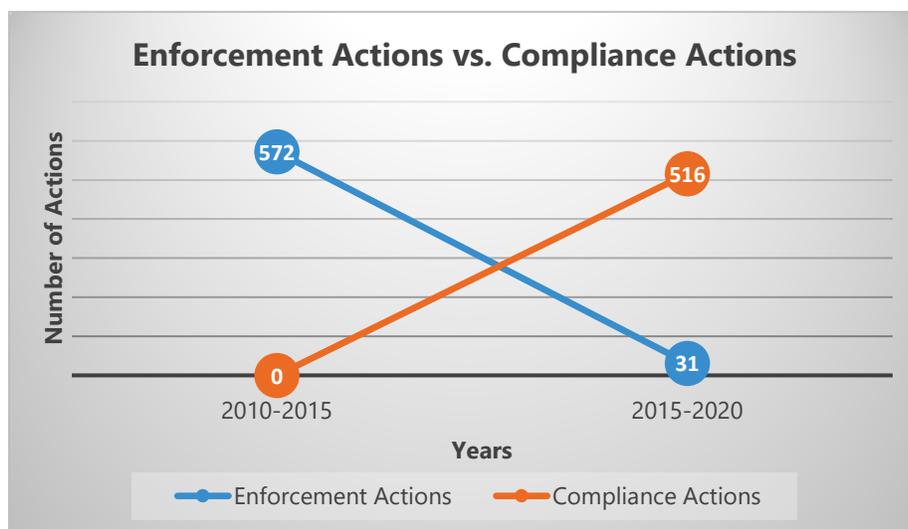
To identify safety issues and effectively correct them in a timely manner, FAA shifted from an enforcement-based oversight model in October 2015 to one that stresses a more collaborative approach with carriers. Previously, under FAA's enforcement-based program, the level of action taken by the Agency was commensurate with the type of violation. For example, FAA inspectors investigating a mechanic's failure to follow aircraft manual repair instructions would likely initiate enforcement action in the form of an administrative letter of correction. In contrast, the Compliance Program encourages a collaborative approach between FAA and air carriers to achieve rapid compliance, identify safety errors, and emphasize improvements to procedures or training programs over penalizing air carriers—as long as the carrier demonstrates that it is willing and able to take corrective action.<sup>6</sup> Now when an FAA inspector identifies a non-compliance that meets the criteria, FAA may issue a non-punitive compliance action to an air carrier, and the Agency expects the carrier to determine the root cause and proposed corrective action(s) to prevent reoccurrence. The errors are identified, reported, and analyzed to establish accountability without assigning blame so that the specifics of each case can determine the appropriate corrective action. However, for instances where an air carrier is unwilling or unable to collaboratively correct compliance or safety issues, inspectors must use enforcement-based oversight tools, such as assessing civil penalties or suspending operations. As shown below in figure 2, the number of enforcement actions against American Airlines dropped dramatically since FAA transitioned to its Compliance Program approach in 2015.

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<sup>6</sup> A compliance action is FAA's non-punitive method for addressing unintentional deviations stemming from flawed systems and procedures, simple mistakes, lack of understanding, or diminished skills. In contrast, a legal enforcement action is punitive in nature and could result in civil penalties or suspension of operations. In this report, we refer to legal enforcement action as an enforcement action imposed by FAA.

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Figure 2. FAA's Shift From Enforcement Actions to Compliance Actions—American Airlines



Source: OIG analysis of FAA data

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## FAA Lacks Effective Oversight Controls To Ensure American Airlines' Corrective Actions for Maintenance Non-Compliances Addressed Root Causes

FAA lacks effective controls to ensure that American Airlines provided comprehensive root cause analyses to show why maintenance non-compliances occurred. In addition, FAA accepted the results of the carrier's root cause analysis and closed out compliance actions before the air carrier implemented its corrective actions.

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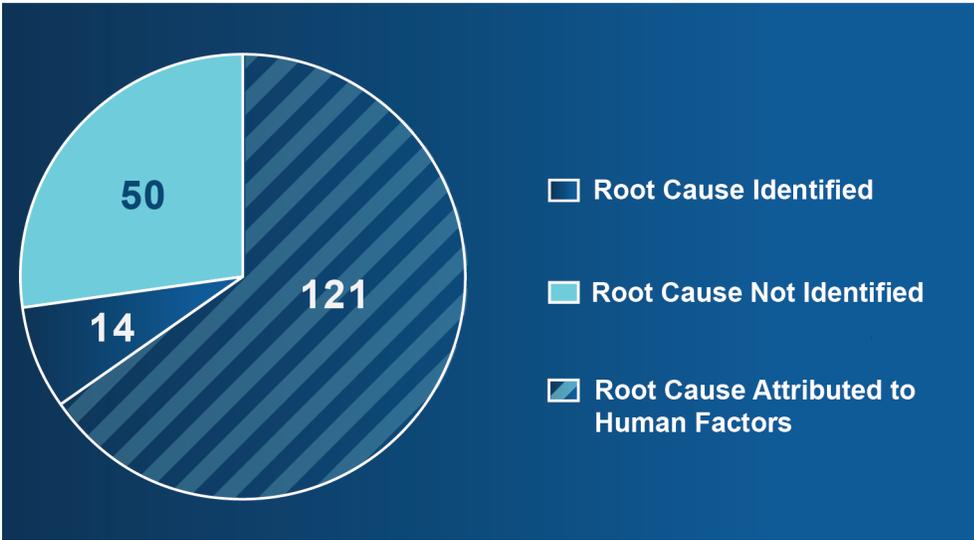
## FAA Did Not Ensure American Airlines Provided Comprehensive Root Cause Analyses for Maintenance Non-Compliances

FAA did not ensure American Airlines provided comprehensive root cause analysis for maintenance non-compliances. The concept of root cause analysis is to get to the underlying cause of the problem, identify the factors that are

causing the problem, and recommend solutions that address all of the factors. A key principle of root cause analysis is to identify underlying problems that increase the likelihood of errors while avoiding the trap of focusing on mistakes by individuals. Root cause analysis became an integral part of FAA oversight with the implementation of the Compliance Program in 2015. According to FAA guidance, inspectors should work with air carriers to identify and address the root cause of a problem and then develop appropriate corrective actions to prevent future reoccurrence.

However, we found that FAA inspectors accepted root cause analyses by the air carrier that did not identify the true root cause of the problem. Specifically, we reviewed 60 randomly selected compliance actions from fiscal years 2016 to 2020, consisting of 185 maintenance non-compliance cases. In 171 of 185 cases (92 percent), American Airlines did not identify the true root cause of non-compliances either because the root cause was not identified at all or the root cause was determined to be related to human factors issues. The remaining 14 non-compliances were instances in which the carrier conducted thorough investigations but did not explicitly state the underlying cause of the non-compliance (see figure 3).

Figure 3. Breakdown of FAA’s Acceptance of American Airlines’ Root Cause Analysis of Maintenance Non-Compliances



Source: OIG analysis of FAA data

Of the 171 instances of insufficient root cause analysis, we identified 50 instances (29 percent) in which the carrier did not address the root cause of the problem at all. In these 50 instances, the carrier either did not provide a root cause or merely restated the results of its investigation as a root cause without determining why the non-compliance occurred. For example, in 2016, FAA notified American

Airlines that unidentified aircraft parts were found in an administrative building on a paper recycle bin and tops of lockers. These parts were not properly tagged to indicate whether they were usable or not. FAA expected the carrier to investigate and provide a root cause analysis into why the non-compliance occurred and identify appropriate corrective actions to prevent reoccurrence. However, in its response, American Airlines repeated that the aircraft parts were found on the paper recycle bin and the carrier was unable to determine why they were there. Conversely, American Airlines did identify the root cause of a non-compliance involving mechanics documenting excessive tire pressure in hot aircraft tires. In this example, the carrier conducted a thorough investigation into FAA's finding and determined that errors occurred because the mechanic's maintenance manual did not clearly state that hot tire pressure is permitted to be higher than the maximum operational pressure.

FAA also accepted root cause analysis in which human factors<sup>7</sup> were identified as the root cause. According to recently issued FAA guidance,<sup>8</sup> human factors should not be considered the root cause of a non-compliance; instead, investigations into root cause should determine why the individual erred. FAA's guidance is consistent with aviation industry practices in calling for more comprehensive analyses rather than attributing the cause of non-compliance on human factors, such as "the technician did not follow procedures." Further, according to TapRoot,<sup>9</sup> a widely recognized root cause analysis tool, "human error is probably a causal factor."<sup>10</sup> When you see human error as a root cause, the result is often to find blame and ineffective corrective action." Similarly, the healthcare industry stresses addressing root causes that are inherent to the system, and not the people, to improve overall system safety. When individuals are blamed for an incident, remedial action focuses on the person or people involved, but this represents a missed opportunity to make wider reaching changes to the system to prevent future occurrences of a similar error.

Contrary to industry best practices and subsequently FAA's own guidance, inspectors accepted root cause analyses identifying human error as the root cause in 121 (71 percent) of the 171 non-compliances reviewed. For example, in September 2019, FAA found mechanics overlooked a work step on a maintenance task card pertaining to passenger cabin doors. According to the air carrier response to FAA, "the Root Cause was complacency of the Supervisor." Additionally, in January 2018, FAA identified an erroneous maintenance task card

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<sup>7</sup> Human factors is the scientific discipline concerned with understanding how humans interact with other elements of a system in order to optimize human well-being and overall system performance.

<sup>8</sup> Federal Aviation Administration Order 8900.1, Volume 14, *Compliance and Enforcement*, October 16, 2020.

<sup>9</sup> According to its website, TapRoot is a systematic process, software, and training for finding the real root causes of audits, precursor incidents, or major accidents.

<sup>10</sup> A causal factor is a mistake, error, or failure that leads directly to or causes an incident, or fails to mitigate the consequences of the original error.

pertaining to fuselage repairs in which all steps were signed as completed when they should not have been because some steps did not apply to that situation. According to the carrier's assessment of the discrepancy, "The Structures Mechanic was unable to explain why he failed to properly document the inspection." In both of these cases, FAA did not press American Airlines for root causes of the problems and just accepted human error as the reason for the non-compliances.

FAA accepted insufficient root causes in part because the Agency did not adequately train its inspectors on root cause analysis. FAA's Compliance Program and its inspector guidance emphasize the importance of inspectors using critical thinking in problem solving and correctly identifying root causes so they can recommend appropriate corrective actions. While 13 of 18 maintenance inspectors we interviewed received some form of root cause analysis training (e.g., 2-hour computer-based training), 5 of these inspectors received no training. Furthermore, 6 of the 13 inspectors who did receive training—including managers—stated that these courses did not provide the level of detail needed to determine whether corrective action plans would effectively address the root cause of non-compliances.

Further, FAA did not initially ensure the carrier documented its root cause analysis process. According to FAA inspectors and American Airlines officials, they typically work together to uncover the root cause of maintenance non-compliances. The carrier stated that it conducted root cause analyses and verbally discussed the results with FAA to gain concurrence, but at the outset of the Compliance Program, FAA did not require the carrier to formally document root cause determinations. When we asked for documentation of root cause analysis discussions, neither FAA nor American Airlines could provide any. According to inspectors, FAA did not require air carriers to submit written root cause analyses even though inspectors asked American to identify root causes in their notification letters. However, starting in mid-2018, the local oversight office stated that it began requiring the carrier to provide written root cause determinations in its response letters to FAA. As noted above, we also found that many of these root cause analyses still did not identify the true root cause of maintenance discrepancies, and FAA continued to accept the analyses to close out compliance actions. Without a determination of the true root cause of the problem, FAA cannot be sure that corrective actions proposed to address maintenance non-compliances will effectively mitigate the problems and prevent future recurrences.

Ineffective root cause analysis and the associated corrective actions may have contributed to a number of repetitive non-compliances at American Airlines. Based on our review, the most frequent non-compliances were maintenance recordkeeping errors and omissions, insufficient maintenance training, and improperly completed maintenance. For example, recordkeeping errors

(i.e., failure to document required maintenance steps) occurred in 29 of the 60 compliance actions we sampled over a 5-year period. Repetitive maintenance record errors likely occurred because the carrier identified human factors as the root cause of the problem and did not continue its investigations to determine why maintenance personnel erred. As a result, FAA and the carrier missed an opportunity to make more expansive enhancements to the system to prevent future occurrences of the same or a similar error.

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## FAA Inspectors Closed Out Compliance Actions Prematurely

FAA inspectors prematurely closed compliance actions before ensuring that the carrier completed its corrective actions. This is because at the time of our review, FAA's Compliance Program guidance<sup>11</sup> did not require inspectors to validate (i.e., conduct an inspection) that corrective actions are in place and effective at addressing the discrepancies *prior* to closing out a compliance action, as long as the corrective action follow-up inspection is tracked in a separate FAA database. Yet, inspectors could not identify these actions in the database when asked to do so. As a result, the trail of corrective actions tied to a specific compliance action is lost, and inspectors cannot be sure that air carrier non-compliances are actually resolved and corrective actions are effective.

In our review of 185 non-compliances between March 2016 and March 2020, we determined that American Airlines proposed 394 corrective actions (many of these 185 non-compliances contained multiple corrective actions). FAA inspectors accepted all of the corrective actions—including 20 actions that were closed out before American Airlines could actually implement them. For example, in 2018, an inspector identified weaknesses in the carrier's maintenance procedures and its tool calibration program and initiated a compliance action to address the issue. After the carrier submitted its corrective action plan to FAA, the inspector reviewed and approved the plan, closing out the compliance action and stating that FAA had validated the corrective actions—even though the carrier's documented response showed that 8 of the 19 corrective actions would not be completed for up to 5½ months later.

According to senior FAA inspectors, FAA guidance at that time permitted inspectors to close out compliance actions before corrective actions were completed, but guidance stated inspectors should hold open the follow-up inspection record in FAA's inspection database until inspectors can validate the

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<sup>11</sup> FAA revised Order 8900.1, Volume 14, *Compliance and Enforcement* on October 16, 2020, which is after the time period of our review of compliance actions.

corrective action. However, we found that inspectors could not determine whether the follow-up inspection had occurred when consulting their inspection database. This is because when inspectors closed out the compliance action, they did not clearly link the follow-up inspection to its corresponding compliance action. As a result, inspectors were unable to determine whether a follow-up inspection actually occurred, which would have validated that corrective actions were implemented and effective at addressing non-compliances.

In comparison, a similar program—FAA’s Voluntary Disclosure Reporting Program used by air carriers to self-disclose errors to FAA—also requires root causes analysis and submission of comprehensive fixes to prevent future reoccurrence of problems. However, this program goes one step further by requiring FAA inspectors to validate that comprehensive fixes address the problem *before* closing out the disclosure.

Further, as part of its compliance action close-out process, FAA formally notifies American Airlines that it accepts its root cause analyses and proposed corrective actions and considers the compliance actions closed. Yet, we found that this formal notification occurred whether or not FAA had completed its work related to the compliance action. According to FAA guidance at the time of our review, a compliance action is typically considered closed when inspectors document their validation of corrective actions in its inspection database. Further, some corrective actions can be complex and take time for the carrier to implement. However, FAA sent the carrier close out letters, leaving the air carrier to believe that it has met FAA’s requirements for compliance action closure. For example, FAA closed out a compliance action for incorrectly signed maintenance work cards one day after the carrier provided its response to FAA. Some of these work cards showed mechanics how to perform aircraft maintenance checks. This quick turnaround raises questions as to whether inspectors would have had enough time to review the response and validate the effectiveness of the corrective action. American Airlines stated in its response to FAA that one of the corrective actions was not due to be completed until one month later. Yet, FAA informed the carrier in its close-out letter that it “verified that the implementation of the agreed upon comprehensive fixes.” As a result of this process, FAA closeout letters may lead the carrier to believe it does not have to take corrective actions and the case is closed, even though inspectors have not yet validated corrective actions.

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# FAA's Oversight Controls Are Not Effective for Evaluating if American Airlines' Safety Management System Sufficiently Assesses and Mitigates Risk

FAA's oversight of American Airlines' SMS hinders the Agency from fully assessing the carrier's risk management process and assuring the effectiveness of safety risk controls. In particular, FAA is not routinely evaluating the carrier's risk assessments.

Performing risk assessments is the most challenging part of the risk management process because of the subjectivity of accurately identifying the severity of the consequences. As part of the risk assessment, each hazard's associated safety risk is assessed against the risk acceptance criteria and plotted on a risk matrix based on the severity and likelihood of the outcome. The objective of this step is to determine the safety risk level acceptability. A risk matrix provides a visual depiction of the safety risk and enables prioritization in the control of the hazards.

FAA is responsible for overseeing American Airlines' implementation of its SMS, including the carrier's assessment of safety risk ratings and controls. FAA requires American Airlines to use its SMS to determine the level of risk (e.g., "risk rating") associated with maintenance non-compliances and report to FAA what controls failed and what consequences would occur as a result of the failed safety controls.

However, our review found weaknesses in American Airlines' risk assessments and FAA's oversight. Our analysis of 193 findings (from our sample of 60 compliance actions) indicated that the carrier rated 141 of them (73 percent) as "low" or "very low" risk. Table 1 shows examples of non-compliances that were rated "low" or "very low."

Table 1. Examples of American Airlines’ Non-Compliances Rated Low or Very Low Related to Potential Outcomes

Non-Compliance	Potential Outcome Had the Non-Compliance Continued	Severity Risk Category	Reactive Risk Rating
Mechanic failed to perform a bird strike damage inspection	The aircraft departed without the maintenance task being accomplished	Operational Event	Low
Mechanic failed to perform an engine leak check	The work task card would continue to have a signature stamp missing	Operational Event	Very Low
Mechanic documented that tire pressure checks were performed, but never used a tire pressure gauge	Calibrated tire gauges would not have been tracked in accordance with American’s procedures manual	Operational Event	Very Low

Source: OIG analysis of FAA data

While categorizing risk assessments is inherently subjective, accurately identifying these ratings is integral to decision making in SMS, as all actions performed to address the safety issue depend on the initial and subsequent risk assessments. According to American Airlines’ Risk Assessment Matrix, only five risk severity categories are used for risk assessment, although there are 14 severity categories identified. An air carrier official explained that these are the only five categories on its risk matrix that could lead to an accident, incident, injuries, or threats of injuries to their employees. The five categories the carrier uses are:

- Accident or incident (e.g., accident with fatalities or significant aircraft damage),
- Employee or customer injury (e.g., injury or fatality),
- Operational event (e.g., operating with no meaningful safety margins or operating beyond aircraft limitations),
- Security (e.g., terrorist activity or civil unrest), and
- Systems or processes (e.g., disruptions to aircraft operations or system breakdown).

Two of the remaining categories—“regulatory” and “airworthiness”—are rarely used. (According to American Airlines’ SMS guidance, the regulatory category may only be used with management approval.) This is significant because,

according to FAA, the use of “regulatory” or “airworthiness” categories could result in higher risk ratings. Additionally, the risk rating ultimately determines the corrective actions the carrier must take and what level of air carrier management will be responsible for accepting and mitigating the risk. For example, American flew an aircraft with an inoperable emergency evacuation slide for 877 days before reporting the non-compliance to FAA. The inoperable slide was categorized as an “accident or incident” (even though neither event occurred) resulting in a “moderate” risk rating. For this rating, a director-level management authority would be required to approve the risk mitigation plan. However, had American categorized the event as an “airworthiness” issue, the level of risk could have risen to a “serious” risk rating. As a result, this new rating would have required a different set of corrective actions and controls and a higher level of management at American Airlines—a Vice President or higher level—to review and accept the risk mitigation plan.

However, FAA did not evaluate whether American Airlines’ risk ratings adequately captured the level of risk for these findings. This is in part because inspectors lack training on how to review the risk assessments. As part of its oversight of an air carrier’s SMS, FAA inspectors are required to evaluate risk ratings, determine root causes, and develop corrective actions in a similar way the air carrier uses its SMS. To effectively oversee an air carrier’s SMS, inspectors need to be properly trained on safety risk management and have comprehensive guidance to help to facilitate inspections. However, inspectors told us that the training they received was more of a high-level overview of SMS, and it lacked details of how to accurately review air carrier risk ratings. As a result, FAA could not verify whether the 73 percent of findings that American Airlines rated as “low” or “very low” were indeed low risk. This also limits FAA’s ability to effectively assess the carrier’s controls for those safety risks.

A lack of an effective inspection checklist (i.e., data collection tool) also limits FAA’s SMS oversight. Inspectors routinely evaluate SMS using inspection checklists that are designed to identify whether a carrier’s SMS is working effectively. However, according to FAA inspectors, the way FAA’s checklist is written does not provide an opportunity to dig down to the level of detail needed to effectively review American Airlines’ SMS. This is because the questions they answer during a typical inspection are aimed at determining whether the air carrier’s management has sufficient authority and effective processes in place to operate an SMS. For example, one question used in the inspection was *“Were the certificate holder’s process measurement(s) used to evaluate the performance of the Accountable Executive process and if necessary, implement corrective action?”* Although the inspectors’ response to this question contained two examples of aircraft flown in non-airworthy conditions, the details did not relate to whether process measurements were effective and corrective actions were implemented. This indicates that the inspectors devised a

workaround to the inspection checklist in a way that allowed them to more thoroughly examine the carrier’s SMS. Even though this workaround was not a standard inspection process, it allowed FAA to conduct a more comprehensive review of the carrier’s SMS which ultimately disclosed system weaknesses.

As a result of FAA’s limited inspector guidance and training, inspectors may not be effectively and consistently reviewing American Airlines’ SMS. In the last year, FAA has conducted three inspections pertaining to American Airlines’ SMS. Each inspection yielded very different results, as shown in table 2 below.

Table 2. American Airlines’ SMS Inspection Results

Type of Inspection	January 2020	October – December 2020	October 2020 – March 2021
Individual	Finding in 1 of 21 inspection questions		
National (one inspector)		No findings	
Team (six inspectors)			Findings in 19 of 21 inspection questions

Source: OIG analysis of FAA data

While the January 2020 inspection was a routine inspection of SMS, the inspection in October–December 2020 was directed from FAA Headquarters. FAA inspectors for all major air carrier<sup>12</sup> oversight offices were directed to review and report on the overall effectiveness of air carrier’s SMS using a specially-designed checklist. This review did not require any new data collection, and inspectors were asked to simply answer six high-level questions to assess whether air carriers made progress since the inception of SMS. Although this national review was conducted while the team inspection was ongoing, the FAA principal inspector had no findings as a result of this review.

In contrast, during this same timeframe, a team of inspectors conducted a routine inspection of American Airlines’ SMS using the same data collection tool used in January 2020. However, the team used a workaround to be able to assess the SMS more comprehensively, as we mentioned previously. This inspection reported 27 findings to American Airlines. According to FAA, the reason for the

<sup>12</sup> This refers to large, commercial operators regulated under 14 CFR Part 121, Operating Requirements: Domestic, Flag, and Supplemental Operations. These carriers operate larger aircraft with primarily scheduled flights.

significant number of findings in this inspection was twofold: the team consisted of six inspectors that were assigned to review specific portions of SMS; and the workaround resulted in a more thorough review of SMS. The team found multiple issues with maintenance manuals and training, but the team also identified a pattern of improper risk categorization, risk control ineffectiveness, and missing hazard identification documentation, as shown in table 3 below. According to FAA, improper risk categorization and/or control effectiveness negatively impacts the risk assessment.

Table 3. Findings From FAA’s Team Inspection of American Airlines’ SMS

Finding Type	Example 1	Example 2	Example 3
Corrective Actions	Unable to provide data to support that corrective actions were validated and the risk was mitigated for voluntarily reported events	Discrepancy identified in early 2020 remained unresolved, indicating gaps in monitoring corrective actions	
Risk Assessments	Aircraft used in two revenue flights with open mechanical discrepancies. No risk identification documentation found although aircraft was operated contrary to regulatory standards	No hazard identification for discrepancies identified in Voluntary Disclosures, Airworthiness Directive Overflies, and Compliance Actions	No risk assessment for missing engine bushings and improper engine mount strut installation. Aircraft operated for 1,002 cycles in an unairworthy condition.
Root Cause	"Primary Cause" listed does not correlate with the Root Cause found on the FAA Voluntary Disclosure		
Risk Categorization	Aircraft operated in service for 877 days with an inoperable door slide. Risk category was "Accident or Incident." The Hazard identification did not document operating an unairworthy aircraft in revenue service for 877 days or the associated risk assessment.	Operated an aircraft for two flights with an open maintenance discrepancy. Risk category was "Systems or Processes." No associated risk assessment was completed.	

Source: OIG analysis of FAA data

The team’s report not only identified weaknesses in American Airlines’ SMS, but also in FAA’s own review and acceptance of the carrier’s risk ratings. Specifically,

the team sampled compliance actions and voluntary disclosures from American Airlines that the local inspection office had previously reviewed and approved. The team found that the carrier's responses lacked sufficient details to justify appropriate root causes, corrective actions, and risk controls, calling into question why the local inspection office originally closed out these cases. For example, in 2020, the carrier disclosed an engine maintenance non-compliance and described that, had the problem not been caught by maintenance mechanics, the aircraft would have continued to operate in an unairworthy condition. Yet, at the time of disclosure, FAA accepted the disclosure and corrective actions and closed the case even though American Airlines stated the aircraft was unairworthy. In another example in 2020, an aircraft operated for over 2 years with an inoperable emergency escape slide. According to the team's assessment, the carrier incorrectly identified the hazard category and risk controls to prevent the event from reoccurring. However, the local inspection office reviewed and accepted the carrier's response anyway and closed the case.

While the local oversight office's team inspection of the SMS successfully uncovered significant findings, they have not previously conducted any such team inspections. As a result, FAA may be missing opportunities to identify weaknesses in American Airlines' SMS related to assessing and mitigating safety risks.

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## Conclusion

Ensuring that air carriers are complying with maintenance requirements and promptly addressing non-compliances is critical to maintaining safety of commercial air carrier operations. FAA continues to improve its oversight system, including working more closely with air carriers such as American Airlines to improve compliance and implement effective SMS. To further enhance aviation safety, FAA must continue to lead and implement strong oversight controls to help ensure that American Airlines more closely analyzes risks to its operations, adequately identifies root causes of issues, and develops appropriate and effective corrective actions that will prevent reoccurrence of maintenance non-compliances. These steps will be critical to maintain confidence that U.S. air carriers are operating at the highest degree of safety.

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## Recommendations

To improve the effectiveness of FAA's oversight of American Airlines' maintenance program, we recommend that the Federal Aviation Administrator:

- 1) Develop and implement root cause analysis training for inspectors more in line with training in the aviation industry.
- 2) Develop and implement a management control to ensure that inspectors maintain the link between the compliance action and the corrective action validation inspection within its inspection databases.
- 3) Develop and implement a management control to ensure inspectors require air carriers to provide written root cause analyses and that these analyses do not specifically identify human factors issues as root causes.
- 4) Develop and implement a management control to ensure that inspectors do not send compliance action close out letters until the corrective actions have been completed and validated.
- 5) Develop and implement a team inspection approach in order to periodically assess the air carrier's Safety Management System.
- 6) Develop and implement Safety Management System training for inspectors that is specifically designed to aid inspectors in evaluating air carrier risk assessments.
- 7) Revise the Safety Management Systems data collection tool to allow inspectors to perform more detailed reviews and accurately document the results of these reviews.

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## Agency Comments and OIG Response

We provided FAA with our draft report on August 10, 2021, and received its response on September 22, 2021, which is included as an appendix to this report. FAA concurred with five of our seven recommendations and partially concurred with two. FAA provided appropriate planned actions and completion dates for recommendations 1, 2, 4, and 6. We are requesting that FAA reconsider its response or provide additional information for recommendations 3, 5, and 7, as detailed below.

FAA partially concurred with recommendation 3. The Agency agreed that additional guidance is needed to address root cause analysis, but states it cannot statutorily require an air carrier to provide written root cause analyses. Alternatively, FAA stated it will publish a policy that provides clear expectations when requesting outputs and performing analyses of an air carrier's SMS processes. However, the Agency did not address how it will ensure inspectors do not accept human factors as root causes. While FAA's response reflects a more narrow interpretation of its power to obtain records of certificated air carriers

than the Agency's long-standing interpretation of its authority as stated in 14 C.F.R. § 119.59 (Conducting tests and inspections), we agree with FAA's proposed alternative action if the additional guidance clarifies that human factors should not be identified as the root cause of a non-compliance. Accordingly, we are requesting additional information regarding how FAA's planned actions will address this concern. Until then, we consider recommendation 3 open and unresolved.

FAA concurred with recommendation 5. However, FAA's planned action does not meet the intent of our recommendation. In its response, FAA proposed enhancing its National Certificate Holder Evaluation Program (CHEP) to provide an independent team inspection approach to oversight. However, CHEP inspections are conducted by outside inspectors once every 5 years to evaluate the air carrier's ability to adhere to Federal aviation regulations. Conversely, inspectors in the local inspection offices conduct SMS-specific evaluations annually. As we noted in our report, FAA's team inspection resulted in a more comprehensive assessment than could be accomplished by a single inspector. We ask FAA to reconsider its response regarding team inspections at local inspection offices as part of SMS oversight. Until then, we consider recommendation 5 open and unresolved.

FAA partially concurred with recommendation 7, stating that an update is not needed to its current SMS Data Collection Tool (DCT). However, FAA did not explain how it made this determination. During our audit, FAA inspectors expressed concerns that the current tool hinders their ability to conduct detailed SMS reviews. We agree with FAA's proposed alternative action as long as the additional guidance will demonstrate how inspectors can use the current tool to conduct and document thorough SMS assessments. Accordingly, we are requesting additional information regarding (1) how FAA determined the DCT did not need to be updated and (2) how its updated guidance will demonstrate how inspectors can use the current DCT to conduct a thorough assessment. Until then, we consider recommendation 7 open and unresolved.

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## Actions Required

We consider recommendations 1, 2, 4, and 6 resolved but open pending completion of the planned actions. In accordance with DOT Order 8000.1C, we request that FAA provide, within 30 days of this report, the additional information on recommendations 3, 5, and 7, as described above.

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## Exhibit A. Scope and Methodology

We conducted this performance audit between November 2019 and August 2021 in accordance with generally accepted Government auditing standards as prescribed by the Comptroller General of the United States. 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 initially planned to conduct an industry-wide audit of FAA's oversight of air carrier maintenance programs. However, we decided to refocus the audit after determining that FAA had adjusted its oversight strategy from emphasizing enforcement actions to working with carriers collaboratively to address the root causes for violations of safety regulations. Furthermore, the congressional request asking us to examine FAA's oversight of air carrier maintenance highlighted both Allegiant Air and American Airlines. Allegiant Air was experiencing continued maintenance problems while American Airlines was being sued by its own mechanics due to alleged pressure to shortcut maintenance to keep aircraft in service. We decided to report on these two carriers separately. We issued our findings on FAA's oversight of Allegiant Air in December 2019, and this report presents our findings related to FAA's oversight of American Airlines.

Our audit objective was to assess FAA's processes for investigating improper maintenance practices at American Airlines. Specifically, we examined the effectiveness of FAA's oversight of American Airlines and determined whether FAA ensures that the carrier implemented effective corrective actions to address the root causes of maintenance problems. We conducted our audit work both physically and virtually at FAA Headquarters and the FAA Certificate Management Offices in Irving, TX, and Coraopolis, PA—which are responsible for overseeing American Airlines. We also interviewed key management officials at American Airlines to understand their maintenance programs and obtain their perspective of FAA's air carrier oversight. Due to the COVID-19 pandemic, we conducted all of our work at American and follow-up interviews with FAA management virtually.

To assess FAA's ability to investigate improper maintenance practices at American Airlines, we reviewed and evaluated FAA policies and procedures that govern the oversight of air carrier maintenance. We interviewed 17 inspectors—who were available at the time of our site visits—regarding American Airlines' maintenance programs. We also reviewed correspondence exchanged between FAA and American. Additionally, we analyzed FAA inspection data from 2010 to 2021, obtained from its Enforcement Information System, SharePoint site, submissions to FAA's Hotline database, and its SAS.

To determine whether FAA ensured American Airlines implemented effective corrective actions to address the root causes of maintenance problems, we analyzed FAA's Compliance Actions. We obtained a list of all airworthiness compliance action records—516 in all—from fiscal years 2016 to 2020. We then drew a sample of 60 closed cases and requested that FAA provide corresponding records. We performed a file review of all 60 closed records to determine if FAA inspectors required the carrier to address the underlying causes of non-compliances and if they conducted follow-up inspections of the Compliance Actions.

To quantify how often FAA accepted root causes attributed to human error instead of addressing the underlying root cause, we determined that the 60 cases we reviewed contained a total of 185 instances of non-compliance. We then analyzed the root causes of these 185 instances and determined that 121 of these instances contained air carrier investigative results attributing human error as the root cause. For example, if it was stated that American officials "coached and counseled" an employee after the employee committed an error, we counted this as a human factors root cause because no other reason was given as to why the error was committed. Similarly, to determine whether FAA conducted follow-up inspections for the 60 Compliance Actions in our analysis, we reviewed each of the 185 non-compliances and identified 394 associated corrective actions. We then compared the dates of closure for these corrective actions to the dates associated with FAA's close-out letters to determine that 20 corrective actions were closed out before inspectors validated the effectiveness of the corrective actions.

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## **Exhibit B.** Organizations Visited or Contacted

### **Department of Transportation**

FAA Headquarters, Flight Standards Service

FAA Office of Audit and Evaluation

FAA System Approach for Safety Oversight Program Office

FAA Quality Control & Investigations Branch A

FAA American Airlines Certificate Management Office

FAA Contracts and Program Administration Branch

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### **Other Organizations**

American Airlines

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## Exhibit C. List of Acronyms

CHEP	Certificate Holder Evaluation Program
DCT	Data Collection Tool
DOT	Department of Transportation
FAA	Federal Aviation Administration
OIG	Office of Inspector General
SAS	Safety Assurance System
SMS	Safety Management System

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## Exhibit D. Major Contributors to This Report

TINA NYSTED	PROGRAM DIRECTOR
KEVIN GEORGE	PROJECT MANAGER
NATHANIEL CALDWELL	SENIOR AUDITOR
RUTH FOYERE	SENIOR ANALYST
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WAYNE VAN DE WALKER	SENIOR AUDITOR
AUDRE AZUOLAS	SENIOR TECHNICAL WRITER
SETH KAUFMAN	DEPUTY CHIEF COUNSEL
MAKESI ORMOND	STATISTICIAN

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## Appendix. Agency Comments



# Federal Aviation Administration

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## Memorandum

Date: September 22, 2021

To: Matthew E. Hampton, Assistant Inspector General for Aviation Audits

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

Subject: Federal Aviation Administration's (FAA) Response to Office of Inspector General (OIG) Draft Report: FAA Lacks Effective Oversight Controls to Determine Whether American Airlines Appropriately Identifies, Assesses, and Mitigates Aircraft Maintenance Risks

A handwritten signature in blue ink, appearing to read "Clay Foushee".

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The FAA's approach to aviation industry safety oversight incorporates the principles of Safety Management Systems (SMS) and the FAA Compliance Program. It is a risk management-based approach that has sustained an exemplary safety record. The Agency is strongly committed to continuous improvement of that record and will continuously implement enhancements to our oversight programs as they are identified.

We have reviewed the draft report and offer the following observations:

- The draft report asserts that the FAA can require an air carrier to provide a written root cause determination. The FAA can request a root cause determination from an air carrier as part of an investigation, but there is no specific statutory or regulatory provision requiring an air carrier to provide such a determination. However, the FAA can pursue traditional enforcement mechanisms if a certificate holder is not effectively identifying and addressing the root causes of non-compliance. The Agency believes that identifying and effectively addressing root causes of noncompliance is the most effective way to prevent a recurrence, and safety risk assessment is an essential element of a well implemented SMS, which is required.
- The draft report suggests that there is no existing inspection team in place to periodically assess an air carrier's SMS program. However, the National Certificate Holder Evaluation Program (CHEP) has been in existence since 2005. The CHEP is independent of Certificate Management Offices (CMO) that have general oversight responsibility for air carriers. The CHEP performs an in-depth evaluation of the design and performance of 14 CFR part 121 certificate holders' systems. This evaluation includes oversight of the application of safety attributes within the certificate holder's technical processes. The safety attributes directly correlate to the requirements in 14 CFR part 5 for an approved SMS. A CHEP team is required to perform an evaluation when a certificate holder's risk

factors increase. With enhancements, the Agency believes that the CHEP model can satisfy the OIG’s recommendation for a “team inspection approach.”

- The OIG recommends “root cause analysis training for inspectors” and “Safety Management System training for inspectors that is specifically designed to aid inspectors in evaluating air carrier risk assessments.” The Agency agrees that training in these areas is vital to the effectiveness of safety oversight, and the FAA intends to address the OIG recommendations for both types of training in parallel. In a December 2019, audit report, the OIG recommended additional root cause analysis training for inspectors, and in May 2021, the Agency provided an update to OIG stating that FAA would complete a competency assessment for aviation safety inspectors and engineers by September 2022. That competency assessment will form the basis for determining any necessary additional root cause analysis and SMS training revisions.

Upon review of the recommendations, the FAA concurs with Recommendations 1, 2, 4, and 6. For recommendations 1 and 6, the FAA plans to begin implementing this training by December 31, 2022. The FAA plans to implement controls for recommendations 2 and 4 by September 30, 2022.

The FAA concurs with Recommendation 5. The Agency intends to make enhancements to the existing National CHEP to provide more comprehensive oversight of certificate holders’ SMS. The FAA will incorporate SMS custom DCTs into the National CHEP. This will provide a standardized team inspection approach to the assessment of a certificate holder’s SMS. The FAA plans to complete this action by March 31, 2022.

The FAA partially concurs with Recommendation 3. The FAA cannot statutorily require an air carrier to provide a written root cause analysis. SMS should detect noncompliance and the Agency can utilize other enforcement mechanisms when certificate holders fail to identify noncompliance as expected. However, the Agency agrees that additional guidance is needed on the topic of root cause analysis. As an alternative action, the FAA will publish policy that provides clear expectations for FAA personnel when requesting the outputs of an air carrier’s SMS processes and when performing analyses of such information. The FAA plans to implement the alternative action, publishing revised guidance, by December 31, 2022.

The FAA partially concurs with recommendation 7. While the FAA consistently updates its Data Collection Tools (DCTs) based on Safety Assurance System (SAS) user feedback, the FAA does not believe that a specific revision for the SAS DCTs is necessary. However, the Agency agrees that additional guidance is needed on the use of the DCTs for reviewing SMS. In particular, the guidance should clarify that the DCTs should not be viewed as limiting and how investigative personnel can use the existing tools to conduct a thorough assessment. The FAA will implement the alternative action, publishing revised guidance, by September 30, 2022.

The FAA appreciates this opportunity to respond to the OIG draft report. Please contact H.Clayton Foushee at [Clay.Foushee@faa.gov](mailto:Clay.Foushee@faa.gov) if you have any questions or require additional information about these comments.

U.S. Department of Transportation  
Office of Inspector General

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# Fraud & Safety Hotline

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