

REVIEW OF AIR CARRIERS' USE OF AIRCRAFT REPAIR STATIONS

Federal Aviation Administration

Report Number: AV-2003-047

Date Issued: July 8, 2003




Memorandum

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

Subject: **ACTION:** Review of Air Carriers' Use of Aircraft Repair Stations
Report No. AV-2003-047

Date: July 8, 2003

From: Alexis M. Stefani 
Principal Assistant Inspector General
for Auditing and Evaluation

Reply to
Attn. of: JA-10

To: Federal Aviation Administrator

This report presents the results of our review of Air Carriers' Use of Aircraft Repair Stations. An executive summary of the report follows this memorandum.

The objectives of this audit were to determine if the Federal Aviation Administration (FAA): (1) ensures that maintenance work at FAA-approved repair stations is performed by trained, qualified personnel and complies with approved maintenance procedures; (2) verifies that foreign civil aviation authorities conducting inspections on FAA's behalf ensure that aircraft are adequately safeguarded, repairs are completed properly, and any identified deficiencies are corrected; and (3) monitors changes in air carriers' maintenance expenses and repair station usage to identify notable trends and effectively target FAA's surveillance resources.¹

The purpose of this report is to focus on FAA's safety oversight of current requirements for domestic and foreign repair station operations and identify where improvements are needed. We recognize that some differences exist between foreign and domestic repair station requirements. For example, FAA certification of domestic repair stations lasts indefinitely, whereas foreign repair stations must be recertified every 1 to 2 years. However, we did not evaluate, nor are we taking issue with, the differences in the rules currently governing the operation of domestic and foreign repair stations.

In reviewing FAA's oversight of repair stations, our audit evaluated whether the facilities we visited were complying with existing FAA standards which apply

¹ In February 2003, we issued a report to the Transportation Security Administration (TSA) covering our fourth objective, which was to ensure that repair stations have controls in place to provide adequate security of aircraft and repair facilities. Because the report contained sensitive security information, it may not be released without the written permission of TSA.

under current law. The type and extent of problems we found at domestic and foreign repair stations were similar. The vulnerabilities all relate to a lack of effective FAA oversight that needs to be improved in order to further strengthen safety.

Air carriers have used repair stations for many years both because repair stations can complete repairs for less cost and because repair stations can provide specialized expertise in areas, such as engine repairs, that would otherwise require air carriers to have specialized equipment and staff. The use of repair stations is becoming an integral and fundamental part of air carriers' operations, with major air carriers now using outsourced facilities for up to 47 percent of their maintenance costs. Although FAA has placed significant emphasis on improving its oversight of air carriers' in-house maintenance programs, FAA has not placed a similar focus on its oversight of aircraft repair stations. As air carriers take aggressive steps to reduce operating costs, it is clear the trend toward increased use of repair stations is likely to continue. Our report contains recommendations for specific actions FAA needs to take to enhance its oversight of aircraft maintenance work performed at these facilities.

On June 19, 2003, FAA provided written comments (attached as an Appendix to this report) to our May 30, 2003 draft report. We subsequently met with FAA senior management on July 2, 2003, to further discuss the report and FAA's response. FAA concurred with our recommendations and agreed to:

- develop a new process to identify repair stations air carriers use to perform safety critical repairs and target inspector resources based on risk assessments or analysis of data collected on air carriers' outsourcing practices;
- form a workgroup to evaluate various measurements available to identify trends in the source of maintenance and select the proper metrics. The workgroup will complete its work within 6 months, and FAA will develop policies and procedures to use these measures to identify trends and make changes in inspector resources as warranted. In the meantime, FAA will identify where critical repair work is performed and consider any available financial data to determine if there is a trend toward outsourcing such work;
- develop procedures to improve information sharing through the Safety Performance Analysis System by requiring certificate management inspectors to document the name of the repair station they have reviewed and revising the guidance for district office inspectors to more thoroughly document repair station inspections;
- clarify its policies to develop a comprehensive, standardized approach to repair station surveillance, including the review of total repair station operations;

- conduct follow-up reviews with the three foreign aviation authorities to ensure they are complying with recently issued policy pertaining to inspection documentation requirements, and instruct Field Office Managers with responsibility for these agreements to ensure that documentation is in English and addresses the elements of repair station inspections;
- develop a process to capture results of FAA and foreign aviation authority inspections for repair stations monitored by other aviation authorities;
- develop a procedure to verify that foreign aviation authorities place adequate emphasis on FAA regulations when conducting inspections at FAA-certified facilities;
- clarify requirements for foreign aviation authorities to send changes to FAA-certified repair station operations to FAA for approval; and
- clarify that the current sample size for conducting sample inspections (10 percent of the repair stations) is the minimum adequate number needed to gain assurance that foreign aviation authorities' inspections meet FAA standards. The fact that FAA is clarifying its policy on the number of sample inspections it can perform at foreign repair stations is a step in the right direction, particularly given that FAA inspectors stated the 10 percent sample inspection limit was too restrictive.

FAA's response is constructive and the actions the agency commits to will significantly improve safety oversight of both domestic and foreign repair stations. When implemented, a new process to target inspections based on risk assessments or analysis of air carrier outsourcing practices should notably enhance the level of FAA's oversight. Likewise, the planned actions to develop new procedures and clarify requirements for inspections of FAA-certified repair stations conducted by foreign aviation authorities is an important action that will strengthen FAA's ability to effectively monitor the quality of foreign authorities' oversight.

A complete description of our recommendations, FAA's comments, and our responses are discussed in detail in Agency Comments and Office of Inspector General Response on pages 31 through 34 of this report.

In accordance with the requirements of Department of Transportation Order 8000.1C, we request that you provide target dates for completing planned actions within 30 days. We appreciate the courtesies and cooperation of Federal Aviation Administration representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-1992 or David A. Dobbs, Assistant Inspector General for Aviation Audits, at (202) 366-0500.

Attachment

Executive Summary

Review of Air Carriers' Use of Aircraft Repair Stations

Federal Aviation Administration

Report No. AV-2003-047

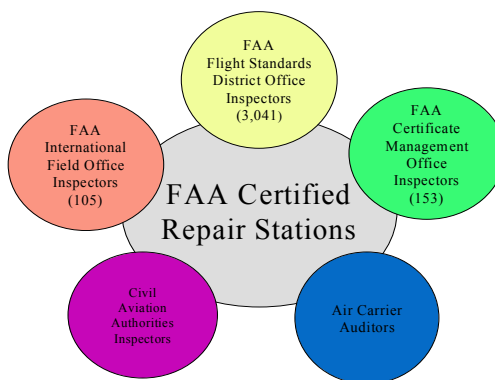
July 8, 2003

BACKGROUND AND OBJECTIVES

Currently, there are approximately 650 foreign and 4,600 domestic repair stations certified by the Federal Aviation Administration (FAA). Repairs by FAA-certified repair stations are highly regarded throughout the world. To obtain FAA certification, repair stations must demonstrate that they have equipment, personnel, manufacturers' maintenance instructions, and inspection systems to ensure repairs will be completed using FAA standards.

According to FAA, oversight of these facilities is performed by 1,742 FAA aviation safety inspectors located throughout the United States, Europe and Asia. Repair stations are also monitored by air carrier groups and international aviation authorities. As illustrated in Figure 1, these groups, along with FAA, create a series of overlapping controls designed to ensure repairs are completed properly.

Figure 1. Oversight of FAA-Certified Repair Stations



When repair stations are certified by more than one country, aviation authorities from each country conduct oversight of those facilities. Repair stations are billed for the cost of this oversight by each authority. To reduce the financial burden on repair stations and to eliminate duplicative surveillance activities, FAA and the

European Joint Aviation Authorities¹ developed Bilateral Aviation Safety Agreements and accompanying Maintenance Implementation Procedures. A Bilateral Aviation Safety Agreement is a government-to-government agreement that lays out a framework for the aviation authorities to cooperate on aviation safety issues. Maintenance Implementation Procedures define the terms and conditions under which the authorities accept each other's maintenance facility inspections, thereby reducing redundant regulatory oversight.

Currently, 138 FAA-certified repair stations are being monitored by the French, German, and Irish aviation authorities. FAA inspectors continue to provide oversight for the remaining 512 FAA-certified repair stations located in foreign countries.

The objectives of this audit were to determine if FAA: (1) ensures that repair stations have controls in place to provide adequate security of aircraft and repair facilities; (2) verifies that foreign civil aviation authorities conducting inspections on FAA's behalf ensure that aircraft are adequately safeguarded, repairs are completed properly, and any identified deficiencies are corrected; (3) monitors changes in air carriers' maintenance expenses and repair station usage to identify notable trends and effectively target FAA's surveillance resources; and (4) ensures that maintenance work at FAA-approved repair stations is performed by trained, qualified personnel and complies with approved maintenance procedures.

This report does not address security at aircraft repair stations. Because of the sensitive nature of the information, issues pertaining to security at repair stations were addressed in a separate document.

RESULTS IN BRIEF

The use of repair stations to complete aircraft maintenance is becoming as fundamental to air carriers' maintenance programs as their own internal maintenance facilities. Although air carriers have outsourced portions of their maintenance work for years, this practice has recently become more pronounced. As of December 2002, major air carriers² were using repair stations for 47 percent of their total aircraft maintenance costs. While major air carriers spent \$1.5 billion on outsourced maintenance work in 1996, the amount spent on outsourced maintenance had increased to \$2.5 billion in 2002. This trend has been largely driven by the substantial cost savings that can be realized from using repair

¹ The European Joint Aviation Authorities represent 37 European countries that have agreed to cooperate in developing and implementing common safety regulatory procedures.

² Major air carriers are those that transport the most passengers: Alaska Airlines, America West Airlines, American Airlines, Continental Airlines, Delta Air Lines, Northwest Airlines, Southwest Airlines, United Airlines, and US Airways.

stations. Air carriers can save as much as 30 to 40 percent by outsourcing aircraft maintenance because labor rates are lower at repair stations. Also, air carriers do not have to maintain the capabilities to perform specialized repairs at their in-house facilities if the work is outsourced. While some air carriers are currently achieving significant cost reductions through workforce wage concessions, it is unclear whether the savings will be enough to reverse the current trend toward outsourcing.

Despite the increase in air carriers' use of these facilities, FAA has continued to concentrate its resources on oversight of air carriers' in-house maintenance operations. For example, inspectors at one air carrier completed 400 inspections of the air carrier's in-house maintenance operations in fiscal year (FY) 2002, while only completing 7 outsourced maintenance inspections of repair stations used by the air carrier during the same time period. During this same year, this air carrier outsourced 44 percent of its maintenance cost.

FAA Needs to Reevaluate Its Oversight Structure for Repair Stations. Two different groups of FAA inspectors monitor repair station operations; however, neither group inspects repair stations on a regular basis, nor do the inspections cover the entire repair station operation. Within FAA's Flight Standards Service, the inspector workforce is divided into two distinct groups. First, Flight Standards District Office inspectors are responsible for monitoring the safety of various types of aviation operators located in their assigned geographical area or district. The second group, Certificate Management Office inspectors, is assigned the responsibility of monitoring the operations and maintenance activities of major air carriers.

Inspectors located in FAA's Flight Standards District Offices (district office inspectors) have primary responsibility for oversight of repair station operations; however, they are only required to visit each facility once per year. Also, these district office inspectors have responsibility for oversight of numerous other operators that fall within their geographical area of responsibility. District office inspectors in the 9 offices we reviewed were responsible for oversight of an average of 9 repair stations and 14 other certificates. However, we did find instances in which district office inspectors were assigned oversight responsibility for many more certificates. For example, 1 FAA inspector was assigned oversight responsibility for 21 repair stations, 21 agricultural operations, 12 service-for-hire operators, 3 general aviation operators, 2 helicopter operations, and 1 maintenance school. As a result, district office inspectors may limit their surveillance time at repair stations and do not monitor all phases of repair station operations during their inspections.

As part of their oversight of major air carrier operations, Certificate Management Office (certificate management) inspectors also conduct periodic inspections of repair stations. However, the inspections are infrequent and are primarily designed to assess whether the repair station is following the air carrier's maintenance manual to complete repairs. For example, certificate management inspectors would not review work the repair station performs for other air carriers, nor would they review a repair station's overall operation.

Compounding the weaknesses in FAA's oversight structure is the fact that district office and certificate management inspectors do not share the limited repair station inspection information they have obtained. A primary tool designed to permit such information sharing is FAA's Safety Performance Analysis System (SPAS). While SPAS could provide FAA inspectors in any office with access to safety data that can be used to target inspections to areas of the greatest need, the two groups of inspectors do not provide sufficient repair station inspection information in the system to make it useful. For example, certificate management inspectors are not required to record which repair stations they inspect, and district office inspectors do not identify what they did to complete their inspections. FAA needs to implement better methods of sharing data between certificate management and district office inspectors regarding repair station inspections and findings.

Greater Emphasis Needed on Repair Station Oversight. In the past few years, FAA has given much-needed attention to its oversight of air carriers' in-house maintenance. For example, in December 2001, we reported that independent FAA inspection teams identified aircraft maintenance deficiencies such as fuel leaks under the wings and engine oil and hydraulic leaks on landing gear. These maintenance problems indicated that the carriers' systems for monitoring their own maintenance work, and work performed by repair stations, were not functioning properly; however, FAA inspectors responsible for oversight of these air carriers had not identified the shortcomings in how the carriers monitored their maintenance work. As a result, FAA has taken steps to improve its oversight of air carrier operations and air carrier maintenance programs, referred to as Continuing Analysis and Surveillance Systems.

Similar emphasis is also needed on the process and level of oversight inspectors apply at aircraft repair stations. When we visited 12 domestic and 9 foreign repair stations, we identified problems such as mechanics using incorrect aircraft parts and outdated maintenance manuals during repairs, and performing improper calibrations of tools and equipment at 18 of the 21 (86 percent) repair stations reviewed. We found these discrepancies by reviewing the parts, repair manuals, tools, and equipment used to complete selected repairs—a process which allowed us to evaluate the entire repair process from the time the parts were received for repair until they were released to the customer. However, FAA inspectors tend to

only look at segments of the repair process because of the limited time they have to devote to repair station inspections. To correct the kind of weaknesses we found, FAA must develop a more comprehensive approach to repair station inspections that includes a review of all aspects of repair station operations. FAA has acknowledged the need to consider additional methods of repair station oversight. FAA senior management officials recently advised us that the Agency is working on a risk management approach to oversight of repair stations.

FAA Should More Closely Monitor Foreign Aviation Authority Oversight of Repair Stations. Although widely used by U.S. air carriers, some FAA-certified foreign repair stations are not inspected by FAA inspectors at all because other civil aviation authorities review these facilities on FAA's behalf. FAA permits foreign authorities to inspect FAA-certified repair stations to prevent duplicative inspections and reduce the financial burden on foreign repair stations. Therefore, this arrangement has positive features that make continuation of the program beneficial to all parties. However, FAA has not implemented adequate oversight procedures for ensuring the quality of inspections conducted on its behalf.

Foreign inspectors do not provide FAA with sufficient information to determine what was inspected, what problems were found, and how they were corrected. In 14 of 16 (88 percent) files we reviewed, the inspection documentation provided to FAA was incomplete or incomprehensible. For example, although it should be submitted in English, inspection documentation provided by one country was submitted to FAA in French. Yet, the one FAA inspector who was fluent in French was only assigned 3 of the 10 facilities for which inspection documentation was submitted in French. As a result of the weaknesses in inspection documentation, FAA could not verify that inspections conducted on its behalf ensured repair stations met FAA standards.

As part of FAA's agreement with foreign authorities performing oversight on its behalf, FAA inspectors can perform "sample inspections" of up to 10 percent of facilities already reviewed by foreign inspectors. When FAA performed a sample inspection of a repair station that had been inspected by a foreign aviation authority, FAA inspectors found 45 deficiencies, many of which directly related to FAA requirements. These deficiencies ranged from failure to properly calibrate tools to subcontracting out portions of the work to facilities that were not FAA-certified repair stations. We found that foreign inspectors often focused more on European regulations than FAA requirements during their reviews. Representatives from one foreign authority advised us that they did not feel it was necessary to review FAA-specific requirements when conducting repair station inspections. To ensure FAA-certified repair stations are following FAA standards, FAA should consider performing more sample inspections of facilities inspected

by foreign authorities to ensure that these repair stations are following FAA standards.

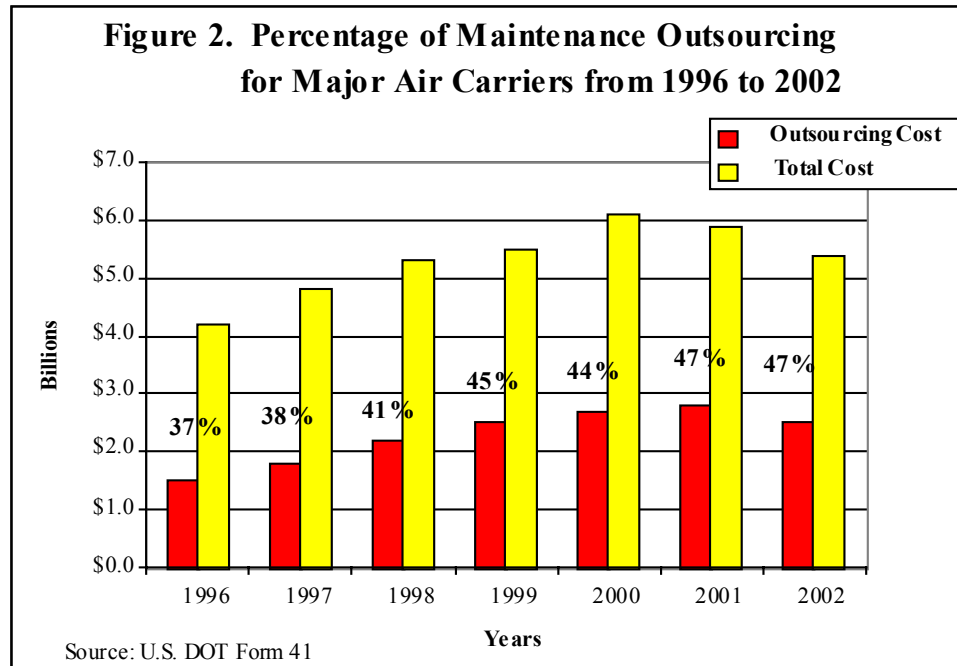
Conclusion. The type and extent of problems we found at domestic and foreign repair stations were similar. These vulnerabilities all relate to a lack of effective FAA oversight and, if not corrected, could lead to an erosion of safety. FAA must take action to obtain data to determine trends in air carriers' use of repair stations, determine which repair stations the carriers are using to perform maintenance, adjust its surveillance so that it performs more frequent and detailed reviews of the facilities air carriers use the most, and develop a documented system to share inspection information between FAA offices. Additionally, FAA must clarify its inspection documentation requirements and take steps to ensure inspections conducted by foreign authorities verify that FAA standards are followed. If FAA cannot take these actions to enhance its oversight of repair stations, more fundamental changes in FAA's structure may be necessary.

PRINCIPAL FINDINGS

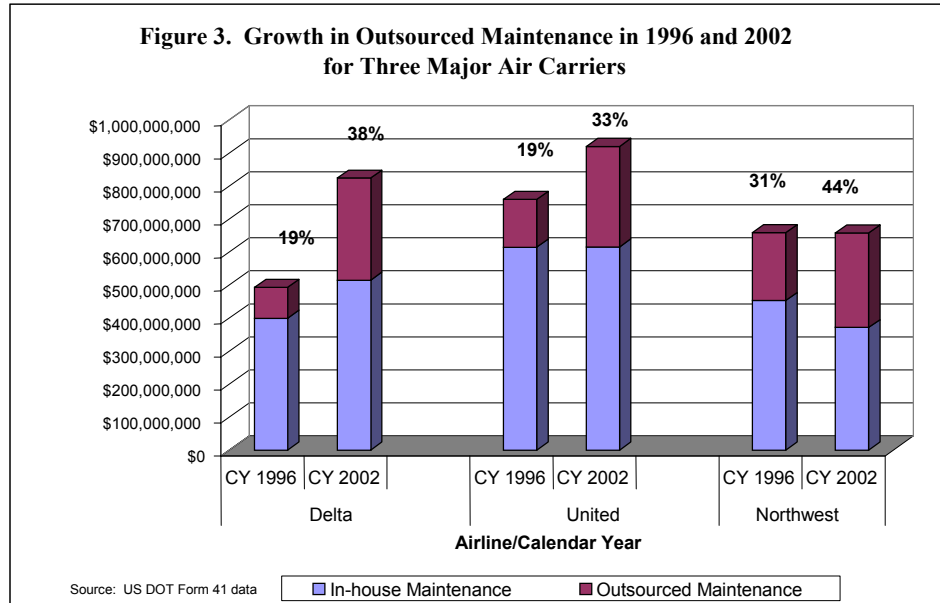
Air Carriers Have Increasingly Gravitated to Repair Stations for Aircraft Maintenance, Yet FAA Has Made No Similar Shift in Its Oversight of These Facilities

Even though air carriers are currently outsourcing close to half of their maintenance expense, FAA has continued to focus its surveillance on air carriers' in-house facilities with no comparable shift toward increased oversight of work performed at repair stations. While aircraft repair stations have long been used to supplement air carriers' in-house maintenance work, major air carriers have gone from outsourcing just over a third of their maintenance expense to outsourcing nearly half of their aircraft maintenance costs,³ as shown in Figure 2.

³ To determine outsourced maintenance percentages, we compared the amount of direct maintenance expense air carriers incurred for outside repairs to the amount the carriers incurred for total direct maintenance expense as shown on "Form 41" financial data that air carriers submit to the Department's Bureau of Transportation Statistics.



As shown in Figure 2, major air carriers spent almost a billion dollars more on outsourced maintenance in 2002 than in 1996. Because of the financial benefits, some air carriers have customarily placed heavy reliance on outsourcing maintenance work to keep operating costs down. For example, four major air carriers (America West, Continental, Alaska, and Southwest) have consistently outsourced at least 63 percent of their maintenance costs to repair stations in the last 5 years. However, with the sharp economic downturn in the aviation industry, even those carriers that did not traditionally rely on extensive outsourcing are re-evaluating this decision. For example, Delta Air Lines outsourced 19 percent of its maintenance expense in 1996; however, Delta doubled the percentage it outsourced to 38 percent in 2002. Similar shifts towards outsourcing for Delta and two other air carriers not typically known to extensively outsource maintenance work are shown in Figure 3.



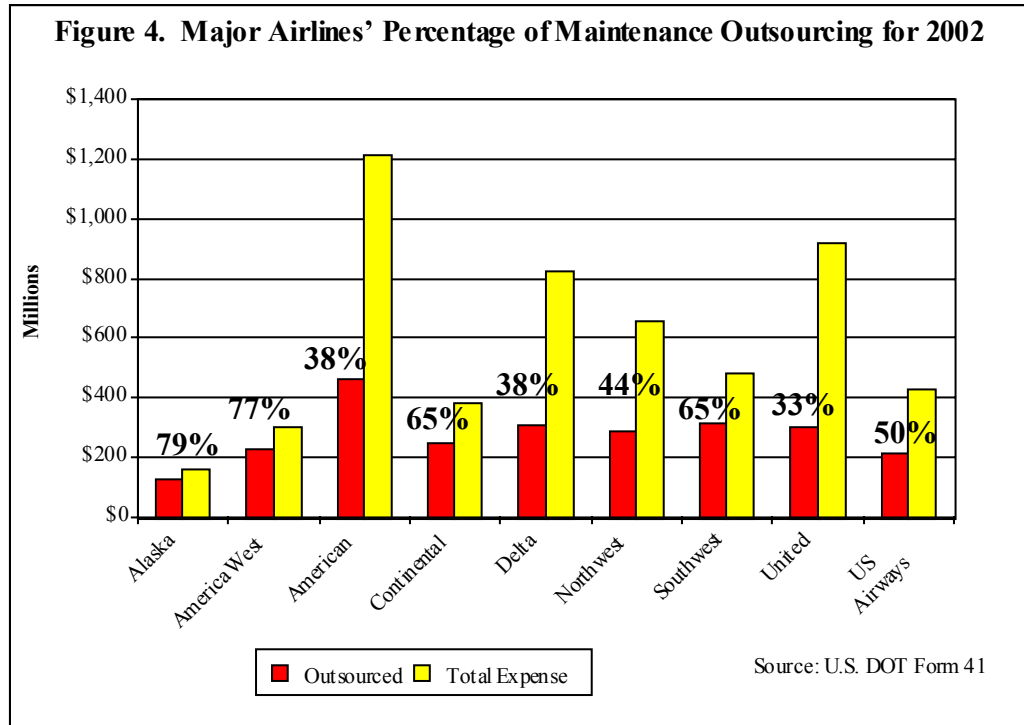
Recently, many airlines have reduced their workforce, closed maintenance facilities, and retired aircraft to reduce operating costs. Some airlines have used the bankruptcy process to restructure their costs and renegotiate labor contracts. At least one major air carrier has announced plans to abrogate its current union contract, which restricts the amount of maintenance work that can be outsourced, in order to outsource more. This carrier has already closed two of its maintenance facilities and reports that sending more of its aircraft maintenance to repair stations will save 50 percent of the amount it spends on major aircraft repairs.

The financial benefits air carriers realize as a result of maintenance outsourcing is attributed to different factors. First, air carriers can negotiate lower labor rates at outsourced facilities because repair stations often have lower overhead and pay lower wages to their mechanics. While details of labor rates are closely guarded by air carriers, in-house labor rates to complete airframe work have been reported to be as high as \$83 per hour, while labor rates for the same repair at a repair station range from \$45 to \$47 per hour. Labor rates charged by some foreign repair stations are even lower. For instance, one repair station we visited in Mexico charges approximately \$40 per hour for airframe repairs. One airline reported that air carriers save 30 to 40 percent by sending maintenance work to repair stations instead of completing the repairs in-house.

In addition to the lower labor rates, air carriers use repair stations because, in some instances, these facilities have expertise in certain specialized areas that air carriers' in-house maintenance facilities are not equipped or staffed to handle. For example, many carriers outsource engine repairs because of the high cost required to maintain the capability to repair them. These types of repairs require specialized equipment, staffing, and inventory. As a result, sending work such as

engine repairs to specialty shops is less expensive for air carriers than it would be to equip their in-house facilities for this type of work.

As of December 2002, major air carriers outsource from 33 to 79 percent of their total aircraft maintenance expense, as shown in Figure 4.



FAA inspectors must recognize this increased use of outsourced maintenance and adjust their level of oversight accordingly. Yet, we found no indication that FAA has taken action to adjust its surveillance activities to more closely monitor air carriers' use of these facilities. In fact, we found that FAA has no process in place to determine how much air carriers use repair stations. This problem is particularly pronounced in air carriers' use of foreign repair stations—FAA could not tell us how much maintenance work is sent overseas. When we attempted to identify which repair stations were used most by selected air carriers, inspectors stated that they do not collect this information and do not feel it is part of their oversight responsibility to monitor this activity. As a result, FAA is not tracking a key segment of air carriers' maintenance operations. FAA must ensure it provides a balanced look at all entities performing major maintenance work for air carriers.

FAA Should Consider a New Approach to Repair Station Oversight

Two groups of inspectors within FAA monitor aircraft repair stations; however, neither group places adequate emphasis on these facilities as part of their surveillance. FAA's district office inspectors have primary responsibility for conducting repair station inspections; however, they typically only inspect repair stations once or twice a year. Although FAA's certificate management office inspectors periodically inspect repair stations as part of their responsibility for oversight of air carrier operations, these inspections are infrequent and do not include a review of the work the repair station performs for other customers. In addition, district office and certificate management office inspectors do not share with each other the inspection information they have obtained. We found vulnerabilities of varying degrees within the operations of 18 of the 21 repair stations we visited, which suggest FAA's oversight process has been ineffective.

FAA Has Enhanced Its Oversight of Air Carriers' Internal Maintenance Procedures, But Has Not Made Similar Adjustments to Its Repair Station Oversight. Aircraft maintenance is an essential component of a safe aviation system. In recent years, FAA has taken steps to address shortcomings in its oversight of air carriers' internal maintenance. For example, after the 1996 ValuJet crash, FAA formed a task force to perform a 90-day review of FAA's oversight of air carriers. In response to the findings from this review, FAA introduced its Air Transportation Oversight System (ATOS), a new air carrier inspection system aimed at proactively evaluating an air carrier's entire operation. However, although ATOS inspectors can inspect outsourced maintenance facilities used by their assigned carrier, we found that ATOS inspections primarily focus on oversight of major air carriers' internal operations and systems. FAA has not taken steps to enhance its oversight of repair stations.

In 1997, the National Transportation Safety Board recommended that FAA (1) ensure that passenger aircraft maintenance receives the same level of FAA oversight, regardless of whether it was performed in-house or by repair stations, and (2) review the workload of inspectors assigned oversight responsibility for repair stations to ensure those inspectors have sufficient time and resources to perform surveillance. Although these recommendations were made over 6 years ago, we found the same weaknesses in repair station oversight prevail today.

FAA needs to modify its process for repair station oversight. Inspectors responsible for oversight of air carrier operations (ATOS certificate management inspectors) do not inspect repair stations completing significant portions of maintenance work for their assigned air carrier with the level of intensity with which they inspect the carrier's internal maintenance program. For example, in FY 2002, certificate management inspectors for 1 air carrier completed

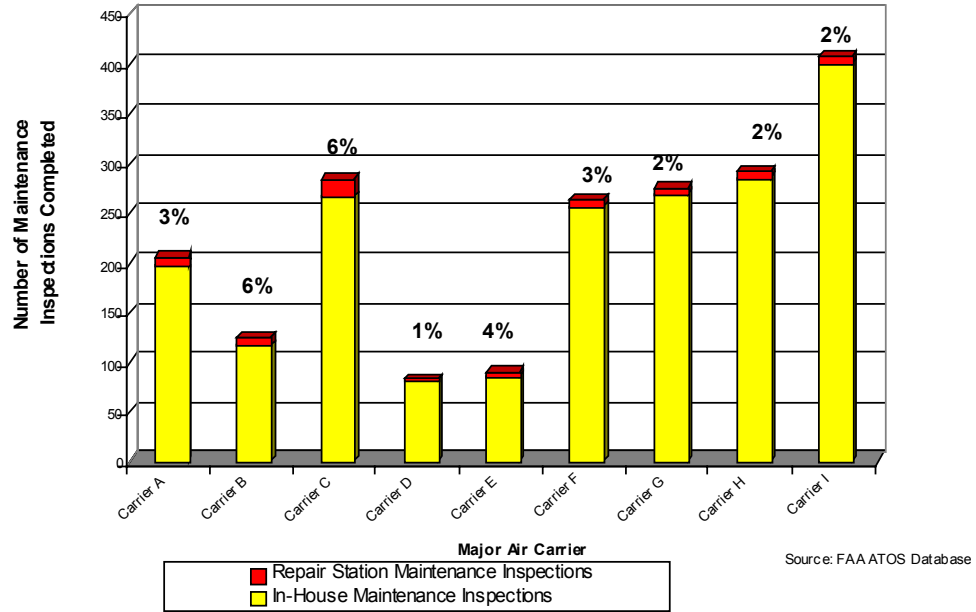
292 maintenance-related inspections, of which only 6 (2 percent) were for outsourced maintenance. Given the current trend toward outsourcing, FAA certificate management inspectors must re-evaluate this approach.

Further, the FAA district office inspectors that have primary responsibility for repair station oversight have so many other operators to oversee, they cannot devote the level of intensity to repair station oversight that is warranted. Further compounding these problems is the fact that the two groups of FAA inspectors do not share the limited repair station inspection information they have obtained. These shortcomings in FAA's oversight structure limit the effectiveness of the surveillance that inspectors provide of repair station operations and preclude FAA from getting maximum utilization of its inspector resources.

Certificate Management Office Inspectors. In October 1998, as part of its new ATOS system, FAA assigned designated groups of inspectors to perform continuous monitoring of all phases of each major air carrier's internal operations. For example, in one Certificate Management Office, FAA assigned 27 inspectors to oversee one carrier's maintenance operations. Every year, these inspectors review numerous areas of the carrier's maintenance programs, including aircraft airworthiness requirements, maintenance technicians' experience requirements, maintenance manual currency, inventory control, deferred maintenance programs, compliance with Airworthiness Directives, maintenance training programs, and air carrier's systems for oversight of repair stations. This volume and variety of inspections is possible because certificate management office inspectors make multiple visits to the air carrier's facility each year.

While certificate management inspectors are responsible for oversight of their air carrier's operations, they are not required to regularly inspect repair stations that may be completing significant amounts of the air carrier's maintenance work. Certificate management inspectors rely on inspectors from other FAA offices to monitor these facilities. For example, in 2002, certificate management inspectors performed 199 reviews of 1 air carrier's internal maintenance operations and only 7 reviews of repair stations used by this carrier. However, this air carrier outsourced 65 percent of its maintenance costs in 2002. As shown in Figure 5, the level of intensity with which certificate management office inspectors inspect repair stations is consistent among the certificate management offices, regardless of how much each air carrier currently uses outsourced facilities.

Figure 5. Percentage of Repair Station Inspections Completed by FAA Certificate Management Inspectors in FY 2002



District Office Inspectors. Primary responsibility for oversight of repair stations falls with FAA’s district office inspectors. However, these inspectors are only required to perform one review at each repair station per year, regardless of the amount of work these facilities complete for major air carriers on critical aircraft parts. FAA senior management officials stated that contrary to our findings, district office inspectors actually perform thousands of repair station inspections each year.

In reviewing FAA’s Performance Tracking and Reporting System, we determined that FAA inspectors do in fact *record* thousands of instances where repair station inspections were performed. However, in evaluating the records supporting these inspections, we found that the number of inspections recorded is misleading. For example, we determined that one FAA inspector recorded completion of a repair station inspection when he accompanied our auditors to the repair station. This inspector did not remain on site with us for the review but his inspection record indicated that he completed a facility inspection during this visit.

In other instances, we found that inspectors recorded completion of inspections for reviewing manual changes submitted by the repair stations to the FAA office for review. In still another instance, we found that an inspector recorded completion of *10 different inspections* in 1 day for a visit to 1 repair station. While inspectors do perform other functions in their oversight of repair stations, such as approving changes to the facility’s procedures manual, which are captured in FAA’s inspection database as inspection activities, we found that inspectors generally conduct full facility inspections at their assigned repair stations only once or twice

a year. Because district office inspectors are also responsible for oversight of many different types of operators, the amount of time they can devote to repair station inspections is often limited. For example, 1 FAA inspector was assigned oversight responsibilities for 32 agricultural operators, 19 repair stations, 7 on-demand operators, 2 helicopter operators, and 1 maintenance school.

Because of their multiple responsibilities, district office inspectors do not have time to apply the level of intensity to repair station oversight that certificate management inspectors are able to apply to air carriers' in-house maintenance operations. As a result, district office inspectors typically evaluate a few phases of a repair station's operations, such as tool calibration or maintenance manual currency, during a facility inspection. Because of the competing demands of their workload, inspectors informed us they sometimes spend as little as 3 hours on a repair station inspection. One inspector advised us that he could complete a small repair station inspection in *20 minutes*, and eight inspectors informed us they could complete inspections within 2 to 8 hours. FAA senior management officials questioned the inspection time reported by FAA inspectors. They contend that if these inspectors had followed the guidance that outlines the tasks inspectors are required to complete during an inspection, inspectors could not have completed inspections this quickly. However, because district office inspectors do not document what they did to complete an inspection, we have no way of knowing whether the inspectors completed all required tasks.

FAA senior management officials recently informed us that they are conducting a test to reassign oversight of repair stations that are operated by a major air carrier to the same office that provides oversight of the carrier. If FAA elects to change oversight responsibility for air carrier repair stations, this change could help to reduce some of the workload for district office inspectors. However, the change in oversight responsibilities would create new challenges. For example, FAA must ensure that certificate management inspectors are properly trained to perform inspections that evaluate both how the facility operates as a repair station, and whether repairs performed for other air carriers meet FAA standards. Currently, certificate management inspectors only review repair stations to determine if the work performed complies with their assigned air carrier's maintenance requirements.

Further complicating the inspectors' ability to fully evaluate repair station operations is the fact that inspectors responsible for oversight of foreign repair stations typically do not conduct unannounced inspections at their assigned facilities. Because gaining access to foreign countries is a time consuming process, requiring employees to notify the U.S. Embassy in advance of their travel and, in most cases, to obtain a visa issued by the country to be visited, these inspectors are unable to conduct surprise inspections. As a result, FAA inspectors

typically rely on inspections at foreign facilities that may have had several months advanced notice to prepare for the inspection.

Sharing of Information. Compounding the weaknesses in FAA’s current oversight structure for repair stations is the fact that the two groups of inspectors that conduct repair station inspections do not share inspection information. Inspectors’ primary means of sharing information is through FAA’s newly integrated SPAS. This system was designed to act as a repository of vital inspection information that *all* inspectors could use for targeting surveillance to the areas of greatest need.

However, key pieces of inspection information are omitted from the SPAS database. For example, certificate management inspectors are not required to provide the names of repair stations they have inspected and district office inspectors are not required to identify what areas they reviewed at each repair station they inspected. As a result, certificate management and district office inspectors are unable to use the database to share historical data on repair station inspections and help FAA better target its inspector resources. In addition, inspectors in FAA’s International Field Office in Germany, which has oversight responsibility for 238 repair stations in 29 countries, advised us that they do not have access to SPAS at all. FAA senior management officials recently informed us that the manager of the FAA office in Germany acknowledged telling us that office did not have access to SPAS; however, she stated she had “misinformed” us on this issue. Because the manager and staff were so adamant in their assertion that inspectors in the Germany field office did not have access to SPAS during our visit, we can only conclude that the inspectors were not using this database at that time.

Areas That Need Improvement. Our review disclosed weaknesses in repair station operations at 18 of the 21 (86 percent) repair stations we visited. For example, we identified repair stations that did not: (1) use the parts required by the maintenance manual in completing repairs, (2) properly calibrate tools and equipment that could be used in repairs, (3) have information on file to show that mechanics approving completed repairs possessed the necessary training and qualifications, or (4) correct deficiencies previously identified by FAA inspectors. Left uncorrected, these deficiencies could lead to an erosion of safety. These problems went undetected by FAA surveillance because of the weaknesses in FAA’s oversight structure and the process inspectors used during repair station inspections.

Parts and Equipment. Some FAA inspectors review in-process work when conducting inspections at repair stations. While this is the best approach to ensure that the work the repair station is presently performing is completed according to

FAA standards, it limits the inspector's ability to review the entire repair process from beginning to end. As a result, important safety problems may not be detected. For example, during our review of completed work, we determined that one domestic repair station used three incorrect bushings during the overhaul of a portion of a flight control assembly on a Boeing 727 aircraft. According to a Boeing engineer, if these parts failed, it could result in aircraft handling problems. FAA's surveillance at this facility had not detected the use of incorrect parts because inspectors did not routinely compare parts used in repairs to those called for in the maintenance manual. We found problems with parts and equipment used in repairs at 15 of the 21 facilities (71 percent) we visited. FAA inspectors should ensure that they review the entire repair process at repair stations including completed and in-process work.

Training. Of the 21 repair stations we visited, 8 repair stations (38 percent) did not maintain training files for supervisory personnel that substantiated that they had qualifications and abilities to supervise the repairs performed. For example, one repair station employee could not demonstrate through training records that he was qualified to complete the final inspection for a repair of an engine oil pressure transmitter, although he did inspect the work. Although the employee was properly licensed by FAA, his training files contained no evidence that the repair station had provided him training on how to properly inspect this repair. In 2005, FAA's new rule governing repair station operations will require that each repair station have a training program that will ensure it can demonstrate that employees have necessary training to perform their work. With this impending change, FAA inspectors should begin to look at how repair stations document the training and qualifications of repair station personnel.

Policies and Procedures. We found problems with maintenance policies and procedures at 15 of the 21 repair stations we visited. During a tour of one repair station, we identified the repair station's failure to properly segregate scrapped parts from usable parts. These parts were part of a ballscrew assembly, which the repair station compared to the jackscrew assembly that failed on Alaska Airlines Flight 261. These parts were left unlocked and uncontrolled on the shop floor right next to where maintenance work was being done. The scrapped parts were awaiting disposition instructions from the customer and did not appear to be physically damaged. The scrapped parts could have been mistakenly used by a mechanic in a repair. This was a standard practice used by the repair station and should have been identified during routine surveillance by FAA inspectors.

Uncorrected Repetitive Deficiencies. We identified instances in which FAA inspectors found deficiencies during repair station inspections but did not take action to ensure that these deficiencies were corrected or did not determine the root cause of the problems. For example, we found that one domestic repair

station did not properly cover and protect hoses and lines used to test fuel pumps. Failure to cover these lines and hoses could allow debris to enter these parts, which could affect the operation of the engine. The FAA inspector had identified the problem at this repair station on **three** separate occasions but did not take decisive action to ensure the problem was corrected. More disturbing, when we identified this problem for the **fourth** time and notified the inspector, the inspector still did not take enforcement action against the repair station. Of the 21 repair stations we visited, 2 foreign and 2 domestic repair stations failed to correct deficiencies previously identified by inspectors.

Conclusion. Air carriers' increased use of repair stations and the procedures FAA uses to provide oversight of these facilities have left vulnerabilities in the quality of aircraft repairs performed at these facilities. To identify and address repair station deficiencies, FAA should modify the way it conducts inspections to keep pace with the changing aviation environment. FAA certificate management inspectors should monitor air carrier maintenance expenses and repair station usage for trends and target surveillance toward maintenance facilities air carriers use to complete significant amounts of their aircraft maintenance. Additionally, inspection results should be shared with FAA inspectors responsible for repair station oversight for more effective use of FAA resources.

FAA Should Strengthen Its Oversight of Surveillance Conducted by Foreign Civil Aviation Authorities

FAA inspectors' primary means of monitoring surveillance currently conducted by three foreign civil aviation authorities is through desk reviews of inspection documentation provided by each authority. However, the inspection documentation FAA receives from these authorities does not contain sufficient information to effectively monitor the quality of the foreign authorities' oversight. Further, foreign inspectors tend to focus inspections on European regulations rather than FAA standards. While FAA can perform sample inspections at FAA-certified foreign repair stations, its internal guidance limits the number of such inspections it can conduct each year. As a result, FAA is unable to determine if the work performed at some FAA-certified foreign repair stations meets FAA standards.

Through agreements with other countries, inspectors in three foreign countries conduct oversight and certification inspections of aircraft repair stations for FAA. In October 1999, the Governments of the United States and France signed an agreement under which FAA and its French counterpart agreed to accept each other's surveillance systems, including recommendations for FAA repair station certification and certification renewal, and continued monitoring of maintenance

practices. To date, the French Civil Aviation Authority has assumed oversight responsibility for 76 FAA-certified repair stations.

In April 1999 and June 1997, the United States entered into similar agreements with the Governments of Ireland and Germany, respectively. To date, 62 repair stations in Ireland and Germany have been turned over to the applicable aviation authority for oversight responsibility. However, the number of FAA-certified repair stations monitored by foreign authorities could significantly expand in the future because of ongoing efforts by European countries to develop a single European aviation authority. The European Union, currently consisting of 15 countries, including Germany, Ireland and France, has agreed to form the European Aviation Safety Agency (Agency), and be legally bound to enter into agreements with other countries *only* as a single entity. FAA may develop a bilateral aviation safety agreement with the Agency, which could encompass Agency oversight of FAA-certified repair stations in the 15 member countries.

Inspection Documentation Provided to FAA Is Incomplete or Incomprehensible. Although inspectors from foreign civil aviation authorities make determinations that repair stations are performing work using FAA-approved practices, FAA has not required these authorities to provide sufficient information to FAA inspectors to verify that these determinations were sound. We reviewed inspection documentation provided by the French civil aviation authority in detail and found that the documentation was incomplete or incomprehensible in 14 of 16 (88 percent) repair station files we selected for detailed review. For example, although inspection records should be provided to FAA in English, key records on what was reviewed and what was found at repair stations were often submitted in French. While at the International Field Office, we identified only one FAA inspector fluent in French.

In other cases, FAA was unable to determine what areas the aviation authority reviewed and whether the problems identified during inspections were corrected. For example, all four of the inspection files we reviewed of repair stations in Germany and Ireland were lacking sufficient inspection documentation from the aviation authorities to determine whether corrective actions for identified discrepancies were taken or were adequate. For example, the inspection documentation for one repair station in Germany presented a finding that “No conditions fixed, decision in isolation case” and no corrective action was identified. There was no evidence in the repair station files to indicate that FAA notified the foreign civil aviation authorities of the need for more thorough and comprehensible inspection documentation.

FAA Standards Are Not Emphasized During Surveillance. In addition to providing poor documentation of inspection results, foreign inspectors tailored

their surveillance more toward European regulations than FAA regulations. This became evident when FAA conducted a sample inspection at one repair station monitored by foreign inspectors and identified numerous deficiencies pertaining to FAA requirements.

For example, FAA inspectors found that the repair station was subcontracting out work to other foreign facilities that were not FAA-certified and performing repairs for which the repair station was not FAA-approved. The aviation authority that inspected this facility did not identify these issues during its surveillance at the facility. Further, FAA has not developed a procedure, within the sample inspection process, to determine why the foreign authority did not identify FAA-related deficiencies during its routine oversight. Moreover, although sample inspections are highly effective in assessing the quality of foreign authority inspections, FAA has agreed to limit the number of such inspections it will perform to 10 percent.

At two repair stations in France where French inspectors performed oversight, we identified deficiencies that needed to be addressed. For example, personnel who were responsible for conducting final inspections on aircraft repairs at one repair station could not read and understand an Airworthiness Directive (AD)⁴ when asked, because the document was written in English. The agreement between France and the United States specifically requires repair station personnel that are approving repairs to be able to read and understand the English language. The AD in question required the repair station to perform additional work steps to prevent premature failure of a key engine part. The foreign aviation authority's inspectors never identified this as a problem. As a result, our audit tests reiterated FAA sample inspection findings that indicate foreign civil aviation authorities do not emphasize FAA regulations when conducting inspections at repair stations.

While the use of reciprocal agreements for inspection of repair stations was developed to ease the financial burden on repair stations and to eliminate duplicative surveillance activities, FAA has not implemented adequate oversight procedures for ensuring the quality of inspections conducted on its behalf. Before agreements with other countries are implemented, FAA must ensure it receives sufficient inspection documentation from inspectors at the three civil aviation authorities already conducting inspections on its behalf. Also, FAA must ensure that foreign inspectors provide increased emphasis on FAA requirements to give FAA assurance that FAA-certified repair stations inspected by other aviation authorities meet FAA standards.

⁴ FAA issues Airworthiness Directives to provide actions that operators must take to correct or prevent an unsafe condition on an aircraft.

RECOMMENDATIONS

To enhance FAA oversight of domestic and foreign repair stations, we recommended that FAA:

- use air carrier maintenance financial data to identify trends in the source of maintenance and adjust oversight inspections accordingly.
- develop a process to identify the repair stations air carriers use to perform safety critical maintenance and target inspector resources based on a risk assessment of data collected on air carriers' outsourcing practices.
- require both certificate management and district office inspectors to include complete repair station inspection information in the Safety Performance Analysis System to assist in targeting use of inspector resources.
- develop a comprehensive, standardized approach to repair station surveillance by requiring inspectors to review all aspects of repair station operations, from the time repairs are received until they are released to the customer.
- modify existing inspection documentation requirements with applicable foreign aviation authorities and develop procedures to verify that inspectors from foreign aviation authorities place adequate emphasis on FAA requirements when conducting reviews on FAA's behalf.
- revise procedures for conducting sample inspections of repair stations being monitored by foreign aviation authorities to permit FAA to conduct the number of inspections necessary to ensure that FAA-certified repair stations are complying with FAA standards.

AGENCY COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

On June 19, 2003, FAA provided comments to our May 30, 2003 draft report. On July 2, 2003, we met with FAA senior management officials to further discuss the report and FAA's response.

In its comments, FAA stated that our sample size may have been too small to obtain accurate information and draw positive conclusions. We would point out

that, in order to obtain a representative sample of repair stations to review, we selected facilities that were geographically dispersed throughout the country and the world and that varied substantially in the type of work they performed. For example, we visited repair stations in six different states that covered all regions of the United States and five countries in Europe, Asia and South America. The repair stations we visited performed repairs on all parts of the aircraft including: the airframe, engines, landing gear, flight control assemblies, and fuel pumps.

In addition, before initiating our audit work, we consulted with the Office of Inspector General Statistician to determine the number of repair stations we should visit to perform a review of a statistically representative sample of domestic and foreign repair stations. Our sample size exceeded the Statistician's recommendation to review 10 domestic and 10 foreign repair stations. Finally, it is important to recognize that the results of our review identified systemic problems at the repair stations we visited, which, as we stated in the report, demonstrates that FAA needs to improve its oversight of the work performed at these facilities.

In responding to the report, FAA concurred with all of our recommendations. Specifically, FAA agreed to:

- form a workgroup to evaluate various measurements available to identify trends in the source of maintenance and select the proper metrics. The workgroup will complete its work within 6 months, and FAA will develop policies and procedures to use these measures to identify trends and make changes in inspector resources as warranted. In the meantime, FAA will identify where critical repair work is performed and consider any available financial data to determine if there is a trend toward outsourcing such work;
- develop a new process to identify repair stations air carriers use to perform safety critical repairs and target inspector resources based on risk assessments or analysis of data collected on air carriers' outsourcing practices;
- develop procedures to improve information sharing through the Safety Performance Analysis System by requiring certificate management inspectors to document the name of the repair station they have reviewed and revising the guidance for district office inspectors to more thoroughly document repair station inspections;
- clarify its policies and procedures for requiring a comprehensive, standardized approach to repair station surveillance, including the review of total repair station operations;

- conduct follow-up reviews with the three foreign aviation authorities to ensure they are complying with recently issued policy regarding inspection documentation requirements, and instruct Field Office Managers with responsibility for these agreements to ensure that documentation is in English and addresses the elements of repair station inspections;
- develop policies and procedures to capture results from foreign aviation authority inspections and FAA sample inspections of foreign repair stations in its Program Tracking and Reporting System;
- develop a procedure to verify that foreign aviation authorities place adequate emphasis on FAA regulations when conducting inspections on FAA's behalf;
- clarify procedures requiring foreign aviation authorities to obtain FAA approval on any changes to FAA-certified repair station operations that directly impact FAA requirements; and
- clarify that the current sample size for conducting sample inspections (10 percent of the repair stations) is the minimum adequate number needed to gain assurance that the foreign aviation authority's inspections meet FAA standards. The fact that FAA is clarifying its policy on the number of sample inspections it can perform at foreign repair stations is a step in the right direction, particularly given that FAA inspectors stated the 10 percent sample inspection limit was too restrictive.

FAA's response was constructive and the actions the agency commits to should significantly improve safety oversight of both domestic and foreign repair stations. However, FAA will have to provide target dates for completing the actions before we consider these recommendations resolved.

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Chapter 1. Introduction

Background

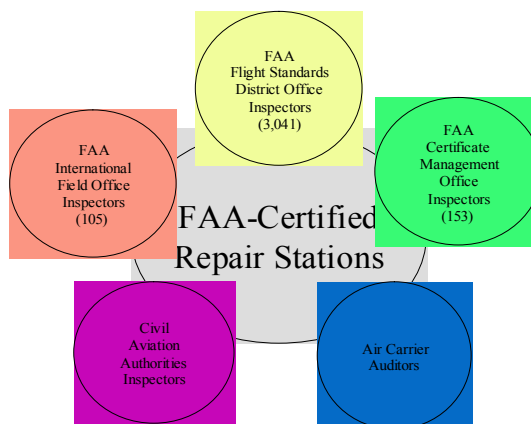
The recent economic downturn in the aviation industry has caused many carriers to look for ways to reduce operating costs. Because of the cost savings that can be realized, air carriers have increasingly turned to outside repair facilities to perform their aircraft maintenance work. In 1996, major air carriers spent \$1.5 billion (37 percent of their total maintenance costs) for outsourced aircraft maintenance. However, in 2002, the major carriers outsourced \$2.5 billion (47 percent of their total maintenance costs) in maintenance work. During this same time period, U.S. carriers experienced 13 accidents and incidents, 10 of which have been tied to improper maintenance or maintenance mistakes. Of these 10 accidents tied to improper maintenance, 4 have been linked to aircraft repair stations.

Currently, there are approximately 650 foreign and 4,600 domestic Federal Aviation Administration (FAA)-certified repair stations. According to FAA, 1,742 of its 3,300 aviation safety inspectors perform surveillance at these facilities. In addition to performing oversight of repair stations, these inspectors also provide oversight for 700 aviation training facilities and 139 commercial air carriers, and perform other duties such as accident investigations.

Scope of FAA Oversight
Approximately 3,300 FAA safety inspectors provide oversight worldwide to:
5,250 repair stations
139 commercial air carriers
637,000 active pilots
273,000 aircraft mechanics
7,600 commercial aircraft
11,000 charter aircraft
220,000 general aviation aircraft
700 aviation training facilities

Work performed at aircraft repair stations is monitored by many different entities, as illustrated in Figure 1. These groups create a series of overlapping controls designed to ensure repairs are completed properly.

Figure 1. Oversight of FAA-Certified Repair Stations



Although all these groups provide oversight of repair stations, FAA is ultimately responsible for ensuring repair stations operate in a manner that ensures repairs are completed according to FAA’s standards.

FAA Flight Standards District Office (district office) inspectors have primary responsibility for conducting surveillance at aircraft repair stations. Repair stations that perform maintenance for the major commercial air carriers are also inspected by FAA’s Certificate Management Office (certificate management) inspectors through FAA’s Air Transportation Oversight System (ATOS). Certificate management inspectors are assigned to one specific air carrier. In addition to overseeing the operations of the air carrier, certificate management inspectors can perform repair station inspections of the facilities that perform significant work for their assigned air carrier.

When repair stations are certified by more than one country, aviation authorities from each country conduct oversight of those facilities. Repair stations are billed for the cost of this oversight by each authority. To reduce the financial burden on repair stations and to eliminate duplicative surveillance activities, FAA and the European Joint Aviation Authorities¹ developed Bilateral Aviation Safety Agreements and accompanying Maintenance Implementation Procedures. A Bilateral Aviation Safety Agreement is a government-to-government agreement that lays out a framework for the aviation authorities to cooperate on aviation safety issues. Maintenance Implementation Procedures define the terms and conditions under which the authorities accept each other’s maintenance facility inspections, thereby reducing redundant regulatory oversight.

¹ The European Joint Aviation Authorities represent 37 countries that have agreed to cooperate in developing and implementing common safety regulatory procedures.

Through Maintenance Implementation Procedures, the United States has empowered the aviation authorities of France, Germany and Ireland to perform oversight on FAA's behalf for repair stations located in their respective countries. In October 1999, the Governments of the United States and France signed an Agreement under which FAA and its French counterpart agreed to accept each other's surveillance systems. To date, oversight of 76 FAA-certified repair stations has been assumed by French inspectors. In April 1999 and June 1997, the United States entered into similar agreements with the Governments of Ireland and Germany, respectively. To date, oversight of 62 FAA-certified repair stations in Ireland and Germany have been turned over to the applicable aviation authority.

The aviation authorities of France, Germany and Ireland now conduct surveillance at 138 repair stations on FAA's behalf. However, FAA-certified repair stations in other countries are still monitored by FAA inspectors. Of the 650 FAA-certified foreign repair stations, over 500 are still certified and inspected by FAA inspectors.

In August 2001, FAA published a new rule governing domestic repair station operation (Title 14 Code of Federal Regulations Part 145). The two major changes to the existing rule are requirements for repair stations to have a repair station manual, which incorporates a training program, and a quality control manual. The repair station manual will describe how the facility will operate (i.e., organizational structure, recordkeeping systems, and training program). The quality control manual will describe the repair station's inspection program and quality system (i.e., procedures for inspecting incoming parts and materials, calibrating tools, and maintaining up-to-date manuals).

Currently, repair stations are required to have an Inspections Procedures Manual, which essentially contains the same information FAA will soon require in two separate manuals, with the exception of the training program. The training program requirement was added to the new rule to ensure repair station personnel are trained and knowledgeable on the work performed and to ensure training records are maintained for a minimum of 2 years.

The new repair station rule was originally scheduled to become effective April 6, 2003 (for the repair station manual) and April 6, 2005 (for the training program). However, FAA delayed the April 6, 2003, effective date for repair station manuals for 180 days to give repair stations more time to develop the manuals because FAA guidance on how to prepare the manuals has not yet been issued.

Generally, there are four basic areas in which requirements differ between domestic and foreign repair stations. These differences are highlighted below.

Key Differences in the Requirements for Domestic and Foreign Repair Stations

Domestic Repair Stations

- Do not pay for certification costs incurred by FAA
- FAA certification lasts indefinitely
- FAA requires employees to be subject to drug and alcohol testing
- Certain repair station personnel are required to be certified by FAA

Foreign Repair Stations

- Pay fee for certification and renewal costs incurred by FAA
- FAA certification must be renewed every 1 to 2 years
- FAA does not require employees to be subject to drug and alcohol testing
- Repair station personnel are not required to be certified by FAA. However, personnel may be certified by the aviation authority where they are located.

Objectives, Scope, and Methodology

The objectives of this audit were to determine if FAA: (1) ensures that repair stations have controls in place to provide adequate security of aircraft and repair facilities; (2) verifies that foreign civil aviation authorities conducting inspections on FAA's behalf ensure that aircraft are adequately safeguarded, repairs are completed properly, and any identified deficiencies are corrected; (3) monitors changes in air carriers' maintenance expenses and repair station usage to identify notable trends and effectively target FAA's surveillance resources; and (4) ensures that maintenance work at FAA-approved repair stations is performed by trained, qualified personnel and complies with approved maintenance procedures.

This report does not address security at aircraft repair stations. Because of the sensitive nature of the information, issues pertaining to security at repair stations inspected by FAA and those inspected by civil aviation authorities on FAA's behalf were addressed in a separate document.²

² Report Number AV-2003-026, "Security at Aircraft Repair Stations," dated February 28, 2003.

The audit fieldwork was conducted from February 2002 to March 2003 at FAA Headquarters, nine Flight Standards District Offices, three Certificate Management Offices, and five International Field Offices. In addition, we visited 12 domestic and 9 foreign aircraft repair stations to evaluate the effectiveness of FAA's oversight of the repair stations' maintenance. We also visited two foreign repair stations to evaluate the effectiveness of FAA's monitoring of surveillance conducted by other civil aviation authorities on FAA's behalf.

We contracted with Simat, Helliessen and Eichner, Inc. (SH&E), an international air transport consulting firm, to assist us in reviewing maintenance procedures at four of the domestic and seven of the foreign aircraft repair stations we visited. We accompanied SH&E on all of their repair station reviews. The repair stations included in the audit are listed in Exhibit A.

To evaluate trends in air carriers' outsourced maintenance practices, we obtained "Form 41" financial data that air carriers submit to the Department's Bureau of Transportation Statistics for major air carriers from 1996 to 2002. We compared the amount of direct maintenance expense air carriers incurred for outside airframe and engine repairs to the amount the carriers incurred for total direct maintenance expense for flight equipment.

To evaluate repair station operations, we selected recent work orders for repairs performed on U.S. registered aircraft. For each of the work orders selected, we performed the following audit tests: determined if the repair station used the correct and current maintenance manual; determined if the repair station used the appropriate parts in the repair and if the parts were traceable to an approved source; and determined if the mechanics who performed the work had evidence of task-specific training in their training files. We also observed shop conditions and repair procedures during our tour of each repair facility.

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.

Prior Audit Coverage

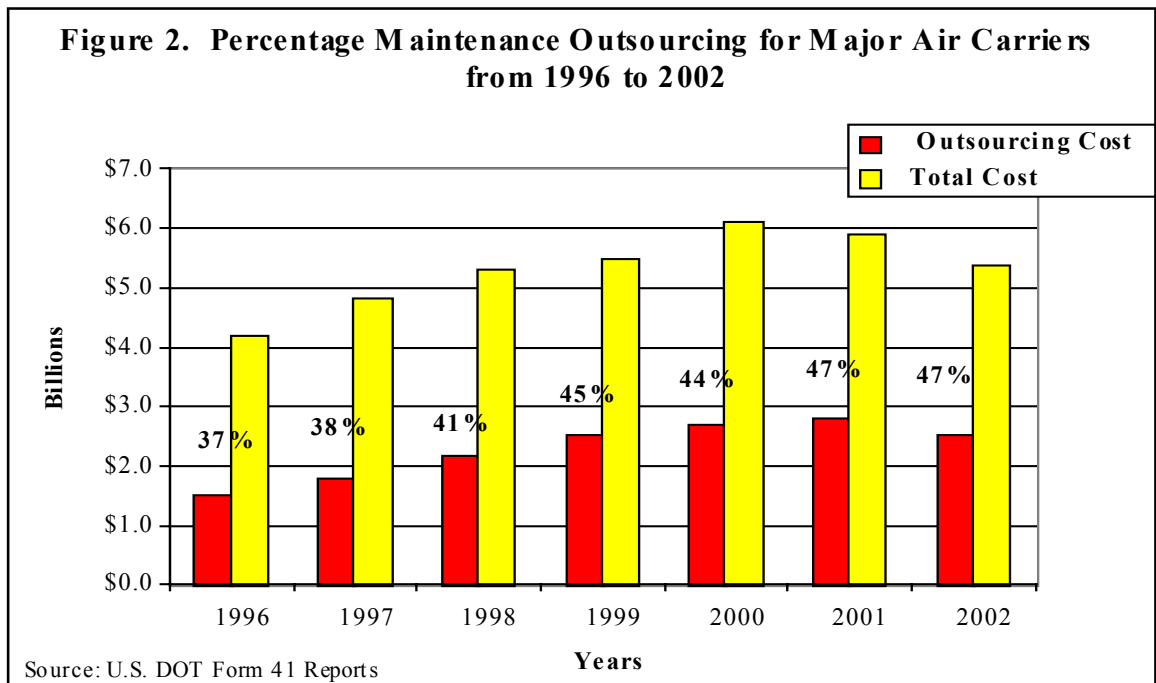
We issued Report R4-FA-4-009, "Report on Audit of the Certification and Surveillance of Domestic and Foreign Repair Stations," on March 7, 1994. The audit disclosed use of aircraft parts of unknown design, quality, and origin; outdated repair manuals; substitute parts not approved by manufacturers; and parts repaired by subcontractors not approved by the FAA. The audit also disclosed the need to improve the clarity of the Federal Aviation Regulations (FAR) and FAA technical guidance, the prioritization of surveillance inspections, and the quality of

surveillance inspections and reports. As a result of this audit, FAA issued new guidance to clarify when parts can be substituted for those called for in the maintenance manual. Additionally, FAA revised its guidance to provide additional information on the type of documentation that should be available in the FAA's inspection files and when FAA inspectors should perform follow-up inspection activity. FAA also stated the proposed revision to FAR Part 145 would address some of the issues presented in the report. (FAA expected the new rule to be issued in 1995; however, the rule was not issued until 2001.)

The General Accounting Office (GAO) issued Report GAO/RCED-98-21, "FAA Oversight of Repair Stations Needs Improvement," in October 1997. The audit disclosed that FAA's inspection approach limited its ability to ensure compliance at large repair stations. The report stated that even though teams of inspectors were shown to be more effective, most FAA offices assigned an individual inspector to each repair station, including large and complex repair stations. FAA inspectors admitted that their inspections were not as thorough as they would like due to demands on their time. The report also concluded that better inspection documentation is needed to ensure repair stations are complying with regulations and to identify performance trends. While FAA generally agreed with GAO's recommendations, FAA did not indicate how or when the recommendations would be implemented.

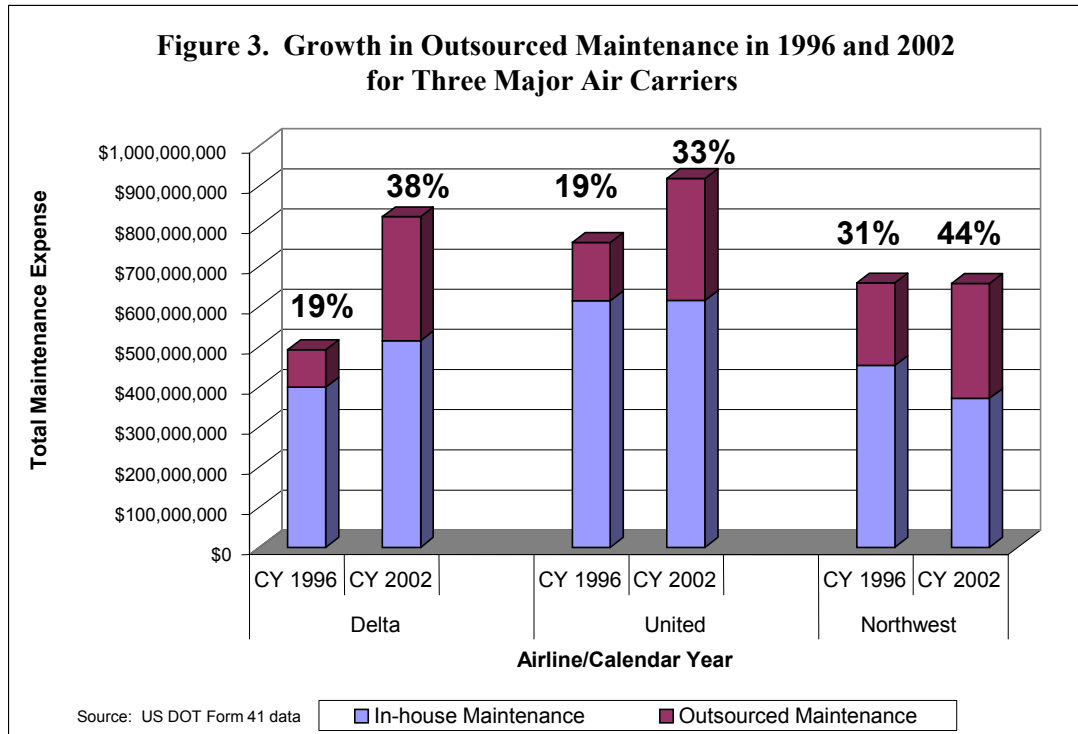
Chapter 2. Air Carriers Have Increasingly Used Repair Stations for Aircraft Maintenance

Even though air carriers are currently using repair stations for close to half of their maintenance expense, FAA has continued to focus its surveillance on air carriers' in-house facilities with no comparable shift toward increased oversight of work performed at repair stations. As illustrated in Figure 2, air carriers outsourced just over a third of their maintenance expense to repair facilities in 1996; however, air carriers outsourced nearly half of their maintenance costs in 2002.



Because of the financial benefits, some air carriers have customarily placed heavy reliance on outsourcing maintenance work to keep operating costs down. For example, four major air carriers (America West, Continental, Alaska, and Southwest) have consistently outsourced at least 63 percent of their maintenance costs to repair stations during the last 5 years. However, with the sharp economic downturn in the aviation industry, even those carriers that did not traditionally rely on extensive outsourcing are re-evaluating this decision. For example, Delta Air Lines outsourced 19 percent of its maintenance expense in 1996; however, the carrier doubled the percentage of maintenance expense that it outsourced in 2002 to 38 percent. Similar dramatic shifts towards outsourcing for Delta Air Lines and

two other air carriers not typically known to extensively outsource maintenance work are shown in Figure 3.



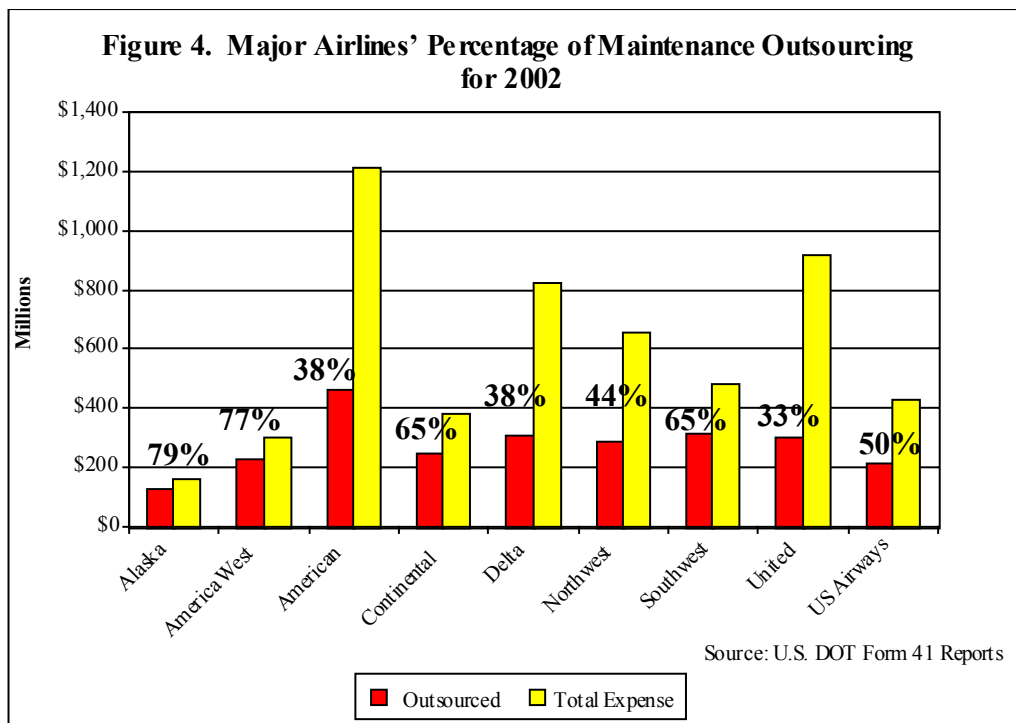
Recently, many airlines have reduced their workforce, closed maintenance facilities, and retired aircraft to reduce their operating expenses. Some airlines have used the bankruptcy process to restructure their costs and renegotiate labor contracts. At least one major air carrier has announced plans to abrogate its current union contract, which restricts the amount of maintenance work that can be outsourced, in order to outsource more. In fact, this air carrier has closed two of its maintenance bases. The airline has reported that it will save 50 percent on costs for major aircraft repairs by outsourcing the work to repair stations.

Air carriers outsource portions of their maintenance work in order to reduce their overall maintenance costs. Air carriers can negotiate lower labor rates at outsourced facilities because repair stations often have lower overhead and pay lower wages to their mechanics. While details of labor rates are closely guarded by air carriers, in-house labor rates to complete airframe work have been reported to be as high as \$83 per hour, while the same repair at a repair station ranges from \$45 to \$47 per hour. One major air carrier informed us that repairs to seats and coffee makers can be performed by repair stations for about \$32 per hour; however, if this same work were completed in-house it would cost \$83 per hour.

Labor rates charged by some foreign repair stations are even cheaper. For instance, one repair station we visited in Mexico informed us that they generally charge about \$40 per hour for airframe repairs. One airline reported that air carriers save about 30 to 40 percent by sending maintenance to repair stations instead of completing the repairs in-house.

Air carriers also use aircraft repair stations because they have expertise in certain specialized areas that air carriers' in-house facilities are not equipped or staffed to handle. For example, many carriers outsource engine repairs because of the high cost required to maintain the capability to repair them. These types of repairs require specialized equipment, staffing, and inventory. As a result, sending these types of repairs to specialty shops is less expensive for air carriers than it would be to equip their in-house facilities for this type of work.

As of December 2002, major air carriers outsourced from 33 to 79 percent of their total aircraft maintenance expense, as shown in Figure 4.

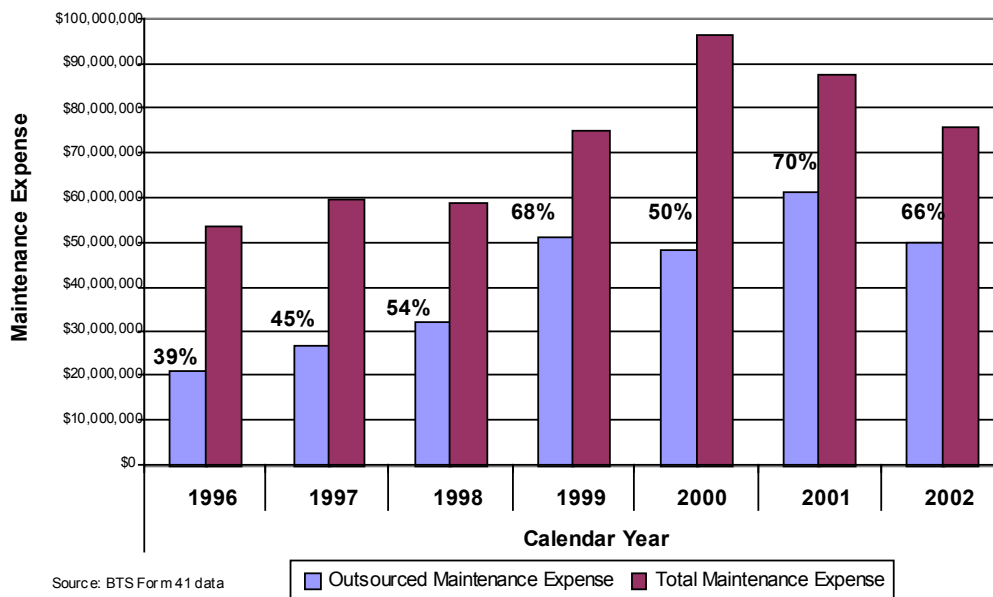


FAA inspectors must recognize this increased use of outsourced maintenance and adjust their level of oversight accordingly. We identified these trends through analysis of publicly available U.S. Department of Transportation Form 41 reports compiled by the Bureau of Transportation Statistics (BTS). Major air carriers submit financial data, such as total maintenance costs and outsourcing costs, to BTS quarterly. Monitoring the data for trends in increased outsourcing could help

FAA determine when shifts in inspector resources are warranted due to changes in where maintenance work is completed.

While our audit focused on major air carriers' use of aircraft repair stations, we performed a limited analysis of outsourcing by other air carriers. Based on this analysis, we determined that trends in maintenance outsourcing may be common throughout the industry. For example, Atlantic Southeast Airlines, a subsidiary of Delta Air Lines, currently uses outsourced maintenance providers for two-thirds of its maintenance costs, as shown in Figure 5.

Figure 5. Percentage of Outsourced Maintenance Expense for Atlantic Southeast Airlines from 1996 to 2002

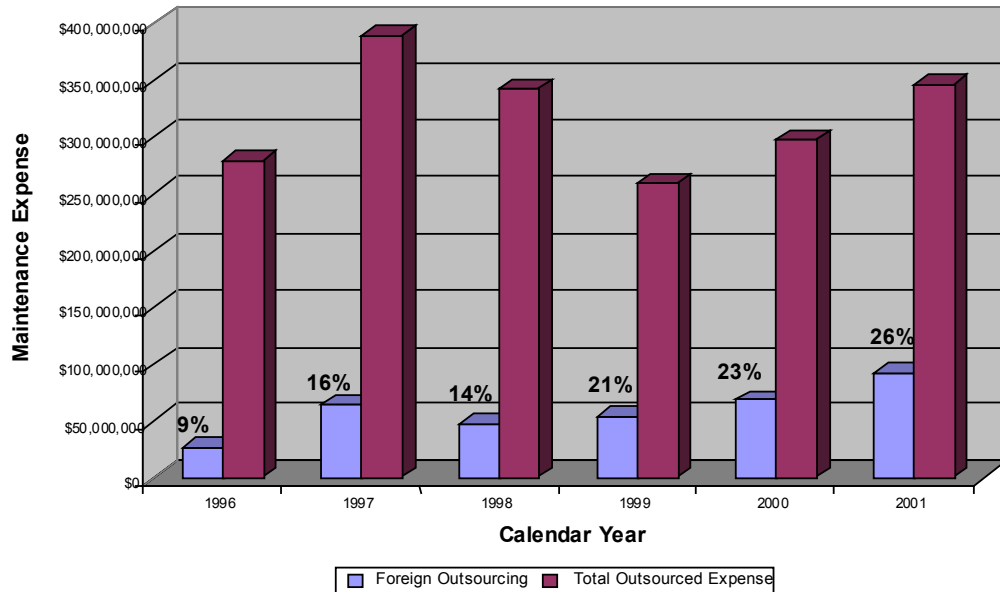


Yet, we found no indication that FAA has taken action to adjust its surveillance activities to more closely monitor air carriers' use of these facilities. In fact, we found that *FAA has no mechanism in place to obtain information on how much work is outsourced, domestically or overseas.* FAA inspectors believe it is not part of their oversight responsibility to track this information.

Since Form 41 reports that air carriers provide to the Department do not distinguish the amount of maintenance expense attributable to foreign and domestic repair stations, we requested that five major air carriers provide detailed information on the amount of maintenance work they outsourced to domestic and foreign repair stations from 1996 to 2001. Only one air carrier fully complied with our request. The other air carriers provided outsourcing information that was incomplete. For the one carrier that fully complied with our request, we

determined the amount of maintenance work that was outsourced to foreign repair stations increased from 9 percent of total outsourcing costs in 1996 to 26 percent of outsourcing costs in 2001, as illustrated in Figure 6.

Figure 6. Increase in Outsourcing to Foreign Repair Stations by One Major Air Carrier From Calendar Year 1996 to 2001



The use of domestic and foreign repair stations to complete aircraft maintenance is becoming an integral part of air carriers' maintenance programs. As a result, FAA must find ways to provide greater oversight of those entities performing maintenance work for air carriers, both domestically and overseas.

Chapter 3. FAA Should Consider a New Approach to Repair Station Oversight

Two groups of inspectors within FAA monitor aircraft repair stations; however, neither group places adequate emphasis on these facilities as part of their surveillance. FAA's district office inspectors have primary responsibility for conducting repair station inspections. However, the district office inspectors in the 9 offices we reviewed had oversight responsibility for an average of 23 operators. Because of this tremendous workload, district office inspectors typically only complete full facility inspections at repair stations once or twice a year.

FAA's certificate management inspectors conduct periodic inspections at repair stations as part of their responsibility for oversight of their air carrier's operations. However, these inspections are infrequent and do not include a review of the work the repair station performs for other customers or a review of the entire repair station's operations.

In addition, district office inspectors and certificate management inspectors do not share with each other the limited repair station inspection information they have obtained. This is due to the inadequate information input into FAA's safety databases and the lack of a documented system to share inspection information.

We identified discrepancies of varying degrees at 18 of the 21 repair stations that indicate FAA oversight of repair stations needs to be improved. For example, we identified repair stations that did not: (1) use the parts required by the maintenance manual in completing repairs, (2) properly calibrate tools and equipment that could be used in repairs, (3) have information on file to show that mechanics approving the repair possessed the necessary training and qualifications, or (4) correct deficiencies previously identified by FAA inspectors.

FAA Has Enhanced Its Oversight of Air Carriers' Internal Maintenance Procedures, But Has Not Made Similar Adjustments to Its Repair Station Oversight. Aircraft maintenance is integral to the safe operation of aircraft. In recent years, FAA has taken steps to address shortcomings in its oversight of air carriers' internal maintenance operations. For example, after the 1996 ValuJet crash, FAA formed a task force to perform a 90-day review of FAA's oversight of air carriers. In response to the findings from this review, FAA introduced ATOS, a new air carrier inspection system aimed at proactively evaluating an air carrier's entire operation. Additionally, after the January 2000 Alaska Airlines crash, FAA launched a National Program Review to evaluate air carriers' management

programs, including aircraft maintenance. As a result of this review, FAA identified best practices in the industry and areas in which air carriers could improve their maintenance programs, including Continuing Analysis and Surveillance Systems used by air carriers to monitor the effectiveness of their own maintenance work, and work performed by repair stations. However, FAA has not made similar advancements in its oversight of repair stations used by air carriers.

In 1997, the National Transportation Safety Board made recommendations to FAA aimed at improving its oversight of repair stations. Two of the Board's recommendations were that FAA should:

- Ensure that passenger air carriers' maintenance functions receive the same level of FAA surveillance, regardless of whether those functions are performed in house or by a contract maintenance facility; and
- Review the volume and nature of work requirements of principal maintenance inspectors assigned to FAA-certified repair stations that perform maintenance for air carriers, and ensure that these inspectors have adequate time and resources to perform surveillance.

While these recommendations were made over 6 years ago, we found that the same weaknesses in repair station oversight prevail today. We found that certificate management inspectors, responsible for oversight of air carrier operations, do not inspect the repair stations used by their air carrier with the level of intensity with which they inspect the air carrier's internal maintenance program. Further, the district office inspectors, responsible for oversight of repair stations, cannot devote the level of intensity to repair station oversight that is warranted due to the competing demands of overseeing multiple operators. Further, these two groups of FAA inspectors do not communicate with each other. These shortcomings in FAA's oversight structure limit the effectiveness of the surveillance inspectors provide of repair stations. FAA has acknowledged the need to consider additional methods of repair station oversight. FAA senior management officials recently advised us that the Agency is working on a risk management approach to oversight of repair stations.

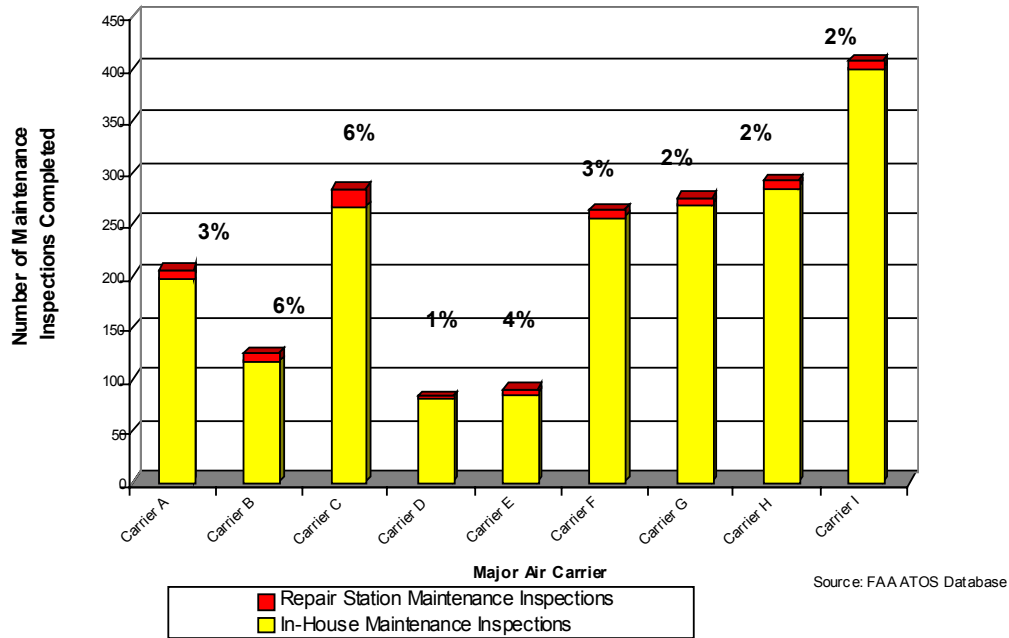
Certificate Management Office Inspectors. In October 1998, as part of its new ATOS system, FAA assigned designated groups of inspectors to perform continuous monitoring of all phases of each major air carrier's internal operations. For example, in one certificate management office, FAA assigned 27 inspectors to oversee one air carrier's maintenance operations. Every year, certificate management inspectors review numerous areas of the carriers' maintenance programs, including aircraft airworthiness requirements, maintenance technicians'

experience requirements, maintenance manual currency, inventory control, deferred maintenance programs, compliance with Airworthiness Directives, maintenance training programs, and air carriers' systems for oversight of repair stations. This volume and variety of inspections are possible because certificate management inspectors make multiple visits to in-house maintenance facilities each year.

Certificate management inspectors *may* inspect repair stations as part of their surveillance of an air carrier's maintenance program. However, these reviews are primarily focused on determining if the repair station followed the carrier's repair procedures when completing repairs. Air carrier procedures may reflect FAA-approved changes unique to an individual carrier's fleet. However, because repair stations are only one element of certificate management inspectors' oversight responsibilities for the vast operations of large air carriers, only a small sample of repair stations are reviewed each year.

In fiscal year (FY) 2002, certificate management inspectors completed an average of 220 inspections of internal maintenance procedures for the major carriers. During this same time period, these inspectors completed an average of only 7 inspections of outsourced maintenance facilities used by these carriers. For example, in FY 2002, one Certificate Management Office completed 400 inspections of its air carrier's internal maintenance operations and only 7 outsourced maintenance inspections. This air carrier outsourced 44 percent of its maintenance expense to repair stations in 2002. The level of intensity with which certificate management inspectors monitor repair stations is consistent among the Certificate Management Offices, regardless of how much the air carrier currently outsources, as shown in Figure 7.

Figure 7. Percentage of Repair Station Inspections Completed by FAA Certificate Management Inspectors in FY 2002



Under FAA’s current oversight structure, inspectors do not track which repair stations air carriers are using most frequently. Each air carrier is required to advise FAA of its repair stations that are “Substantial Maintenance Providers.” These repair stations are designated as “Substantial Maintenance Providers” because they have the capabilities to conduct major repairs for the air carrier’s aircraft fleet. However, these repair stations may not be completing a *substantial amount* of work for the air carrier. For example, one foreign repair station designated as a Substantial Maintenance Provider for a major U.S. air carrier had not conducted any significant maintenance work for the carrier in almost 3 years. However, because it was designated as a Substantial Maintenance Provider for the carrier, it is subject to FAA oversight by the certificate management office. FAA’s surveillance would be better targeted to those repair stations the carrier uses regularly. However, because FAA inspectors are not required to obtain air carrier financial data as part of their surveillance of air carrier operations, this important safety indicator is not used.

District Office Inspectors. FAA district office inspectors are directly responsible for ensuring all FAA-certified repair stations complete repairs according to FAA standards. However, these inspectors have oversight responsibility for many other operators in addition to repair stations.

FAA’s current pay structure is designed to compensate inspectors based on the nature of their work assignments and their level of responsibility. Work

assignments that are more technically complex bring higher compensation. For example, a principal inspector for a large air carrier will be paid more than an inspector performing general surveillance duties, because principal inspectors shoulder more responsibility.

As a result of this current pay structure, it is not uncommon for inspectors to be responsible for the oversight of several operators, repair stations, mechanics and training schools. For example, one inspector in the Southern Region was assigned 32 agricultural operators, 19 repair stations, 7 on-demand operators, 2 helicopter operators, and 1 maintenance school. Because of these competing demands, inspectors may limit their surveillance time at aircraft repair stations.

Because of other workload responsibilities, district office inspectors do not monitor all phases of repair stations' operations. Although a team of inspectors is assigned responsibility for a major air carrier's in-house maintenance operation, the district office inspectors in the 9 offices we reviewed had oversight responsibility for an average of 23 operators, 9 of which were repair stations. In fact, one inspector admitted there is not enough time to perform thorough repair station inspections and that he just "skims the top" of repair stations' operations.

While inspectors may visit repair stations throughout the year, they typically conduct full facility inspections once or twice a year. FAA senior management officials stated that contrary to our findings, district office inspectors actually perform thousands of repair station inspections each year. In reviewing FAA's Performance Tracking and Reporting System, we determined that FAA inspectors do in fact *record* thousands of instances where repair station inspections were performed. However, in evaluating the records supporting these inspections, we found that the number of inspections recorded is misleading. For example, we determined that one FAA inspector recorded completion of a repair station inspection when he accompanied our auditors to the repair station. This inspector did not remain on site with us for the review but his inspection records indicated that he completed a facility inspection during this visit.

In other instances, we found that inspectors recorded completion of inspections for reviewing manual changes submitted by the repair stations to the FAA office for review. In still another instance, we found that an inspector recorded completion of *ten different inspections* in one day for a visit to one repair station. While inspectors do perform other functions at repair stations, such as approving changes to the facility's procedures manual, which are captured in FAA's inspection database as inspection activities, we found that, generally, inspectors conduct full facility inspections at their assigned repair stations only once or twice a year.

In addition, the amount of time FAA dedicates to these repair station inspections can be surprisingly short. For example, one inspector told us that a repair station inspection may take as little as 20 minutes, and eight district office inspectors we interviewed claimed they could perform an inspection within 2 to 8 hours. Inspections of such short duration are possible because inspectors generally only look at segments of the repair station's operations, such as tool calibration or maintenance manual currency, during each visit. FAA senior management officials questioned the inspection time reported by FAA inspectors. They contend that if these inspectors had followed the guidance that outlines the tasks that are required to complete an inspection, inspectors could not have completed inspections this quickly. However, because district office inspectors do not document what they did to complete an inspection, we have no way of knowing whether the inspectors completed all the required tasks.

Some air carriers also operate FAA-certified repair stations that conduct work for other air carriers. Currently, district office inspectors are responsible for conducting surveillance at these facilities. FAA senior management officials recently informed us that FAA is conducting tests to determine the feasibility of reassigning oversight of repair stations operated by major carriers to the same Certificate Management Office that provides oversight of the air carrier.

If FAA does elect to change the oversight structure for air carrier repair stations, the change may reduce some of the workload for the district office inspectors. If and when this change occurs, FAA must then ensure that certificate management inspectors are properly trained in conducting repair station inspections that include a review of work completed for all customers, not just its own air carrier. For example, if inspectors responsible for oversight of Delta Air Lines assume responsibility for Delta's repair station, these inspectors must be trained on how to review Delta's procedures for completing work on aircraft other than Delta's. Additionally, FAA will need to develop a way to capture these inspections in its inspection databases.

Further complicating the inspectors' ability to fully evaluate repair station operations is the fact that inspectors responsible for oversight of foreign repair stations typically are unable to conduct unannounced inspections at their assigned facilities. Gaining access to foreign countries is a time consuming process, requiring employees to notify the U.S. Embassy in advance of their travel and, in most cases, obtaining a visa issued by the country to be visited. FAA inspectors informed us that in some cases, foreign travel requires inspectors to obtain a formal invitation from the country to make the site visit. As a result, these inspectors are unable to conduct surprise inspections and must typically rely on

inspections conducted at facilities that may have had months to prepare for the inspection.

FAA Inspection Offices Do Not Share Inspection Information. FAA's certificate management inspectors and district office inspectors both conduct inspections at aircraft repair stations. However, these offices do not routinely share valuable inspection information with each other.

Inspectors' primary means of sharing information is through FAA's newly integrated Safety Performance Analysis System (SPAS). This system was designed to act as a repository of vital inspection information that *all* inspectors could use for targeting surveillance to the areas of greatest need. However, this database is only as good as the information that is put into the system. For example, certificate management inspectors are not required to provide the names of repair stations they have inspected, and district office inspectors are not required to provide what was inspected at each repair station in the databases that are entered into SPAS. As a result, key pieces of inspection information are omitted, and inspectors are unable to share important historical inspection information. If the data provided in these databases included all repair station names visited and the areas reviewed at each facility, certificate management and district office inspectors could use this valuable tool to better target FAA's inspector resources.

In addition to the need to improve the usability of FAA's inspection database, FAA district offices responsible for repair station oversight and the certificate management offices responsible for oversight of the major air carriers must establish better lines of communication. When a certificate management inspector performs a review at a repair station, the inspector only ensures that the repair station is performing repairs in accordance with the policies and procedures of the specific air carrier that Certificate Management Office is responsible for overseeing. The inspector does not perform an overall evaluation of the repair station.

The district offices have the responsibility of performing a thorough review of all repair stations. However, the district offices and the certificate management offices do not routinely communicate with each other regarding the results of repair station inspections. As a result, certificate management inspectors may be unaware of critical repair station violations that could impact the operations of their air carriers. With better communication about inspection results, these FAA offices should become more familiar with the operations and identified weaknesses of the repair stations they oversee and should be able to better target their inspection resources.

Further, some FAA inspectors do not have access to the SPAS database at all. During our visit to FAA's International Field Office in Germany, we requested information from the SPAS database for various repair stations within that office's geographic area of responsibility. The inspectors in this office informed us they did not have access to this database. FAA senior management officials recently informed us that the manager of the FAA office in Germany acknowledges telling us that office did not have access to SPAS; however, she stated she had "misinformed" us on this issue. Because the manager and staff were so adamant in their assertion that inspectors in the Germany field office did not have access to SPAS during our visit, we can only conclude that the inspectors were not using this database at that time.

The FAA office in Germany is responsible for oversight of over 230 repair stations. Of these repair stations, 13 are designated as Substantial Maintenance Providers for major air carriers. Certificate management inspectors typically conduct reviews of facilities designated as Substantial Maintenance Providers, as part of their oversight of air carrier operations. However, because inspectors in the Germany International Field Office stated that they did not have access to SPAS, or were not using the system, these inspectors could not access or use inspection results for repair station reviews performed by certificate management inspectors. Access to certificate management inspections of repair stations in their jurisdiction would help the inspectors in Germany better target their inspection resources.

FAA Should Revise Its Oversight Process to Correct Weaknesses That Could Lead to an Erosion of Safety if Left Uncorrected. Our review disclosed discrepancies in domestic and foreign repair station operations that went undetected by FAA surveillance at 18 of the 21 (86 percent) repair stations we visited. These discrepancies went undetected by FAA surveillance because of the weaknesses in FAA's oversight structure and the process FAA inspectors used during repair station inspections. For example, FAA had not identified problems with repair stations' use of improper parts and equipment in repairs and qualification of maintenance personnel. In addition, mechanics at one major U.S. air carrier identified 6,000 discrepancies on an aircraft that had returned from a major maintenance check at a foreign repair station. As a result of these discrepancies, the air carrier submitted six service difficulty reports³ to FAA. These service difficulty reports detailed severe corrosion and cracks throughout the aircraft. Other discrepancies we identified at repair stations included using improper parts and equipment, insufficient training documentation, inadequate policies and procedures, and uncorrected repetitive deficiencies.

³ Air carriers are required to submit a service difficulty report to FAA within 72 hours of the detection or occurrence of each failure, malfunction, or defect that has endangered or may endanger the safe operation of an aircraft.

Parts and Equipment. FAA's oversight of foreign and domestic repair stations did not verify that the repair stations used FAA-approved parts and properly calibrated equipment in repairs at 15 of the 21 (71 percent) facilities we visited.

Through our audit work and the work performed by our contractor, we found problems at seven foreign and eight domestic repair stations, such as mechanics using the wrong part or using parts that could not be traced to the manufacturer, and using equipment and tools that were not properly calibrated. For example, one domestic repair station used three incorrect bushings during the overhaul of a portion of a flight control assembly on a Boeing 727 aircraft. According to a Boeing engineer, if these parts failed, it could result in aircraft handling problems. However, FAA's surveillance at this facility had not detected the use of incorrect parts because inspectors do not routinely compare parts used in repairs to those called for in the maintenance manual.

Seven months after our initial review, we made a return visit to this repair station to follow up on the improper part substitution. Even though the FAA inspector claimed to have made several visits to the facility to correct the deficiencies identified, we found that the computerized replacement part listing, which is used by mechanics performing the repair, still referenced the improper part number. Because the repair station failed to correct the computerized parts listing, the repair station mechanics could have inadvertently continued using the incorrect bushings in subsequent repairs. As a result of our follow-up visit, the FAA inspector opened an investigation related to the repair station's procedures for substituting parts.

In another example, one foreign repair station routinely extended the calibration interval for numerous tools used in the repair of aircraft parts without substantiation and concurrence from the manufacturers of the tools. This practice could result in parts being returned to service that do not meet the standards and specifications called for in the manufacturers' maintenance manuals.

Training. Of the 21 repair stations we visited, 8 repair stations (38 percent) did not maintain training files for final inspection and supervisory personnel that substantiated that they had qualifications and abilities to supervise the repairs performed. For example, training records for one repair station employee did not show that the employee was qualified to complete the final inspection for a repair of an engine oil pressure transmitter, though he did inspect the work. Although the employee was properly licensed as a mechanic by FAA, his training files contained no evidence that the repair station had provided him specific training on how to properly inspect this repair.

Although the current FAR Part 145 does not specifically require that employee training records show that employees are qualified and trained to do the work, new repair station regulations do contain specific training record requirements. Beginning in April 2005, the new regulation will require certificated repair stations to have an FAA-approved employee training program that includes initial and recurrent training. This training program must ensure that each employee assigned to perform maintenance and inspection functions is capable of performing the assigned task. The new rule will also require repair stations to document each employee's training and maintain the records for a minimum of 2 years. The sooner repair stations begin to comply with these impending requirements imposed by the new regulation, the easier the transition will be when the new rule becomes effective.

Policies and Procedures. We identified weaknesses in maintenance practices at 15 of the 21 repair stations (71 percent) that we visited. Of these 15 repair stations, 7 were foreign and 8 were domestic. Our findings raised questions about the repair stations' ability to ensure repairs had been completed properly. We found instances where these repair stations used outdated maintenance manuals, failed to segregate scrapped parts from usable parts, and neglected to notify FAA of changes to the repair station's work capabilities.

Each repair station maintains a list of work that FAA has approved it to perform. Air carriers rely on these lists as FAA certification that the facility has demonstrated that it has the personnel and equipment to perform the work. However, we found one foreign repair station, whose FAA-approved capabilities list authorized the facility to conduct tests to detect surface and internal defects on aircraft parts, did not have the capabilities to accomplish these types of inspections. The FAA inspector responsible for oversight of this repair station did not identify and correct the inaccuracy in the repair station's capability list. As a result, FAA left its stamp of approval for the facility to conduct tests on items it did not have the expertise to complete.

In another example, one domestic repair station failed to properly segregate scrapped parts from usable parts. The parts were the large threaded component of a ballscrew assembly, which the repair station compared to the jackscrew assembly that failed on Alaska Airlines Flight 261. These aircraft parts were left unlocked and uncontrolled on the shop floor right next to where the work was being done. The scrapped parts were awaiting disposition instructions from the customer and did not appear to be physically damaged. These parts could have been mistakenly used by a mechanic in a repair or stolen and illegally sold on the black market, thus finding their way back onto in-service aircraft.

We also identified five repair stations (two domestic and three foreign) that failed to complete all required work steps or failed to sign-off on other work that had been accomplished. For example, a mechanic at one domestic repair station failed to sign-off that he completed required corrosion inspections on an anti-icing duct connected to an engine. Because the mechanics failed to sign-off on all finished work steps, the customer has no assurance that the repairs were completed as required by the maintenance manual.

Uncorrected Repetitive Deficiencies. In some cases, FAA identified deficiencies during repair station inspections, but did not take action to ensure that these deficiencies were corrected or failed to determine the root cause of the problem. Of the 21 repair stations we visited, 2 foreign and 2 domestic repair stations failed to correct deficiencies previously identified by FAA inspectors. For example, we found that one domestic repair station failed to properly cover and protect hoses and lines used in repairs. The FAA inspector had previously found this problem on **three** separate occasions but did not take decisive action to ensure the problem was corrected. More disturbing, even after we identified this problem for the **fourth** time and notified the inspector, the inspector still did not take enforcement action against the repair station.

FAA inspectors also failed to identify the underlying cause of the deficiencies identified at repair stations, which could result in repetitive deficiencies. For example, during an annual inspection at one foreign repair station, an FAA inspector identified a thermometer that was not properly calibrated. The repair station informed FAA that it had taken steps to properly calibrate the thermometer. Because the repair station personnel received no further response from the FAA inspector, they assumed their corrective action was adequate. However, the repair station should have determined the reason its calibration program failed to identify that the tool had not been calibrated. Consequently, repair station personnel could have overlooked other tools that had not been properly calibrated.

Summary. The problems we identified at aircraft repair stations can be attributed to FAA inspectors' inability to perform continuous, comprehensive surveillance at these facilities due to their oversight responsibilities for all aviation certificates. Because FAA repair station surveillance is merely one part of the wide range of their responsibilities, FAA inspectors face significant challenges in ensuring that safety standards are maintained. For example, one FAA inspector was assigned oversight responsibility for 21 repair stations, 21 agricultural operations, 12 service-for-hire operators, 3 general aviation operators, 2 helicopter operations, and 1 maintenance school. The FAA inspector's responsibilities include inspecting the various facilities, approving changes to operating procedures, and ensuring the safety of air carrier operations. Because the rules and regulations

differ for each certificate type, FAA inspectors must be knowledgeable and experienced in every discipline in order to provide effective oversight. Due to the large workload, inspectors typically only conduct one repair station facility inspection annually.

Because inspectors rely on infrequent visits at each repair station, inspectors must enhance their inspection procedures to ensure they accomplish an efficient and effective review of all aspects of the repair station's operations. Currently, each inspector determines how he will satisfy his surveillance requirements. Based on our inspector interviews and observations, annual inspections primarily consist of reviewing repair stations' written procedures and in-process maintenance work. Due to time constraints, inspectors do not routinely verify the source of parts used or if the parts used were the ones authorized by the manufacturer. Additionally, inspectors do not typically review training records of personnel authorizing the repairs to determine if they have been properly trained.

To make more efficient use of inspectors' surveillance time at aircraft repair stations, FAA should develop a comprehensive, standardized approach to repair station surveillance that includes reviews of the actual work performed from the beginning to the end of the repair process. For example, by reviewing documentation maintained by the repair station for the work performed (i.e., work order packages), inspectors can determine whether the repair station used the most current manuals to complete repairs, the parts called for in the manual, properly calibrated tools and equipment to complete the repair, and personnel that were adequately trained. By fully evaluating the work performed, FAA inspectors can efficiently and effectively evaluate all aspects of the repair station's operations.

Chapter 4. FAA Should Strengthen Its Oversight of Surveillance Conducted by Foreign Civil Aviation Authorities

FAA has not effectively monitored surveillance currently conducted by three foreign aviation authorities on FAA's behalf. FAA inspectors' primary means of monitoring surveillance conducted by other authorities is through desk reviews of inspection documentation provided by each authority. However, the inspection documentation FAA receives does not contain sufficient information to effectively determine whether repair stations are complying with FAA standards. Further, foreign inspectors tend to focus their inspections on compliance with European regulations rather than FAA standards. Because of the poor documentation received and the lack of focus by foreign authorities on FAA requirements, FAA is unable to determine if FAA-certified foreign repair stations meet FAA standards.

Through agreements with other countries, inspectors in three foreign countries conduct oversight and certification inspections of FAA-certified aircraft repair stations for FAA. In October 1999, the Governments of the United States and France signed an agreement under which FAA and its French counterpart agreed to accept each other's surveillance systems, including recommendations for FAA repair station certification and certification renewal, and continued monitoring of maintenance practices.

To date, the French Civil Aviation Authority has assumed oversight responsibility for 76 FAA-certified repair stations. In April 1999 and June 1997, the United States entered into similar agreements with the Governments of Ireland and Germany, respectively. To date, 62 repair stations in Ireland and Germany have been turned over to the applicable aviation authority for oversight responsibility. However, the number of FAA-certified repair stations monitored by other foreign aviation authorities could significantly expand in the future because of ongoing efforts by European countries to develop a single European aviation authority that includes aviation activities in at least 15 member countries, including France, Germany and Ireland. If the United States elects to continue aviation agreements with the European Union, the new agreement would cover aviation activities in all member countries.

Inspection Documentation Provided to FAA Is Incomplete or Incomprehensible. Although inspectors from foreign civil aviation authorities make determinations that repair stations are performing work using FAA-approved practices, FAA has not required these authorities to provide sufficient

information to FAA inspectors to verify that these determinations were sound. FAA has agreed to accept the foreign aviation authorities' inspection forms as documentation of completed inspections. However, these forms contain incomplete or incomprehensible information. As a result, FAA inspectors cannot verify that inspections conducted on its behalf ensure repair stations meet FAA standards. Additionally, there was no evidence in the repair station files to indicate that FAA notified the aviation authorities of the need for more thorough inspection documentation.

We reviewed inspection documentation provided by one aviation authority in detail and found that the inspection documentation provided was incomplete or incomprehensible for 14 of 16 repair station files (88 percent) sampled. For example, a foreign aviation authority submitted an inspection report to FAA in which the findings, while written in English, were incomprehensible. One finding stated:

In reference to the Manifold n° 2570 dated 18/10/99, the response to the observation n° 12 was not respected. This problem is recurring and the launched corrective actions are ineffective....

The corrective action identified for this finding merely states “GQ01G019/DP”.

While references to particular documents were probably easily understood by the inspectors at the foreign aviation authority because they had the documentation in question, an FAA inspector who did not have access to these documents would not be able to ascertain what this finding or the subsequent corrective action entailed. According to the information provided, the finding appears to be repetitive, and FAA should be aware of the issues involved. However, there is no evidence in FAA's file on this repair station that FAA requested additional clarifying information from the aviation authority that completed the inspection.

During our review of FAA's inspection files, we identified another inspection report submitted to FAA by a foreign aviation authority in which three of the four required sections of the report were written in French. The sections of the inspection report that were in French included the areas the inspectors reviewed during the inspection and the findings and corrective actions taken by the repair station. As a result, unless they were fluent in French, FAA inspectors could not determine, based on the documentation provided, whether this repair station was complying with FAA standards or whether the corrective actions taken satisfied FAA requirements. During our visit to this FAA office, we identified one FAA inspector that was fluent in French. This inspector was only assigned 3 of the 10 facilities for which inspection documentation was submitted in French.

We also reviewed four inspection files of FAA-certified repair stations inspected by the aviation authorities of Germany and Ireland. All four of these files lacked sufficient documentation for FAA to determine if corrective actions were taken or if the corrective actions taken were adequate. The explanations of findings at one repair station were incomprehensible. For example, the inspection documentation for one repair station in Germany stated a finding was “No conditions fixed, decision in isolation case.” Additionally, no corrective action was identified for this discrepancy.

To further complicate FAA’s historical tracking of repair station operations, inspections conducted by other aviation authorities are not included in FAA’s inspection database. For example, we reviewed FAA’s inspection database for nine repair stations that had been turned over to the French civil aviation authority for surveillance. FAA’s database did not contain inspection information from the time the surveillance responsibilities had been turned over to the French authorities for all nine repair stations. (Most repair stations were turned over to the French authorities in 2000; we reviewed the inspection database in 2002.) FAA inspectors informed us that FAA had not developed a way to capture inspections conducted by other authorities in their inspection database (Program Tracking and Reporting System). Additionally, inspectors were concerned about the possible legal ramifications of documenting inspection results performed by another entity. As a result, FAA’s inspection database is incomplete for repair stations turned over to other aviation authorities from the point the repair stations’ surveillance responsibilities were released to other aviation authorities. This lack of inspection information also affects certificate management office inspectors who use this database to target surveillance for repair stations that are used by the major air carriers.

FAA Standards Are Not Emphasized During Surveillance. In addition to the poor documentation received from the aviation authorities, the foreign aviation inspectors tailor surveillance more toward European regulations than FAA regulations. Under the current agreement, there are over 20 differences between European repair station regulations and FAA regulations. Some of the FAA repair station requirements that are not required by the European regulations follow.

- The repair station must have procedures to ensure personnel that approve aircraft parts for return to service and personnel responsible for supervision or final inspection of work on U.S. registered aircraft are able to read, write, and understand English.
- The repair station must retain an English-language copy of the manufacturers’ maintenance manuals used to complete repairs.

- The repair station must have procedures explaining how they will ensure they have all FAA Airworthiness Directives applicable to the work they are performing.
- If the repair station contracts work out to a non-FAA-certified repair station, the subcontracted repair station must be under the control of the principal repair station's quality monitoring system.

The foreign aviation authorities' emphasis on European regulations when conducting inspections at FAA-certified repair stations became evident when FAA conducted independent sample inspections at some of the facilities monitored by foreign inspectors and identified numerous deficiencies pertaining to FAA requirements. For example, FAA conducted a sample inspection at 1 repair station that resulted in 45 findings such as the repair station subcontracting out work to repair stations that were not FAA-certified, repairing parts that the repair station was not approved by FAA to repair, failing to properly calibrate tools, and storing scrapped parts with usable parts. The aviation authority that inspected this facility did not identify these issues during its surveillance at the facility. Further, FAA has not developed a procedure, within the sample inspection process, to determine why the foreign authority did not identify these deficiencies during its routine oversight.

We selected two repair stations for review to determine the effectiveness of the French aviation authority's surveillance at an FAA-approved facility. We identified deficiencies that needed to be addressed at both facilities. For example, personnel at one repair station that were responsible for conducting final inspections on aircraft repairs were unable to read and understand an Airworthiness Directive (AD) when asked because the document was written in English. FAA issues ADs to provide actions that operators must take to correct or prevent an unsafe condition in an aircraft. The AD in question required the repair station to perform additional work steps to prevent premature failure of a key engine part. According to FAA, failure to follow these instructions could result in engine failure. However, at this facility, FAA had little assurance that the personnel approving the repair understood what type of work needed to be done to satisfy the requirements of the Airworthiness Directive.

Although the agreement between France and the United States specifically requires repair station personnel that are approving repairs to be able to read and understand the English language, the inspectors from this foreign authority did not identify this as a problem at the repair station. As a result, our own audit tests reiterated FAA sample inspection findings that indicate foreign aviation

authorities do not emphasize FAA regulations when conducting inspections at repair stations.

FAA has permitted foreign authorities to issue operating certificates and approve changes to the repair station's procedures without FAA's knowledge. For example, at one repair station we visited, we determined that changes to the repair station's capability list (i.e., the list that details the parts or equipment on which the repair station is qualified and approved to perform work) were not sent to FAA for approval. These revisions, though directly impacting FAA's certificate with the repair station, were unknown to FAA. As long as the revisions do not change the repair station's ratings, foreign aviation authorities are not required to send any changes in the repair station's operations to FAA for approval. This further hinders FAA in effectively monitoring that FAA-certified repair stations are complying with FAA requirements.

In finalizing its agreements with France, Germany and Ireland, FAA developed a process to monitor surveillance conducted by foreign authorities. The foreign authorities and FAA agreed that FAA could conduct sample inspections of FAA-certified repair stations for which the French, German and Irish authorities would provide oversight. However, in FAA's internal guidance to inspectors on how to monitor this foreign oversight process (Advisory Circular 145-7A), FAA limits the number of sample inspections FAA can conduct to 10 percent of the number of repair stations in each country. For example, the French Aviation Authority provides oversight of 76 FAA-certified repair stations. According to its guidance, FAA should only conduct seven inspections of the repair stations in France each year.

Because the Maintenance Implementation Procedures for the bilateral agreements with France, Germany and Ireland have been recently implemented, FAA should not place limitations on its ability to conduct sample inspections at FAA-certified repair stations until it has assurance that the program is operating as intended and the inspections conducted by other authorities verify that the repair stations continue to meet FAA standards. Based on the problems FAA identified during sample inspections and problems we identified at repair stations where foreign oversight was conducted, FAA should modify its informal agreement with the foreign governments and its advisory circular to increase the number of sample inspections it can conduct each year.

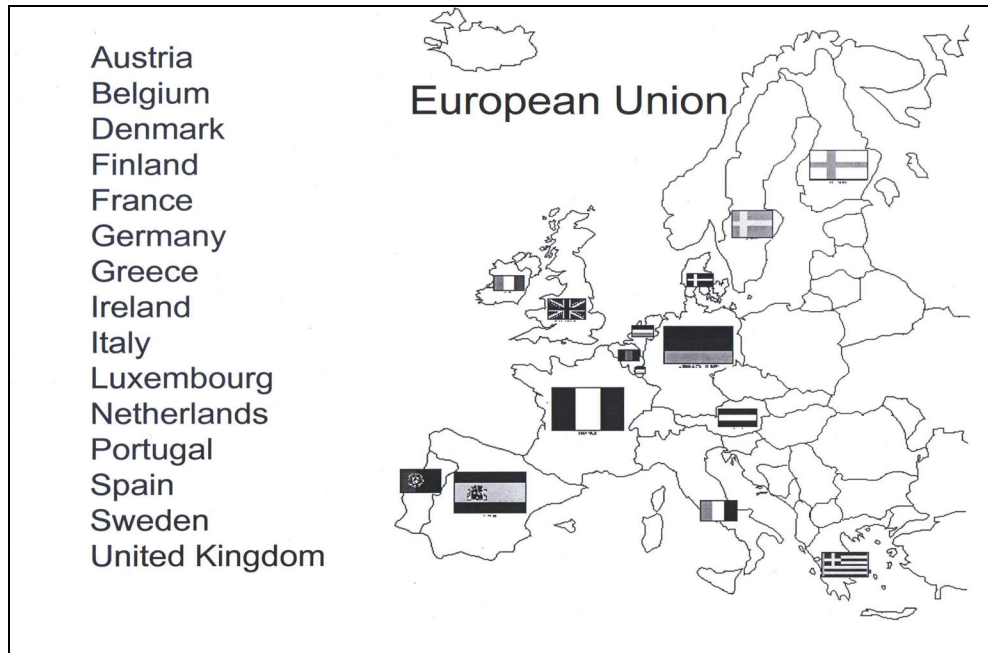
When asked how they thought this new process was working, French civil aviation authority officials stated the system could be improved. These officials targeted three areas in which they thought the process should be changed:

- Delete the requirement to conduct annual inspections of FAA-certified repair stations (i.e., revise the inspection requirements to once every 2 years);
- Delete the requirement to inspect the repair stations for the 22 differences in FAA and European regulations; and
- Lower the number of sample inspections FAA can conduct each year.

We disagree with changes proposed by representatives from the French aviation authority because these elements of the program are necessary to ensure that FAA-certified repair stations operate in accordance with FAA standards, as is required of any other FAA-certified repair station. For example, altering surveillance so FAA-certified foreign repair stations are not inspected at least once annually and are not inspected for compliance with FAA regulations would be inconsistent with FAA's oversight structure for domestic and other foreign repair stations not covered under this program. FAA must work with the applicable countries to improve the current process before any changes to the process are considered.

Due to the poor inspection documentation FAA receives from foreign aviation authority inspectors, FAA is already severely hindered in its ability to verify the quality and reliability of inspections conducted by foreign aviation authorities. While this program was developed to ease the financial burden on repair stations and to eliminate duplicative surveillance activities, FAA must closely monitor the inspections conducted on its behalf to ensure that FAA-certified repair stations continue to meet FAA standards.

It is particularly important that FAA improve its monitoring of surveillance conducted by foreign aviation authorities on its behalf before agreements with other countries are completed. At least 15 European countries have agreed to form a combined European Aviation Safety Agency that would be the only legally recognized organization with authority to act on behalf of all the member countries. With the formation of this Agency, current agreements with individual European countries can no longer exist. In order for FAA and foreign aviation authorities to maintain an agreement for the foreign authorities to provide oversight of FAA-certified repair stations, the United States would have to execute an agreement with the newly formed Agency. As shown in the diagram below, in addition to the three agreements the United States currently has with France, Germany and Ireland, the new agreement could include as many as 12 additional countries.



Note: France, Germany and Ireland already have bilateral agreements with the United States.

It is imperative that FAA make substantial improvements in its oversight of surveillance conducted by the three civil aviation authorities already conducting inspections on its behalf before negotiations with other countries are finalized. The incomplete documentation FAA receives from the aviation authorities coupled with the number of deficiencies FAA identified during sample inspections and those identified during our audit indicate that improvements are needed. Specifically, FAA must ensure it is obtaining the documentation needed to properly oversee this program.

Chapter 5. Recommendations

The use of domestic and foreign repair stations is becoming an integral part of air carriers' maintenance programs. FAA must ensure it find ways to provide greater oversight of those entities performing maintenance work for air carriers, both domestically and overseas. We recommend that FAA:

1. Collect and monitor air carrier maintenance financial data to identify trends in the source of maintenance and make shifts in inspector resources as warranted.
2. Develop a process to:
 - a. Identify repair stations that air carriers use to perform aircraft maintenance;
 - b. Identify the repair stations that are performing safety critical repairs; and
 - c. Target inspector resources based on risk assessments, or analysis of data collected on air carrier outsourcing practices.
3. Implement procedures to improve information sharing through FAA's newly integrated Safety Performance Analysis System by:
 - a. Requiring certificate management inspectors to document the name of the repair stations they have reviewed in the Air Transportation Oversight System database; and
 - b. Requiring district office inspectors to include the areas inspected, the results, and corrective actions taken in the Program Tracking and Reporting System.
4. Develop a comprehensive, standardized approach to repair station surveillance by requiring inspectors to review all aspects of repair station operations, from the time the repair is received until it is released to the customer.
5. Modify existing inspection documentation requirements with foreign aviation authorities so that FAA receives sufficient documentation to ensure FAA-certified repair stations meet FAA standards.

6. Develop a process to capture results from (a) foreign aviation authority inspections and (b) FAA sample inspections of foreign repair stations in FAA's Program Tracking and Reporting System.
7. Develop procedures to verify that foreign aviation authorities place adequate emphasis on FAA regulations when conducting reviews at FAA-certified facilities.
8. Clarify requirements with foreign aviation authorities to ensure that changes to FAA-certified foreign repair stations' operations that directly impact FAA requirements are sent to FAA for approval.
9. Modify procedures for conducting sample inspections to permit FAA inspectors to:
 - a. Conduct the number of inspections necessary to gain assurance that foreign aviation authority inspections meet FAA standards during the initial implementation periods when foreign authorities conduct inspections on FAA's behalf; and
 - b. Base the number of inspections in subsequent years on analysis of data collected from prior sample inspections.

Agency Comments and Office of Inspector General Response

On June 19, 2003, FAA provided written comments to our May 30, 2003 draft report. On July 2, 2003, we met with FAA senior management officials to further discuss the report and FAA's response.

In its comments, FAA stated that our sample size may have been too small to obtain accurate information and draw positive conclusions. We would point out that, in order to obtain a representative sample of repair stations to review, we selected facilities that were geographically dispersed throughout the country and the world and that varied substantially in the type of work they performed. For example, we visited repair stations in six different states that covered all regions of the United States and five countries in Europe, Asia and South America. The repair stations we visited performed repairs on all parts of the aircraft including: the airframe, engines, landing gear, flight control assemblies, and fuel pumps.

In addition, before initiating our audit work, we consulted with the Office of Inspector General Statistician to determine the number of repair stations we should visit to perform a review of a statistically representative sample of domestic and foreign repair stations. Our sample size exceeded the Statistician's

recommendation to review 10 domestic and 10 foreign repair stations. Finally, it is important to recognize that the results of our review identified systemic problems at the repair stations we visited, which, as we stated in the report, demonstrates that FAA needs to improve its oversight of the work performed at these facilities.

In responding to the report, FAA concurred with all our recommendations. Specifically, FAA agreed to:

- form a workgroup to evaluate various measurements available to identify trends in the source of maintenance and select the proper metrics. The workgroup will complete its work within 6 months, and FAA will develop policies and procedures to use these measures to identify trends and make changes in inspector resources as warranted. In the meantime, FAA will identify where critical repair work is performed and consider any available financial data to determine if there is a trend toward outsourcing such work;
- develop procedures to target inspections based on a risk assessment or analysis of data collected on air carriers' outsourcing practices;
- develop procedures to improve information sharing through the Safety Performance Analysis System by requiring certificate management inspectors to document the name of the repair station they have reviewed in the Air Transportation Oversight System database and revising the guidance for district office inspectors to more thoroughly document repair station inspections;
- clarify policies and procedures that require a comprehensive, standardized approach to repair station surveillance, including a review of all aspects of the repair station's operation. FAA stated it has been exploring the use of various different ideas and philosophies regarding repair station oversight, such as a "certificate management" type of concept for large, complex repair stations. Additionally, an FAA surveillance team concept may also be employed at large, complex repair facilities;
- conduct follow-up reviews with the three foreign aviation authorities to ensure they are complying with recently issued policy regarding inspection documentation requirements, and instruct Field Office Managers with responsibility for these agreements to ensure that documentation is in English and addresses the elements of repair station inspections;
- develop policies and procedures to capture results from foreign aviation authority inspections and FAA sample inspections of foreign repair stations in its Program Tracking and Reporting System;

- develop policies and procedures to verify that foreign aviation authorities place adequate emphasis on FAA regulations when conducting inspections on FAA's behalf;
- clarify policies and procedures with foreign aviation authorities that require the authorities to obtain FAA approval on any changes to FAA-certified repair station operations that directly impact FAA requirements; and
- clarify that the current sample size for conducting sample inspections (10 percent of the repair stations) is the minimum adequate number needed to gain assurance that the foreign aviation authority's inspections meet FAA standards. The fact that FAA is clarifying its policy on the number of sample inspections it can perform at foreign repair stations is a step in the right direction, particularly given that FAA inspectors stated the 10 percent sample inspection limit was too restrictive.

When properly implemented, these actions will be responsive to our recommendations and should significantly enhance FAA's surveillance of domestic and foreign repair stations. However, FAA will have to provide target dates for completing these actions before we can consider these recommendations resolved.

Exhibit A. Entities Visited

FAA

Headquarters:

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

AFS District Offices:

Atlanta Flight Standards District Office Atlanta, GA

Boston Flight Standards District Office Bedford, MA

Greensboro Flight Standards District Office Greensboro, NC

Houston Flight Standards District Office Houston, TX

Los Angeles Flight Standards District Office El Segundo, CA

Miami Flight Standards District Office Miami, FL

Oakland Flight Standards District Office Oakland, CA

San Antonio Flight Standards District Office San Antonio, TX

Seattle Flight Standards District Office Renton, WA

AFS Certificate Management Offices:

Continental Airlines Certificate Management Office Houston, TX

Delta Air Lines Certificate Management Office Atlanta, GA

United Airlines Certificate Management Office San Francisco, CA

AFS International Field Offices:

Dallas/Ft. Worth International Field Office Dallas, TX

Frankfurt International Field Office Frankfurt, Germany

Miami International Field Office Miami, FL

San Francisco International Field Office	San Francisco, CA
Singapore International Field Office	Singapore

Air Carriers

Continental Airlines	Houston, TX
Delta Air Lines	Atlanta, GA
United Airlines	San Francisco, CA

Domestic Aircraft Repair Stations

Avborne Heavy Maintenance	Miami, FL
AAR Landing Gear Services	Miami, FL
Air Operations International	Miami, FL
Alameda Aerospace	Alameda, CA
Skytronics Incorporated	El Segundo, CA
Argo-Tech	Inglewood, CA
Aviation Technologies	San Antonio, TX
San Antonio Aerospace	San Antonio, TX
Goodrich Aviation Technical Services	Everett, WA
TIMCO	Greensboro, NC
Senior Operations	Sharon, MA
Parker Hannifan	Ayer, MA

Foreign Aircraft Repair Stations

ST Aviation Services (SASCO)	Singapore
Rohr Aero Services-Asia Pte Ltd.	Singapore
Hong Kong Aircraft Engineering Co. (HAECO)	Hong Kong

Hong Kong Aero Engine Services (HAESL)	Hong Kong
Mexicana	Mexico City, Mexico
AeroMexico	Mexico City, Mexico
GE-Celma	Petropolis, Brazil
GE-VARIG	Rio de Janeiro, Brazil
VARIG Engineering and Maintenance	Rio de Janeiro, Brazil
Snecma Services	Chatellerault Cedex, France
Air France	Roissy Charles DeGualle Cedex, France

Exhibit B. Major Contributors to This Report

THE FOLLOWING INDIVIDUALS CONTRIBUTED TO THIS REPORT:

<u>Name</u>	<u>Title</u>
Lou E. Dixon	Program Director
Tina B. Nysted	Project Manager
Thomas D. Jefferson	Senior Auditor
Mike J. Leibrecht	Senior Analyst
Mark A. Gonzales	Analyst
Curtis Gelber	Analyst
Brian J. Huckaby	Auditor
Katherine A. Yutzey	Analyst

Appendix. Management Comments



U.S. Department
of Transportation
**Federal Aviation
Administration**

Memorandum

Subject: **INFORMATION**: Review of Air Carriers' Use of Aircraft Repair Stations Date: June 19, 2003


From: Acting Assistant Administrator for Financial Services and Chief Financial Officer Reply to Attn. of:

To: Assistant Inspector General for Aviation Audits

Thank you for the opportunity to provide comments on your draft report. We value this independent assessment of air carriers' use of repair stations and appreciate your recognition of the many overlapping controls that are in place to ensure proper completion of all repairs.

While we agree with the intent of each recommendation, we disagree with some statements and inferences in the draft report. We are providing general comments and a response to each recommendation in the attachment. Because of the short deadline, we were unable to provide timelines for the proposed actions.

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


John F. Hennigan

Attachment

Federal Aviation Administration's (FAA) Response to

Draft Office of Inspector General's (OIG) Report on Review of Air Carriers' Use of Aircraft Repair Stations

General Comments:

The use of domestic and foreign repair stations is vital to the strength of our airline industry. Airlines use repair stations for various reasons including the technical expertise or specialization that resides in many repair stations, as well as location and cost. FAA and foreign aviation authorities work closely in monitoring repair stations in those countries in which the FAA and the foreign regulatory authority have a Bilateral Aviation Safety Agreement (BASA) and Maintenance Implementation Procedures (MIP). Currently the FAA monitors nearly 1,159 Federal Aviation Regulation (FAR) Part 145 repair stations throughout the United States for the foreign aviation authorities. These Part 145 repair stations are Joint Aviation Authorities Approved Maintenance Organizations. Foreign regulatory authorities monitor nearly 138 FAR Part 145 foreign repair stations for the FAA.

The sample size of repair stations used to perform this audit may have been too small to get accurate information and draw positive conclusions. Considering there are about 650 foreign and 4,600 domestic Part 145 certified repair stations, evaluating 9 foreign and 12 domestic Part 145 certified repair stations might not have provided enough data for a thorough analysis. (The exact number of repair stations fluctuates daily).

Response to Recommendations:

OIG Recommendation 1: Collect and monitor air carrier maintenance financial data to identify trends in the source of maintenance and make shifts in inspector resources as warranted.

FAA Response: Concur. We agree, in principle, that a measure may be needed to identify trends in the source of maintenance and make changes in inspector resources as warranted; however, we do not agree that financial data is the only suitable measurement. Financial data may not provide the most reliable measurement of the work, or the criticality of the work, that is outsourced. We will form a work group to evaluate the various measurements available and select the proper metrics. The group will complete its work within 6 months, and we will develop policies and

procedures to use these measures to identify trends in the source of maintenance and to make changes in inspector resources as warranted. In the meantime, we will identify where certain critical repair work, such as heavy maintenance checks, is performed and consider any available financial data to determine if there is a trend toward outsourcing such work.

OIG Recommendation 2: Develop a process to: (a) identify repair stations that air carriers use to perform aircraft maintenance, (b) identify the repair stations that are performing safety critical repairs and, (c) target inspector resources based on risk assessment or analysis of data collected on air carrier outsourcing practices.

FAA Response: Concur. The current process to identify repair stations that air carriers use to perform safety critical repairs can be improved. We will develop a new process to target inspector resources based on risk assessment or analysis of data collected on air carriers outsourcing practices.

OIG Recommendation 3: Implement procedures to improve information sharing through FAA's newly integrated Safety Performance Analysis System by requiring: (a) certificate management office inspectors to document the name of the repair stations they have reviewed in the Air Transportation Oversight System database and; (b) district office inspectors to include the areas inspected, the results, and corrective actions taken in the Program Tracking and Reporting System.

FAA Response: Concur. We will develop procedures to improve information sharing through the Safety Performance Analysis System by requiring Certificate Management Office inspectors to document the name of the repair station they have reviewed in the Air Transportation Oversight System database and revise the guidance to Flight Standards Field Office inspectors to more thoroughly document repair station inspections.

OIG Recommendation 4: Develop a comprehensive, standardized approach to repair station surveillance by requiring inspectors to review all aspects of repair station operations, from the time the repair is received until it is released to the customer.

FAA Response: Concur. The intent of current policy is to review all aspects of the repair station operation during a repair station facility inspection. However, we will clarify policies and procedures that will require a comprehensive and standardized approach to repair station surveillance, including the review of the total repair station operations. The

FAA has been exploring the use of different ideas and philosophies on repair station oversight, such as a “certificate management” for large and complex repair stations. Also, FAA will consider employing a surveillance team concept at the large and more complex repair stations.

OIG Recommendation 5: Modify existing inspection documentation requirements with foreign aviation authorities so that FAA receives sufficient documentation to ensure FAA certified repair stations meet FAA standards.

FAA Response Concur. In September and October 2002, we issued new policy instructions to our inspectors and to the foreign aviation authorities regarding the documentation to be submitted to ensure that repair stations meet FAA standards. These instructions were developed by the inspectors responsible for oversight of these repair stations and addressed inspector concerns. Although the OIG team knew this new guidance was being drafted, they did not have the benefit of it during their audit. We will do follow-up reviews with the three national aviation authorities to ensure they are complying with the new policy. In addition, Field Office Managers with responsibility for these agreements will ensure that documentation will be in English and will address the elements of the repair station inspection.

OIG Recommendation 6: Develop a process to capture results from a) foreign aviation authority inspections and b) FAA sample inspections of foreign repair stations in FAA’s PTRS.

FAA Response: Concur. We will develop policies and procedures to capture results from foreign aviation authority inspections and FAA sample inspections of foreign repair stations in the PTRS.

OIG Recommendation 7: Develop procedures to verify that foreign aviation authorities place adequate emphasis on FAA regulations when conducting reviews at FAA certified facilities.

FAA Response: Concur. We will develop policies and procedures to verify that foreign aviation authorities place enough emphasis on the FAR when conducting reviews at FAA certified foreign repair stations in countries, where a BASA/MIP has been implemented.

OIG Recommendation 8: Clarify requirements with foreign aviation authorities to ensure that changes to FAA certified foreign repair stations’

operations that directly impact FAA requirements are sent to FAA for approval.

FAA Response: Concur. We will clarify policies and procedures that require foreign aviation authorities to send changes to FAA certified foreign repair station operations that directly impact FAA requirements for FAA approval.

OIG Recommendation 9: Modify procedures for conducting sample inspections to permit FAA inspectors to: (a) conduct the number of inspections necessary to gain assurance that foreign aviation authority inspections meet FAA standards during the initial implementation periods when foreign authorities conduct inspections on FAA's behalf; and (b) base the number of inspections in subsequent years on analysis of data collected from prior sample inspections.

FAA Response: Concur. We will clarify that the current sample size is the minimum adequate sample to make a positive determination of the acceptability of a foreign aviation authority's competence to perform repair station surveillance for the FAA.

Section 508 Compliant Materials for the OIG’s Review of Air Carriers’ Use of Aircraft Repair Stations

Executive Summary

Figure 1. Oversight of FAA-Certified Repair Stations

Entity	Number of Inspectors
FAA Flight Standards District Office Inspectors	3,041
FAA Certificate Management Office Inspectors	153
FAA International Field Office Inspectors	105
Air Carrier Auditors	Information Not Available
Civil Aviation Authorities Inspectors	Information Not Available

Figure 2. Percentage of Maintenance Outsourcing for Major Air Carriers from 1996 to 2002

(\$ in billions)

Year	Outsourcing Cost	Total Cost	Percentage of Outsourced Maintenance
1996	\$1.5	\$4.2	37 percent
1997	\$1.8	\$4.8	38 percent
1998	\$2.2	\$5.3	41 percent
1999	\$ 2.5	\$5.5	45 percent
2000	\$2.7	\$6.1	44 percent
2001	\$2.8	\$5.9	47 percent
2002	\$2.5	\$5.4	47 percent

Source: U.S. DOT Form 41 Data

Figure 3. Growth in Outsourced Maintenance in 1996 and 2002 for Three Major Air Carriers

(\$ in millions)

Air Carrier	Year (CY)	In-House	Outsourced	Total Cost	Percentage of Outsourced Maintenance
Delta	1996	\$399.1	\$93.2	\$492.3	19 percent
Delta	2002	\$514	\$309.5	\$823.5	38 percent
United	1996	\$614.5	\$144.8	\$759.3	19 percent
United	2002	\$615.2	\$304.2	\$919.4	33 percent
Northwest	1996	\$453	\$205.6	\$658.6	31 percent
Northwest	2002	\$371.1	\$286.2	\$657.3	44 percent

Source: U.S. DOT Form 41 Data

Figure 4. Major Airlines' Percentage of Maintenance Outsourcing for 2002

(\$ in millions)

Air Carrier	Outsourced Maintenance	Total Expense	Percent of Outsourced Maintenance
Alaska	\$129	\$163.7	79 percent
America West	\$229.2	\$298.1	77 percent
American	\$465.2	\$1,212.4	38 percent
Continental	\$249.8	\$384.2	65 percent
Delta	\$309.5	\$823.5	38 percent
Northwest	\$286.2	\$657.3	44 percent
Southwest	\$313.7	\$481.8	65 percent
United	\$304.2	\$919.4	33 percent
US Airways	\$215.1	\$427.3	50 percent

Source: U.S. DOT Form 41 Data

Figure 5. Percentage of Repair Station Inspections Completed by FAA Certificate Management Inspectors in FY 2002

Air Carrier	Number of In-House Maintenance Inspections Completed	Repair Station Inspections Completed	Percentage of Inspections Done at Repair Stations to Total Inspections Completed
Carrier A	199	7	3 percent
Carrier B	117	8	6 percent
Carrier C	266	18	6 percent
Carrier D	82	1	1 percent
Carrier E	87	4	4 percent
Carrier F	256	8	3 percent
Carrier G	270	6	2 percent
Carrier H	286	6	2 percent
Carrier I	400	7	2 percent

Source: FAA ATOS Database

Chapter 1

Figure 1. Oversight of FAA-Certified Repair Stations

Entity	Number of Inspectors
FAA Flight Standards District Office Inspectors	3,041
FAA Certificate Management Office Inspectors	153
FAA International Field Office Inspectors	105
Air Carrier Auditors	Information Not Available
Civil Aviation Authorities Inspectors	Information Not Available

Chapter 2

Figure 2. Percentage of Maintenance Outsourcing for Major Air Carriers from 1996 to 2002

(\$ in billions)

Year	Outsourcing Cost	Total Cost	Percentage of Outsourced Maintenance
1996	\$1.5	\$4.2	37 percent
1997	\$1.8	\$4.8	38 percent
1998	\$2.2	\$5.3	41 percent
1999	\$ 2.5	\$5.5	45 percent
2000	\$2.7	\$6.1	44 percent
2001	\$2.8	\$5.9	47 percent
2002	\$2.5	\$5.4	47 percent

Source: U.S. DOT Form 41 Data

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Source: U.S. DOT Form 41 Data

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South West	\$313.7	\$481.8	65 percent
United	\$304.2	\$919.4	33 percent
US Airways	\$215.1	\$427.3	50 percent

Source: U.S. DOT Form 41 Data

Figure 5. Increase in Outsourcing to Foreign Repair Stations by One Major Air Carrier From Calendar Year 1996 to 2001

(\$ in millions)

Year	Foreign Repair Station Outsource Maintenance Expense	Total Maintenance Expense	Percentage of Outsourced Maintenance Expense
1996	\$26.6	\$280.1	9 percent
1997	\$64.2	\$389.8	16 percent
1998	\$47.8	\$342.9	14 percent
1999	\$54.2	\$259.7	21 percent
2000	\$68.4	\$298.7	23 percent
2001	\$91.7	\$347.2	26 percent

Source: U.S. DOT Form 41 Data

Figure 6. Percentage of Outsourced Maintenance Expense for Atlantic Southeast Airlines from 1996 to 2002

(\$ in millions)

Year	Outsource Maintenance Expense	Total Maintenance Expense	Percentage of Outsourced Maintenance Expense
1996	\$21	\$53.3	39 percent
1997	\$26.6	\$59.5	45 percent
1998	\$32.1	\$59	54 percent
1999	\$51.2	\$75.1	68 percent
2000	\$48.3	\$96.2	50 percent
2001	\$61.2	\$87.3	70 percent
2002	\$49.8	\$76	66 percent

Chapter 3

Figure 7. Percentage of Repair Station Inspections Completed by FAA Certificate Management Inspectors in FY 2002

Air Carrier	Number of In-house Maintenance Inspections Completed	Repair Station Inspections Completed	Percentage of Inspections done at Repair Stations to Total Inspections Completed
Carrier A	199	7	3 percent
Carrier B	117	8	6 percent
Carrier C	266	18	6 percent
Carrier D	82	1	1 percent
Carrier E	87	4	4 percent
Carrier F	256	8	3 percent
Carrier G	270	6	2 percent
Carrier H	286	6	2 percent
Carrier I	400	7	2 percent

Source: FAA ATOS Database