United States Government Accountability Office

GAO

Report to Congressional Requesters

September 2005

AVIATION SAFETY

FAA Management Practices for Technical Training Mostly Effective; Further Actions Could Enhance Results

GAO-05-728

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GAO Accountability·Integrity·Reliability

Highlights

Highlights of GAO-05-728, a report to congressional requesters

Why GAO Did This Study

One key way that the Federal Aviation Administration (FAA) makes air travel safer is to inspect the manufacture, operation, and maintenance of aircraft that fly in the United States. To better direct its resources, FAA is shifting from an inspection process that relied on spot-checks of compliance with regulations to one that evaluates operating procedures and analyzes inspection data to identify areas that pose the most risk to safety (called system safety). While FAA believes the new approach requires some technical knowledge of aircraft, Congress and GAO have long-standing concerns over whether FAA inspectors have enough technical knowledge to effectively identify risks.

GAO reviewed the extent that FAA follows effective management practices in ensuring that inspectors receive up-to-date technical training. In addition, GAO is reporting on technical training that the aviation industry provides to FAA.

What GAO Recommends

Within the context of an overall system safety approach, GAO recommends that FAA take several actions, including systematically assessing inspectors' technical training needs. FAA officials generally agreed with the contents of this report and agreed to consider GAO's recommendations.

www.gao.gov/cgi-bin/getrpt?GAO-05-728.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Gerald Dillingham at (202) 512-2834 or DillinghamG@gao.gov.

What GAO Found

For its technical training, FAA follows many of the effective management practices for training that GAO has advocated and is improving its efforts in others. (See below.) In planning, FAA has linked technical training efforts to its goal of safer air travel and has identified technical proficiencies needed to improve safety inspectors' performance in meeting this goal. It plans to better relate training to job tasks and is in the early stages of developing an approach to set priorities for new courses and course revisions.

FAA Mostly Follows Effective Management Practices for Its Technical Training

Element	Extent followed
Practices in planning training efforts	Mostly
Practices in developing training curriculum and courses	Mostly
Practices in delivering training	Partially
Practices in evaluating training efforts	Mostly

Source: GAO.

In developing technical courses, FAA has a structured process aimed at ensuring that courses meet performance objectives. It allows inspectors and others to identify the need for new training courses and to aid in developing courses. FAA is developing an initiative to systematically identify specific technical competencies and training requirements for inspectors.

In delivering courses, FAA offers a wide array of technical courses from which inspectors can select to meet job needs. From GAO's survey of FAA's inspectors, we estimate that only about half think that they have the technical knowledge needed for their jobs. FAA officials told us that inspectors' negative views stem from their wanting to acquire proficiencies that are not as crucial in a system safety environment. GAO also estimates that 28 percent of inspectors believe that they get the technical training that they request. However, FAA's records show that FAA approves about 90 percent of these requests, and inspectors are making good progress in receiving training. Over half of the inspectors have completed at least 75 percent of technical training that FAA considers essential.

In evaluating courses, FAA continuously assesses technical training through end-of-course evaluations and surveys of inspectors and supervisors. FAA is developing an approach to measure the impact of training on FAA's mission goals, such as reducing accidents. This is a difficult task.

Technical and Other Training Enables FAA to Inspect a Wide Variety of Aircraft

Source: FAA.

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Abbreviations

FAA	Federal Aviation Administration
ATOS	Air Transportation Oversight System

GAO
Accountability * Integrity * Reliability

United States Government Accountability Office
Washington, D.C. 20548

September 7, 2005

The Honorable Ted Stevens, Chairman
The Honorable Daniel K. Inouye, Co-Chairman
Committee on Commerce, Science and Transportation
U.S. Senate

The Honorable Don Young, Chairman
The Honorable James L. Oberstar, Ranking Member
Committee on Transportation and Infrastructure
House of Representatives

FAA's overarching goal for technical training is to improve aviation safety. One key way that the Federal Aviation Administration (FAA) makes air travel safe for the public and the movement of goods is to inspect the manufacture, operation, and maintenance of aircraft that fly in the United States. To do so, about 3,700 FAA inspectors perform hundreds of thousands of inspections annually.[1] Carrying out these inspections has become more challenging with the rapid growth in the number and type of aircraft in use and their increasing technical sophistication.

Concerns about the quality of inspections heightened after the investigation of the 1996 crash of ValuJet flight 592 revealed deficiencies in FAA's inspection system. In response, FAA began to make fundamental changes in its approach to inspections. Traditionally, FAA aviation safety inspectors relied on their expertise to conduct inspections that spot-checked manufacturing processes, aircraft operations, and aircraft maintenance for compliance with regulations. FAA is transitioning to a risk-based system safety approach to inspections that requires inspectors to apply data analysis and auditing skills to identify, analyze, assess, and

[1]In addition, FAA delegates about 90 percent of its safety inspection activities to about 13,600 private persons and organizations, known as designees. The designees augment FAA's inspection workforce by allowing inspectors to concentrate on what FAA considers to be the most critical safety areas. For example, while designees conduct routine functions, such as approvals of aircraft technologies that the agency and designees have had previously experience with, FAA inspectors focus on new and complex aircraft designs or design changes. For an assessment of the designee programs, see GAO, *Aviation Safety: FAA Needs to Strengthen the Management of Its Designee Programs*, GAO-05-40 (Washington, D.C.: Oct. 8, 2004).

control the potential hazards and risks of flying and to prevent accidents.[2] While we have endorsed FAA's move toward a system safety approach to inspections, congressional oversight committees and we have had long-standing concerns over whether FAA inspectors have sufficient knowledge of increasingly complex aircraft, aircraft parts, and systems to effectively identify safety risks.

The Vision 100 – Century of Aviation Reauthorization Act, enacted in December 2003, requires that we report on FAA's actions to ensure that inspectors receive up-to-date training on the latest technologies. We call this technical training, although this use of the term "technical" differs somewhat from FAA's use of the term.[3] Consistent with the act, this report focuses on the extent to which FAA follows effective management practices for (1) planning, (2) developing, and (3) delivering up-to-date technical training, and (4) ensuring that technical training for inspectors contributes to improved performance and results. It also discusses the degree to which the aviation industry provides technical training to FAA safety inspectors and discusses the safeguards in place to help preclude the appearance of or an actual conflict of interest when inspectors receive certain kinds of training from a regulated entity. Finally, as required by the act, the report provides information on the amount of travel required of inspectors in receiving technical training. (See app. I.)

[2]System safety is a multidisciplinary, integrated, and comprehensive regulatory approach using engineering and management principles, criteria, and techniques to identify and mitigate high-risk areas. When FAA uses it in the oversight of airlines, the system safety approach covers every aspect of an airline's operations, from the design of the hardware to the culture and attitudes of the airline's personnel. The approach calls for a systematic review of an airline's policies and procedures to ensure that they incorporate such basic safety principles as clear lines of responsibility and written documentation. According to FAA, the approach allows it to concentrate and target inspector resources where there is the greatest safety risk. The success of a system safety approach to regulation depends on comprehensive safety data, sophisticated analysis tools, and a workforce well trained in risk assessment, auditing, systems thinking, and communications.

[3]In addition to training involving aviation technologies (such as use of new materials in aircraft and aircraft electronic systems), FAA includes in its definition of technical training, topics such as inspector job skills, risk analysis, data analysis and training in software packages, such as spreadsheets. Our use of the term "technical" is limited to aviation technologies.

This report focuses on how FAA ensures that its inspectors possess the technical proficiency they need to do their jobs through following effective management practices and whether inspectors are receiving the technical training that FAA has determined is essential for its inspectors.[4] We did not attempt to assess the technical proficiency that FAA's workforce requires (and will require in the near future) and compare it with the proficiency that currently exists. Because of the diversity and size of the inspector workforce and the wide variety of aircraft technologies that FAA is responsible for overseeing, this type of assessment would have been a massive undertaking and would be more properly done by FAA. We also did not attempt to compare the technical training received by inspectors with the tasks and activities that inspectors perform. FAA's inspector activity database contains tens of thousands of task and activity records, and the manner in which these records are stored did not allow us to electronically sort and analyze the data. However, to provide some insight into these two issues, we did discuss these issues with FAA officials and surveyed FAA's inspectors on their views, as described below.

To assess whether FAA follows effective management practices regarding technical training, we compared FAA's management of its inspector technical training efforts with effective management practices outlined in our 2004 guide for assessing strategic training activities in the federal government and determined the extent to which FAA followed the relevant elements of this guidance.[5] In addition, we analyzed FAA documents pertaining to planning, developing, delivering, and evaluating inspector training and discussed these activities with FAA officials involved in inspector training and the management of inspection programs at FAA headquarters in Washington, D.C., and the FAA Training Academy in Oklahoma City. To examine the training provided, including technical training, we analyzed FAA data on training courses taken by inspectors from 2002 through 2004 and FAA's evaluation of technical training courses during that period. We discussed technical training with safety inspectors

[4]We considered all training that FAA classifies as either mandatory, position essential, or continuing development as essential training. Mandatory is training that is required for *all* newly hired inspectors and previous experience may not be substituted for this training. Position essential is training or a skill that is required based on an inspector's current position (e.g., training required for maintenance inspectors). To determine which courses were technical, we reviewed the description for each course taken from 2002 through 2004 and determined whether it was primarily technical in nature, within our use of the term.

[5]GAO, *Human Capital: A Guide for Assessing Strategic Training and Development Efforts in the Federal Government*, GAO-04-546G (Washington, D.C.: Mar. 1, 2004).

and their supervisors at 7 of FAA's approximately 130 field locations. The locations were chosen to represent the range of FAA inspection responsibilities. We also conducted a self-administered electronic survey posted on the World Wide Web to a stratified random sample of FAA safety inspectors to obtain their views about their technical proficiency and the technical training they receive. We received useable responses from 79 percent of the inspectors surveyed. This report does not contain all the results from the survey. The survey and a complete tabulation of the overall results (excluding results by type of inspector, which are too voluminous to present) can be viewed at GAO-05-704SP. Finally, we obtained further perspective on FAA's training curriculum through semistructured interviews with 16 experts from the aviation industry and the field of aviation education who were selected on the basis of having extensive background and knowledge of the technical areas covered by FAA inspections. As part of our review, we assessed internal controls and the reliability of FAA's data on the amounts and types of training received that are pertinent to this effort. We determined that the data elements were sufficiently reliable for our purposes. We conducted our work from March 2004 through July 2005 in accordance with generally accepted government auditing standards. (See app. III for additional information on our scope and methodology.)

Results in Brief

FAA has made training an integral part of its safety inspection system, which in recent years has emphasized risk analysis techniques over individual inspector technical knowledge of aircraft, aircraft parts, and systems. FAA has generally followed several effective management practices for planning, developing, delivering, and assessing the impact of its technical training for its aviation safety inspectors, although some practices have yet to be fully implemented. Regarding planning for technical training, for example, FAA's training efforts for the most part follow effective management practices and are intended to support its goals for improving aviation safety, and they largely focus on effectively implementing a system safety approach to inspections. According to FAA, it has identified gaps in several of the competencies required to conduct system safety inspection, including risk assessment, data analysis, auditing, and systems thinking, and the agency is currently working to address these gaps. In FAA's view—although it recognizes the importance of inspectors staying up to date with changes in aviation technology—the competencies needed for system safety inspections are the most critical for inspectors, and the gaps in these competencies are much larger than gaps in technical skills and competencies relating to the production, operation, and

maintenance of aircraft. In addition, FAA Office of Aviation Safety officials said that inspectors do not need a substantial amount of technical training because inspectors are hired with a high degree of technical knowledge of aircraft and aircraft systems, and they can sufficiently keep abreast of many of the changes in aviation technology through FAA and industry training courses and on-the-job training. Nevertheless, FAA plans to identify specific technical competencies and training requirements as part of a process intended to better relate training to the job tasks of each inspector specialty.[6]

FAA also for the most part follows effective management practices for developing its inspector technical training curriculum. For example, FAA integrates the development of courses with overall strategies to improve performance and to meet emerging demands. In this regard, FAA develops courses that support changes in inspection procedures resulting from regulatory changes or agency initiatives, such as the implementation of the system safety approach to inspections. FAA will also consider developing training courses that are requested by inspectors and managers. FAA also works to match the training delivery approach with the nature of the material presented to best meet inspector and agency needs—such as delivery at a central location in FAA's Training Academy in Oklahoma City, Oklahoma; in multiple locations closer to field offices; or through computer-based instruction. While following many effective practices in this area, FAA has not systematically identified the technical skills and competencies each type of inspector needs to effectively perform inspections. As a result, technical courses are developed on an ad hoc basis rather than as part of an overall curriculum for each inspector specialty. FAA has recognized this problem and is developing an initiative that will systematically assess whether the complete array of training for each inspector specialty meets performance requirements.

In delivering technical courses, FAA has followed effective management practices to differing degrees. For example, FAA has established clear accountability for ensuring that inspectors have access to technical training, developed a way for inspectors to choose courses that meet job needs and further professional development, and offers a wide array of

[6]FAA inspectors specialize in conducting inspections of various aspects of the aviation system, such as aircraft and parts manufacturing, aircraft operations, aircraft airworthiness, and cabin safety. See the background section of this report for more information on inspector specialization.

technical and other courses. However, inspectors are for the most part dissatisfied with the technical training they receive. From an analysis of the survey, we estimate that only about half of FAA's inspectors think that they have the technical knowledge needed to do their jobs,[7] only about one-third are satisfied with the technical training they have recently received, and less than half believe that they get to take the technical training that they request. However, our analysis of FAA training data indicates that FAA has approved about 90 percent of the technical courses requested by inspectors, and inspectors in general are making good progress in completing the technical training essential for their positions (77 percent of the inspectors have completed at least half of their essential courses, and 46 percent have completed at least 80 percent of their essential courses). In addition, according to the survey, we estimate that only 23 percent of FAA's inspectors think that they receive technical training in time to do their current job. FAA's records do not allow us to assess the timeliness of training. FAA officials told us that inspectors' negative views on their technical knowledge and the training they received stem from their not accepting FAA's move to a system safety approach. That is, the inspectors are concerned about acquiring individual technical proficiency that is not as crucial in a system safety/risk management environment. Given that it has not completed assessing whether training for each inspector specialty meets performance requirements, FAA is not in a position to make definitive conclusions concerning the adequacy of inspector technical training.

FAA for the most part follows several effective management practices in evaluating individual technical training courses. For example, it continuously assesses technical training through participant end-of-course evaluations and surveys of inspectors and supervisors that focus on the application of skills and knowledge to the job. FAA also requires that each

[7]Because of the statistical survey techniques we employed in surveying FAA's inspectors, we are 95 percent confident that the results we present are within 4.6 percentage points of the results that we would have obtained if we had surveyed all 3,000 front-line inspectors. That is, we are 95 percent confident that had we surveyed all inspectors, between 48 and 57 percent of them would have told us that, to a great or very great extent, they have the technical knowledge to do their jobs. All percentage estimates from the survey have a margin of error of plus or minus 4.6 percentage points or less, unless otherwise noted.

Throughout the survey we used a 5-point scale (very great, great, moderate, some, and no extent). For the most part, we report on the degree to which inspectors expressed their views to a very great or great extent because we believe that "a moderate extent" does not represent a strong positive or negative view and does not represent a level of performance to which a high-performing organization should aspire.

training course receive a systematic evaluation every 3 years to determine if the course is up to date and relevant to inspectors' jobs, although training officials noted that many courses have yet to undergo such an evaluation. However, FAA has taken limited action to evaluate the overall impact of its technical training on inspector performance in achieving mission goals, such as reducing accidents. Although FAA surveys its employees on their attitudes regarding many aspects of their employment, including the extent to which they were able to apply agency training to their jobs and perform their jobs effectively, it is not able to isolate inspectors' responses from those of its other employees. Moreover, the survey does not ask employees to differentiate between the types of training they receive, such as technical and nontechnical training. Experts on training in government agencies emphasize the importance of using an approach to evaluating training that goes beyond individual course evaluations and includes such indicators as the amount of learning that occurs from training programs and their organizational impact. However, training experts acknowledge that isolating performance improvements resulting from training programs is difficult for any organization.

FAA has increasingly relied on the aviation industry to provide technical training in fiscal years 2002 through 2004. In fiscal year 2004 (latest data available), industry delivered nearly half of FAA's technical training. Although FAA pays for most of the technical training that industry provides, from fiscal years 2002 through 2004 about, 17 percent of industry-provided technical training was supplied to FAA in exchange for an in-kind service, such as delegating authority to conduct inspections, (called quid pro quo arrangements) with some apparently limited additional training supplied at no cost to the agency. To a large degree, FAA has established safeguards to help preclude actual or appearances of a conflict of interest, such as executing agreements with aviation industry training providers it regulates outlining the conditions under which it will accept training for in-kind service or at no cost. However, FAA has not included provisions covering its enforcement and oversight authority in all agreements with aviation industry training providers. In addition, two regional officials said that their regions accept free training on a limited basis outside the formal agreements with the training providers; one of these officials identified 57 instances over the past 5 years in which inspectors received free training from aircraft manufacturers or operators. Because these opportunities generally arise at the local office level, whether such an offer is reviewed by legal counsel is dependent on the office manager, the manager's understanding of the FAA policy, and a judgment about whether a specific

training opportunity raises any concern that should be reviewed by legal counsel.

Although FAA has followed effective management practices in many areas in providing technical training to its safety inspectors, we are making several recommendations aimed at, among other things, improving FAA's identification of gaps in inspectors' technical knowledge that relate to their jobs, better aligning the timeliness of training to when inspectors need the training to do their jobs, gaining inspectors' acceptance for changes made or planned to their training, and ensuring that the acceptance of training from aviation industry providers does not limit FAA's enforcement authority or pose a real or potential conflict of interest.

In commenting on a draft of this report, the Department of Transportation generally agreed with the information that we presented and agreed to consider our recommendations. However, the department expressed the view that we should have considered, as positive responses, the views of inspectors who responded to survey questions as "moderate extent," along with those who responded to a "great extent" or "very great extent." The extent scale that we used in our survey represents a unidirectional scale. As such, it is possible to interpret any point along that scale, other than "no extent," as positive, depending upon how a question is worded. Generally, we presented information in the report with both "very great extent" and "great extent" combined to represent the clearly most positive responses.

Background

Ensuring the safety of the nation's aviation system is the shared responsibility of FAA and the aviation industry. Aircraft manufacturers are responsible for building safe aircraft. Aircraft operators are responsible for the safe maintenance and operation of aircraft. FAA is responsible for, among other things, certifying that the manufacture of aircraft and aircraft parts meets FAA standards, encouraging the development of new aviation technologies, and conducting periodic inspections to ensure continued compliance with safety regulations. Within FAA, the Office of Aviation Safety (1) directs and manages aviation safety through inspection (called surveillance by FAA) and oversight programs; (2) creates and amends standards and policies; and (3) certifies that aircraft, manufacturers, maintenance services, and individuals who operate aircraft meet FAA safety standards before they carry out their activities (called certification).

FAA's 3,700 inspectors are located in more than 130 offices throughout the world. About 3,000 of these are front-line inspectors. These inspectors

specialize in conducting inspections of various aspects of the aviation system, such as aircraft and parts manufacturing, aircraft operation, aircraft airworthiness, and cabin safety. (See table 1.)

Table 1: Types of Inspectors, Responsibilities, and Numbers, as of April 2005

Inspector type	Areas of responsibility	Number
Air carrier operations	Responsible for evaluating airmen (pilots, aviators, or aviation technicians) for initial and continuing qualifications, airmen training programs, equipment, and facilities, and aircraft operations for adequacy of facilities, equipment, and procedures to ensure the safe operation of the aircraft. Air carrier inspectors are responsible for evaluating pilots, dispatchers, air carriers, and similar operators.	908
Air carrier maintenance	Focuses on evaluating mechanics and repair stations for initial and continuing certification and mechanic training programs. Examines the overall aircraft maintenance program, including the development of maintenance manuals and the procedures for repairing aircraft and their components. Inspects aircraft and related equipment for airworthiness. Air carrier inspectors evaluate maintenance programs of air carriers and similar operators.	831
General aviation operations	Duties are similar to air carrier operations inspectors, with the exception that general aviation operations inspectors are responsible for evaluating pilots, flight instructors, air taxis, and similar operators.	636
General aviation maintenance	Duties are similar to air carrier maintenance inspectors, with the exception that general aviation maintenance inspectors evaluate maintenance programs of air taxis and similar operators.	571
Air carrier avionics	Responsible for inspecting aircraft electronics and related systems for airworthiness, evaluates avionics technicians, repair stations, and technician training programs. Air carrier inspectors conduct surveillance and oversight of air carriers and similar operators.	341
Aircraft certification	Administers and enforces safety regulations and standards for the production and/or modification of aircraft. Evaluates and oversees the plants that build or assemble aircraft. Inspects prototype or modified aircraft, aircraft parts, and avionics for conformity with design specifications and safety standards. Issues certificates for all civil aircraft.	187
General aviation avionics	Duties are similar to air carrier avionics inspectors, with the exception that general aviation avionics inspectors conduct surveillance and oversight of air taxis, travel clubs, and similar operators.	180
Cabin safety	Serves as a resource and technical authority on cabin safety requirements, such as verifying that emergency equipment is onboard the aircraft, as they relate to activities affecting civil aviation.	60
Total		**3,714**

Source: GAO summary of FAA information.

Some inspectors, such as operations and airworthiness inspectors, further specialize according to the type of aircraft and aircraft operators they oversee. Other inspectors, such as general aviation inspectors, are responsible for inspecting a wide range of aircraft, such as those used for agriculture, air taxi service, industry, and pleasure. (See fig. 1.) In addition, they inspect flight instructors. Some air carrier inspectors are assigned to one of the 16 carriers that are currently subject to the Air Transportation Oversight System (ATOS) program, which is intended to identify safety problems through risk analysis;[8] while other air carrier inspectors are responsible for overseeing the operations of several smaller carriers in a geographic area.

[8]The goal of ATOS is to identify safety trends in order to spot and correct problems at their root cause before an accident occurs. This program allows FAA inspectors to now look at an airline as a whole, to see how the many elements of its operations—from aircraft to pilots to maintenance facilities to flight dispatch to cabin safety—interact to meet federal standards. The program will ultimately encompass all of the approximately 120 American airlines that operate in the United States, at any given time.

Figure 1: FAA's Safety Inspections Cover a Wide Range of Activities

Source: FAA.

Note: As a workforce, FAA inspectors conduct a wide variety of inspections, including ensuring that pilots are qualified to operate air carrier and general aviation aircraft and inspecting air carrier and general aviation aircraft for safety.

FAA requires that candidates for safety inspector positions have extensive technical qualifications and experience, which is usually gained during careers in the aviation industry. For example, prospective manufacturing inspectors need experience in and knowledge of industrial technologies. Similarly, operations inspectors need pilot licenses to fly specific makes and models of aircraft; maintenance inspectors need to have certifications to repair the aircraft's airframe and power plant; cabin safety inspectors

need extensive experience in aircraft cabin safety procedures; and avionics inspectors need extensive experience in servicing an aircraft's avionics system, which includes radar and other electrical systems.

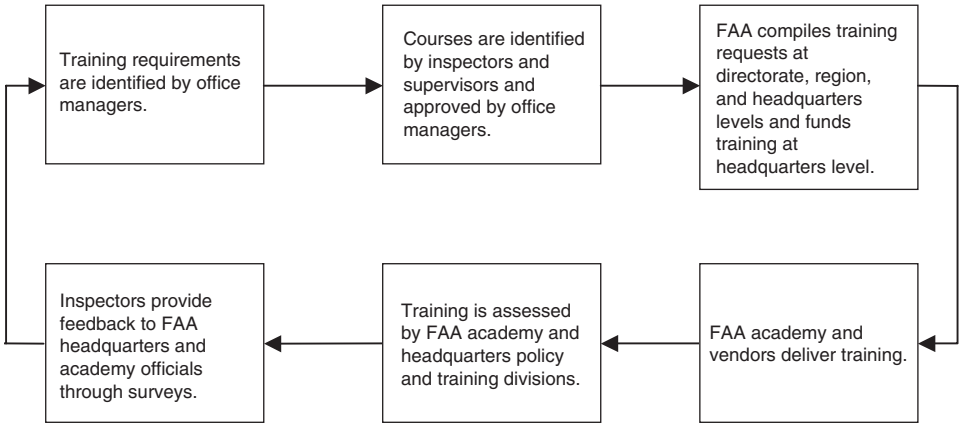
To supplement the skills inspectors bring with them from their previous careers in the aviation industry, FAA provides inspectors with extensive training in federal aviation regulations; inspection and investigative techniques; and technical skills, such as flight training required for operations inspectors. The services within FAA's Office of Aviation Safety that are responsible for conducting inspections of aircraft operators and aircraft repair stations[9] (Flight Standards) and manufacturers (Aircraft Certification) have each established training units that develop curricula and specific courses for inspectors. Most of the regulatory, inspection, and investigative courses are taught by FAA instructors at the FAA Training Academy in Oklahoma City, Oklahoma. Much of the technical training (training that enhances skills concerning the production, maintenance, and operation of aircraft, aircraft parts, airworthiness, and systems) is contracted out to vendors, such as flight schools. (App. I provides information on the amount of inspector training provided by FAA and vendors.) FAA is also making increased use of nonclassroom training delivery methods, such as computer-based instruction, Web-based training, interactive video training, and correspondence courses. Inspectors also receive extensive on-the-job training, particularly when they are first hired. FAA has spent an average of $43 million per year on inspector training activities from fiscal years 2002 through 2004 and plans to spend $41 million in fiscal year 2005.

The Flight Standards and Aircraft Certification training divisions have training priorities, which are set by the Associate Administrator for Aviation Safety. Determining training needs is based on the inspectors' job. Acquiring training is a shared responsibility between inspectors and their supervisors. (See fig. 2.) Each year inspectors and their supervisors meet to decide which training inspectors will request in the coming year. The inspectors are expected to choose training that will fulfill their mandatory training requirements in areas such as basic aircraft accident investigation, air carrier airworthiness, aviation safety inspector job functions, and data analysis and related skills needed to perform system safety inspections. Inspectors can also request training that they believe will further their

[9]A repair station is an FAA-certified maintenance facility that is authorized to perform maintenance or alterations on U.S.-registered aircraft.

professional development. FAA's directorate, regional, and headquarters offices then compile and fund the training requests. Headquarters training officials coordinate with the FAA academy and other training vendors to deliver the training. Inspectors provide feedback to headquarters and academy officials through surveys and course evaluations.

Figure 2: FAA Safety Inspector Training Roles and Responsibilities



Source: GAO presentation of FAA information.

FAA's transition to the ATOS system safety concept represents a major change in the way the agency operates as it shifts the oversight emphasis from the traditional methods of inspection to identifying and assessing risks to safety. Under the traditional or compliance approach, inspectors rely upon random inspection activities, such as observing aircraft parked at departure gates. When applying the system safety approach inspectors develop comprehensive surveillance plans for each air carrier. Developing the plans requires using existing safety data, risk indicators and the inspector's knowledge of the operations to determine the priority and frequency of inspection activities. The resulting comprehensive surveillance plan includes a series of inspection tasks to determine whether an airline has systems in place to ensure safety and a second series of inspections to verify that the airline is actually using those systems.

FAA has taken steps to introduce concepts used in ATOS into its traditional oversight process for the air carriers not in the ATOS program. In November 1999, FAA instructed its inspectors to begin adjusting planned inspections for new air carriers, on the basis of evaluation of areas of

potential safety risks.[10] In 2002, inspectors were instructed to perform safety risk evaluations of all other non-ATOS carriers using ATOS risk assessment principles as part of their inspections. However, the inspections of the non-ATOS carriers are still based on a determination of whether air carriers are complying with regulations rather than whether air carriers' systems are operating effectively.[11] According to FAA, in the transition to the system safety concept, safety inspectors are learning new skills, such as data analysis, risk assessment, computer operations, auditing, systems thinking, and interpersonal skills. Inspectors will continue to need technical expertise in avionics, cabin safety, operations, maintenance, and aircraft production and design, and may need training in composites, basic accident investigation, and nondestructive inspections courses. FAA has concluded that it will take a significant training effort to develop and maintain both the system safety approach as well as the technical competencies.

Strategic Planning Activities Generally Reflect Effective Practices and Focus on Reducing a Large Gap in System Safety Knowledge

FAA's strategic planning acknowledges the central importance of aviation safety inspectors and defines their role as mission critical. In its planning activities for training, FAA has, for the most part, followed effective management practices by developing strategic approaches to training that have established broad training priorities for inspectors, among other things. (See table 2.)

[10]Air carriers are considered new entrants (or new air carriers) for their first 5 years of operation.

[11]We will issue a report on FAA's oversight of non-ATOS carriers later this year.

Table 2: Extent That FAA Followed Effective Management Practices in Planning for Training

Effective management practice	Extent followed
Ensures training goals and related performance measures and targets are consistent with overall mission and goals	Fully
Ensures human capital professionals work in partnership with agency leadership in addressing agency priorities, including training, in strategic and annual performance planning processes	Fully
Determines skills and competencies its workforce needs to achieve current and emerging agency goals and identifies gaps—including those training strategies can help address	Mostly
Identifies appropriate level of investment for training and prioritizes funding so that the most important training needs are addressed first	Partially
Ensures agency strategic and tactical changes are promptly incorporated into training efforts	Fully

Source: GAO.

Establishing training goals and performance measures that further overall agency goals. One of the goals of the inspector training program is to provide the training required to support inspectors in the FAA transition to a system safety approach for meeting its goal of increased safety. Both Flight Standards and Aircraft Certification have developed training initiatives to support this training goal. Flight Standards also has eight training initiatives focused on improving aviation safety in general, each of which has related performance measurements or targets along with strategies, time lines, and resource estimates.[12] In addition, to support the FAA safety goal, the Office of Aviation Safety, which contains both the Flight Standards and Aircraft Certification services, measures what the services have done to prepare their workforce to operate in a system safety environment. This measurement includes information on how the services have developed and delivered training, redesigned existing courses, and validated inspector competencies.

[12]In addition, Flight Standards has recently moved forward with a curriculum transformation strategy that will fundamentally change how its training program is managed. Acknowledging that its training activities tend to be fragmented, sometimes working at cross purposes, and sometimes leaving major gaps, Flight Standards' transformation strategy calls for a transition from the current course management structure to one that is curriculum based. The new structure will integrate individual training courses into a logical curriculum for each type of inspector that incorporates the specialty needs of inspectors. Flight Standards believes this new approach will cover inspectors' technical training needs, including their training on current technologies. Under this transformation strategy, training curriculum oversight teams will be formed for each inspector specialty to ensure that those inspectors receive the appropriate technical training.

Human capital professionals partnering with agency leadership. In June 2003 Flight Standards established a human capital council which brings senior managers together with training officials to oversee all human capital efforts to, among other things, establish priorities that will both maintain existing inspector technical competencies as well as new and emerging system safety competencies. In Aircraft Certification, the manager responsible for training programs is involved in the service's annual planning process and also participates in weekly meetings of senior level managers. The training manager keeps the training development staff informed of new or changing priorities that could affect the training program.

Determining gaps in workforce skills and competencies. Both Flight Standards and Aircraft Certification conducted human capital analysis for their aviation safety inspectors that revealed significant gaps in their needed competencies and skills as FAA continues its implementation of a more risk assessment-based system approach to safety oversight. In Flight Standards the analysis involved a team of FAA senior managers and FAA subject-matter experts.[13] The team reviewed the existing competency requirements for inspectors and then determined which competencies should be modified or added over the next 5 years. The list of competencies compiled was then reviewed by another group of subject-matter experts, primarily program managers, who estimated the relative importance of the competencies (existing and new) in the next 5 years as well as the gaps between the current workforce's actual and needed level for each competency. The largest critical competency gaps for the inspectors in Flight Standards included (1) risk assessment, (2) data analysis, (3) systems thinking, and (4) designee and industry oversight.[14] Technical proficiency training was the only competency that Flight Standards did not identify as having a critical competency gap, and the list of competencies for Flight Standards field inspectors issued in February 2005 does not include technical proficiency. FAA Office of Aviation Safety officials said that inspectors do not need a substantial amount of technical training courses because inspectors are hired with a high degree of technical knowledge of aircraft and aircraft systems, and they can sufficiently keep abreast of many of the changes in aviation technology through FAA and

[13]We did not attempt to assess how Flight Standards conducted its analysis because it could not locate documentation associated with it.

[14]Flight Standards officials said that the office is validating the inspector competencies.

industry training courses and on-the-job training. Flight Standards officials said that the list of competencies contains items that cut across all inspection specialties and that it will be the role of individual curriculum oversight teams to identify the technical skills and competencies for each inspector specialty. Flight Standards officials said they will establish these teams as part of an effort to develop specific curriculums for each inspector specialty (see the following section on developing training activities).

Aircraft Certification subject-matter experts who manage inspectors identified four similar critical competency gaps for the implementation of system safety for its manufacturing inspectors. The gaps included (1) business and management, (2) data analysis/risk assessment, (3) system thinking skills, and (4) designee oversight. Aircraft Certification officials noted that these are skills that its inspectors need to perform their primary inspection function, which is ensuring that manufacturers meet design specifications for aircraft parts and components. Inspectors do this by inspecting the processes and quality assurance systems involved in aircraft and parts manufacturing.

Prioritizing funding for training activities. Currently in Flight Standards, requests for course development projects come from the operational policy divisions to the training division. The training division then works closely with these individual policy divisions (such as the Air Transportation Division or the Aircraft Maintenance Division) to develop or revise the courses they request. However, the existing process does not explicitly consider which course development projects are most critical. During fiscal year 2005, Flight Standards plans to develop an approach that will consider the organizational factors necessary to prioritize requests for new courses and revision of current courses, including exploring ways to engage senior management. According to FAA officials, a curriculum oversight steering committee will provide strategic direction and prioritization for the service's training needs. Aircraft Certification already employs a process that prioritizes training activities on the basis of three factors: impact on aviation safety, inspector job functions, and the needs of the customer. Training division officials meet each year to establish training priorities and to determine the resources needed to meet these priorities. According to these officials, they are guided by FAA strategic plans and direction they receive from operational program managers.

Promptly incorporating strategic and tactical changes into training and development. Flight Standards has recognized the need to quickly

deploy its training in order to reduce the time lag between the identification of training needs and its delivery as inspector performance requirements change. Currently Flight Standards has quarterly and semiannual training program reviews between the training division, the Flight Standards organizations which sponsor the training, and the FAA academy to discuss the sponsoring organizations' training needs. It is also the responsibility of staff who oversee individual courses, known as course mentors, to ensure courses reflect changes in FAA policies and procedures or new developments in aviation technologies. In Aircraft Certification an executive-level mentor is selected from its management team for each course and is responsible for managing the development of new courses and the updating of existing courses to respond to changes in FAA policies and priorities. We did not attempt to assess the extent to which FAA incorporates strategic and tactical changes into its inspector training curriculum.

FAA Follows Effective Management Practices in Developing Individual Courses but Recognizes the Need to Develop a Unified Curriculum

FAA has for the most part followed effective management practices for developing individual safety inspector courses. (See table 3.) These practices, such as establishing guidelines that call for the formation of course development teams for each new course and that require each team to follow a series of progressive course development steps, are aimed at enhancing course quality and ensuring that the content of the course meets the intended course goals and performance objectives. However, FAA has not systematically identified technical training needs because it develops courses on a course-by-course basis rather than as part of an overall curriculum framework.

Table 3: Extent That FAA Followed Effective Management Practices in Developing Courses

Effective management practice	Extent followed
New courses developed to meet emerging demands and improve performance	Fully
Course development teams enable stakeholders to provide input	Fully
Guidelines provide progressive course development steps with ongoing evaluation at each step	Fully
Merits of different course delivery methods are considered	Fully
Criteria used for decisions regarding outside training providers	Fully
Analysis of training needs and course development linked to overall curriculum approach[a]	Partially

Source: GAO.

[a]This management practice is not specifically identified in our assessment guide. However, a management approach that assesses training needs holistically rather than on a course-by-course basis can provide for a more systematic assessment of whether and how training will help meet organizational needs.

FAA Follows Many Effective Management Practices for Developing Technical Courses

FAA follows many effective management practices for developing technical training courses for Flight Standards and Aircraft Certification safety inspectors.

Ensuring new courses meet emerging demands and improve performance. At the very beginning of any new course development effort, Flight Standards and Aircraft Certification validate the need for new aviation safety inspector training by discussing (1) the facts that indicate the need for training, (2) the desired outcome of the training in terms of performance, and (3) the target audience of inspectors who will receive the training. Before any substantial course development activities occur, Flight Standards and Aircraft Certification training guidelines require that a task analysis be conducted. The purpose of the task analysis is to identify essential tasks, knowledge, and skills needed for effective safety inspector job performance. FAA then uses this task analysis as the basis for determining the scope, content, and sequencing of training topics for each new course.

Flight Standards and Aircraft Certification have also created different ways for field and headquarters personnel to request the development of new aviation safety inspector training courses when a new training need has emerged. Field personnel who see a need for safety inspectors to perform a new task or acquire new knowledge can submit training development requests. In addition, officials in Flight Standards and Aircraft Certification can propose new training courses for inspectors when regulatory changes

occur or when new FAA initiatives, such as the system safety approach for aviation safety inspectors, create a need for additional inspector knowledge and skills. Those proposing new courses must describe how the proposed course will contribute to FAA's mission, explain the inspector knowledge and skills that will be acquired by taking the course, define the target audience for the proposed course, and describe the impact on the inspector workforce if the course is not developed.

Glass Cockpit Displays

Source: Cessna Aircraft Company, used by permission.

Glass cockpit displays provide pilots with aircraft, navigation, and flight information in large easy-to-read displays. Older instrumentation consisted of numerous individual instruments for airspeed, attitude, altitude, heading, and various engine and navigation readings that can make information difficult to read. Glass cockpit displays have large display screens that show flight, engine, and navigation information on a few easy-to-read screens. These large glass cockpit screens allow the pilot to select and display flight information when needed. For example, at various times the pilot can display flight progress, weather, a diagram of destination airport runways, or an approach procedure for landing.

Enabling qualified personnel to participate as stakeholders. When Flight Standards and Aircraft Certification begin to develop a new course, a training development team is formed and different policy, technical, and training personnel participate in team activities throughout new course development. As a result, each member of the course development team has different skills and unique perspectives that he or she can contribute to course development. Each course development team has a course mentor whose role is to work with other team members through all course development stages to ensure that the content of the course meets the intended course goals and performance objectives. In addition, Flight Standards and Aircraft Certification also encourage course development teams to have subject-matter experts. According to FAA, these subject-matter experts, who can be FAA employees or even outside consultants, can improve the quality and accuracy of the new course because they have specific knowledge and experience in one or more course topics. For example, Flight Standards is now developing a new course for the advanced avionics "glass cockpit" displays that are increasingly being used by air carrier and general aviation operators. (See sidebar.) The expertise and knowledge of the course development team for the new advanced avionics glass cockpit display course were significantly enhanced by subject-matter experts who were assigned to the team and had experience approving aircraft equipped with these advanced avionics displays.

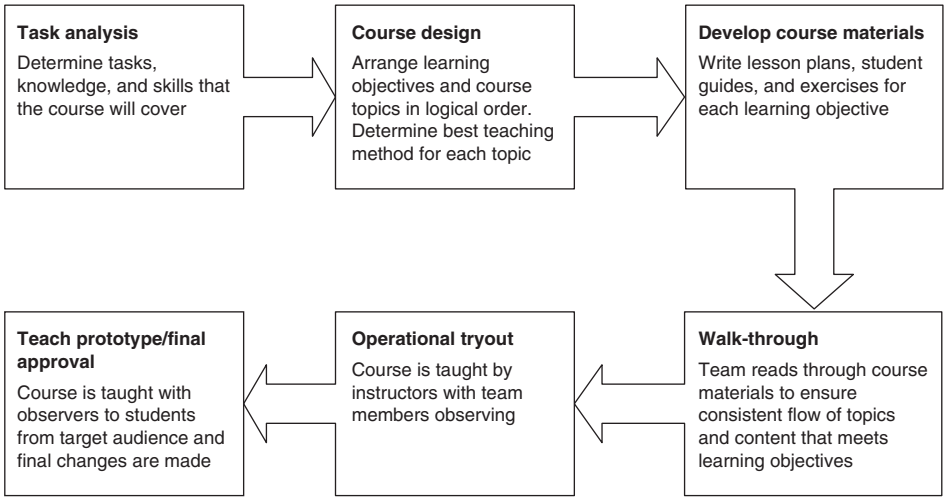
Besides the course mentor and subject-matter experts, other key team members on course development teams include instructional systems designers who provide expertise in training design and course developers who write the actual lesson plans for the new course.

Experts outside of FAA can also provide input on course development in many technical subjects. For example, FAA established a partnership with universities and affiliated industry associations and businesses throughout the country to form Centers of Excellence, which conduct aviation research in a number of areas including advanced materials, aircraft emissions, and airworthiness. The General Aviation Center of Excellence,

formed in 2001, has conducted research on aircraft seat-restraint systems, increasing aircraft landing safety, and aircraft de-icing. In addition to their technical expertise, many universities and private sector companies in the aviation industry have substantial experience conducting aviation training and education programs. For example, Embry-Riddle Aeronautical University, which is the lead university for the General Aviation Center of Excellence, has been in the aviation training industry since 1926; and in addition to pilot and maintenance training, it offers more than 30 degree programs, including programs in engineering, aviation management, and aviation safety science. FAA already contracts with Embry-Riddle for some inspector flight training and recently expanded the number of training locations with another General Aviation Center of Excellence program. Airlines also have substantial experience offering pilot, crew, and maintenance training. FAA receives input from training providers like Embry-Riddle on course development as part of contracted training courses. FAA officials who work with Centers of Excellence said that there could be more opportunities for the agency to utilize the technical and aviation training expertise of the Centers of Excellence in developing its inspector training program.

Using a structured approach for course development. Flight Standards and Aircraft Certification both use a structured course development approach that calls for progressive course development steps and ongoing evaluation of the training at each step. This approach provides course development teams with a description of activities that should occur at each step, which helps to ensure that lesson plans, course materials, and course delivery methods enable the student to meet course objectives and increase job performance. (See fig. 3.)

Figure 3: FAA's Structured Approach for Course Development



Source: GAO presentation of FAA information.

Flight Standards and Aircraft Certification have also built quality controls into their course development guidelines by requiring evaluation at each of these course development steps. Generally, after each stage in the course development process described in figure 3, the course development team reviews the work that occurred up to that point. For example, once the course developer has created lesson plans and any course materials, all members of the course development team review and make suggestions for revising them. Both Flight Standards and Aircraft Certification evaluate and test newly developed training in the final stages of course development. For example, Flight Standards conducts an operational tryout to see how effective the course is, with actual course instructors teaching the new course lesson plans and team members acting as observers. New FAA courses are tested again in the final prototype stage when instructors, with observers, teach the course in front of students from the course's planned target audience. These students provide feedback on each lesson in the course in such areas as clarity of objectives, appropriateness of the level of instruction, and the usefulness of training materials. These quality checks are aimed at ensuring that lesson plans flow smoothly and support the course objectives.

Considering different approaches for presenting courses. Flight Standards and Aircraft Certification generally make decisions on the delivery approach or method to use for aviation safety inspector courses in

the initial stages of course development. For example, the course development team will consider factors such as the complexity of the topic, how soon the course is needed, and how many students will need the training. In the case of training a large number of inspectors on a relatively simple topic or a quick refresher course, a short self-paced computer-based or Web-based training course might be selected. Because the course development process can take months to complete, self-paced training can also be used when the knowledge or information needs to be conveyed quickly to a large number of students.

However, when a course requires interaction and hands-on learning and it covers a lengthy or complex topic, the course development team could decide that a classroom format followed by practical exercises is the most suitable delivery method. (See fig. 4.) For example, in developing the glass cockpit course discussed above, the course development team considered several factors, including the complexity and the rapid growth of the technology and the fact that relatively few students have had a chance to become familiar with glass cockpit systems. The course development team then decided to use a combination of classroom and practical exercises as the primary delivery methods. Under this course format, students participate in classroom lecture and discussion sessions for the introductory lesson on glass cockpit technology. The students then have practical exercises on flight simulators with glass cockpit displays to integrate and reinforce the knowledge gained in the classroom.

Figure 4: FAA Inspectors Receiving Training in a Classroom Setting

Source: FAA.

Note: When covering a technical or complex subject FAA will often use a classroom format that allows for group interaction and practical exercises.

Using criteria for decisions on outside training providers. Flight Standards and Aircraft Certification have developed and apply criteria for deciding whether to use outside training providers for their new aviation safety inspector courses. For example, one criterion is whether FAA or an outside training provider has more technical expertise. Generally, FAA will use its own instructors to teach many of the introductory courses that inspectors receive when they first join FAA. This is because many of these courses provide the new safety inspector with a familiarization of inspector responsibilities and job functions and a description of aviation regulations, and FAA is usually the most appropriate training provider to cover these topics. However, in a given aviation technology area, some private sector companies that concentrate in a technology will have more expertise than FAA. For example, because an outside training provider has more specialized technical knowledge in composite materials,[15] Flight Standards

[15]Composite materials are materials that when combined are stronger than the individual materials by themselves. The benefits of using composite materials in aviation include light weight, durability, and corrosion resistance.

contracts with this provider to deliver composites and composites repair training.

FAA Plans to More Systematically Identify Technical Training Needs in Developing Its Inspector Training Curriculum

As discussed above, FAA's course development activities follow many effective management practices for developing individual courses, but it has not yet systematically identified its inspectors' overall training needs to ensure that the curriculum addresses the unique training needs of each type of inspector. However, FAA is developing a specific training curriculum for each type of inspector.

Flight Standards recognizes that it manages courses as individual components and that it needs to develop courses and address training needs for each of its inspector specialties as part of an overall curriculum. In addition, our survey indicates that only 27 percent of inspectors said that the current set of FAA recommended training courses for each inspector type captures the training needed to do their jobs to a great or very great extent.[16] Flight Standards recognizes that for curriculum transformation to work effectively, a strategy for curriculum management, as opposed to course management, needs to be clearly articulated. In response, Flight Standards is developing a new performance-based training initiative with the goal of systematically assessing the complete array of training to ensure it meets the performance requirements of the many specialties, disciplines, and positions in Flight Standard's ranks. In an effort to implement a more curriculum-based approach that addresses different inspector training needs, the curriculum transformation plan recommends creating curriculum oversight teams for each type of inspector made up of representative inspectors from the field and from headquarters. Rather than the current approach, in which course development teams focus on individual courses, these curriculum oversight teams would be responsible for the overall curriculum for each type of inspector, including defining training requirements and ensuring that curriculum and course content are current and consistent with Flight Standards policy and practices in the field. The Flight Standards steering committee is responsible for chartering these curriculum oversight teams and approving the curriculum they develop for each inspector type. Flight Standards estimates that it will complete implementation of its curriculum transformation plan in 2008. If effectively implemented, we believe that these approaches would allow

[16]The 95 percent confidence interval for this estimate is from 23 to 32 percent.

Flight Standards to develop a more systematic method for identifying training needs and provide a curriculum that is more relevant to different types of inspectors and their needs.

While Flight Standards is in the first stages of implementing its new curriculum-based approach to training, Aircraft Certification has recently taken steps to revise existing courses and develop new courses within an overall curriculum approach. For example, it formed a curriculum study team and completed a proposed curriculum for its manufacturing aviation safety inspectors and has revised inspector courses and other aspects of training according to its new curriculum plan. Aircraft Certification has only one type of aviation safety inspector; Flight Standards has avionics, maintenance, and operations inspectors for both general aviation and air carriers as well as other inspectors, such as cabin safety inspectors. Because Aircraft Certification has only one type of safety inspector, a permanent curriculum study team may not be absolutely necessary.

FAA Provides Extensive Support for Delivering Training; However, Many Inspectors Believe Improvements Could Help Them Do Their Jobs More Effectively

FAA recognizes that effective delivery of quality inspector training is crucial to the success of the agency's mission to obtain industry compliance with safety standards and promote the continuing safety of air travel. FAA has generally followed effective management practices for training deployment to help ensure effective delivery of training, but improvements could be made. (See table 4.) Experts from the aviation and academic communities whom we consulted generally agreed that, for the most part, the courses FAA offers meet current and emerging technical needs. However, many inspectors question whether the training they receive is sufficient to provide them with the technical knowledge needed to perform their jobs.

Table 4: Extent That FAA Follows Effective Management Practices in Delivering Technical Training

Effective management practice	Extent followed
Clearly delineates accountability for achieving agency training goals	Fully
Uses a suitable and timely process for selecting inspectors for technical training given inspectors' current duties and existing skills	Partially
Fosters an environment that is conducive to learning	Fully
Takes steps to encourage employee buy-in to goals and priorities of technical training	Partially

Source: GAO.

FAA Generally Follows Several Effective Management Practices for Delivering Technical Training

FAA generally follows several of the effective management practices that are important for delivering technical training.

Clearly delineating accountability for ensuring access to technical training. According to FAA officials, FAA program and training officials have developed a list of mandatory and recommended courses for each inspector position. These training lists contain some technical courses but focus mainly on courses involving the fundamentals of the inspection process (such as courses covering inspection of automation systems, compliance and enforcement procedures, and system safety concepts) and job tasks for each safety inspector specialty. FAA inspection program managers note that the recommended course lists are not more prescriptive for technical training because the need for technical training depends on the specific types of aircraft and equipment with which inspectors work. Thus, decisions on technical training needs are mainly the responsibility of the individual inspectors and their immediate supervisors, in accordance with FAA guidance that provides decision-tree criteria for approving training requests. After inspectors and their supervisors agree on inspectors' technical training requests, regional, headquarters, and academy training executives determine which courses will be taught. From there, FAA training divisions work with the FAA academy to implement the training by developing course schedules and inspector quota allocations.

Using a suitable process for selecting inspectors for technical training. FAA's automated training request process provides inspectors with the opportunity to plan for, request, and be selected for the technical training necessary for their positions. The Flight Standards and Aircraft Certification lists of technical and other courses essential for each inspector position, as well as other courses that are available to further inspectors' professional development, are available for review and planning by the inspectors and their supervisors.[17] The training system contains information on all the training courses previously completed by the inspectors and outlines their progress toward meeting training requirements. With the supervisor's guidance and approval, each year inspectors request training courses reflecting training needs related to the inspector's position, office inspection activity, and succession planning. However, both FAA and its inspectors recognize the need for more timely

[17]About 34 percent of all essential courses are technical and range from 0 percent for Air Certification inspectors to 50 percent for air carrier avionics inspectors. See table 10 in appendix II for additional results.

selection of inspectors for technical training, another aspect of technical training. This topic is discussed later in this report.

Fostering an environment conducive to learning. FAA has provided many of the elements necessary to promote inspectors' learning of technical material, including allowing them time away from work to receive classroom or computer-based training. FAA also has invested in technologies such as computer-based and interactive-video training that help meet the demand for technical and other training. Similarly, FAA has moved some training closer to the inspector duty locations to facilitate and encourage training attendance and has begun experimenting with bringing training to the duty locations when appropriate. FAA's on-the-job training program also gives inspectors hands-on experience with the aircraft and components for which they are responsible. In addition, FAA streamlined the process for acquiring training opportunities that arise on short notice, such as when inspectors are assigned a new aircraft type to inspect. Finally, FAA's training management system allows inspectors to schedule available technical training courses tailored to their individual needs.

Acting to obtain inspector buy-in for training goals and priorities. While believing that its inspectors have sufficient technical knowledge to perform inspections, FAA has recognized the need to facilitate communication between inspectors and management in order to gain inspector buy-in for a training program emphasizing system safety over technical courses. Currently, FAA primarily depends on its local office managers (the inspectors' supervisors) to communicate training goals and priorities to the inspectors, mostly during the annual training planning process. According to FAA training officials, this information is also disseminated to inspectors in strategic training plans and other guidance on training. FAA officials further note that inspectors have opportunities to communicate their views on training in course evaluations and employee surveys.

Nevertheless, FAA recognizes the need to increase communication between inspectors and management with respect to the training program. Flight Standards recognizes that without inspector buy-in the safety inspectors will not be able to effectively execute system safety oversight and thus this buy-in is recognized as critical to Flight Standards success. FAA is concerned that inspectors have not fully bought into the system safety approach to inspections. In an attempt to gain support for and understanding of the system safety approach and the ways in which inspectors will be affected by the change, Flight Standards plans to host

focus groups with management and inspectors, conduct individual interviews with all Flight Standards employees, and create an outreach and communication team to foster better understanding between FAA management and the inspectors. Similarly, Aircraft Certification has planned a number of steps to increase communication between management and the inspector workforce, including facilitated focus groups, individual interviews, and more effective employee feedback mechanisms. These actions may well be needed because, as discussed in the following section, inspectors are generally dissatisfied with the technical training that they receive.

Inspectors Are Generally Dissatisfied with the Technical Training That They Receive

Although FAA has followed or is taking steps to follow many of the effective management practices in planning, developing, and delivering technical training, inspectors expressed widespread dissatisfaction with this training. Inspector dissatisfaction covered three areas: (1) having insufficient technical knowledge to do their jobs, (2) not being able to take training they say they needed, and (3) not receiving training in time to do their jobs.

One possible explanation for this seeming contradiction is that, although FAA generally employs sound approaches for putting its technical training in place, its actual delivery falls short—the latter being the view of the bulk of its inspector workforce. We were not able to assess this possible explanation because, as discussed at the beginning of this report, we had no practical way to assess the amount of training necessary for inspector proficiency or the timeliness of the training provided. Another possible explanation is that the technical training that FAA provides meets the current and future needs of the agency to a large degree and its inspectors have unrealistic expectations about technical training. This is the view of FAA, and its reasons are discussed later in this section.

Having Sufficient Technical Knowledge and Training

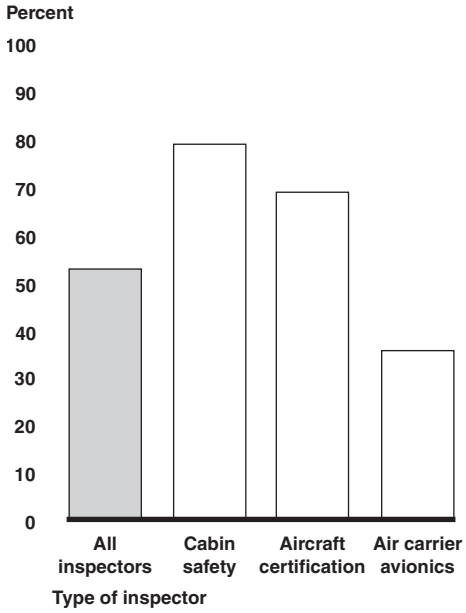
On the basis of our survey, we estimate that only about half of FAA inspectors believe, to a great or very great extent, that their technical knowledge is sufficient to enable them to do their jobs properly.[18] (See fig. 5.) This belief varies somewhat among inspector specialties. Some inspectors—such as those who specialize in cabin safety and aircraft certification—told us that, to a great or very great extent (78 percent and 68 percent, respectively), they have enough technical knowledge to do their jobs.[19] On the other hand, only a third of air carrier avionics inspectors told us that they currently have sufficient technical knowledge to do their jobs.[20]

[18]The 95 percent confidence interval for this estimate is from 48 to 57 percent.

[19]The 95 percent confidence interval for the cabin safety inspector responses is from 62 to 94 percent. The 95 percent confidence interval for the aircraft certification inspector responses is from 51 to 85 percent.

[20]The 95 percent confidence interval for this estimate is from 22 to 48 percent. The survey also asked inspectors about their knowledge of the automated systems used in their jobs, such as ATOS or the Performance Tracking and Reporting Subsystem, because these are important tools for the system safety approach to inspections. We estimate that about 46 percent of inspectors believe, to a great or very great extent, that they have enough knowledge of automated systems to do their jobs. The 95 percent confidence interval for this estimate is from 42 to 51 percent.

Figure 5: Inspectors Responding that to a Great or Very Great Extent They Currently Have Enough Technical Knowledge to Do Their Jobs



Source: GAO survey of FAA inspectors.

Note: See table 13 in appendix II for additional results.

One reason for the disparity of views concerning technical knowledge among inspectors of different specialties could be their perceived need for specialized knowledge. For example, cabin safety inspectors noted that much of their knowledge of the cabin environment comes from previous experience with airlines and through on the job experience. Similarly, according to FAA, Aircraft Certification inspectors bring with them a high degree of technical knowledge, gained in previous careers in the aviation industry; and typically these inspectors need less technical training than other types of inspectors. Our analysis of training received confirms that aircraft certification and cabin safety inspectors receive less technical training than other inspector specialties. Additionally, as shown above, they are the most satisfied of all inspector specialties that they have the technical knowledge needed to do their jobs. Alternatively, avionics inspectors—who were the least satisfied that they have received enough technical training to do their jobs—indicated that they believe they require specialized knowledge of the avionics systems they inspect. Inspector training data shows that these inspectors receive the most technical training of all inspector specialties. (This topic is discussed in more detail

later in the report. See table 6.) However, from our survey, they believe that they need more.

Our survey also indicates that most inspectors believe that the technical training they have recently received has not greatly contributed to their ability to perform inspections.[21] Specifically, we estimate that about 35 percent of the inspectors believe that the technical training that they received in the last 2 years helped them do their current jobs to a great or very great extent.[22] The results ranged from a high of 39 percent for air carrier operations inspectors to a low of 23 percent for general aviation avionics inspectors.[23] The higher percentage for operations inspectors could be attributed to the fact that they are required to take flight training on an annual basis, whereas other inspector specialties such as avionics, maintenance, and cabin safety do not have similar requirements for annual training. In comments included with their surveys, inspectors expressed opinions on whether they have sufficient training to do their jobs. Of the 240 inspectors who took the time to write narrative responses about the sufficiency of training, 31 offered positive comments, 105 were strongly negative, and another 119 had weaker negative comments. In addition, 37

[21]FAA notes that its course evaluations support that 78 percent of its employees report that training has improved their job performance. However, its survey results are not comparable to ours. First, FAA's results represent responses to evaluations for all courses, both technical and nontechnical. In addition, it represents inspectors who responded that FAA training greatly improved, improved, and somewhat improved their job performance. In analyzing the results of our survey, we did not include the third category, as it does not represent a strong endorsement for the results of FAA training.

[22]The 95 percent confidence interval for this estimate is from 30 to 39 percent. FAA officials stressed that training occurs over the span of a career and cautioned that asking inspectors' views about 2 years experience would present a distorted view. According to our analysis, FAA inspectors have been with the agency an average of 9.3 years, according to our survey inspectors have been in their current position an average of 5.3 years. We recognize FAA's concern. However, it is not reasonable to expect inspectors to recall their views on training received over a large time span, as doing so could lead to unreliable results. In addition, since this report focuses on FAA's current actions to ensure up-to-date technical training, we believe it is more useful to measure inspectors' views about the training that they are receiving or have recently received.

[23]The 95 percent confidence intervals for these estimates are from 29 to 49 percent and from 6 to 39 percent, respectively.

inspectors indicated they found themselves inspecting aircraft or components they had not been trained on.[24]

Our survey also indicates that inspectors believe that most of the technical knowledge they possess was gained in their previous careers in the aviation industry. For inspectors who said that to a great or very great extent they have sufficient technical knowledge to do their jobs, we estimate that 80 percent also noted that the knowledge and skills they brought to FAA from their previous careers contributed, to a great or very great extent, to this technical knowledge.[25] We estimated that lower percentages of inspectors from this group rated technical training from FAA instructors (25 percent) and aviation industry sources (41 percent) as contributing, to a great or very great extent, to the technical knowledge needed to perform their jobs.[26] Our analysis of survey responses indicates that the amount of time since inspectors left their careers in the aviation industry was not a factor in inspectors' views about their job-related technical knowledge. Newer inspectors were no more likely than longer-tenured inspectors to say that to a great or very great extent they have enough technical knowledge of the aircraft, systems, or operations they inspect to do their jobs.

FAA officials indicated to us that inspectors will always believe they need more training. In addition, FAA officials further stated that inspectors need to have only enough technical knowledge of aircraft, systems, and components to be effective inspectors: they need to know enough to ask the right questions, recognize potential problems, and be able to understand issues that arise. Full proficiency with the aircraft and components is not necessary. However, FAA officials indicated that inspectors believe that full or near full proficiency is necessary. An FAA official attributed inspectors' views about the perceived insufficiency of technical training to many of them not fully accepting the agency's transformation to a system safety approach to inspections with its emphasis on risk analysis over technical knowledge. The traditional inspection system relied to a great extent on an individual inspector's

[24]Our survey provided the opportunity for inspectors to relate anything they wanted us to know about technical training. Some inspectors submitted both positive and negative comments.

[25]The 95 percent confidence interval for this estimate is from 76 to 84 percent.

[26]The 95 percent confidence intervals for these estimates are 21 to 29 percent and 36 to 45 percent, respectively.

technical expertise to identify safety problems with operations or aircraft systems. Although the system safety approach requires inspectors to have an understanding of aircraft and aircraft systems, it is more important for them to have the skills to analyze data to identify vulnerabilities in aircraft operators' and manufacturers' systems for ensuring safety. FAA officials believe that as inspectors gain experience with system safety, they will better understand the more limited role technical knowledge plays in this inspection approach.

Most of the inspector training experts we consulted on the inspector technical training curriculum generally agreed with FAA's position. Seven of the 10 experts we contacted told us that the technical courses that FAA offers sufficiently covered existing and emerging technical areas.[27] In particular, they noted that the flight training for operations inspectors was adequate for performing flight checks. However, two experts were concerned that there was not enough training in advanced aviation technologies for maintenance and avionics inspectors. These experts thought that maintenance and avionics inspectors should have periodic refresher training that would allow them to become more familiar with changes in the aircraft and systems they deal with during inspections. The experts did not comment on whether individual inspectors receive all the technical training necessary for their positions since this would have required an extensive, detailed review of training records.

Most representatives from airlines we contacted were at least moderately satisfied that FAA inspectors have sufficient technical knowledge and training.[28] On the basis of their experience with FAA inspectors, 19 of the 23 airline representatives we consulted said that to a great extent (7 responses) or moderate extent (12 responses) FAA inspectors had the technical knowledge to fulfill inspection responsibilities. Regarding training, 16 of the 23 thought that to a very great extent (1 response) or moderate extent (15 responses) FAA inspectors have the technical training to fulfill these responsibilities.

[27]See appendix III for a list of these experts. Experts commented in the area of their expertise.

[28]We contacted representatives from the airlines that belong to the Air Transport Association and the Regional Airline Association to obtain their perspectives on FAA inspector technical training.

Being Able to Take Requested Training

Also reflecting the disparity in views between inspectors and FAA management concerning technical training, many inspectors indicate that they are not greatly encouraged to take technical training and that to a large extent they do not get all the technical training they request. However, inspectors' views are not supported either by FAA training request data or from progress made in taking training courses deemed essential by FAA.[29] On the basis of our survey, we estimate that less than half (43 percent) of inspectors think their supervisors encourage them to request the technical training needed to do their current jobs.[30] We also estimate that about 28 percent of FAA's inspectors believe, to a great extent or very great extent, that they receive the technical training that they request.[31] (See fig. 6.) If we include responses citing receiving requested training to a moderate extent, we then estimate that about 49 percent of inspectors overall believe that they receive the training they request at least to a moderate extent.[32]

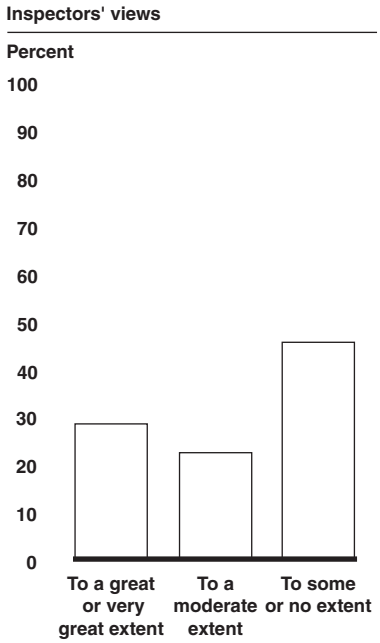
[29]See footnote 4 for how we defined essential training.

[30]The 95 percent confidence interval for this estimate is from 38 to 48 percent.

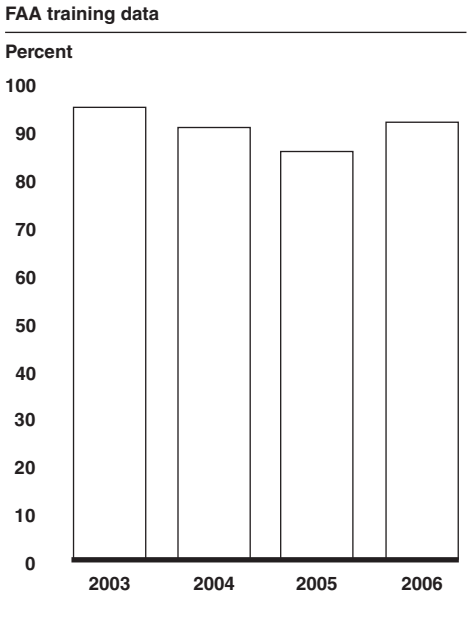
[31]The 95 percent confidence interval for this estimate is from 23 to 32 percent.

[32]The 95 percent confidence interval for this estimate is from 45 to 54 percent.

Figure 6: Extent to Which Requested Technical Training Is Approved



Source: GAO survey of FAA inspectors.



Source: GAO analysis of FAA data.

Note: See table 14 in appendix II for additional results.

Our survey also indicates that inspectors with longer tenures at FAA have more difficulty getting technical training they request than inspectors who have recently been hired. According to the survey, of those inspectors with 10 or more years with FAA, we estimate that 55 percent said that requested technical training was approved to some or no extent as compared to an estimated 35 percent of inspectors who had been with FAA 3 years or less.[33] This may be due in part to newer inspectors' technical training opportunities tending to be essential courses, requests likely to be approved. In contrast, inspectors with more experience request courses outside of FAA requirements, requests more likely to be denied. As discussed earlier, FAA records did not allow us to assess the merits of the inspectors' views.

[33]The 95 percent confidence intervals for these estimates are 47 to 64 percent and 27 to 43 percent, respectively.

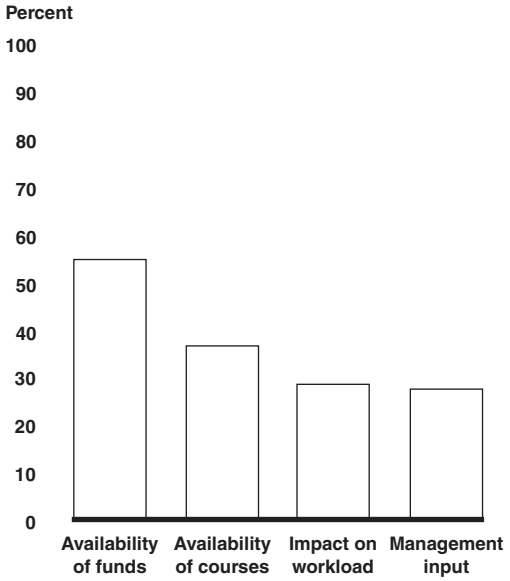
FAA's data on the extent to which requested courses were taken do not support the inspectors' contention that they do not receive requested training. According to Flight Standards data, for fiscal years 2003 through 2005, on average FAA approved about 90 percent of requested technical training and has approved a similar percentage for upcoming fiscal year 2006. (See fig. 6.) FAA officials note that these data do not include late course cancellations that occur after the training schedule for the year is set. Though we were unable to obtain similar data from Aircraft Certification data on course cancellations or denials, these courses occasionally get cancelled or changed. In fiscal year 2005, one course was cancelled by Aircraft Certification. Officials told us that if a training course essential for an inspector to perform their job is cancelled, the inspector will be placed in the next available course. Aircraft Certification inspectors represent about 5 percent of the inspector workforce (excluding supervisors, managers, and others in the aviation safety inspector job series who do not perform front-line inspections).

According to FAA, the agency tries to accommodate inspectors' requests for technical training to the extent possible. However, an inspector's request for technical training may be denied because (1) the inspector's need for the course was not adequately justified based on the inspector's current position, (2) the inspector had already completed a similar course, or (3) insufficient funding was available. Officials also said that, infrequently, a technical course requested by an inspector may be cancelled due to low enrollment or because its content is outdated. According to the officials, when a requested course is cancelled, inspectors can request it the next time it is offered, and in the meantime they can choose a replacement course from the list of courses for their position. Inspectors' views on why they did not get training that they requested corresponded somewhat with the reasons that FAA cited. We estimate that about 54 percent of the inspectors believe that lack of funds hindered or greatly hindered their ability to get requested technical training.[34] (See fig. 7.) Inspectors cited other reasons somewhat less frequently: about 36 percent cited availability of courses, 28 percent cited impact on their workload, and 27 percent cited management's determination about the need for them to attend the course as hindering or greatly hindering their ability to receive

[34]The 95 percent confidence interval for this estimate is from 50 to 59 percent.

the training they requested.[35] Because it was impractical to investigate the reasons why thousands of training requests were granted or denied, we were not able to reconcile inspectors' views with FAA data.

Figure 7: Inspectors' Views on Factors Hindering Their Ability to Take Requested Technical Training



Source: GAO survey of FAA inspectors.

Note: See tables 15 through 18 in appendix II for additional results.

In addition to receiving most of the technical training they request, our analysis of inspectors' training records indicates that most are making good progress in taking the technical training FAA considers essential for their jobs. Our analysis of FAA training data[36] indicates that over half of the inspectors have completed at least 75 percent of their essential technical

[35]The 95 percent confidence intervals for these estimates are 32 to 41 percent, 23 to 32 percent, and 23 to 31 percent, respectively.

[36]We analyzed the training records for FAA's approximately 3,000 front-line inspectors only. The analysis did not include supervisors, managers, and others in the aviation safety inspector job series who do not perform front-line inspections.

training courses for their positions.[37] (See table 5.) In addition, more than three-quarters have finished at least half of these essential technical courses. However, only 20 percent of air carrier avionics inspectors have completed 75 percent of their technical courses. Avionics inspectors have the most technical training requirements, due to the complexity of the aircraft components they inspect.

Table 5: Percent of Inspectors Completing Essential Technical Courses

Type of inspector	Percent of inspectors completing at least 75 percent of technical courses	Percent of inspectors completing at least 50 percent of technical courses
Air carrier avionics	20	69
Air carrier maintenance	46	82
Air carrier operations	36	74
Cabin safety	59	85
General aviation avionics	52	78
General aviation maintenance	53	84
General aviation operations	69	88
Aircraft certification[a]	N/A	N/A
All inspectors	46	80

Source: GAO analysis of FAA data.

Note: N/A = nonapplicable.

[a]Aircraft certification inspectors have no essential technical courses according to the definition of technical training used in this report. Aircraft Certification considers all training related to the inspection process as technical training.

There are several reasons that may explain why inspectors have not completed most or all of their essential training—technical and other. First, a significant portion of the inspector workforce is relatively new to the agency and would thus not be expected to have completed the essential training. In fact, FAA data show that 28 percent of the inspectors have been employed by FAA for less than 5 years. Second, inspectors change

[37]About 81 percent of the inspectors have completed at least half of their essential courses, both technical and nontechnical. (See table 11 in app. II.) In addition to the essential courses, most inspectors were also able to take other technical training courses that they, their supervisors, and FAA management have determined are related to their jobs. Inspectors averaged 1.7 technical courses outside of their list of essential courses over the past 3 fiscal years. (See table 12 in app. II.)

specialties, which can affect their training requirements. Third, FAA allows inspectors to substitute prior experience for some essential technical training courses, and such substitutions are not always reflected in inspector training records. Finally, because the lists of essential training courses have been developed only within the past few years, some inspectors may not have had time to complete new essential courses. FAA officials emphasized that, especially in Flight Standards, training is carried out over the course of an inspector's career rather than occurring primarily at the beginning of the career. According to Aircraft Certification officials, although their service's inspectors receive training over the course of their careers, they receive the majority of their training within the first year on the job. This early training emphasizes the skills needed to perform inspections.

Overall, according to our analysis, inspectors have taken an average of 3.4 technical training courses from fiscal years 2002 through 2004, or about one per year. (See table 6.) Avionics and maintenance inspectors have taken more technical training on average. Generally, these avionics and maintenance inspectors require more technical training than other inspector specialties because they often inspect several different models of aircraft.

Table 6: Average Number of Technical and Nontechnical Training Courses Taken, Fiscal Years 2002 through 2004

Type of inspector	Technical courses	Nontechnical courses
Air carrier avionics	4.8	9.6
Air carrier maintenance	3.9	9.6
Air carrier operations	2.6	9.7
Cabin safety	1.2	8.5
General aviation avionics	4.0	8.8
General aviation maintenance	4.0	9.9
General aviation operations	3.1	9.6
Aircraft certification	1.2	5.4
All inspectors	3.4	9.4

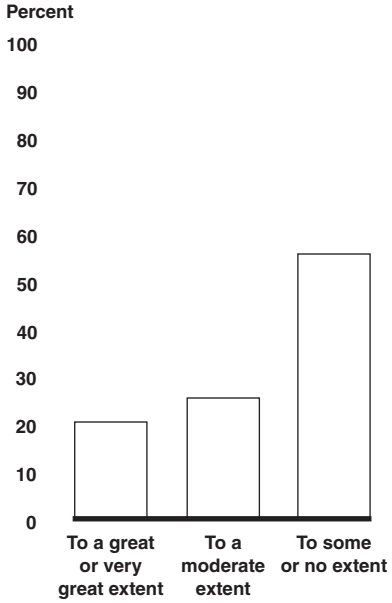
Source: GAO analysis of FAA data.

Receiving Training in a Timely Manner

With the rapid development of aircraft and aircraft components, especially aircraft avionics, a training delivery mechanism that is responsive to these

changes is critical. For the most part, FAA inspectors are dissatisfied with receiving the technical training they need in time to do their jobs. We estimate that only 20 percent of inspectors believe to a great or very great extent that they have received technical training in time to do their jobs.[38] (See fig. 8.) No more than one-third of any type of inspector thought that technical training was timely to a great or very great extent, and none of the general aviation avionics inspectors who responded to our survey thought that this was so.[39] Avionics are the most rapidly changing technological components of aircraft, which could account for this result. As discussed at the beginning of this report, FAA's records did not allow us to assess the extent to which inspectors received training before they conducted inspection activities related to that training.

Figure 8: Inspectors' Views on the Extent to Which Technical Training Is Delivered in a Timely Manner



Source: GAO survey of FAA inspectors.

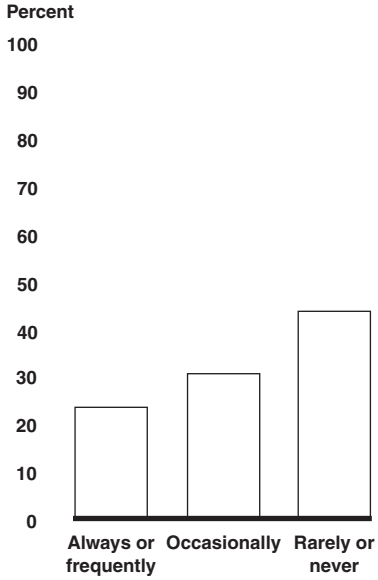
Note: See table 19 in appendix II for additional details.

[38]The 95 percent confidence interval for this estimate is from 16 to 24 percent.

[39]The maximum value for the upper end of the 95 percent confidence interval for all other inspectors is 49 percent. The 95 percent confidence interval for general aviation avionics inspectors is between 0 and 13 percent.

Similarly, we estimate that only about 23 percent of all inspectors indicated that they always or frequently received technical training on the equipment they were to inspect prior to scheduled inspection activities.[40] (See fig. 9.) No more than 35 percent of inspectors in any specialty responded this way. In comments supplied with their surveys, many inspectors expressed the view that FAA is slow to react to changes in industry technology and slow to develop courses in response to the changes.

Figure 9: Inspectors' Views on the Extent to Which They Received Technical Training Prior to Scheduled Oversight Activities



Source: GAO survey of FAA inspectors.

Note: Approximately 4 percent of inspectors responded that they had no basis to judge or did not know. See table 20 in appendix II for additional details.

[40]The 95 percent confidence interval for this estimate is from 19 to 26 percent. Inspector dissatisfaction with the timeliness of training delivery is not limited to technical training. Inspectors also expressed concern about the timeliness of automation training. According to our survey, about 29 percent of inspectors indicated, to a great or very great extent, that this type of training was received in time to do their current job. The 95 percent confidence interval for this estimate is from 24 to 33 percent.

FAA has recognized the need to provide training on a timelier basis and has taken some actions that have yet to be fully implemented. One of the goals of Flight Standards is to establish a way to ensure that training is current and well designed, can be tailored to the needs of the individual employees, and is administered in a fast and flexible way in response to changing needs. Flight Standards plans to improve training delivery by taking advantage of new delivery mechanisms, increasing utilization of vendors where appropriate, and streamlining training programming and scheduling to reduce the lag time between the identification of training needs and the delivery of training. In addition, Flight Standards recently instituted a process to continuously monitor courses and to update their content when changes in FAA policy or aviation technology warrant doing so. Ensuring that course content is up to date and that courses are available when needed is an important aspect of delivering timely training. In fiscal year 2005,[41] Flight Standards developed 5 new courses, revised 16 existing courses, and completed 13 course evaluations.[42] Similarly, Aircraft Certification officials indicated that they have been evolving toward a more integrated approach to training delivery, mixing classroom training with Web-based technologies, on-the-job training and adding additional job aids, in part, for providing more timely training. These officials also noted that Aircraft Certification has a long history of providing just-in-time training when new work processes or job-related information needs to be disseminated to inspectors quickly.

Although FAA Uses Several Approaches to Evaluate Technical Training Provided, Assessing Impact on Performance Remains to Be Done

For the most part, FAA has followed—or has begun to implement—effective management practices in evaluating its efforts to provide technical training to inspectors and ensuring that this training leads to improved performance and results. (See table 7.) For example, it continuously assesses technical training through participant end-of-course evaluations and surveys of inspectors and supervisors that focus on the application of skills and knowledge to the job. While FAA's evaluation efforts provide information about these areas, these assessments have not measured the impact of training on FAA's mission goals, such as reducing accidents. Isolating improvements in mission performance that are a result of training programs is difficult for any agency.

[41]As of June 2005.

[42]Flight Standards estimates that in addition it will develop 7 new courses, revise 9 existing courses, and complete 9 course evaluations by the end of fiscal year 2005.

Table 7: Extent That FAA Followed Effective Management Practices in Evaluating Its Training Program

Effective management practice	Extent followed
Systematically plans for and evaluates the effectiveness of training and development efforts	Mostly
Uses the appropriate analytical approaches to assess its training and development programs	Mostly
Uses appropriate performance data (including qualitative and quantitative measures) to assess the results achieved through training and development efforts	Partially
Incorporates evaluation feedback into the planning, design, and implementation of its training and development efforts	Fully
Incorporates different perspectives (including those of line managers and staff, customers, and experts in areas such as financial, information, and human capital management) in assessing the impact of training on performance	Mostly
Assesses the benefits achieved through training and development programs	Partially

Source: GAO.

FAA Mostly Follows Several Effective Practices for Evaluating Technical Training

FAA has taken several actions to evaluate the effectiveness of its technical training efforts. Collectively, the actions generally cover the effective management practices cited in table 7 by continuously and systematically evaluating the technical courses FAA provides for inspectors. In performing these evaluations, FAA has focused primarily on obtaining inspectors' and, to some extent, their supervisors' views on individual courses. FAA requires that participant evaluations be distributed after each training course for inspectors. The evaluations ask participants to rate the extent to which the course and course material (e.g., workbooks, slides, labs, and tests) met objectives as well as the extent to which the instructor provided assistance. According to FAA, participants return the evaluations 95 percent of the time. FAA also sends surveys to inspectors and their supervisors 90 to 180 days after course completion to obtain their perspectives on whether the course was needed and the extent to which the inspector is applying new skills and knowledge to the job. FAA reports that since the inception of post-course surveys, the return rate from inspectors and supervisors has ranged from 49 to 50 percent. The post-course survey results from the six most highly attended technical courses in the last 2 years reflected generally positive responses. These findings suggest that survey respondents generally think that the individual technical courses they received helped them in their jobs. Results from both the participant course evaluations and post-course surveys are automated and are available to training officials. In addition, according to Flight Standards training officials, they assess all complaints concerning a

course and discuss the issues identified with the Flight Standards office that sponsors the course.

According to FAA, it is the responsibility of the mentor for each training course to use the information from the participant evaluations and post-course surveys as well as other tools to determine if courses are meeting their objectives and enhancing inspectors' ability to do their jobs. In February 2005, Flight Standards established a policy that its course mentors evaluate each course for which they are responsible at least every 3 years using a standardized approach. According to the policy, course mentors should review the results of participant evaluations and post-course surveys as well as personally sit in the course to determine if a course is still current and is meeting objectives. Flight Standards has a performance plan initiative to track the completion of planned course evaluations. Flight Standards began training mentors on these and other mentor responsibilities and procedures in April 2005, and some course mentors have already begun thorough evaluations of their courses. Prior to this date, Flight Standards officials said that participant evaluations and post-course surveys were used by its Quality Assurance Branch in its annual course reviews and were routinely reviewed by FAA academy course managers and their supervisors to update or improve courses. However, because Flight Standards had not assigned specific individuals to be responsible for a particular course, some requests for updates were not tracked. According to Flight Standards officials, with the implementation of the course mentor program, each course will now have a point of contact for all course improvements and updates.

Aircraft Certification is implementing a new approach for evaluating courses that officials believe will provide course mentors and other training officials more comprehensive information on technical courses sponsored by each office. The approach is based on the work of Dr. Robert O. Brinkerhoff, in particular his Success Case Method and High Impact Learning approach.[43] This approach helps to increase and demonstrate organizational results from learning. With the Success Case Method, post-course surveys are used to gauge the extent of reported application of learning and are then validated through personal interviews with selected

[43]Robert O. Brinkerhoff and Anne M. Apking, *High Impact Learning: Strategies for Leveraging Business Results from Training*, (Cambridge: Perseus, 2001) and Robert O. Brinkerhoff, *The Success Case Method*, (San Francisco: Berrett-Koehler Publishers, Inc., 2003).

course participants. Using such interviews, Aircraft Certification seeks to determine whether and how much training was actually transferred to the job and if there was an impact on the organization as a result of the training. The High Impact Learning methodology allows for up-front evaluation prior to development or revision of courses to ensure that the objectives of the proposed training will lead to organizational impact through "impact mapping" of course objectives to organizational goals. Results of Success Case Method learning evaluations will be available to the course mentor, course managers at FAA's Training Academy, and program officials at FAA headquarters. Aircraft Certification began implementing the evaluation tool in spring 2005 and has thus far prototyped it with one course and plans to have it applied to all its technical courses within 2 years.

FAA has also surveyed employees for their views on training in general, and one of these surveys will lead to revisions to the overall inspector curriculum, according to FAA. Every 2 years, FAA surveys all of its employees about many aspects of their employment, including the training they receive. This employee attitude survey asked employees about the extent to which they received the training they needed to effectively perform their jobs and whether or not they have been able to apply that training. However, the survey does not ask employees to differentiate between the types of training they receive, such as that relating to inspection processes or technical skills. In addition, although FAA isolates responses according to employee's work location—such as headquarters and Flight Standards and Air Certification field offices—it does not ask respondents their position, so inspectors' responses cannot be identified. As a result, although the survey can be useful for FAA's workforce as a whole, it is not as useful for isolating safety inspectors' attitudes about their technical training.

In order to obtain information on inspector training in particular, in August 2004, Flight Standards conducted a separate survey of 51 field inspectors and 8 field and 3 headquarters inspection program managers that revealed inspector dissatisfaction about several aspects of training. Because of its limited nature, Flight Standards recognizes that the survey does not necessarily represent the views of the entire inspector workforce. Of the 51 field inspectors who agreed or strongly agreed with certain statements—the only large group surveyed—21 percent indicated they received the training they needed, 10 percent said training is current and technically up to date, and less than 20 percent indicated training supports current or

future job requirements in Flight Standards.[44] Flight Standards officials expressed concern about inspectors' negative views toward the training they receive. Officials said that as part of their plans for a curriculum for inspectors, they will identify and implement measures necessary to monitor course satisfaction and content currency, and the data they gather from monitoring the course will provide the basis for continuous course improvement. According to Aircraft Certification officials, their office has not undertaken any similar surveys to field inspectors.

FAA officials said that they also encourage inspectors to submit suggestions for revising existing courses or adding new courses to provide training in the technical skills not covered in the current curriculum. According to Flight Standards training program officials, inspector suggestions for new courses are placed in a pool of potential new courses, which are reviewed by program staff on the basis of need and the availability of funds. Suggestions for course revisions are now reviewed by course mentors as part of the course evaluation process.[45]

Although FAA has a process for inspectors to make recommendations regarding technical courses, our survey indicated that many inspectors are either not aware of or do not take advantage of this process. According to our survey, we estimate that 55 percent of the inspectors believe they have had an opportunity to recommend new courses for their position to some or no extent.[46] In addition, 49 percent thought they had an opportunity to recommend new content in existing courses for their position to some or no extent.[47]

[44]We do not present the results of the 8 field and 3 headquarters managers because of the small numbers, and some did not answer all questions.

[45]According to data provided by Flight Standards, there have been over 60 requests for revised, updated, or new courses to be developed since 2000, with more than 33 of them submitted since 2003 (plus a possible 11 more that were undated requests). Of all that have been submitted, 23 were technical.

[46]The 95 percent confidence interval for this estimate is from 50 to 60 percent.

[47]The 95 percent confidence interval for this estimate is from 44 to 54 percent.

FAA Lacks Comprehensive Data on How Technical Training Contributes to Improved Performance and Results

The analytical approach FAA employed for evaluating technical training programs emphasized individual course evaluations and employee surveys that collect useful, but limited, information on the effectiveness of technical training courses. According to experts on training in government, agencies should adopt a balanced, multilevel approach to evaluating their training and development efforts. One commonly accepted model is the Kirkpatrick model, which consists of five levels of assessment.[48] The first level measures the training participants' reaction to, and satisfaction with, the training program or planned actions to use new or enhanced competencies. The second level measures the extent to which learning has occurred because of the training effort. The third level measures the application of this learning to the work environment through changes in behavior that trainees exhibit on the job because of the training or development program. The fourth level measures the impact of the training program on the agency's program or organizational results. Finally, the fifth level—often referred to as return on investment—compares the benefits (quantified in dollars) with the costs of the training and development program.

As discussed earlier, the course evaluations and surveys FAA uses to evaluate its technical and other training programs for inspectors cover, to some extent, the first three levels of assessment. Aircraft Certification has taken the first steps in evaluating the impact of training on organizational results (the fourth level) by linking course objectives to organizational goals, and Flight Standards is in the initial stages of implementing a process to assess the return on investment from the courses in its training program. Experts acknowledge that isolating performance improvements resulting from training programs and the cost-effectiveness of these programs is difficult for any organization. Federal agencies, such as FAA, have to consider the feasibility and cost-effectiveness of conducting these in-depth evaluations, along with budgetary and staffing circumstances that may limit the agencies' ability to complete such evaluations. The challenge of performing evaluations of the impact and cost-effectiveness of its training efforts is great for FAA. Along with undertaking these evaluations, FAA

[48]Donald L. Kirkpatrick, *Evaluating Training Programs: The Four Levels* (San Francisco: Berrett-Koehler Publishers, Inc., 1994). Kirkpatrick conceived a commonly recognized four-level model for evaluating training and development efforts. The fourth level is sometimes split into two levels, with the fifth level representing a comparison of costs and benefits quantified in dollars. The fifth level, return on investment, is attributed to Jack Phillips and is taught in education and training seminars linking the two methodologies.

must also determine how its ongoing shift to a system safety approach to inspections is affecting its organizational goals of reducing accidents and increasing the overall safety of flying.

Industry Provides Much of FAA's Technical Training; Additional Safeguards Needed to Prevent Real or Appearances of Conflicts of Interest

Over the past 3 years, the aviation industry has provided about 40 percent of the technical training for FAA's safety inspectors. To a limited degree, inspectors have received training from the aviation industry in exchange for in-kind services or at no cost to FAA. Although FAA has taken steps to address concerns over possible real or apparent conflicts of interest resulting from receiving this training, it has not consistently applied these policies.

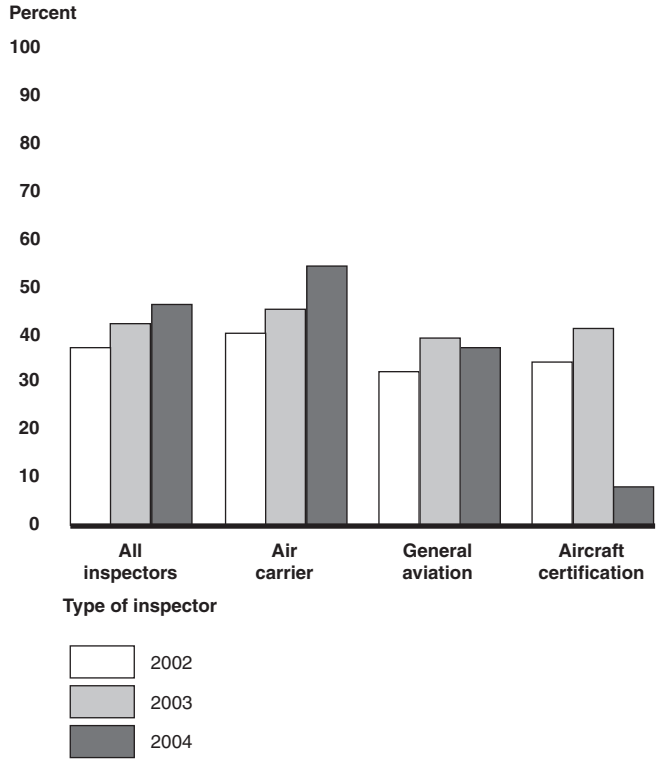
FAA Contracts with the Aviation Industry for Much of the Technical Training Provided to Inspectors

FAA provides technical training to its inspectors either through the FAA Academy (with courses taught in Oklahoma City or at FAA regional locations) or through contracts with the outside training providers, including some in the aviation industry that FAA regulates under FAA's gift authority. Technical training provided by the aviation industry includes

- pilot training;
- aircraft maintenance training;
- training covering inspection technologies and procedures; and
- training on aircraft systems, structures, and components.

FAA has increasingly relied on industry to provide technical training to its inspectors over the past 3 fiscal years. In fiscal year 2004 (latest data available), industry delivered nearly half of FAA's technical training. (See fig. 10.) Industry-provided training occurs most frequently for air carrier and general aviation operations inspectors because it is often more economical to have flight training provided by an outside vendor than for FAA to maintain or lease its own aircraft for this purpose.

Figure 10: Percent of Technical Training Provided by Industry as Reported by FAA, Fiscal Years 2002 through 2004



Source: GAO analysis of FAA data.

Note: Numbers reported as a percent of total FAA- and industry-provided training for each type of inspector. See table 21 in appendix II for additional details. Because aircraft certification inspectors receive limited technical training, the percent of this training provided by industry can vary widely from year to year.

Under Limited Circumstances, FAA Receives Training in Exchange for In-Kind Services

In addition to paying industry to provide technical training for inspectors, FAA employs two arrangements by which inspectors obtain training from the aviation industry in exchange for in-kind services. In return for receiving training from the aviation industry, FAA delegates certain regulatory authority to qualified employees of the entity being overseen

(called quid pro quo arrangements).[49] Both programs apply to Flight Standards operations inspectors called aircrew program managers and training center program managers. FAA's Aircraft Certification service does not have any equivalent arrangements by which inspectors receive training in exchange for in-kind services.

Under the aircrew designated examiner program, there is an arrangement between FAA and major passenger-carrying airlines, cargo-only carriers, and regional airlines by which FAA delegates, under the supervision of FAA inspectors, certain pilot certification authority and responsibility to pilots of the airline.[50] In exchange, FAA inspectors receive training in the airline-specific programs and procedures in airline-specific aircraft or simulators at no cost to the agency. Airlines benefit from the increased flexibility of being able to certify their own pilots and not having to arrange and schedule certification by an FAA inspector. FAA also benefits from this flexibility because delegating the certification activities increases its capacity for and efficiency of its oversight and management activities. In addition, because the training received is airline-specific, it further enhances the inspectors' knowledge of the specific aspects of the airlines' operations that they are responsible for overseeing. The aircrew designated examiner program originated in 1982 as an agreement between a single airline and FAA, stemming from FAA's inability to meet industry's increasing demand for certification specialists. Each agreement between FAA and the airline is governed by a memorandum of understanding that outlines the reasons for establishing the specific aircrew designated examiner agreement, lists the aircraft types involved, and contains an overview of how the program requirements will be met by both parties. This arrangement was approved by the FAA ethics officer and was reviewed by the Department of Transportation Inspector General.

[49]In addition, FAA receives a very limited amount of training for free from aircraft manufacturers during the development and deployment of a new or reconfigured aircraft type. FAA inspectors and representatives from the aircraft manufacturer certify each other initially by flying in the new aircraft. During these initial flights, the FAA inspector works closely with a manufacturer's test pilot to learn to operate the aircraft while also identifying requirements for special training or operation of the aircraft that will be necessary to certify future pilots. In addition, the criteria for pilot certification on the unique characteristics of the aircraft are identified during this process. As this is accomplished, the FAA inspector also learns to fly the aircraft at no cost to FAA. These instances account for less than 10 training sessions per year for FAA inspectors, according to FAA.

[50]These qualified pilots become designated check airmen who are then permitted to conduct flight checks or instruction in an airplane for the purpose of certifying other air carrier pilots to ensure they are properly trained and able to fly the aircraft.

FAA does not keep central records of training received through these arrangements, and it was not practical for us to gather the data from over 100 FAA field locations. Therefore, we asked FAA's nine regional office officials to contact their respective flight standards district offices and certificate management offices to compile these data. Some data was provided to us with incomplete information, sometimes without names or specific dates. Because of the many remote locations that gathered this information for us, it was not practical for us to independently verify the completeness or accuracy of these data.

Overall, FAA regional office-supplied data indicate that FAA has memoranda of understanding with 61 airlines and 42 training centers under the two programs, encompassing about 300 fleets in total. (See table 8.)

Table 8: Number of Memoranda of Understanding and Fleets Enrolled as Part of the Aircrew Designated Examiner Program and Agreements with Training Centers

	Number of memoranda of understanding	Number of fleets
Aircrew designated examiner program	61	141
Training centers	42	162
Total	**103**	**303**

Source: GAO analysis of FAA supplied data.

Note: This information may not be complete and was not independently verified. (See text.)

For the aircrew designated examiner program, FAA regional officials indicated that the agency has memoranda of understanding with 61 of the 134 airlines, and these agreements cover 141 aircraft fleets. More than 175 training activities took place per year, on average, from fiscal years 2002 through 2004, representing nearly 30 percent of all technical training received by air carrier operations inspectors. (See table 9.)

Table 9: Numbers of Inspectors Trained under Aircrew Designated Examiner Program and Agreements with Training Centers, Fiscal Years 2002 through 2004

	2002	2003	2004	Average per year
Aircrew designated examiners				
Number of inspectors trained	111	114	155	127
Number of training activities	155	170	200	175
Training centers				
Number of inspectors trained	43	45	59	49
Number of training activities	51	52	73	59

Source: GAO analysis of FAA supplied data.

Note: This information may not be complete and was not independently verified. (See text.)

Similar to the aircrew designated examiner program, FAA's Flight Standards office also employs memoranda of understanding with private, FAA-certified training centers that provide training, testing, and pilot certification services to commercial and private pilots throughout the United States. Under these agreements, certain training center employees may be certified by FAA to serve as designees provided they meet FAA requirements. On behalf of FAA, these training center designees certify commercial and private pilots as qualified to operate an aircraft. FAA assigns one or more inspectors to each training center. The inspector is responsible for FAA regulatory management and oversight of the training center through periodic inspections of training center equipment, training courses, course materials, and instructors. As part of the agreement granting designee authority to the employee of the training center, the FAA inspector receives aircraft-specific training from the training center at no cost to the agency. This training benefits FAA by increasing inspector knowledge and familiarization with the actual equipment being inspected, thereby providing more effective oversight of the training center. In addition, FAA does not have to utilize inspectors to certify the individual pilots. The training center benefits from having its own employees authorized to certify the pilots attending training at the center, rather than having to schedule and wait for FAA inspectors to accomplish the certifications.

According to FAA regional officials, FAA has agreements with 42 of the approximately 50 training centers across the United States that include 162 aircraft simulator fleets. From the data FAA regional offices supplied, we determined that an average of 59 instances of training per year occurred

under these arrangements from fiscal years 2002 through 2004. (See tables 8 and 9.)

In total, the technical training provided by industry sources in exchange for in-kind services through these two sets of arrangements accounts for approximately 17 percent of all industry-provided training and approximately 7 percent of all technical training provided to inspectors.

The memoranda of understanding described above were formalized, in part, to eliminate actual or appearances of a conflict of interest. The U.S. Government Standards of Ethical Conduct precludes federal employees from accepting gifts, including training, from those whom they regulate. An exception includes anything that is paid for or secured by the government under contract. FAA considers the granting of check airmen authority to designated examiners to be payment in-kind for the training received by FAA inspectors. The purpose of the memoranda of understanding for the two arrangements discussed above is to outline the nature of the payment in-kind that FAA will provide to eliminate the appearance that FAA is receiving a service for free. The memoranda of understanding address the conflict-of-interest issue by explicitly outlining the duties and responsibilities of both FAA and the operator employees who are party to the agreement, and they also outline the specific nature of the in-kind exchange.

For the aircrew designated examiner program, a sample memorandum of understanding was written into FAA guidance in 1989. In 1997, a Department of Transportation Office of the Inspector General report expressed concerns that the aircrew designated examiner program might entail a conflict of interest by precluding FAA from enforcing its safety regulations.[51] As a result, FAA altered the memoranda of understanding by eliminating any language that could be construed as limiting FAA's oversight authority and by specifically adding language to the contrary.

Unlike the memoranda of understanding for the aircrew designated examiner program, the memoranda of understanding between FAA and training centers do not contain a provision stating that FAA will take enforcement action against any individual who violates any regulation.

[51]U.S. Department of Transportation, Office of Inspector General, *Free Industry Flight Training of Inspectors: Federal Aviation Administration*, AV-1998-042 (Washington, D.C.: Dec. 9, 1997).

When we brought this to their attention, FAA officials indicated that the absence of this enforcement language in the training center memoranda of understanding was most likely the result of a simple oversight. As a result of our inquiry, FAA officials told us that they are revising their guidance to incorporate this enforcement language for future arrangements under a memorandum of understanding. Although this action will address any concerns about future arrangements, it does not make enforcement authority explicit under existing arrangements.

Some Inspectors Receive Free Training without Getting Approval from FAA Legal Counsel

Some safety inspectors have received training opportunities from aircraft manufacturers or operators that they regulate at no cost to FAA and without providing an in-kind service in exchange. FAA requires that any such free training opportunities be reviewed by FAA legal counsel, at the regional or headquarters level, to determine propriety of accepting the training. However, some Flight Standards inspectors have received free training for which FAA gave them training credit in the absence of prior approval from legal counsel. According to Aircraft Certification officials, its inspectors do not receive training credit for free training offered by aircraft manufacturers, although both Aircraft Certification and Flight Standards inspectors often audit classes, at no charge to FAA, without receiving credit.

As mentioned above, U.S. Government Standards of Ethical Conduct generally preclude federal employees from accepting gifts, including training, from those they regulate. FAA generally does not accept offers of gifts unless there is some recognized need, or if acceptance will result in cost savings or other benefits in carrying out its work. FAA is allowed, however, to receive free training from the aviation industry in limited circumstances as a gift under the FAA Administrator's gift acceptance authority. Under this authority, the FAA Administrator can accept any gift of services in carrying out aviation duties and powers. FAA's Chief Counsel concluded in 1988 that FAA may accept free training if the session is necessary for the employee to perform his or her responsibilities, with respect to the provider's projects, and the information cannot be obtained from another source. Before inspectors can receive free training, they must obtain approval from FAA legal counsel, either at the regional or national level.

Because FAA does not keep central records of free training received, and gathering this data was not practical, we asked FAA's nine regional offices to request and compile this information for us. In response, two of the nine

regions indicated that they accept free training on a limited basis. One region cited 57 instances, over the past 4 years, of training accepted and credited to inspectors' personnel records that was provided free of charge. We were able to independently verify only 12 of these instances because some of the data lacked specific dates, some lacked inspector names, and some of the training was presented as completed but with no specific information at all. For the second region, although it could not identify specific records of such training, an official indicated that perhaps five instances of free training were accepted over the past 3 years.

FAA's policy regarding acceptance of free training is not well known or uniformly applied by its regional offices. Though some regions indicated that the acceptance of free training of any type is not allowed under any circumstances, other regions were unsure how the policy for acceptance of this type of training is applied. Regarding the two regions that told us they had accepted free training, an official from the first region indicated that sometimes the regional legal counsel's office was asked to comment on the propriety of the training and sometimes not. In cases where legal counsel determined the training was improper, according to the official, the training was not accepted. An official from the second region indicated that free training opportunities were taken advantage of when normal FAA channels for obtaining the same training were often slow or difficult; therefore, accepting this training became necessary if inspectors were to receive it at all. Similar to the official from the first region where free training is routinely accepted, this official indicated that legal counsel was sometimes contacted for an opinion on the propriety of accepting a specific instance of training, and sometimes not. Because these opportunities generally arise at the local office level, whether such an offer is reviewed by legal counsel is dependent on the office manager, the manager's understanding of the FAA policy, and a judgment about whether a specific training opportunity raises any concern that should be reviewed by legal counsel.

Both the government standards of ethical conduct and FAA policy address the propriety of accepting gifts and free training, but FAA has not clearly communicated this policy and the processes for accepting free training to its regional offices. None of the regions we contacted were able to cite any specific, relevant policy guidance governing this issue. Several of the FAA officials we interviewed cited "verbal policy" from FAA headquarters and a general, long-standing understanding that acceptance of such training is not allowed. Other regional officials indicated that although acceptance of free training is generally to be avoided due to conflict-of-interest considerations, they would treat each occurrence separately and likely consult with the regional legal counsel for an opinion on the propriety of accepting free training. In fact, one region supplied us with an opinion from the regional legal counsel, stating that as a general rule, FAA has long held that the agency must pay for its own training. The document goes on to say that it is permissible to accept such an opportunity to audit the class but warns that an inspector is not to consider it formal training. Many regional and headquarters officials we spoke with indicated that it is common practice for FAA inspectors to audit training in this manner, for informational purposes and not for formal FAA training credit. On the basis of our survey, about 37 percent of inspectors indicated that, in the past 2 years, they have attended or inspected a technical training course offered by an airline or manufacturer for which they did not receive credit.[52]

FAA headquarters officials agreed that the FAA order governing the acceptance of gifts and the government's standards of ethical conduct address the broad issue of gift acceptance. However, our work indicates that these policies may not be clearly and uniformly understood by the FAA regional offices.

Conclusions

In providing training to its inspectors, FAA follows many of the effective management practices we have outlined in our guide for assessing training and development efforts in the federal government. In doing so, FAA has put in place thoughtful, structured processes for linking training to strategic goals, identifying and developing courses to improve individual and agency performance, actively encouraging and supporting technical training, ensuring that inspectors have opportunities to receive this technical training, and obtaining inspectors' and their supervisors' views on

[52]The 95 percent confidence interval for this estimate is from 33 to 42 percent.

the extent to which technical training affects job performance. FAA also recognizes the need for improvements, including (1) systematically assessing inspectors' needs for technical and other training, (2) better timing of technical training so that inspectors receive it when it is needed to perform their jobs, and (3) better linking the training provided to achieving agency goals of improving aviation safety. FAA has begun to act in these areas, and we believe that, if effectively implemented, the actions should improve the delivery of training and ultimately help lead to fewer aviation accidents, fatalities, and injuries. Therefore, it is important for FAA to follow through with its efforts.

FAA's plans for inspector training are premised on the assumption that inspectors currently have enough technical proficiency overall and that future training efforts should be geared toward closing gaps in proficiencies that the agency has determined inspectors require for system safety inspections, such as risk assessment and data analysis. However, FAA has not convinced inspectors of the merits of its approach nor has it systematically identified inspectors' training needs for conducting system safety inspections. Inspectors instead believe that they are not receiving all the training they need to stay current with rapidly changing aviation technologies. Many inspectors spoke out strongly on this issue—it is clearly a hot-button topic for them. Therefore, it is essential that as FAA continues to implement a system safety inspection process, it works closely with inspectors to demonstrate the benefits of the system safety approach, how inspectors' technical and other training needs will be met, and how aviation safety will benefit from a system safety approach.

Finally, FAA has recognized that the manufacturers and operators of aircraft and aircraft systems can be the best source of much of the technical training for its inspectors. While FAA pays for most of the training its inspectors receive from aviation sources, some of this training is provided at no cost or in exchange for in-kind services. However, because FAA keeps only scattered records on the extent to which such training occurs, we cannot tell how widespread it is or whether FAA legal counsel reviewed each training activity for propriety. FAA has not communicated its policy on the acceptance of training without charge; and, as a result, some FAA regions have accepted training that has not been approved and could pose conflict-of-interest issues—or the appearance of such a conflict—for the agency.

Recommendations for Executive Action

We are making five recommendations, three involving technical training and two involving industry provided training. Regarding technical training, we recommend that the Secretary of Transportation direct the FAA Administrator to complete the following two actions that are either planned or are in early stages of development or implementation:

- To ensure that inspector technical training needs are identified and met in a timely manner, the Administrator should systematically assess inspectors' technical training needs, increase inspector involvement in the decision-making process for assessing the need for courses, including the need for more training for maintenance and avionics inspectors to familiarize them with recent changes in aviation technology, and ensure the technical curriculum meets those needs. The Administrator should also take the actions needed, including developing guidelines for inspectors, supervisors, and training managers, to ensure that technical training is requested and delivered closer to the time it is needed to help inspectors perform their jobs.

- With a view toward maximizing the contributions of training to furthering FAA's safety mission, FAA's training organizations should determine the feasibility of developing measures of the impact of inspector training, including technical training, on achieving organizational goals.

Third, to gain better acceptance from the inspector workforce for changes being made and planned for the inspector training curriculum, we recommend that the Secretary of Transportation direct the FAA Administrator to increase the focus of its training efforts on how system safety/risk management will improve inspections and aviation safety.

Fourth, we recommend that the Secretary of Transportation direct the FAA Administrator to ensure that all existing and future memoranda of understanding pertaining to training received in exchange for in-kind services contain language stating that the agreement does not preclude FAA from fulfilling its oversight and enforcement role.

Finally, to preclude situations where the provision of free training by the aviation industry may create a conflict of interest or result in the appearance of such a conflict, we recommend that the Secretary of Transportation direct the FAA Administrator to review its policies on the acceptance of free training accepted from the aviation industry to ensure

they are understood by inspectors, supervisors, managers, and regional counsel; implement a process for monitoring field office compliance with these policies; and follow up on any noncompliance.

Agency Comments and Our Evaluation

We provided a draft of this report to the Department of Transportation and received comments from FAA officials, including its Deputy Associate Administrator for Aviation Safety. FAA generally agreed with the report's findings and agreed to consider our recommendations. The FAA representatives appreciated the report's positive recognition of its efforts to provide safety inspectors with the technical training they need to effectively accomplish their mission.

FAA officials suggested that we modify how we grouped our presentation of findings from our survey of inspectors. Specifically, they maintained that our analysis of results should have included "moderate extent" along with "very great" and "great extent" as a positive response because the inspectors would have viewed a "moderate extent" response as a positive response. Thus, in FAA's view, combining the "moderate extent" responses with "great extent" and "very great extent" responses would more accurately reflect the respondents' intent. The extent scale that we used in our survey represents a unidirectional scale. As such, it is possible to interpret any point along that scale, other than "no extent," as positive, depending upon how a question is worded. Generally, we presented information in the report with both "very great extent" and "great extent" combined to represent the clearly most positive responses. The combination of "very great extent" and "great extent" responses was intended to give FAA a clearer understanding of inspectors' perceptions and guidance as to where the application of its efforts is likely to have the greatest effect. Although this approach served our purposes best, there are naturally multiple ways in which one might combine response categories. As such, we have provided detailed results showing responses for each question by each response category in appendix II and the e-supplement to this report.

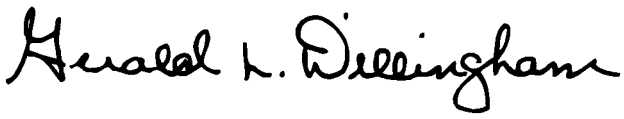
The officials also noted that we defined technical training for the purpose of this report differently from what FAA considers to be technical training for inspectors. While these officials appreciated the recognition of the differences in the two definitions in our report, they said that the different definitions account for some disparity between what FAA considers the percentage of training achieved and that shown in the draft report. For example, the department considers the use of computer automation tools

as a critical element of an inspector's ability to provide effective and efficient safety oversight. Because the Vision 100 – Century of Aviation Reauthorization Act required that we focus on training in the latest aviation technologies—which we termed technical training—we did not include courses such as the use of computer tools in our assessment. Nevertheless, our draft and final reports acknowledge the importance of other training provided to inspectors, particularly training in skills relating to system safety and risk assessment.

The department also provided several clarifying comments and technical corrections, which we have incorporated in this report as appropriate.

We are sending copies of this report to congressional committees and subcommittees with responsibilities for transportation safety issues; the Secretary of Transportation; the Administrator, FAA; and the Director, Office of Management and Budget. We will also make copies available to others upon request. This report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you have any questions about this report, please contact me at (202) 512-2834 or dillinghamg@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Staff who made key contributions to this report are listed in appendix IV.



Gerald L. Dillingham, Ph.D.
Director, Physical Infrastructure Issues

Inspector-Reported Travel for Technical Training

The Vision 100 – Century of Aviation Reauthorization Act required that we report on the amount of travel required of Federal Aviation Administration (FAA) inspectors in receiving training. To attempt to accomplish this requirement, we asked FAA to provide us with information on the number of times each inspector was in travel status for training, the location of the training, and the duration of the trips. FAA was not able to readily provide this information, citing limitations of its databases that track inspector travel. FAA told us that it is able to access and review individual inspector travel records, but its information systems are not set up to compile and analyze travel data for inspectors' travel for training, as a whole. In part, this information is not readily available because the data are stored in multiple databases, and the information is recorded differently, depending on how the training is arranged and budgeted. Further, FAA officials told us that (1) these data would be extremely time consuming to collect and compile and (2) a manual search for location of training would be necessary in some cases. On the basis of our inquiries, we concluded that it was not unreasonable for FAA to lack an easily accessible, comprehensive set of travel data.

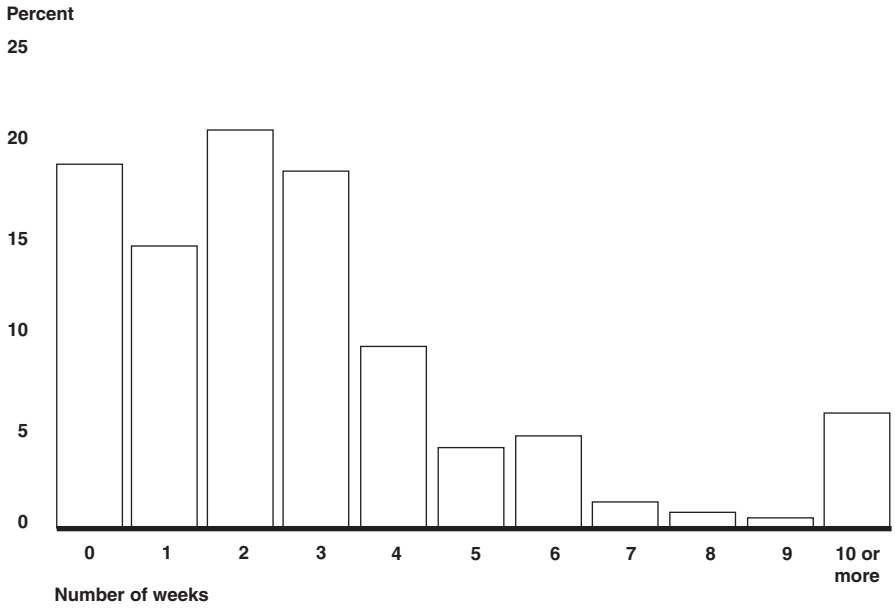
Thus to obtain information on inspectors' travel for training we used our survey of aviation safety inspectors (conducted in late 2004). We asked inspectors to tell us how many weeks they were on travel status for technical training in the past 12 months. On the basis of our survey, we estimate that inspectors spend an average of about 3.1 weeks per year on travel status for technical training.[1] (See fig. 11.) We found that an estimated 54 percent of inspectors were on travel status for 1 to 3 weeks, and 27 percent spent 4 weeks or more on travel for technical training.[2] About 19 percent of inspectors spent no time on travel status for technical training in the past year.[3]

[1]The 95 percent confidence interval for this estimate is from 2.7 to 3.5 weeks.

[2]The 95 percent confidence intervals for these estimates are from 50 to 59 percent and 22 to 31 percent, respectively.

[3]The 95 percent confidence interval for this estimate is from 15 to 23 percent.

Figure 11: Number of Weeks Inspectors Reported Spending on Travel for Technical Training within the Past 12 Months



Source: GAO survey of FAA inspectors.

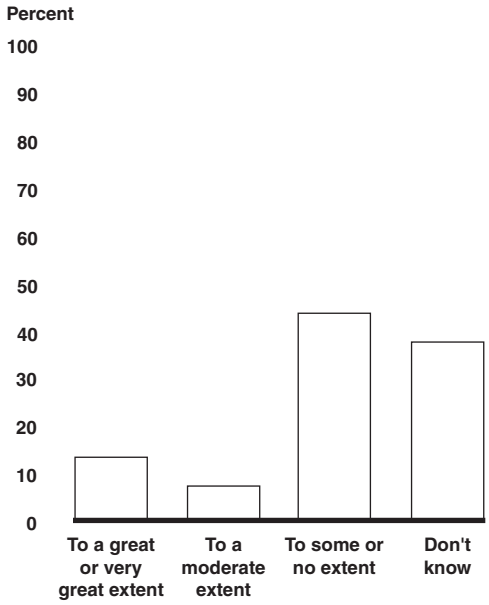
On average, Flight Standards inspectors spent more time on travel for technical training than did Aircraft Certification inspectors, according to our analysis of survey responses. Flight Standards inspectors spent an average of approximately 3.2 weeks over the past year, and Aircraft Certification inspectors were on travel for training for approximately 2 weeks.[4]

The Vision 100 – Century of Aviation Reauthorization Act contained a "Sense of the House" that stated that, if possible, FAA inspectors should be allowed to take training at the location most convenient for the inspector. As part of our survey, we asked the inspectors the extent to which there are opportunities for FAA to offer or contract for technical training closer to the inspectors' work location. According to our survey, we estimate that approximately 13 percent of inspectors indicated, to a great or very great

[4]The 95 percent confidence intervals for these estimates are from 2.8 to 3.6 weeks and 1.0 to 3.0 weeks, respectively.

extent, that such opportunities existed.[5] (See fig. 12.) However, more than one-third of inspectors indicated they did not know if such training opportunities existed.[6] We did not attempt to verify inspectors' views on opportunities for nearby technical training.

Figure 12: Inspectors' Views on the Extent to Which Technical Training Opportunities Exist Closer to Their Work Location



Source: GAO survey of FAA inspectors.

Note: See table 22 in appendix II for additional details.

[5]The 95 percent confidence interval for this estimate is from 9 to 16 percent.

[6]The 95 percent confidence interval for this estimate is from 32 to 41 percent.

Additional Details on Training Data and Selected Inspector Survey Responses

Tables 10 through 22 provide additional inspector training data as well as additional detail on inspectors' views on FAA technical training, as discussed earlier in this report. The survey results, exclusive of inspector specialty breakouts, can be found at GAO-05-704SP.

The stratified random sample of FAA inspectors was designed to have an overall margin of error of plus or minus 4 percentage points at a 95 percent level of confidence. Due to nonresponse, the actual overall margin of error is plus or minus 4.6 percentage points. The individual types of FAA inspectors represent strata in the sample. The precision for results within each stratum is less than the overall precision for population level estimates. Estimates for each individual type of safety inspector (stratum level) have margins of error greater than 4.6 percentage points. Estimates are more accurate for strata that have a larger number of responding inspectors than for those with fewer inspectors in them.

For tables in this appendix that provide results of our survey of safety inspectors, we present both the estimated percentage of those responding in a certain way to each question and the confidence interval associated with that estimate. For example, in table 13, we report on the percentage of general aviation inspectors who responded to a great extent that they have enough technical knowledge to do their job as 39 (31 – 46). This means that we estimate that 39 percent of all general aviation inspectors believe this to a great extent. Had we surveyed the population of all general aviation inspectors, we are 95 percent confident that the percentage point responding "to a great extent" for this survey question would lie between 31 and 46 percentage points. The confidence interval reflects the sampling error that corresponds to the estimate of 39 percent. The tables associated with our survey in this appendix provide the number of respondents within each row. In some cases, the numbers are small because FAA has relatively few of these types of inspectors. See appendix III for more information on how we conducted our survey.

Table 10: Percent of Essential Courses That Are Technical in Nature

Type of inspector	Number of essential technical courses	Number of essential courses overall	Percent of essential courses that are technical
Air carrier avionics	14	28	50
Air carrier maintenance	8	22	36
Air carrier operations	1	10	10
Cabin safety	3	12	25
General aviation avionics	12	26	46
General aviation maintenance	8	23	35
General aviation operations	2	13	15
Aircraft certification	0	7	0
All inspectors	**48**	**141**	**34**

Source: GAO analysis of FAA data.

Table 11: Percent of Inspectors Completing Essential Courses

Type of inspector	Percent of inspectors completing at least 75 percent of essential courses	Percent of inspectors completing at least 50 percent of essential courses
Air carrier avionics	13	81
Air carrier maintenance	25	83
Air carrier operations	30	79
Cabin safety	73	88
General aviation avionics	30	81
General aviation maintenance	36	86
General aviation operations	47	88
Aircraft certification	9	94
All inspectors	**30**	**84**

Source: GAO analysis of FAA data.

Note: See text for a discussion of why inspectors may not have completed essential courses.

Table 12: Average Number of Technical Training Courses Taken Outside of Requirements, Fiscal Years 2002 through 2004

Type of inspector	Average number of technical courses
Air carrier avionics	1.5
Air carrier maintenance	1.7
Air carrier operations	2.3
Cabin safety	0.2
General aviation avionics	1.4
General aviation maintenance	1.8
General aviation operations	2.6
Aircraft certification	1.2
All inspectors	**1.7**

Source: GAO analysis of FAA data.

Table 13: Inspectors' Views on Extent to Which They Currently Have Enough Technical Knowledge to Do Their Jobs

		Percent (confidence interval)				
Type of inspector	**Unweighted sample size**	**Very great**	**Great**	**Moderate**	**Some**	**None**
Air carrier	**231**	**13** (9-18)	**40** (34-46)	**33** (27-39)	**12** (9-17)	**1** (0-4)
Air carrier avionics	46	7 (2-17)	28 (17-42)	37 (24-52)	28 (17-42)	0 (0-6)
Air carrier maintenance	88	8 (3-15)	44 (35-54)	35 (26-45)	9 (4-17)	3 (1-9)
Air carrier operations	79	20 (13-30)	41 (31-51)	30 (21-40)	9 (4-16)	0 (0-4)
Cabin safety	18	28 (11-50)	51 (30-71)	11 (2-31)	11 (2-31)	0 (0-15)
General aviation	**132**	**10** (6-16)	**39** (31-46)	**36** (29-44)	**15** (10-22)	**0** (0-2)
General aviation avionics	22	0 (0-13)	45 (25-67)	36 (18-58)	18 (6-39)	0 (0-13)
General aviation maintenance	56	13 (6-23)	41 (29-53)	36 (24-49)	11 (4-21)	0 (0-5)
General aviation operations	54	11 (4-22)	33 (22-47)	37 (25-49)	19 (10-31)	0 (0-5)
Aircraft certification	**25**	**20** (7-39)	**48** (29-67)	**28** (13-48)	**4** (0-19)	**0** (0-11)
All inspectors	**388**	**12** (9-16)	**40** (35-45)	**34** (29-38)	**13** (10-16)	**1** (0-2)

Source: GAO survey of FAA inspectors.

Note: The data in this table represent the responses from inspectors to the following question, "To what extent do you currently have enough technical knowledge about the aircraft, systems, or operations you inspect to do your present job?" For more detail about the estimates and the corresponding confidence intervals (numbers in parentheses), please see the text at the beginning of this appendix. Some of the row percentages will not add up to 100 percent due to rounding. See figure 5 for visual illustration.

Table 14: Inspectors' Views on Extent to Which Requested Technical Training Is Approved

Percent (confidence interval)

Type of inspector	Unweighted sample size	Very great	Great	Moderate	Some	None	Don't know
Air carrier	**231**	**8** (5-12)	**23** (18-28)	**24** (19-30)	**28** (22-33)	**13** (9-18)	**4** (2-7)
Air carrier avionics	46	4 (1-14)	22 (12-35)	24 (13-38)	37 (24-51)	9 (3-19)	4 (1-14)
Air carrier maintenance	88	3 (1-9)	24 (16-33)	27 (19-37)	28 (20-38)	11 (6-19)	6 (2-12)
Air carrier operations	80	14 (7-23)	21 (13-31)	21 (13-31)	24 (15-34)	17 (10-27)	2 (0-8)
Cabin safety	17	12 (2-33)	34 (17-54)	24 (8-47)	18 (6-40)	6 (0-25)	5 (0-22)
General aviation	**132**	**5** (2-9)	**19** (13-26)	**17** (12-24)	**30** (22-37)	**24** (17-31)	**6** (3-11)
General aviation avionics	22	5 (0-22)	5 (0-22)	18 (6-39)	36 (18-58)	27 (11-49)	9 (1-28)
General aviation maintenance	56	7 (2-17)	18 (9-30)	20 (11-32)	29 (18-41)	20 (11-32)	7 (2-17)
General aviation operations	54	2 (0-9)	26 (15-39)	15 (7-26)	28 (17-41)	26 (15-39)	4 (1-12)
Aircraft certification	**25**	**4** (0-19)	**16** (5-35)	**28** (13-48)	**16** (5-35)	**28** (13-48)	**8** (1-24)
All inspectors	**388**	**6** (4-9)	**21** (17-25)	**22** (18-26)	**28** (24-32)	**18** (14-21)	**5** (3-8)

Source: GAO survey of FAA inspectors.

Note: The data in this table represent the responses from inspectors to the following question, "To what extent have the technical training courses you requested been approved?" For more detail about the estimates and the corresponding confidence intervals (numbers in parentheses), please see the text at the beginning of this appendix. Some of the row percentages will not add up to 100 percent due to rounding. See figure 6 for visual illustration.

Table 15: Inspectors' Views on Whether Availability of Courses Helped or Hindered Their Ability to Take Requested Technical Training

Percent (confidence interval)

Type of inspector	Unweighted sample size	Greatly helped	Helped	Neither helped nor hindered	Hindered	Greatly hindered	No basis to judge	Don't know
Air carrier	**231**	**4** (2-7)	**24** (18-29)	**27** (22-33)	**30** (24-36)	**8** (5-12)	**5** (3-8)	**2** (1-4)
Air carrier avionics	46	4 (1-14)	22 (11-35)	28 (17-42)	35 (22-49)	9 (3-20)	0 (0-6)	2 (0-10)
Air carrier maintenance	88	3 (1-9)	27 (19-37)	20 (13-30)	34 (25-43)	9 (4-17)	2 (0-7)	3 (1-9)
Air carrier operations	79	4 (1-10)	22 (13-32)	34 (24-44)	25 (17-36)	6 (2-14)	9 (4-17)	0 (0-4)
Cabin safety	18	6 (0-24)	16 (5-36)	28 (11-50)	12 (2-31)	17 (5-38)	22 (8-43)	0 (0-15)
General aviation	**131**	**3** (1-7)	**18** (12-26)	**34** (27-42)	**25** (18-32)	**9** (5-15)	**8** (4-14)	**2** (0-5)
General aviation avionics	21	0 (0-13)	10 (1-29)	33 (15-56)	29 (12-51)	14 (3-35)	14 (3-35)	0 (0-13)
General aviation maintenance	56	4 (1-12)	23 (13-36)	38 (26-49)	21 (12-34)	7 (2-17)	5 (1-14)	2 (0-9)
General aviation operations	54	4 (1-12)	17 (8-29)	31 (20-45)	28 (17-41)	9 (3-20)	9 (3-20)	2 (0-9)
Aircraft certification	**25**	**8** (1-24)	**20** (7-39)	**36** (19-56)	**4** (0-19)	**20** (7-39)	**12** (3-30)	**0** (0-11)
All inspectors	**387**	**4** (2-6)	**22** (18-25)	**30** (26-35)	**27** (23-31)	**9** (7-12)	**7** (5-9)	**2** (1-3)

Source: GAO survey of FAA inspectors.

Note: The data in this table represent the responses from inspectors to the following question, "Have the following factors helped or hindered your ability to take the technical training you requested to do your current job? Factor: Availability of courses." For more detail about the estimates and the corresponding confidence intervals (numbers in parentheses), please see the text at the beginning of this appendix. Some of the row percentages will not add up to 100 percent due to rounding. See figure 7 for visual illustration.

Table 16: Inspectors' Views on Whether Availability of Funds Helped or Hindered Their Ability to Take Requested Technical Training

Percent (confidence interval)

Type of inspector	Unweighted sample size	Greatly helped	Helped	Neither helped nor hindered	Hindered	Greatly hindered	No basis to judge	Don't know
Air carrier	**229**	**4** (2-8)	**10** (6-14)	**21** (16-26)	**28** (22-33)	**24** (18-29)	**7** (4-11)	**7** (4-10)
Air carrier avionics	46	9 (3-20)	6 (2-16)	15 (7-28)	39 (26-54)	17 (8-30)	0 (0-6)	13 (5-25)
Air carrier maintenance	87	3 (1-9)	16 (9-25)	22 (14-31)	24 (16-34)	22 (14-31)	6 (2-12)	7 (3-14)
Air carrier operations	78	4 (1-11)	5 (2-12)	23 (15-33)	26 (17-36)	28 (19-39)	10 (5-19)	4 (1-10)
Cabin safety	18	0 (0-15)	6 (0-24)	17 (5-38)	33 (15-56)	28 (12-51)	16 (5-36)	0 (0-15)
General aviation	**131**	**3** (1-7)	**8** (4-13)	**16** (11-23)	**30** (22-37)	**29** (22-36)	**10** (6-16)	**5** (2-9)
General aviation avionics	22	0 (0-13)	9 (1-28)	18 (6-39)	18 (6-39)	36 (18-58)	14 (3-34)	5 (0-22)
General aviation maintenance	56	2 (0-9)	11 (4-21)	13 (6-23)	32 (21-45)	30 (19-43)	5 (1-14)	7 (2-17)
General aviation operations	53	6 (1-15)	4 (1-12)	19 (10-31)	32 (21-46)	25 (14-37)	13 (6-25)	2 (0-9)
Aircraft certification	**25**	**12** (3-30)	**4** (0-19)	**8** (1-24)	**28** (13-48)	**28** (13-48)	**12** (3-30)	**8** (1-24)
All inspectors	**385**	**4** (3-7)	**9** (6-12)	**18** (15-22)	**29** (24-33)	**26** (22-30)	**8** (6-11)	**6** (4-9)

Source: GAO survey of FAA inspectors.

Note: The data in this table represent the responses from inspectors to the following question, "Have the following factors helped or hindered your ability to take the technical training you requested to do your current job? Factor: Availability of funds." For more detail about the estimates and the corresponding confidence intervals (numbers in appendix), please see the text at the beginning of this appendix. Some of the row percentages will not add up to 100 percent due to rounding. See figure 7 for visual illustration.

Table 17: Inspectors' Views on Whether Management's Determination of Need Helped or Hindered Their Ability to Take Requested Technical Training

Percent (confidence interval)

Type of inspector	Unweighted sample size	Greatly helped	Helped	Neither helped nor hindered	Hindered	Greatly hindered	No basis to judge	Don't know
Air carrier	**230**	**7** (4-11)	**29** (23-34)	**33** (27-39)	**15** (11-20)	**7** (4-11)	**6** (4-10)	**3** (1-6)
Air carrier avionics	46	4 (1-14)	37 (25-51)	30 (19-44)	15 (7-28)	6 (2-16)	2 (0-11)	4 (1-14)
Air carrier maintenance	88	7 (3-14)	28 (20-38)	38 (28-47)	15 (8-23)	7 (3-14)	3 (1-9)	2 (0-7)
Air carrier operations	79	8 (3-15)	25 (17-36)	31 (21-40)	15 (8-24)	8 (3-15)	10 (5-19)	4 (1-10)
Cabin safety	17	6 (0-25)	28 (14-46)	18 (6-40)	25 (10-46)	6 (0-25)	17 (5-38)	0 (0-16)
General aviation	**132**	**6** (3-11)	**23** (17-31)	**28** (21-35)	**19** (13-26)	**13** (8-19)	**8** (4-14)	**2** (1-6)
General aviation avionics	22	0 (0-13)	27 (11-49)	14 (3-34)	23 (8-44)	18 (6-39)	14 (3-34)	5 (0-22)
General aviation maintenance	56	9 (3-19)	23 (13-36)	34 (22-47)	16 (8-28)	13 (6-23)	4 (1-12)	2 (0-9)
General aviation operations	54	6 (1-15)	22 (13-35)	28 (17-41)	20 (11-33)	11 (4-22)	11 (4-22)	2 (0-9)
Aircraft certification	**25**	**4** (0-19)	**20** (7-39)	**20** (7-39)	**28** (13-48)	**12** (3-30)	**16** (5-35)	**0** (0-11)
All inspectors	**387**	**6** (4-9)	**26** (22-30)	**30** (26-35)	**17** (14-21)	**9** (7-13)	**8** (5-10)	**3** (1-5)

Source: GAO survey of FAA inspectors.

Note: The data in this table represent the responses from inspectors to the following question, "Have the following factors helped or hindered your ability to take the technical training you requested to do your current job? Factor: Management's determination of your need for the course." For more detail about the estimates and the corresponding confidence intervals (numbers in parentheses), please see the text at the beginning of this appendix. Some of the row percentages will not add up to 100 percent due to rounding. See figure 7 for visual illustration.

Table 18: Inspectors' Views on Whether Inspection Workload Helped or Hindered Their Ability to Take Requested Technical Training

Percent (confidence interval)

Type of inspector	Unweighted sample size	Greatly helped	Helped	Neither helped nor hindered	Hindered	Greatly hindered	No basis to judge	Don't know
Air carrier	**231**	**1** (0-4)	**5** (3-9)	**58** (52-64)	**21** (16-25)	**7** (4-11)	**6** (4-10)	**2** (1-4)
Air carrier avionics	46	0 (0-6)	9 (3-20)	63 (48-76)	15 (7-28)	9 (3-20)	2 (0-10)	2 (0-10)
Air carrier maintenance	88	2 (0-7)	7 (3-13)	65 (55-74)	15 (9-23)	5 (1-11)	6 (2-12)	1 (0-6)
Air carrier operations	79	1 (0-6)	3 (0-9)	48 (38-59)	29 (20-40)	9 (4-17)	7 (3-15)	2 (0-8)
Cabin safety	18	0 (0-15)	0 (0-15)	62 (39-81)	17 (5-38)	0 (0-15)	22 (8-43)	0 (0-15)
General aviation	**132**	**2** (0-5)	**6** (3-11)	**55** (47-63)	**18** (13-25)	**11** (6-17)	**8** (4-13)	**1** (0-4)
General aviation avionics	22	0 (0-13)	5 (0-22)	59 (37-78)	5 (0-22)	23 (8-44)	9 (1-28)	0 (0-13)
General aviation maintenance	56	0 (0-5)	13 (6-23)	57 (45-69)	14 (7-25)	7 (2-17)	7 (2-17)	2 (0-9)
General aviation operations	54	4 (1-12)	0 (0-5)	52 (39-64)	28 (17-41)	9 (3-20)	7 (2-17)	0 (0-5)
Aircraft certification	**25**	**4** (0-19)	**0** (0-11)	**56** (36-74)	**8** (1-24)	**12** (3-30)	**20** (7-39)	**0** (0-11)
All inspectors	**388**	2 (1-3)	5 (3-8)	57 (52-62)	19 (15-23)	8 (6-12)	7 (5-10)	1 (0-3)

Source: GAO survey of FAA inspectors.

Note: The data in this table represent the responses from inspectors to the following question, "Have the following factors helped or hindered your ability to take the technical training you requested to do your current job? Factor: The impact on your workload of the time commitment required for the training." For more detail about the estimates and the corresponding confidence intervals (numbers in appendix), please see the text at the beginning of this appendix. Some of the row percentages will not add up to 100 percent due to rounding. See figure 7 for visual representation.

Table 19: Inspectors' Views on the Degree to Which Technical Training Is Delivered in a Timely Manner

Percent (confidence interval)

Type of inspector	Unweighted sample size	Very great	Great	Moderate	Some	None
Air carrier	**229**	**1** (0-4)	**20** (15-25)	**27** (21-32)	**38** (32-44)	**14** (10-18)
Air carrier avionics	46	0 (0-6)	15 (7-28)	15 (7-28)	56 (43-70)	13 (5-24)
Air carrier maintenance	87	0 (0-3)	17 (10-26)	37 (27-46)	28 (19-38)	18 (11-28)
Air carrier operations	78	4 (1-10)	27 (18-38)	20 (13-30)	40 (30-50)	9 (4-17)
Cabin safety	18	0 (0-15)	6 (0-24)	44 (24-66)	34 (16-56)	16 (5-36)
General aviation	**132**	**2** (1-6)	**13** (8-19)	**22** (16-29)	**51** (43-59)	**12** (7-18)
General aviation avionics	22	0 (0-13)	0 (0-13)	27 (11-49)	55 (33-75)	18 (6-39)
General aviation maintenance	56	2 (0-9)	16 (8-28)	21 (12-34)	46 (34-59)	14 (7-25)
General aviation operations	54	4 (1-12)	15 (7-26)	20 (11-33)	54 (41-66)	7 (2-17)
Aircraft certification	**25**	**8** (1-24)	**24** (10-44)	**28** (13-48)	**32** (16-52)	**8** (1-24)
All inspectors	**386**	**2** (1-4)	**18** (14-21)	**25** (21-29)	**42** (37-47)	**13** (10-16)

Source: GAO survey of FAA inspectors.

Note: The data in this table represent the responses from inspectors to the following question, "During your FAA career, to what extent have you received technical training in a timely manner – meaning receiving training in time to do your current job?" For more detail about the estimates and the corresponding confidence intervals (numbers in parentheses), please see the text at the beginning of this appendix. The number of inspectors responding "do not know" was 2 percent or less. These results are not presented. Some of the row percentages will not add up to 100 percent due to rounding. See figure 8 for visual representation.

Table 20: Inspectors' Views on the Extent That They Receive Technical Training Prior to Scheduled Oversight Activities

Percent (confidence interval)

Type of inspector	Unweighted sample size	Always	Frequently	Occasionally	Rarely	Never	No basis
Air carrier	**231**	**4** (2-8)	**18** (14-23)	**31** (26-37)	**29** (23-34)	**14** (10-19)	**3** (1-6)
Air carrier avionics	46	0 (0-6)	7 (2-17)	26 (15-40)	61 (46-74)	7 (2-17)	0 (0-6)
Air carrier maintenance	88	6 (2-12)	11 (6-19)	35 (26-45)	22 (14-31)	24 (16-33)	2 (0-7)
Air carrier operations	79	5 (2-12)	29 (20-40)	29 (20-40)	23 (14-33)	9 (4-17)	5 (2-12)
Cabin safety	18	5 (0-21)	28 (12-51)	40 (21-61)	11 (2-31)	11 (2-31)	5 (0-21)
General aviation	**132**	**2** (1-6)	**19** (13-26)	**27** (20-35)	**33** (26-41)	**11** (7-17)	**7** (3-12)
General aviation avionics	22	0 (0-13)	5 (0-22)	18 (6-39)	36 (18-58)	23 (8-44)	18 (6-39)
General aviation maintenance	56	4 (1-12)	20 (11-32)	27 (16-39)	32 (21-45)	14 (7-25)	4 (1-12)
General aviation operations	54	2 (0-9)	24 (14-37)	31 (20-45)	33 (22-47)	4 (1-12)	6 (1-15)
Aircraft certification	**25**	**4** (0-19)	**28** (13-48)	**32** (16-52)	**20** (7-39)	**16** (5-35)	**0** (0-11)
All inspectors	**388**	**4** (2-6)	**19** (15-23)	**30** (26-34)	**30** (26-34)	**13** (10-17)	**4** (3-7)

Source: GAO survey of FAA inspectors.

Note: The data in this table represent the responses from inspectors to the following question, "In thinking about the timing of when you received technical training during your FAA career, how often did the following situations apply? Situation: Technical and/or equipment training was received prior to scheduled oversight/surveillance activities." For more detail about the estimates and the corresponding confidence intervals (numbers in parentheses), please see the text at the beginning of this appendix. Some of the row percentages will not add up to 100 percent due to rounding. See figure 9 for visual representation.

Table 21: Percent of Technical Training Provided by Industry as Reported by FAA, Fiscal Years 2002 through 2004

	2002		2003		2004	
Type of inspector	**Number**	**Percent[a]**	**Number**	**Percent[a]**	**Number**	**Percent[a]**
Air carrier						
Air carrier avionics	181	30	193	42	218	53
Air carrier maintenance	475	39	313	38	323	53
Air carrier operations	282	54	341	57	332	55
Cabin safety	9	39	7	23	6	33
Subtotal	**947**	**40**	**854**	**45**	**879**	**54**
General aviation						
General aviation avionics	77	24	65	33	59	33
General aviation maintenance	240	30	160	28	148	33
General aviation operations	167	41	248	56	222	40
Subtotal	**484**	**32**	**473**	**39**	**429**	**37**
Aircraft certification	28	34	27	41	3	8
Total	**1,459**	**37**	**1,354**	**42**	**1,311**	**46**

Source: GAO analysis of FAA data.

Note: See figure 10 for visual representation

[a]As a percent of total FAA- and industry-provided training for each type of inspector.

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Table 22: Inspectors' Views on the Extent to Which Technical Training Opportunities Exist Closer to Their Work Location

Percent (confidence interval)

Type of inspector	Unweighted sample size	Very great	Great	Moderate	Some	None	Don't know
Air carrier	**231**	**4** (2-7)	**11** (7-15)	**5** (3-9)	**13** (9-18)	**30** (24-35)	**38** (32-44)
Air carrier avionics	46	2 (0-10)	9 (3-20)	2 (0-11)	24 (13-37)	26 (15-40)	37 (24-52)
Air carrier maintenance	87	3 (1-9)	7 (3-14)	8 (4-15)	10 (5-18)	26 (18-36)	45 (35-54)
Air carrier operations	80	5 (2-12)	16 (9-25)	4 (1-10)	11 (6-20)	34 (24-44)	30 (20-39)
Cabin safety	18	0 (0-15)	6 (0-24)	0 (0-15)	6 (0-24)	37 (22-54)	51 (32-70)
General aviation	**132**	**2** (1-6)	**9** (5-15)	**10** (6-16)	**18** (12-24)	**26** (19-33)	**35** (28-43)
General aviation avionics	22	5 (0-22)	0 (0-13)	14 (3-34)	5 (0-22)	23 (8-44)	55 (33-75)
General aviation maintenance	56	2 (0-9)	7 (2-17)	11 (4-21)	11 (4-21)	27 (16-39)	43 (31-55)
General aviation operations	54	2 (0-9)	15 (7-26)	7 (2-17)	30 (19-43)	26 (15-39)	20 (11-33)
Aircraft certification	**25**	**4** (0-19)	**0** (0-11)	**12** (3-30)	**20** (7-39)	**28** (13-48)	**36** (19-56)
All inspectors	**388**	**3** (2-5)	**10** (7-13)	**7** (5-10)	**15** (12-18)	**28** (24-32)	**37** (32-41)

Source: GAO survey of FAA inspectors.

Note: The data in this table represents the responses from inspectors to the following question, "To what extent are there opportunities for FAA to offer or contract for technical training, such as recurrency training, closer to your work location *that is currently held at a central location far from your work location*?" For more detail about the estimates and the corresponding confidence intervals (numbers in parentheses), please see the text at the beginning of this appendix. Some of the row percentages will not add up to 100 percent due to rounding. See figure 12 for visual representation.

Scope and Methodology

To assess the extent to which FAA followed effective management practices in planning for, developing, and delivering up-to-date technical training, and ensuring that the technical training for inspectors contributes to improved performance and results, we identified key elements for assessing effective training and development efforts in the federal government using our recent guide on this subject.[1] We identified the elements of this guidance that were most relevant to the training activities at FAA for aviation safety inspectors and then determined the extent to which FAA followed these practices. In determining the extent to which FAA followed a practice, we used the following scale: "fully" indicated that in our judgment all or virtually all aspects of the practice were followed; "mostly" indicated that more than half were followed; "partially" indicated that less than half were followed; and "not followed" indicated that few or no aspects of the practice were followed. For each element, we obtained information from FAA on its plans and activities and compared this information with the published criteria. We discussed this information with FAA training and program officials to gain their perspectives. In addition to gaining an understanding of these plans, and activities generally, we applied the elements in our training guidance to two emerging technologies (glass cockpits and composite materials) and determined how training needs in these areas were incorporated into training courses for FAA inspectors.

We supplemented these activities in several ways to gain additional perspectives of inspector technical training needs and FAA's efforts to meet these needs. First, we collected materials from and interviewed FAA managers, supervisors, and inspectors at 7 of approximately 130 locations across the United States where FAA inspections take place. These efforts illuminated a mix of FAA inspector responsibilities for air carrier and general aviation operations and maintenance, new aircraft certifications, and oversight of manufacturing facilities. Second, we discussed technical training needs and FAA's actions with senior management of the Professional Airways System Specialists, the collective bargaining unit for air safety inspectors. Third, we sought the advice of two sets of experts, one to provide advice on the overall design of our study and a second to help us assess FAA's technical training curriculum and the extent to which FAA ensures that safety inspectors receive needed technical training. (See table 23.) We selected these experts on the basis of their knowledge of FAA safety inspectors and aviation technologies. We also sought the views of 23

[1]GAO-04-546G.

member airlines of the Air Transport Association and the Regional Airline Association on the technical training of inspectors. Fourth, we visited the FAA Training Academy in Oklahoma City, Oklahoma, and Embry-Riddle Aeronautical University in Daytona Beach, Florida, to learn more about how courses are delivered to inspectors. Fifth, we reviewed National Transportation Safety Board recommendations concerning FAA safety inspector technical training. Lastly, we reviewed our studies and those of the Department of Transportation's Inspector General concerning inspector training and human capital issues. (See the Related Products section of this report for a list of our products.)

Table 23: Experts Consulted for Our Work

Design experts	Curriculum experts
Mr. Gary Kiteley, Executive Director, Council on Aviation Accreditation	Mr. Brian Finnegan, President, Professional Aviation Maintenance Association
Mr. Kent Lovelace, Chairman and Professor, Department of Aviation, University of North Dakota	Mr. David Lotterer, Vice President of Technical Services, Regional Airline Association
Dr. Thomas Q. Carney, Professor and Department Head, Department of Aviation Technology, Purdue University	Mr. Basil Barimo, Vice President, Operations and Safety and Mr. Mont J. Smith, Director, Safety; Air Transport Association of America
Mr. Anthony J. Broderick, Independent Aviation Safety Consultant	Mr. David Wright, Director of Training, Aircraft Owners and Pilots Association, Air Safety Foundation
	Mr. Theodore Beneigh, Professor, Aeronautical Science; Mr. Charles Westbrooks, Assistant Professor, Aeronautical Science; Mr. Fred Mirgle, Director, Aviation and Avionics Training; Mr. Neill Fulbright, Associate Program Coordinator, Avionics Line Maintenance; Embry-Riddle Aeronautical University
	Mr. Walter Desrosier, Vice President, Engineering and Maintenance; Mr. Jens Hennig, Manager, Operations; Mr. Gregory Bowles, Manager, Engineering and Maintenance; General Aviation Manufacturers Association
	Dr. Michael Romanowski, Vice President, Civil Aviation and Mr. Ronald R. Baker, Jr., Manager, Civil Aviation Programs; Aerospace Industries Association
	Ms. Sarah MacLeod, Executive Director and Mr. Paul Hawthorne, Vice President, Operations; Aeronautical Repair Station Association

Source: GAO.

To determine the type and amount of technical and other training that FAA inspectors receive, we obtained course descriptions from FAA and data from the Flight Standards training management system database and spreadsheets from Aircraft Certification for fiscal years 2002 through 2004.

FAA officials indicated their belief that a study of inspector technical training should encompass training records over the whole of the inspectors' careers. However, because the Vision 100 – Century of Aviation Reauthorization Act asked us to study up-to-date training on the latest technologies, we analyzed only the most recent 3 fiscal years of data. The data that we obtained included (1) essential and recommended courses by type of inspector; (2) training completed by each inspector; and (3) inspector specialty, location, and date of employment. We then calculated the amount of inspector training completed by course category and by type of inspector. In addition, we used the training records and course requirements to determine the extent to which inspectors have completed essential FAA courses.

To assess the reliability of the training data, we (1) interviewed knowledgeable agency officials about the data, (2) performed electronic testing of relevant data fields for obvious errors in accuracy and completeness, and (3) collected and reviewed documentation from data system managers about the data and the systems that produced them. We determined that the data were sufficiently reliable for the purposes of this report.

To gather information about inspectors' perspectives on the technical training available to them, we conducted a Web-based survey of a representative sample of FAA safety inspectors. The survey asked a combination of questions that allowed for open-ended and close-ended responses. We drew a stratified random probability sample of 496 inspectors from the population of 2,989 aviation safety inspectors across the United States.[2] We stratified the population into 12 groups on the basis of the type of work the inspector performed. Each sample element was subsequently weighted in the analysis to account statistically for all the members of the population.

Because we followed a probability procedure based on random selection, our sample is only one of a large number of samples that we might have drawn. Since each sample could have provided different estimates, we express our confidence in the precision of our particular sample's results as

[2]Our population included only those inspectors who actively participate in inspection activities as part of their regular job duties. It did not include managers, supervisors, or inspectors detailed to headquarters or regional offices. FAA employs a total of approximately 3,700 safety inspectors.

a 95 percent confidence interval (e.g., plus or minus 4.6 percentage points). This is the interval that would contain the actual population value for 95 percent of the samples we could have drawn. As a result, we are 95 percent confident that each of the confidence intervals in this report will include the true values in the study population. The percentage estimates for all survey respondents have a margin of error of plus or minus 4.6 percentage points. However, the percentage estimates for the subgroups are larger with a range of margin of error of plus or minus between 9.7 and 20.0 percentage points. Survey estimates presented as comparisons between groups are statistically significant when the 95 percent confidence intervals do not overlap.

The surveys were conducted using self-administered electronic questionnaires accessible on the Internet through a secure Web browser. We sent e-mail notifications to 496 inspectors, beginning on December 4, 2004. We then sent each potential respondent a unique password and username to ensure that only members of the target population could participate in the survey. The initial version of the questionnaire that was posted on December 4, 2004, did not include three questions. A revised version was posted on December 14, 2004, before most respondents had answered the questionnaire. Because approximately one-quarter of the respondents did not answer these three new questions (questions 9, 20, and 25d), these results are not included in the report. To encourage respondents to complete the questionnaire, we sent a subsequent e-mail message to further prompt each nonrespondent approximately 2 weeks after the initial e-mail message. We sent nonrespondents two more notices and closed the survey on February 4, 2005. Of the 496 inspectors whom we surveyed, we received 392 useable responses (79 percent).

In addition to these sampling errors, the practical difficulties in conducting surveys of this type may introduce other types of errors, commonly referred to as nonsampling errors. For example, questions may be misinterpreted, or the respondents' answers may differ from those of the inspectors who did not respond. We took steps to reduce these errors.

Finally, we pretested the content and format of the questionnaire with safety inspectors at local FAA offices in Baltimore, Los Angeles, and Seattle. During the pretests we asked the inspectors questions to determine whether (1) the survey questions were clear, (2) the terms used were precise, (3) the questionnaire placed an undue burden on the respondents, and (4) the questions were unbiased. We made changes to the content and format of the final questionnaire on the basis of the pretest results.

To determine the amount of training FAA receives from the aviation industry, we analyzed the training records of all FAA safety inspectors. We obtained FAA's course numbering and categorization system and used it to determine whether individual courses were provided by FAA or by the aviation industry. We computed the total number of technical courses attended by FAA inspectors from fiscal years 2002 through 2004 and identified those provided by the aviation industry. We discussed our results with FAA training officials. See the discussion above for our actions to assess the completeness and reliability of these data.

To determine the amount of training safety inspectors received from industry either (1) in return for in-kind services or (2) for free, we reviewed training records and interviewed FAA headquarters officials and regional officials about FAA policies for accepting these types of training. We also asked about procedures used when such training is requested, including steps taken to ensure that any real or apparent conflict-of-interest issues are addressed. FAA does not keep separate records of these two types of training, and these data cannot easily be identified from the central training data files. Therefore, we instead interviewed officials at FAA's nine regional officials and requested these training data from them. Subsequently, we used the safety inspector training records to validate some of these data. We relied on FAA's nine regional office officials to contact over 100 Flight Standards and Air Certification offices to collect these data for fiscal years 2002 through 2004. Some regions indicated that their offices did not keep full records. Other regions provided us with incomplete data records, sometimes without names or specific dates. Because of the large number of offices from which the data were gathered, it was not practical for us to independently verify the completeness or accuracy of these data. As a result, we cannot be sure that the information FAA supplied includes all industry-provided training received for the 3 fiscal years.

GAO Contact and Staff Acknowledgments

GAO Contact

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Acknowledgments

In addition to the contact named above, James Ratzenberger, Assistant Director; Carl Barden; Nancy Boardman; Brad Dubbs; Alice Feldesman; Jim Geibel; Kim Gianopoulos; David Hooper; Michael Krafve; Ed Laughlin; Donna Leiss; Jean McSween; Minette Richardson; and Sandra Sokol made key contributions to this report.

Related GAO Products

FAA Safety Inspector Training

National Aerospace System: Reauthorizing FAA Provides Opportunities and Options to Address Challenges. GAO-03-473T. Washington, D.C.: February 12, 2003.

Major Management Challenges and Program Risks: Department of Transportation. GAO-03-108. Washington, D.C.: January 1, 2003.

Aviation Safety: FAA's New Inspection System Offers Promise, but Problems Need to Be Addressed. GAO/RCED-99-183. Washington, D.C.: June 28, 1999.

Aviation Safety: Weaknesses in Inspection and Enforcement Limit FAA in Identifying and Responding to Risks. GAO/RCED-98-6. Washington, D.C.: February 27, 1998.

Aviation Safety: FAA Oversight of Repair Stations Needs Improvement. GAO/RCED-98-21. Washington, D.C.: October 24, 1997.

Aviation Safety: Targeting and Training of FAA's Safety Inspector Workforce. GAO/T-RCED-96-26. Washington, D.C.: April 30, 1996.

FAA Technical Training. GAO/RCED-94-296R. Washington, D.C.: September 26, 1994.

FAA Budget: Important Challenges Affecting Aviation Safety, Capacity, and Efficiency. GAO/T-RCED-93-33. Washington, D.C.: April 26, 1993.

FAA Budget: Key Issues Need to Be Addressed. GAO/T-RCED-92-51. Washington, D.C.: April 6, 1992.

Aviation Safety: Commuter Airline Safety Would Be Enhanced with Better FAA Oversight. GAO/T-RCED-92-40. Washington, D.C.: March 17, 1992.

Aviation Safety: FAA Needs to More Aggressively Manage Its Inspection Program. GAO/T-RCED-92-25. Washington, D.C.: February 6, 1992.

Aviation Safety: Problems Persist in FAA's Inspection Program. GAO/RCED-92-14. Washington, D.C.: November 20, 1991.

Serious Shortcomings in FAA's Training Program Must Be Remedied. GAO/T-RCED-90-91. Washington, D.C.: June 21, 1990.

Serious Shortcomings in FAA's Training Program Must Be Remedied. GAO/T-RCED-90-86. Washington, D.C.: June 6, 1990.

Staffing, Training, and Funding Issues for FAA's Major Work Forces. GAO/T-RCED-90-42. Washington, D.C.: March 14, 1990.

Aviation Training: FAA Aviation Safety Inspectors Are Not Receiving Needed Training. GAO/RCED-89-168. Washington, D.C.: September 14, 1989.

FAA Training: Continued Improvements Needed in FAA's Controller Field Training Program. GAO/RCED-89-83. Washington, D.C.: March 29, 1989.

FAA Staffing: Recruitment, Hiring, and Initial Training of Safety-Related Personnel. GAO/RCED-88-189. Washington, D.C.: September 2, 1988.

Aviation Safety: Measuring How Safely Individual Airlines Operate. GAO/RCED-88-61. Washington, D.C.: March 18, 1988.

Aviation Safety: Needed Improvements in FAA's Airline Inspection Program Are Underway. GAO/RCED-87-62. Washington, D.C.: May 19, 1987.

FAA Work Force Issues. GAO/T-RCED-87-25. Washington, D.C.: May 7, 1987.

Human Capital

Human Capital: A Guide for Assessing Strategic Training and Development Efforts in the Federal Government. GAO-04-546G. Washington, D.C.: March 1, 2004.

Human Capital: Selected Agencies Experiences and Lessons Learned in Designing Training and Developing Programs. GAO-04-291. Washington, D.C.: January 30, 2004.

Human Capital Management: FAA's Reform Effort Requires a More Strategic Approach. GAO-03-156. Washington, D.C.: February 3, 2003.

A Model of Strategic Human Capital Management. GAO-02-373SP. Washington, D.C.: March 15, 2002.

Human Capital: A Self-Assessment Checklist for Agency Leaders. GAO/OCG-00-14G. Washington, D.C.: September 1, 2000.

Human Capital: Design, Implementation, and Evaluation of Training at Selected Agencies. GAO/T-GGD-00-131. Washington, D.C.: May 18, 2000.

Human Capital: Key Principles From Nine Private Sector Organizations. GAO/GGD-00-28. Washington, D.C.: January 31, 2000.

Related FAA Training

Federal Aviation Administration: Challenges for Transforming into a High-Performing Organization. GAO-04-770T. Washington, D.C.: May 18, 2004.

Aviation Safety: Data Problems Threaten FAA Strides on Safety Analysis System. GAO/AIMD-95-27. Washington, D.C.: February 8, 1995.

Aircraft Certification: New FAA Approach Needed to Meet Challenges of Advanced Technology. GAO/RCED-93-155. Washington, D.C.: September 16, 1993.

Aviation Safety: Progress on FAA Safety Indicators Program Slow and Challenges Remain. GAO/IMTEC-92-57. Washington, D.C.: August 31, 1992.

Aviation Safety: FAA's Safety Inspection Management System Lacks Adequate Oversight. GAO/RCED-90-36. Washington, D.C.: November 13, 1989.

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