NATIONAL PROGRAM REVIEW

Summary Report

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U.S. Department of Transportation
Federal Aviation Administration
Flight Standards Service
National Program Review

U.S. Department
of Transportation

**Federal Aviation
Administration**

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On September 22, 2000, the Federal Aviation Administration (FAA)'s Flight Standards Service concluded reviews of 9 of the nation's 10 largest airlines. The FAA notes that these reviews were unprecedented and went beyond standard regulatory audits to examine the air carriers' overall management oversight systems. The reviews covered the following four broad management programs, which are intended to identify and resolve regulatory compliance and safety concerns in daily air carrier operations: (1) Continuing Analysis and Surveillance System, (2) Reliability Program, (3) Internal Evaluation Program, and (4) Safety Program. The FAA's objective in conducting these reviews was to establish the effectiveness of these internal programs.

As a result of these reviews, the FAA identified best practices in the industry and opportunities for program enhancements and improvements. The areas described in this report that need further action are being addressed already by the air carriers and their Certificate Management Teams, and in most cases corrective action has been completed. The FAA further notes that many of the air carriers already have begun making significant improvements in their safety management programs based on the results of this review.

The FAA identified the best practices in the industry in each program and developed four model programs. It is the intent of the FAA to make the features of the finest programs available to all air carriers through FAA advisory material developed in collaboration with the air carriers.

The Administrator's major initiative, "Safer Skies," embodies the FAA's philosophy and mission and is designed to bring about a fivefold reduction in fatal accidents. These reviews complement the Safer Skies initiative and the Administrator's overall strategic plan to steadily improve aviation safety and deliver the benefits to the American public.

Sincerely,

L. Nicholas Lacey
Director, Flight Standards Service

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LIST OF ACRONYMS/ABBREVIATIONS

Air Carriers:	Alaska	Alaska Airlines, Inc.
	America West	America West Airlines, Inc.
	American	American Airlines, Inc.
	Continental	Continental Airlines, Inc.
	Delta	Delta Air Lines, Inc.
	Northwest	Northwest Airlines, Inc.
	Southwest	Southwest Airlines Company
	TWA	Trans World Airlines, Inc.
	United	United Airlines, Inc.
	US Airways	US Airways, Inc.

AC	Advisory Circular
ACAP	AFS Certificate Audit Program
AFS–40	Flight Standards System Process Audit Group
AFS–300	Continuous Airworthiness Maintenance Division
ASAP	Aviation Safety Action Program
ASQ	American Society for Quality
ASRP	Aviation Safety Reporting Program
ATA	Air Transport Association
ATOS	Air Transportation Oversight System
CAA	Civil Aviation Authority
CASE	Coordinating Agencies for Suppliers Evaluation
CASS	Continuing Analysis and Surveillance System
CDL	Configuration Deviation List
CFT	Corporate Flight Time
CMO	Certificate Management Office
CMT	Certificate Management Team
CSET	Certification, Standardization, and Evaluation Team
DOD	Department of Defense
DOT	Department of Transportation
EPI	Element Performance Inspection

ETOPS	Extended Range Operation with Two-Engine Airplanes
FAA	Federal Aviation Administration
FOQA	Flight Operational Quality Assurance
14 CFR	Title 14, Code of Federal Regulations
FSAIC	Flight Standards Safety Analysis Information Center
HBAT	Flight Standards Handbook Bulletin for Air Transportation
HBAW	Flight Standards Handbook Bulletin for Airworthiness
IEP	Internal Evaluation Program
ISO	International Organization for Standardization
MEL	Minimum Equipment List
MIS	Mechanical Interruption Summaries
MLG	Main Landing Gear
ODI	Operational Difficulty Index
PMI	Principal Maintenance Inspector
QSMG	Quality System Management Group
RACAP	Regional AFS Certificate Audit Program
RCB	Reliability Control Board
SAI	Safety Attribute Inspection
SCEPTRE	System for Computerizing Economical Performance, Tracking, Recording, and Evaluation
SDR	Service Difficulty Report
TSO	Time Share Options
VTO	Volumetric Top Off

EXECUTIVE SUMMARY

The Federal Aviation Administration (FAA) conducted a National Program Review of 9 of the 10 largest Title 14, Code of Federal Regulations (14 CFR) part 121 air carriers from July 17, 2000, through September 22, 2000. In addition to conducting a standard regulatory inspection, the review teams took an unprecedented look at the air carriers' overall management oversight systems and focused on individual air carrier initiatives and innovations. Specifically, the FAA evaluated the effectiveness of the following four air carrier safety management programs: Continuing Analysis and Surveillance System (CASS), Reliability Program, Internal Evaluation Program (IEP), and Safety Program. CASS is the only one of these four programs required by FAA regulations.

The reviews were conducted by three teams in three rounds. To ensure standardized results, the review teams were kept primarily intact from one review to the next. The review teams used job aids designed specifically for this review. To complete the job aids, the review teams conducted in-depth reviews of each air carrier's documents, interviewed numerous personnel, and reviewed relevant records.

As a result of the daily out-briefings, most of the air carriers had corrective action plans in place for any deficiencies noted before the review teams departed. The FAA notes that, at the conclusion of this review, the air carriers and their Certificate Management Teams (CMTs) were informed of the findings, and have developed action plans that are being implemented. Furthermore, the FAA found that the four safety management programs and their FAA guidance material require continual improvements. As a result, the FAA is reviewing its current advisory material for the CASS and Reliability Programs, and will make revisions as necessary. The FAA encourages a greater sharing of safety-related data among the air carriers in an effort to identify new areas in which the air carriers can focus their efforts.

The FAA found that, overall, the four safety management programs are effective; taken together, these programs for all nine air carriers generate thousands of operational improvements each year. The agency found that when the airlines have programs with written procedures in place, they usually follow them. However, the FAA did find that the airlines could do a better job of documenting procedures for many of their programs. Currently, many airlines depend on informal procedures based on corporate knowledge. The review showed that trend and root cause analysis, as well as the analysis performed before taking corrective action, could be more consistent. Specifically, the frequency of CASS audits should be increased, and airlines could do a better job of meeting their scheduled audit due dates. The airlines' Reliability Programs indicate a greater fragmentation in policy and procedure than any of the other programs. These programs could also be significantly improved with better statistical methodologies and an increased sharing of data between manufacturers and operators. The FAA would like to see the airlines incorporate operations and maintenance into one IEP and run Safety Programs that cover both operations and maintenance, with operations information being fed back into maintenance. The FAA identified airline-specific issues that either were corrected immediately or are being addressed through corrective action plans approved by the agency.

The FAA encourages the air carriers to raise the level of safety in the industry without additional regulations. Therefore, this report includes four model programs the FAA developed based on the job aids and the results of the review. Each of the model programs depicts one way, but not the only way, for an air carrier to set up its program. The FAA notes that the model programs are intended as a starting point for a collaborative FAA/industry effort to develop and implement changes to these programs.

I. INTRODUCTION

BACKGROUND

On January 31, 2000, Alaska Airlines, Inc. (Alaska), flight 261, a Boeing MD–83 (registration No. N963AS), was on a regularly scheduled international passenger flight from Puerto Vallarta, Mexico, to San Francisco, California, when it crashed into the Pacific Ocean near Point Mugu, California. The Federal Aviation Administration (FAA) conducted a special inspection of Alaska's Maintenance Program following the crash that revealed weaknesses in Alaska's air carrier safety management programs. Specifically, the inspection revealed that the authority and responsibility of Alaska's personnel were not well defined; that Alaska's maintenance personnel were not following the procedures in the company manuals; that items were being deferred without using the approved minimum equipment list (MEL)/configuration deviation list (CDL); that adequate controls were not in place to ensure items were being tested to proper standards; and that Alaska's quality control and quality assurance programs were ineffective. At the conclusion of the inspection, the FAA required Alaska to develop an action plan. As a result, Alaska submitted an Airworthiness and Operations Action Plan that identified actions to address the FAA's concerns. Alaska also implemented interim and long-term measures to ensure that its Maintenance Program meets or exceeds all FAA regulations and that all airplanes released from heavy maintenance checks are safe and airworthy with all maintenance properly documented. The FAA accepted Alaska's action plan.

PURPOSE

The FAA questioned how these systemic problems in Alaska's Maintenance Program could go undetected by the FAA and its surveillance program. Therefore, the FAA launched the National Program Review to evaluate the air carrier safety management programs at the other nine major Title 14, Code of Federal Regulations (14 CFR) part 121 air carriers. The review was designed to verify that similar problems do not exist at other air carriers and to evaluate the overall effectiveness of their safety management programs. According to L. Nicholas Lacey, Director of the FAA's Flight Standards Service, the FAA thought "it would be prudent to go back and evaluate how the other major airlines are doing in these same areas." Mr. Lacey added that the review "is not going to be a measure of the state of the industry" but rather will provide the FAA with a sense of whether rulemaking needs to be undertaken or the surveillance program needs to be adjusted.

These reviews are in line with "Safer Skies," a major FAA safety initiative designed to bring about a fivefold reduction in fatal accidents. Under the Safer Skies initiative, the FAA will concentrate its resources on the most prevalent causes of aircraft accidents and use special teams of technical experts to recommend safety advances.

II. SCOPE OF THE REVIEW

The FAA's certification and surveillance oversight system uses safety principles and systematic processes to ensure that air carriers are in compliance with 14 CFR and have safety built into their operating systems. This system provides the FAA with a process for conducting surveillance, identifying and dealing with risks, and providing data and analysis to guide the oversight of each air carrier. This certification and surveillance oversight system currently is being applied to the following 10 part 121 air carriers:

- Alaska Airlines, Inc. (Alaska)
- American Airlines, Inc. (American)
- America West Airlines, Inc. (America West)
- Continental Airlines, Inc. (Continental)
- Delta Air Lines, Inc. (Delta)
- Northwest Airlines, Inc. (Northwest)
- Southwest Airlines Company (Southwest)
- Trans World Airlines, Inc. (TWA)
- United Airlines, Inc. (United)
- US Airways, Inc. (US Airways)

AIRLINES

This initial review was performed on all of the above airlines except Alaska.

AREAS

The FAA chose to evaluate the following four safety management programs during this review:

- Continuing Analysis and Surveillance System (CASS),
- Reliability Program,
- Internal Evaluation Program (IEP), and
- Safety Program.

Although each program has a different focus, they all use a similar methodology to enable air carriers to identify and resolve issues proactively before the issues become operational problems. The overall effect of the four programs working in concert is to provide a safety net for continuous improvements and efficiencies in industry systems.

Continuing Analysis and Surveillance System. Each part 121 air carrier is required by 14 CFR § 121.373 to establish and maintain a system for the continuing analysis and surveillance of the performance and effectiveness of its inspection program(s) and the program covering other maintenance, preventive maintenance, and alterations, and for the correction of any deficiencies in these programs through a continuous process of data collection, analysis, and change.

Under CASS, the air carriers are to establish a quality assurance or internal audit function that provides for a continuous audit of each air carrier's total maintenance system to ensure compliance with 14 CFR and the operator's manuals, and provides timely corrective action for any deficiencies noted.

Reliability Program. Air carriers are **not** required by 14 CFR to have a Reliability Program; a Reliability Program is only necessary if an air carrier intends to change its maintenance intervals. An air carrier's Reliability Program is approved through the air carrier's operations specifications, which identify whether the Reliability Program applies to the airframe, engines, components, or entire aircraft. Once an air carrier's Reliability Program is on its operations specifications, **it becomes a regulatory requirement.** With an approved Reliability Program, an air carrier can adjust its maintenance, inspection, or overhaul intervals without receiving prior FAA approval. Typical Reliability Programs use the following systems: (1) data collection, (2) data analysis, (3) corrective action, (4) performance standards, (5) data display and report, (6) maintenance interval adjustment and process change, and (7) program revision.

Internal Evaluation Program. Air carriers are **not** required by 14 CFR to have IEPs; however, the FAA encourages air carriers to develop IEPs to assist them in the continual monitoring and evaluation of their practices and procedures to improve system effectiveness. An IEP is an independent, continual process that uses audits to identify any deficiencies in an air carrier's programs and systems, develop corrective action plans, and perform follow-up evaluations. An IEP benefits both the air carrier and the flying public.

Safety Program. Section 119.65 of 14 CFR requires all part 121 air carriers to have a Director of Safety who is responsible for keeping the highest management fully informed about the safety status of the entire operation. However, air carriers are **not** required by 14 CFR to have Safety Programs. The FAA has advisory material on Safety Programs and encourages air carriers to develop Safety Programs, which will benefit both the air carrier and the flying public. Each air carrier's Safety Department should address the broad range of risks involved in commercial aviation and include, but not be limited to, operations, maintenance, and ground safety. The primary objectives of a Safety Program are to motivate safe actions through the establishment of a dynamic corporate safety culture; to identify safety hazards; to work with other company departments to develop and implement safety interventions; to monitor intervention strategies to validate their effectiveness; and to communicate the results throughout the air carrier. Flight Standards Handbook Bulletin for Air Transportation (HBAT) 99–19 recommends that an air carrier's Safety Program include the following elements: a safety incident/accident reporting system; accident/incident investigation; safety audits and inspections; an IEP; an operational risk assessment program; open reporting systems; routine monitoring and trend analysis programs; a review of external evaluation programs; and a safety committee or committees.

TIME PERIOD

The National Program Review began on July 17, 2000, and was completed in 66 days. The FAA determined that to standardize the individual reviews, they would have to be conducted in three rounds, with three air carriers reviewed during each round.

The reviews were conducted as follows:

Table 1 – Review Schedule

Dates	Airlines
July 17, 2000, through July 28, 2000	America West Continental United
August 22, 2000, through September 1, 2000	Delta Northwest TWA
September 11, 2000, through September 22, 2000	American Southwest US Airways

III. PROJECT ORGANIZATION

The FAA used the prototype AFS Certificate Audit Program (ACAP) format, which stresses smaller teams performing audits of relatively short duration, for the National Program Review. The prototype ACAP format also calls for open communication between the audit team, the air carrier, and the air carrier's Certificate Management Office (CMO). The objective is to concentrate on a safety dialogue between the air carrier and the FAA. The overall goal is the correction of any discrepancies found during the audit.

TEAMS

Twenty-five individuals were selected to conduct the three rounds of reviews. The 25 team members have a total of approximately 522 years of industry and FAA aviation experience, with an average of 28 years of individual aviation experience, and have worked an average of 13 years for the FAA.

Each review team included at least two individuals from the Flight Standards System Process Audit Group (AFS–40), one of whom was the team leader; at least two individuals from the Certification, Standardization, and Evaluation Team (CSET); and at least one Principal Maintenance Inspector (PMI) from one of the nine air carriers. To ensure standardized results, each review team was kept primarily intact from one review to the next, with the exception of the PMI. A different PMI was used on each review and the PMIs did not review the air carriers they are assigned. Additionally, each team member underwent two days of training, including a comprehensive review of the purpose and structure of the review and the job aids to be used during the review, before conducting the reviews.

JOB AIDS

General

The review was conducted using job aids designed specifically for use during the National Program Review. (See appendixes 1, 2, 3, and 4 for the CASS, Reliability Program, IEP, and Safety Program job aids, respectively, used during the review.) A criteria development group was convened for 1 week to develop four job aids appropriate to the areas to be reviewed. The development group consisted of individuals from AFS–40, the Continuous Airworthiness Maintenance Division (AFS–300), CSET, and the Flight Standards Safety Analysis Information Center (FSAIC). The group reviewed all available guidance materials, including the surveillance tools, applicable Advisory Circulars (ACs); FAA Order 8300.10, Airworthiness Inspectors' Handbook; FAA Order 8400.10, Air Transportation Operations Inspectors Handbook; Flight Standards Handbook Bulletins for Air Transportation (HBAT) and Airworthiness (HBAW); training course materials; and industry information. The new job aids were created using areas that were consistently mentioned in the guidance material, and are divided into four basic areas: attributes, measures, interfaces, and products.

Attributes

The attributes of each job aid are the significant elements that should be covered in each program, and are listed in Table 2. (See appendix 5 for a sample.) For each program attribute, the job aids include a set of "system" questions and corresponding "process" questions. (See appendix 5 for a sample.)

Table 2 – Program Attributes

CASS	Reliability	IEP	Safety
Defined Responsibility	Program Application	Responsibility	Overall
Authority	Organizational Structure	Authority	Senior Management Commitment
Guidance	Data Collection	Guidance	Establishment of Safety Action Group
Establish CASS Program Action Group	Controls	Independent Responsibility	Hazard Identification and Risk Management
Independent Responsibility	Performance Standards	Top Management Review	Ongoing Hazard Reporting Systems
Top Management Review	Data Display and Reporting	Continual Process	Positive Safety Culture
Schedule	Corrective Action Programs	Schedule	Schedule
Corrective Action Plans	Interval Adjustment and Process Change	Corrective Action Plans	Corrective Action Plan
Analysis	Program Revision	Analysis	Regular Evaluation
Records	Evaluation of Inspection	Records	Emergency Response Plan
Training		Training	
Resources		Resources	

System Questions. The system questions, answered "yes" or "no," are designed to allow the team to establish whether the air carrier has a documented policy, process, or procedure in place for each of the attributes. To answer the system questions, the team members review relevant manuals.

Process Questions. The process questions, answered with a rating of 1 to 5 as defined in Table 3, permit the team to determine whether the air carrier is following its policies, processes, and procedures, if they exist, and to what extent. The process question numerical rating is a qualitative rating that relates solely to the observation made in that assessed area during that review. To answer the process questions, the team members interview the personnel associated with the programs and review relevant manuals.

Table 3 – Rating with Description

Rating	Rating Description
1	Almost never
2	Seldom
3	Occasionally
4	Usually
5	Almost always

Measures

The measurement questions are designed to gather specific information on the program for a period of 6 months or 2 years, depending on the question. (See appendix 5 for a sample.) The measurement questions are answered by the team through interviews, document review, and data collection.

Interfaces

The interface question permits the team to list the different organizations within the air carrier with which each program interfaces. (See appendix 5 for a sample.) To answer the interface question, the team interviews appropriate personnel and reviews appropriate documents.

Products

The product questions are designed to target the quality of the air carrier's products for the last 2 years. (See appendix 5 for a sample.) To answer the product questions, the team interviews appropriate personnel and reviews appropriate documents.

Validation

The resulting four job aids were validated before the reviews began by the nine air carriers' PMIs, by subject matter experts, and by the Eastern Region Technical Branch. The PMIs and CSET inspectors used the job aids during their 2-day training session. The review concept and the job aids were also tested at an existing part 121 air carrier following the initial 2-day training session. As a result, the job aids underwent numerous revisions before they were used in the reviews. Furthermore, AFS–40 appointed job aid managers to ensure the job aids remained current and were revised as necessary.

The four job aids were released to the Air Transport Association (ATA) before the first review began. ATA then released the job aids to its member air carriers, which used the job aids to assess their programs independently before the FAA review began. The FAA notes that while this initial release generated a great deal of pre-review activity, this activity was seen as beneficial to all parties and the FAA is confident the overall results were not greatly influenced.

At the completion of the nine reviews, the FAA found that the job aids effectively measured the four air carrier safety management programs.

METHODOLOGY

To accomplish the reviews in the time allotted, the FAA review teams received and reviewed each air carrier's manuals before the review began. After arriving at the air carrier's location, each review team conducted an in-briefing with the air carrier and the air carrier's Certificate Management Office (CMO). The review team described the review procedures and the areas to be examined and assured the air carrier it would immediately inform the air carrier of any regulatory findings. The review team broke into smaller teams to evaluate the four programs individually. To complete the job aids, the review team members conducted an in-depth review of the company's documents, interviewed numerous personnel involved in the program, and reviewed relevant records. The review team conducted a daily out-briefing with the air carrier and its CMO to discuss the day's findings. At the completion of the review, the review team conducted an out-briefing with the air carrier and its CMO to inform them of the team's findings.

IV. FINDINGS

The FAA found that, essentially, the air carriers' four safety management programs were effective. The FAA notes that the four programs overlap and offer the air carriers redundancies that permit them to employ a continuous safety net. The FAA also found that no two air carriers performed exactly alike and that each air carrier prioritized its individual programs differently.

During the review, in an effort to improve the four air carrier safety management programs, the review teams identified potential best practices for each of the four programs at each of the air carriers. However, the reviews also revealed that there are areas that require further action.

As a result of the daily out-briefings, most of the air carriers had corrective action plans in place for any identified deficiencies before the review teams departed. Furthermore, in most cases, specific corrective actions have been completed, and many air carriers have begun making substantial changes to their programs based on the results of the review.

OVERALL FINDINGS

The FAA found that for CASS and the Reliability and Safety Programs, the air carriers generally have policies, processes, or procedures in place for over one-half of the job aid system questions. For the IEP, the air carriers have policies, processes, or procedures in place for approximately one-quarter of the job aid system questions.

The review teams found that all nine air carriers have policies, processes, or procedures in place for each program in the following areas:

Continuing Analysis and Surveillance System

Table 4 – CASS Findings

Attribute	Findings
Defined Responsibility	—
Authority	The air carriers have individuals identified who have the authority to establish and modify their policies and procedures.
Guidance	The air carriers have defined the frequency of their audits and the areas to be audited. The air carriers also have guidelines established for responses to findings.
Establish CASS Program Action Group	The air carriers have defined processes to perform internal and external audits. In addition, the air carriers have written processes to document and forward findings to the appropriate departments for corrective actions.

Attribute	Findings
Independent Responsibility	The air carriers have CASS Program Managers and their organizational charts indicate to whom the CASS Program Manager reports.
Top Management Review	—
Schedule	—
Corrective Action Plans	—
Analysis	—
Records	The air carriers' CASS processes include a provision to maintain files on all accomplished audits.
Training	—
Resources	—

Reliability Program

Table 5 – Reliability Program Findings

Attribute	Findings
Program Application	The air carriers' reliability documents define the components and systems controlled by their Reliability Programs or identify that the entire aircraft is controlled.
Organizational Structure	—
Data Collection	The air carriers have forms for collecting operational data.
Controls	—
Performance Standards	The air carriers have procedures to reevaluate their performance standards periodically.
Data Display and Reporting	—
Corrective Action Programs	—
Interval Adjustment and Process Change	The air carriers have documented procedures for changing their Maintenance Programs.

Attribute	Findings
Program Revision	The air carriers have procedures for making program revisions.
Evaluation of Inspection	The air carriers have documented methods for determining whether there have been increases in aircraft delays and cancellations and in engine shutdown rates.

Internal Evaluation Program

Table 6 – IEP Findings

Attribute	Findings
Responsibility	The air carriers have established IEPs (although not all are in effect).
Authority	—
Guidance	The IEPs define the areas to be audited and unique terms.
Independent Responsibility	The air carriers have management representatives who are responsible for ensuring the IEP is properly maintained.
Top Management Review	The air carriers' organizational charts depict the IEP management's involvement in the program.
Continual Process	—
Schedule	—
Corrective Action Plans	—
Analysis	—
Records	—
Training	—
Resources	—

Safety Program

Table 7 – Safety Program Findings

Attribute	Findings
Overall	The air carriers' Directors of Safety are responsible for ensuring the Safety Program is properly established and maintained.
Senior Management Commitment	The manager of the air carriers' Safety Programs reports directly to top management.
Establishment of Safety Action Group	The air carriers have procedures to solicit and process safety improvement suggestions.
Hazard Identification and Risk Management	There are written procedures for the air carriers to investigate and report on company events such as incidents and mishaps.
Ongoing Hazard Reporting Systems	—
Positive Safety Culture	—
Schedule	—
Corrective Action Plan	—
Regular Evaluation	—
Emergency Response Plan	The air carriers have emergency response plans documented in their manuals.

BEST PRACTICES

In an effort to improve the overall effectiveness of the air carriers' safety management programs, the review teams identified the best practices at each air carrier for each program reviewed. Only by sharing these best practices can each air carrier improve its programs and achieve an overall greater level of safety without further regulation. The best practices for each program attribute were selected from the job aids based on the following criteria:

- The air carrier had a documented policy, process, or procedure;
- The air carrier almost always followed its documented policy, process, or procedure; and
- The review team commented that the policy, process, or procedure contributed to the program's success.

Table 8 – CASS Best Practices

Attribute	Air Carrier	Best Practice
Defined Responsibility	Delta Southwest	The duties and responsibilities of CASS personnel are clearly defined in these air carriers' manuals and match the individual job descriptions.
Authority	American TWA	These air carriers have a clearly identified individual with the authority to make changes to the CASS. Both air carriers' programs require this person's signoff to indicate approval of any change.
Guidance	—	—
CASS Program Action Group	—	—
Independent Responsibility	Delta Northwest Southwest	A person is clearly identified at these air carriers as having responsibility for the CASS; this person is at a management level above the departments being audited.
Top Management Review	—	—
Schedule	Delta Northwest	These air carriers have an automated system to plan audits. The audit schedules contain audit due dates, and both air carriers are able to track overdue audits. Furthermore, both air carriers have procedures in place that define the requirements for follow-up activities. The review teams found that neither air carrier had overdue audits. In addition, Delta has a process to identify and schedule special audits.
Corrective Action Plans	Continental Delta Southwest TWA	These air carriers have formal systems in place to ensure audits are not closed until all findings are answered in an acceptable manner. In addition, they have procedures in place to identify and track required follow-up actions.
Analysis	Delta	This air carrier has documented procedures for the identification of root causes, and the root causes of discrepancies are identified and corrected to prevent recurrence. The air carrier also conducts trend analysis of discrepancies.

Attribute	Air Carrier	Best Practice
Records	American Delta Northwest TWA US Airways	These air carriers have documented procedures for maintaining files. The review team found that their files were complete and well-organized, and that all accomplished audits were filed.
Training	Delta	This air carrier's Quality Systems Management Group personnel receive International Organization for Standardization (ISO) 9000 Auditor and Lead Auditor, American Society for Quality (ASQ), Six Sigma, and Coordinating Agencies for Suppliers Evaluation (CASE) Auditor training. Each auditor receives 999 hours of on-the-job training in quality auditing, project management, problem analysis, and other related skills, and is required to complete recurrent training to maintain his or her certifications.
Resources	—	—

Reliability Program

Table 9 – Reliability Program Best Practices

Attribute	Air Carrier	Best Practice
Program Application	Delta Northwest Southwest US Airways	These air carriers' philosophies toward reliability control are clearly documented and followed. The air carriers' reliability documents define the components of the aircraft controlled by their programs.
Organizational Structure	—	—
Data Collection	Northwest	This air carrier has several methods to ensure operational data are accurate, complete, and current. For example, the Records Department has an alerting process built into its computer system. Random samples confirmed the data quality control was excellent.

Attribute	Air Carrier	Best Practice
Controls	Northwest	This air carrier has an automated component-alerting program that informs shop personnel of the history and reliability of components. The Reliability Control Department produces a "weekly report," which shows the most significant events for the preceding week and includes a ranked hazard matrix.
Performance Standards	—	—
Data Display and Reporting	Northwest United US Airways	These air carriers have reliability systems that display the performance standards and the alerting values. Their reliability documents include a process to address repeat alerts. In addition, these air carriers produce special reports for identifying chronic problems. Northwest has the highest frequency of reliability meetings: weekly, monthly, quarterly, and yearly.
Corrective Action Programs	Northwest	This air carrier uses Level Logic, voting sheets, and implementation forms to control routing and show accountability for corrective actions. The Fleet Reliability Manager assigns a "champion" to the top index subjects for root cause analysis and corrective action determination.
Interval Adjustment and Process Change	—	—
Program Revision	—	—
Evaluation of Inspection	Northwest	This air carrier issues numerous reports that compare historical performance to present conditions in the following areas: delays, cancellations, premature component removal rates, engine shutdown rates, deferred maintenance items, and pilot reports.

Table 10 – IEP Best Practices

Attribute	Air Carrier	Best Practice
Responsibility	America West	This air carrier has a comprehensive list of duties and responsibilities documented in its manual.
Authority	—	—
Guidance	America West	This air carrier continuously reviews its programs and targets resources to risks as a means of providing ongoing oversight of the defined areas. The system is based on system safety concepts and uses trend analysis.
Independent Responsibility	Southwest TWA	The individual responsible for the IEP at these air carriers reports directly to the President and Chief Executive Officer.
Top Management Review	—	—
Continual Process	—	—
Schedule	—	—
Corrective Action Plans	America West	This air carrier's IEP Manager briefs the Chief Operating Officer monthly on any open findings until they are closed in an acceptable manner.
Analysis	—	—
Records	—	—
Training	—	—
Resources	—	—

Safety Program

Table 11 – Safety Program Best Practices

Attribute	Air Carrier	Best Practice
Overall	—	—
Senior Management Commitment	US Airways	This air carrier briefs its President/Chief Executive Officer weekly on Safety Program issues.
Establishment of a Safety Action Group	American	This air carrier has established the following safety action groups: Joint Safety Committee, Accident Prevention Council, Injury/Illness Prevention Program, Station Safety Program, Aviation Safety Action Program (ASAP) Event Review Teams, and Injury Reduction Task Force. All the safety action groups are active, as verified by the minutes of their meetings.
Hazard Identification and Risk Management	US Airways	This air carrier conducts hazard identification, root cause analysis, and risk analysis across all company lines to resolve issues.
Ongoing Hazard Reporting Systems	—	—
Positive Safety Culture	US Airways	This air carrier's "Safety Online" magazine was voted the best aviation safety publication by the Flight Safety Foundation.
Schedule	—	—
Corrective Action Plan	US Airways	This air carrier always identifies root causes, even for isolated problems.
Regular Evaluation	—	—
Emergency Response Plan	Northwest	This air carrier has a well-staffed Emergency Response Department. The air carrier provided examples to the review team of the use and practice of its guidance and emergency plans. The review team found that the scenarios conducted by the air carrier were thorough and comprehensive.

AREAS FOR ACTION

Overall, the review teams noted that there is a lack of written procedures for the air carriers' four programs, although in many instances each air carrier's manuals contain policies. Many of the air carriers' programs depend on informal, unwritten procedures based on individuals' corporate knowledge. However, the review teams noted that despite the lack of written procedures, the air carriers are carrying out their programs using their unwritten procedures. Appendix 6 of this report contains model programs that include a list of FAA guidance material for each program.

Continuing Analysis and Surveillance System

The FAA found that some of the air carriers' audit frequencies are not adequate and the air carriers are not meeting their schedule of audit due dates. The team noted there generally is little or no analysis of findings to determine root causes and there are no procedures to ensure the root cause of each discrepancy is corrected to prevent recurrence. Furthermore, trend analysis of discrepancies is not accomplished consistently. Finally, the teams noted that air carriers are accepting inadequate corrective action plans and are not performing follow-up inspections. The review team noted that the following areas need further action:

Table 12 – CASS Areas Requiring Further Action

Attribute	Areas Requiring Further Action
Defined Responsibility	The duties and responsibilities of the personnel involved in the CASS should be defined in each air carrier's manual.
Authority	—
Guidance	—
Establish CASS Program Action Group	The CASS manual should contain written procedures for corrective action plans and timelines to be developed when deficiencies cannot be resolved quickly. In addition, each air carrier should have a process to schedule follow-up audits to verify the elimination of systemic problems and ensure corrective actions plans are effective.
Independent Responsibility	—
Top Management Review	Each air carrier should develop procedures for top management to review, and document its review of, the CASS and its products.

Attribute	Areas Requiring Further Action
Schedule	The CASS formal schedule should define the requirement for follow-up activities. Each air carrier should have written procedures to identify and accomplish overdue audits. In addition, each air carrier should have a documented process to schedule special audits.
Corrective Action Plans	—
Analysis	Each air carrier should have written procedures for (1) the analysis of findings to determine the root cause of each discrepancy, and (2) the use of audit summaries to conduct trend analysis on discrepancies. In addition, each air carrier should provide management with reports adequate for decisionmaking.
Records	—
Training	—
Resources	Procedures should be included in the CASS manual to enable each air carrier to measure the effectiveness of the quality of its system.

Reliability Program

Overall, the review teams noted that the air carriers' Reliability Programs have fragmented policies and procedures. The air carriers are not consistently conducting trend analysis or further analysis for corrective actions. The FAA identified the following specific areas as needing further action:

Table 13 – Reliability Program Areas Requiring Further Action

Attribute	Areas Requiring Further Action
Program Application	—
Organizational Structure	—
Data Collection	Each air carrier should have documented methods to route data in a timely manner to the proper organizational element for review.

Attribute	Areas Requiring Further Action
Controls	Each air carrier should have documented methods for determining whether the analysis of alert rates has been accomplished in accordance with its Reliability Program. Further analysis should be conducted consistently to determine root causes, and the procedures for root cause analysis should be documented. Furthermore, each air carrier should have documented methods for ensuring changes in operating procedures or techniques take place appropriate to the trend or level of reliability experienced. The reliability documents should include documented methods for determining whether performance standards were revised by the specified personnel.
Performance Standards	—
Data Display and Reporting	—
Corrective Action Programs	Each air carrier should have documented methods for assigning time limits for completion of corrective action. Procedures to assign personnel to find the cause of all areas identified that exceed performance standards should be documented.
Interval Adjustment and Process Change	Each air carrier should have documented methods for (1) ensuring all different aircraft types and models in which a unit or component can be installed were evaluated before internal adjustments are made, and (2) establishing initial performance standards when adding new types of aircraft.
Program Revision	—
Evaluation of Inspection	Each air carrier should have documented methods for evaluating how well its Reliability Program controls its Maintenance Program.

Internal Evaluation Program

The review teams noted that the air carriers need to establish IEPs that incorporate operations and maintenance into one program. The review teams found that resources are not allocated to the IEPs because it is not a regulatory requirement. Specifically, the review teams noted that the following areas need further action:

Table 14 – IEP Areas Requiring Further Action

Attribute	Areas Requiring Further Action
Responsibility	Each air carrier should define its auditor qualifications.
Authority	—
Guidance	Policies and procedures for modification of the IEP should be defined. Written procedures for document revision control should be included in company manuals. Each air carrier should define specific audit objectives and audit frequencies. Procedures to provide ongoing oversight of defined audit areas should be defined. Each air carrier should have written procedures or processes for documenting findings and developing corrective action plans and timelines when deficiencies cannot be resolved quickly. In addition, each air carrier should have written procedures to schedule follow-up audits to verify the elimination of deep-rooted problems, and the follow-up audits should be scheduled.
Independent Responsibility	—
Top Management Review	Each air carrier should have procedures for top management to document its review of the IEP and its products.
Continual Process	Each air carrier should have a procedure to schedule audits and reviews of time-sensitive areas on a continual basis rather than a one-time, annual schedule.
Schedule	The IEP formal schedule should outline all areas to be audited, audit due dates, and required follow-up activities. In addition, each air carrier should have written procedures to identify overdue audits.

Attribute	Areas Requiring Further Action
Corrective Action Plans	Each air carrier should have a system to track audit accomplishments, monitor discrepancies, and highlight necessary follow-up actions. In addition, each air carrier should have defined procedures to identify overdue audit responses and ensure audits are not closed until all findings are answered acceptably.
Analysis	Each air carrier should have written procedures for the analysis of findings to determine root causes and to ensure the root cause of each discrepancy is corrected to prevent recurrence. Furthermore, each air carrier should have a requirement that audit summaries be used to conduct trend analysis of discrepancies.
Records	Each air carrier should have written processes to maintain files on all accomplished audits that include the most recently completed report, the previous audit report, the audit checklist used during the audit with the findings identified, and documentation of any deficiencies.
Training	Each air carrier should have documented formal training programs for its IEP auditors that include on-the-job and recurrent training. The training program also should contain the duties and responsibilities of IEP personnel. IEP auditor training should be documented.
Resources	Each air carrier should have a policy that identifies how to obtain and maintain adequate resources for the IEP. Each air carrier should identify a budget for its IEP.

Safety Program

The FAA found that the air carriers have Safety Programs primarily for operations, and, if they have a Safety Program for maintenance, the two programs are not integrated. In addition, it was noted that there is little or no effective communication between operations and maintenance, and the information collected by the Safety Program is not shared throughout each company.

Table 15 – Safety Program Areas Requiring Further Action

Attribute	Areas Requiring Further Action
Overall	—
Senior Management Commitment	—

Attribute	Areas Requiring Further Action
Establishment of Safety Action Group	—
Hazard Identification and Risk Management	There should be procedures that encourage the review of the following: Aviation Safety Reporting Program (ASRP) data; ASAP data; service difficulty reports (SDRs); Mechanical Interruption Summaries (MIS) data; safety audit and inspection data; and Flight Operational Quality Assurance (FOQA) data. Each air carrier also should ensure that these data are reviewed and integrated appropriately into its Safety Program(s).
Ongoing Hazard Reporting Systems	—
Positive Safety Culture	—
Schedule	—
Corrective Action Plan	—
Regular Evaluation	—
Emergency Response Plan	Each air carrier should have written document control procedures.

MEASURES

The FAA gathered specific data on each of the four programs over a specific timeframe to measure the level of activity of each of the programs. The data indicate that all nine air carriers, taken together, make approximately 7,000 operational improvements in their programs in a year.

Continuing Analysis and Surveillance System

The review team collected data on the air carriers' CASS reports for the last 2 years, if the data were available. The FAA notes that the air carriers conduct their audits at different frequencies and audit different areas. Furthermore, not all air carriers were able to provide 2 years of data for the number of schedule-driven and event-driven audits. Generally, for a 2-year period, 7 air carriers conducted an average of 544 schedule-driven audits and 6 air carriers conducted an average of 257 event-driven audits.

The FAA also gathered data on the number of open findings, open action plans, and closed action plans the air carriers had for a 6-month period. The FAA notes that the data were not gathered for the same 6-month period at each air carrier. The average for the air carriers for which data were available for a 6-month period is—

- Number of findings: 210
- Open action plans: 30
- Closed action plans: 76

Generally, the team found that it takes the nine air carriers an average of 27 days to close out a finding and that, on average, 10 percent of the findings are closed with no action. The FAA notes that two air carriers do not permit any findings to be closed with no action.

Additionally, the FAA gathered data on the top five finding areas for each of the air carriers and the number of event- and schedule-driven findings for each of the top five areas. The FAA found that three air carriers do not track this information. For the air carriers for which data were available, the top finding areas are—

- Technical data/manuals
- Parts/materials
- Logbooks/records
- Equipment
- Training
- Quality Control/Quality Assurance

Reliability Program

The FAA notes that the air carriers have had Reliability Programs in effect for an average of 15 years, with a high of 35 years and a low of one-half year. The FAA gathered data on the air carriers' Reliability Programs for the last 2 years, if data were available, including the number of reliability reports generated and the number of alerts. The FAA notes that the air carriers operate various fleet types. One air carrier operates a single type of airplane, while others operate numerous types of airplanes. Furthermore, the FAA notes that the air carriers operate in completely different operating environments and set their alert rates differently.

The FAA also gathered data on the number of open corrective action plans and closed corrective action plans the air carriers had for a 6-month period. The FAA notes that the data were not gathered for the same 6-month period at each air carrier. The average for the nine air carriers for which data were available for a 6-month period is—

- Open corrective action plans: 15
- Closed corrective action plans: 10

The team found that over a 2-year period, it takes eight of the air carriers an average of 82 days to close out an alert and 120 days to close out a corrective action. On average, for seven air carriers, 27 percent of the alerts are closed with no action. Furthermore, seven air carriers had an average of 57 recurring alerts over a 2-year period. The review team found that over a 2-year period, four air carriers' Reliability Programs changed their Maintenance Programs an average of 64 times.

Additionally, the FAA gathered data on the top five alert areas for each of the air carriers. The FAA found that some air carriers do not track this information. For the air carriers for which data were available, the top alert areas are—

- ATA 32 – Landing Gear
- ATA 34 – Navigation
- ATA 23 – Communications
- ATA 33 – Lights
- ATA 25 – Equipment/Furnishing
- ATA 22 – Autopilot

Internal Evaluation Program

The review team collected data on the air carriers' IEPs for the last 2 years, if the data were available. The FAA notes that not all air carriers have IEPs in effect. Furthermore, the FAA notes that for those air carriers with IEPs, the air carriers conduct their audits at different frequencies and audit different areas. Not all air carriers were able to provide 2 years of data for the number of schedule-driven and event-driven audits. Generally, for a 2-year period, five air carriers conducted an average of 275 schedule-driven audits and five air carriers conducted an average of 67 event-driven audits.

The FAA also gathered data on the number of open findings, open action plans, and closed action plans the air carriers had for a 6-month period. The FAA notes that the data were not gathered for the same 6-month period at each air carrier. The average for the number of air carriers for which data were available for a 6-month period is—

- Number of findings (for six air carriers): 161
- Open action plans (for five air carriers): 18
- Closed action plans (for five air carriers): 25

Generally, the team found that it takes six of the air carriers an average of 36 days to close out a finding and that, on average, five air carriers close 1 percent of their findings with no action. The FAA notes that two air carriers do not permit any findings to be closed with no action.

Additionally, the FAA gathered data on the top five finding areas for each of the air carriers and the number of event- and schedule-driven findings for each of the top five areas. The FAA found that some air carriers do not track this information. For the air carriers for which data were available, the top five finding areas are—

- Records/documentation
- Fueling/fuel storage
- Training
- Calibration
- Manuals

Safety Program

The FAA gathered data on the air carriers' Safety Programs for the last 2 years, if the data were available. The FAA notes that the type of data each air carrier gathers on its Safety Program varies widely. No two air carriers tracked all of the same information. Furthermore, some air carriers do not have systems that enable them to provide 2 years of data for the number of schedule-driven and event-driven audits, findings, open action plans, and closed action plans.

Generally, the team found that seven of the air carriers have applied for an ASAP and, of those, three have been approved.

The FAA also gathered data on the top five finding areas for each of the air carriers and the number of event- and schedule-driven findings for each of the top five areas. Again, the FAA found that some air carriers do not track this information. However, for the air carriers for which data were available, the top five finding areas are—

- Passenger medical incidents
- Altitude deviations
- Rejected takeoffs
- Passenger behavior incidents
- Ground operations incidents

INTERFACES

The FAA notes that there are no standards defining the interfaces that should occur between these four safety management programs and other departments within the air carriers. However, the four programs should interact and share information with one another and with other departments within each air carrier. The FAA gathered information on what departments interact with each other. The FAA generally found that the Operations and Maintenance Departments do not interact or share information.

Continuing Analysis and Surveillance System

The review teams found that the CASS interfaces with the Reliability Department and Maintenance Department at five of the air carriers; with the Engineering Department at four of the air carriers; with the Safety Department at three of the air carriers; and with the IEP Department at two of the air carriers. Certain CASS programs also interface with Flight Operations, Ground Operations, and Quality Control.

Reliability Program

The review teams found that seven air carrier Reliability Programs interface with the Engineering Department; six interface with Quality Assurance; five interface with the Maintenance Department; and four interface with Flight Operations. Some air carrier Reliability Programs also interface with Technical Support, Quality Control, and Customer Support.

Internal Evaluation Program

The review teams found that some IEPs interface with other departments on an informal basis. Generally, the review teams found that IEPs interface with the Maintenance Department at four air carriers, and with Flight Operations, In-Flight, and the Engineering Department at three air carriers. The review teams found that IEPs also interface with Ground Operations, Operations Planning, the Safety Department, and the departments audited.

Safety Program

Several of the air carrier Safety Programs operate independently and do not interface with other departments. However, three air carrier Safety Programs interface with the departments audited, and two air carrier Safety Programs interface with the Maintenance Department, the Engineering Department, Flight Operations, and In-Flight.

V. FOLLOW-UP ACTIONS

The FAA finds that it is important for each air carrier to review this report and encourages the air carriers to contact one another to discuss options for making improvements to their systems.

In addition, based on the results of this review, the following actions have been taken:

Air Carrier Action Plans. The air carriers and their CMTs were informed of the results of this review, which started a process of action planning at the air carriers and the local FAA offices. As a result, all the air carriers have developed action plans to improve the performance of their safety management programs. The action plans are being implemented with the oversight of the local FAA offices, which will validate the results of the corrective actions. The FAA notes that many of the air carriers instituted changes during the review and that some corrective action plans were in place by the time the review teams left the air carriers.

Industry Best Practices. The FAA intends the model programs contained herein to be used as a starting point for a collaborative FAA/industry effort to improve the four safety management programs. The FAA notes that the ATA has volunteered to begin this task and currently is assembling a working group. The results of the ATA's actions will be available for the air carriers to use to enhance their programs and systems.

Improved Guidance. The review identified that there is a lack of comprehensive guidance available to the air carriers on the four programs evaluated. As a result, the following work is underway to improve FAA policy and guidance:

- The development of a Principal Inspector training course;
- A review and update of the Reliability Program training course;
- The development of a CASS training course;
- The development of an auditor training course for inspectors with an emphasis on system analysis;
- A major revision to AC 120–17, Maintenance Control by Reliability Methods; and
- A major revision to AC 120–16, Air Carrier Maintenance Programs.

Surveillance Systems.

- National Program Review. To validate the implementation of these action plans, the FAA expects to conduct a follow-up review of these nine air carriers approximately 6 months after the individual air carrier reports are released. In addition, the FAA will begin reviewing the remaining part 121 air carriers within the next 6 months.

- Current Surveillance System. Flight Standards Service already has initiated a major review of the FAA's current surveillance system being used at the air carriers evaluated. To improve system effectiveness, numerous changes have been identified and are being resolved at the national level.
- ACAP and Regional ACAP. Other major initiatives are ACAP and Regional ACAP (RACAP), which are seen as replacements of the National Aviation Safety Inspection Program. The FAA will begin conducting ACAP and RACAP audits of the air carriers in fiscal year 2001 to ensure the continued effectiveness of the FAA's oversight surveillance system. The FAA notes that this review successfully used the newly developed ACAP format.

VI. CONCLUSIONS

The FAA found that the four air carrier safety management programs are intact and effective in providing a safety net at the air carriers reviewed. The FAA noted that the four programs have built-in redundancies and overlap with each other. However, the FAA found that no two air carriers were performing exactly the same, and that the air carriers prioritize their four programs differently.

During the review, in an effort to improve the four air carrier safety management programs, the review teams identified the best practices of each program at each air carrier. The FAA understands that the nine air carriers operate in a competitive, complex environment; however, the FAA states that the air carriers should not work in isolation. The FAA encourages a greater sharing of safety-related data among the air carriers. The FAA notes that each individual air carrier's accident data are sparse and do not present an overall picture. If the air carriers combine their data, there is a greater chance of identifying new areas where the air carriers can focus their efforts, which could lead to further improvements in safety and raise the overall level of safety in the industry without the implementation of further regulations. Furthermore, by sharing this type of information, each air carrier can improve its individual programs and thereby offer the finest service to the flying public.

The FAA notes that during the review, the review teams identified areas that need further action. Because the review teams maintained open lines of communication with the air carriers and their CMOs, many discrepancies noted were corrected immediately. In addition, the air carriers have implemented corrective action plans based on the areas identified as needing improvement. Many air carriers also have begun implementing significant changes to their programs based on the results of this review.

The FAA finds that the four safety management programs, as well as FAA guidance, require continual improvements. The results of this review highlight the air carriers' successful practices that can be used to improve the individual programs. Therefore, based on the results of this review and the best practices identified, the FAA developed the model programs herein and intends to work with industry to develop improvements to each of the four programs. The FAA also will be updating its internal and external guidance material. The FAA notes that the real challenge for each air carrier is to review this report and to adapt program-specific improvements. Furthermore, the FAA encourages the industry as a whole to make improvements, such as improving the integration of data among the air carriers by establishing standards for sharing safety data.

APPENDIX 1 — CONTINUING ANALYSIS AND SURVEILLANCE SYSTEM JOB AID

APPENDIX 2 — RELIABILITY PROGRAM JOB AID

APPENDIX 3 — INTERNAL EVALUATION PROGRAM JOB AID

APPENDIX 4 — SAFETY PROGRAM JOB AID

APPENDIX 5 — SAMPLE JOB AID

ANSWER		SYSTEM QUESTION *(Review all applicable company manuals and documentation pertaining to the Reliability Program.)*	QUES.	RANKING	PROCESS QUESTION *(This information may be obtained through interviewing the individual with overall responsibility for the Reliability Program. Please indicate how the information was obtained.)*
Yes	No	*Please mark the appropriate box.*	38	ATTRIBUTE	
X		Does the company have a method for establishing initial performance standards (when adding new type aircraft)?			
		Comments: The air carrier must have 9 months of collected data and uses 3-month moving averages.			
		Program Revision			
Yes	No	*Please mark the appropriate box.*	39	1 Low / 2 / 3 / 4 / 5 High / Not Rated	*Please mark the appropriate box.*
X		Are there procedures for program revisions?		X	Is the company following these procedures?
X		Do the procedures clearly identify items that require formal		X	Are changes made to without the required
		Comm nd 17 outline the procedures for revisions.			Comments: The forms that were reviewed indica ad of FAA approval. This was brought to the attentio CMO and was immediately corrected.
Yes	No	*Please mark the appropriate box.*	40	1 Low / 2 / 3 / 4 / 5 High / Not Rated	*Please mark the appropriate box.*
X				X	
		Is there a method for distributing changes to the reliability documents?			Are personnel following the change distribution method?
		Comments: Manual page 5.			Comments:
		Evaluation of Inspection			
Yes	No	*Please mark the appropriate box.*	41	1 Low / 2 / 3 / 4 / 5 High / Not Rated	*Please mark the appropriate box.*
	X			X	
		Is there a documented method for evaluating how well the Reliability Program controls the Maintenance Program?			Is the company using its documented method to evaluate how well the Reliability Program controls the Maintenance Program?
		Comments: The air carrier has no documented procedure to evaluate its Reliability program as it relates to controlling its maintenance program.			Comments:

SYSTEM QUESTION

PROCESS QUESTION

SAMPLE

MEASURES

MEASURES (Interview the individual responsible for the program and the individual responsible for reports, as appropriate. Gather information for past 2 years unless otherwise noted.)						
Number of years the Reliability Program has been established	17 years					
Number of Reports	32 reports					
Number of Alerts	175 between August 1998 and July 2000					
Number of Open Corrective Action Plans (6 months, per month)	Feb 2000: 15	Mar 2000: 20	Apr 2000: 12	May 2000: 7	Jun 2000: 8	Jul 2000: 12
Number of Closed Corrective Action Plans (6 months, per month)	Feb 2000: 2	Mar 2000: 8	Apr 2000: 5	May 2000: 2	Jun 2000: 1	Jul 2000: 2
Frequency of the Reports	Monthly					
How long does it take to close out an alert? (average of past 6 months)	Alerts are resolved in one day at the RCB meeting.					
How long does it take to close out a corrective action? (average of past 6 months)	2 months					
Number of Recurring Alerts	25					
Percentage of Alerts Closed with No Action	0 percent.					
What is the current revision number and date?	Revision 5 is dated July 21, 2000.					
How many times has the Reliability Program changed the Maintenance Program?	The Reliability Program has changed the Maintenance Program 12 times since January 2000					
What type of measure does the company use to ensure the maintenance of the quality of the system?	The air carrier conducts an annual review to recalculate performance standards.					

SAMPLE

ALERTS SUMMARY (List the top five alert areas.)		
#	AREA	# OF ALERTS
1	ATA Code 23— Communications	20
2	ATA Code 25— Equipment/Furnishing	17
3	ATA Code 22— Autopilot	12
4	ATA Code 34— Navigation	8
5	ATA Code 33— Lights	6

INTERFACES

INTERFACES (List the interfaces between this system and other systems within the company.)
The Reliability Department interfaces with Flight Operations, Engineering, Maintenance, Quality Control, and Quality Assurance.

PRODUCTS

PRODUCTS (Interview appropriate personnel, review alert documents, review completed action plans, review initial and follow-on trend analysis information on completed items, and document procedures for guidance revision. Base information on the past 2 years.)	
Product	**Comments**
• Alert Documents (Reliability Reports)	Satisfactory.
• Action Plans	Satisfactory.
Trend Analysis	
• Initial	Satisfactory.
• Follow-on	Satisfactory.
Revised Guidance	
• Frequency of Revisions	Satisfactory.
• Revision Control	Satisfactory.
• Person Able to Request Revisions	Satisfactory.
• Person Responsible for Making Revisions	Satisfactory.

SAMPLE

APPENDIX 6 — MODEL PROGRAMS

The FAA developed the following four model programs to be used as a starting point for a collaborative FAA/industry effort to implement some of the best practices identified during this review. The model programs are based on the job aids used during, and the results of, the review and depict one way, but not the only way, for air carriers to set up their programs. The model programs depict the major components the FAA encourages the air carriers to include in each program. However, the FAA stresses that the model programs do not contain all the specific details that should be in each program.

CONTINUING ANALYSIS AND SURVEILLANCE SYSTEM

Objective: To provide surveillance and analysis of the air carrier's continuous airworthiness maintenance program for performance and effectiveness and to implement corrective action for any deficiencies noted.

Criteria:

- 14 CFR § 121.373;
- FAA Order 8300.10, volume 2, chapter 65;
- FAA Order 8300.10, volume 3, chapter 37;
- AC 120–16C, Continuous Airworthiness Maintenance Programs;
- HBAW 9605C; and
- HBAW 9506A.

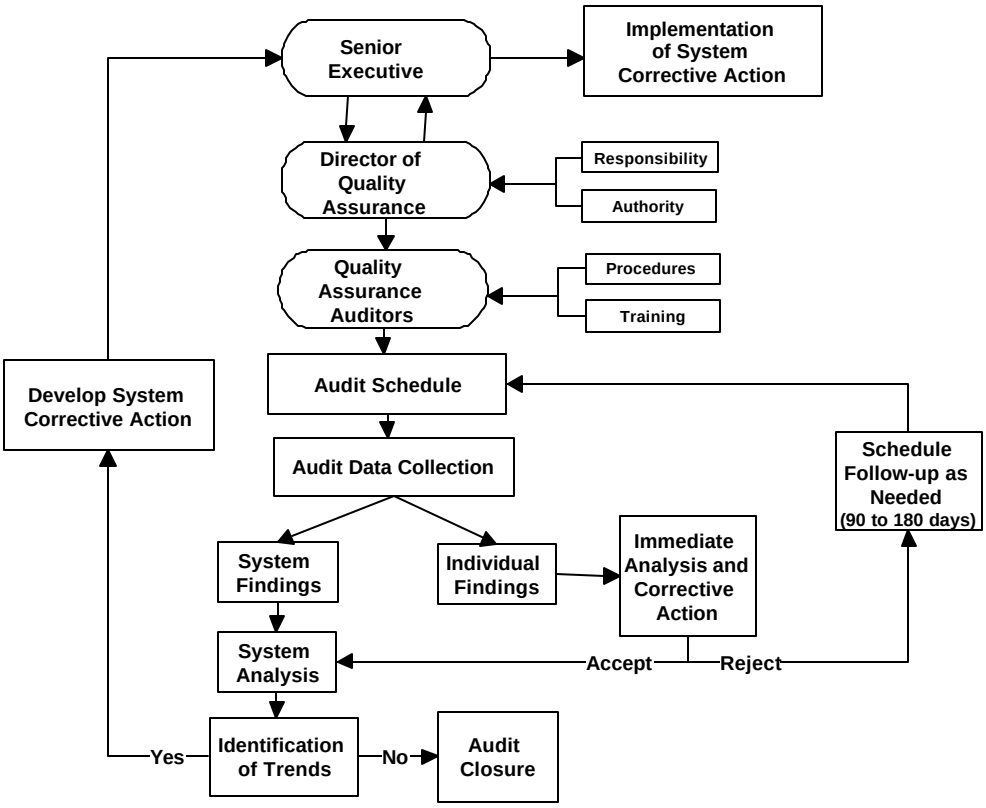
Significant Elements: An air carrier's CASS should include, but is not limited to, the following elements:

- *Defined Responsibility.* Defines the duties and responsibilities of personnel involved in the CASS.
- *Authority.* Identifies the individual with authority to make changes to the CASS.
- *Guidance*. Describes the air carrier's CASS and how to make changes to it.
- *Establish CASS Program Action Group*. Details the CASS audit process.
- *Independent Responsibility.* Identifies the CASS program manager and the responsibilities of the CASS program manager and includes an organizational chart depicting the CASS organization and its reporting authority.
- *Top Management Review*. Describes the procedures for top management review and the documents reviewed as part of the CASS.
- *Schedule*. Includes the air carrier's schedule of CASS audits and activities and defines the air carrier's procedures for post-audit activities.

- *Corrective Action Plans.* Contains the air carrier's system for closing audits and conducting follow-up activities.
- *Analysis.* Defines the procedures to conduct root cause and trend analysis.
- *Records.* Provides for the retention of audit files.
- *Training.* Includes the qualifications required for the air carrier's CASS personnel and the requirement to maintain training records.
- *Resources.* Contains procedures to measure the effectiveness of the quality of the air carrier's CASS.

Overview: Depicted in Figure 1 is a sample CASS. The FAA notes that an air carrier's CASS may be different but should include the same significant elements. The Director of Quality Assurance has the responsibility and authority for the CASS. As such, the Director of Quality Assurance maintains the CASS manuals and checklists, reviews all reports, and sets the audit frequencies and due dates. The Quality Assurance auditors accomplish the audits in accordance with the audit schedule and gather the data on the system audited. If there are any findings, the system process owner will develop immediate corrective action to resolve the specific problem. If the corrective action is rejected by Quality Assurance and the process owner, the audit department will reevaluate the data and schedule follow-up activities as necessary. If the immediate corrective action is accepted, the audit is closed for factfinding and system analysis is conducted to establish root causes. Furthermore, the data are entered into a data base where trends are identified. If trends are identified, system corrective action is developed with recommendations that are forwarded to the senior executive level for implementation. Follow-up audits are then scheduled through the same process to validate the system corrective action. If no trends are identified, the audit is closed.

Figure 1 – Model CASS



Description of Elements in CASS Flowchart:

Procedures. The CASS manual should define or describe the following:

- Duties and responsibilities of the personnel involved in the CASS.
- Policies and procedures for implementing changes to the CASS.
- Document control procedures for the air carrier's CASS documents.
- Frequency of the air carrier's audits, its audit objectives, and the areas to be audited.
- A format for CASS audit reports and guidelines for responses to findings, such as due dates and report formats.
- Unique terms.
- A process for conducting internal and external audits.
- A formal schedule that outlines all the areas to be audited.
- Procedures for maintaining and documenting all accomplished audits.
- Procedures to measure the effectiveness of the quality of the CASS system.

Senior Executive. The air carrier's organizational chart should indicate who the CASS program manager reports to. Furthermore, the overall program responsibility for the air carrier's CASS should be at a higher level than the organizations being audited. The air carrier's CASS manual should contain defined procedures for top management, such as the Chief Executive Officer, President, or designee, to review and document its review of the CASS program and products.

Director of Quality Assurance. The air carrier should have an individual identified who has the authority to establish and modify the air carrier's policies and procedures. In addition, the air carrier should have a CASS program manager who has the responsibility to ensure the CASS is properly established, implemented, and maintained.

Quality Assurance Auditors. The CASS manual should include written processes for the air carrier to track findings to ensure discrepancies are resolved. The air carrier should have a documented procedure to validate the audits done by third parties, if the air carrier does not conduct its own internal and external audits.

Training. The air carrier should have defined procedures to determine the qualifications and competency of its CASS personnel. Furthermore, the air carrier should define the qualifications required for its CASS personnel. The air carrier also should have a documented process to maintain training records for its CASS personnel.

Best Practice Observed During Review

One air carrier has a formal, comprehensive training program for its auditors. Each auditor receives more formal training than described in the air carrier's manual. The auditors' training includes ISO 9000 Auditor and Lead Auditor, ASQ, Six Sigma, and CASE Auditor training. Furthermore, each auditor receives 999 hours of on-the-job training. The air carrier also maintains a complete training history of each auditor assigned. In addition, each auditor is required to complete recurrent training to maintain his or her certifications, as defined by the various training programs.

Audit Schedule. The air carrier should have systems to plan audits and track audit accomplishments. The CASS formal schedule should outline the audit due dates. In addition, the air carrier should have documented procedures to provide ongoing, continual oversight of the defined audit areas. The CASS formal schedule should define a requirement for follow-up activities and the CASS manual should contain the process for the air carrier to schedule follow-up audits to verify the elimination of systemic problems and to ensure corrective action plans are effective. Procedures should be defined in the CASS manual for the air carrier to identify and accomplish overdue audits and to schedule special audits.

Audit Data. The air carrier should have specific audit checklists for each of the audit areas. The CASS manual should contain the processes to document and forward findings to the appropriate departments for corrective action.

Immediate Analysis and Corrective Action. The air carrier's CASS manual should contain the processes for corrective action plans and timelines to be developed when deficiencies cannot be resolved quickly.

Follow-up. The air carrier should have procedures defined in its CASS manual to identify and track necessary follow-up actions.

Audit Closure. The air carrier should have a formal system for ensuring audits are not closed until all findings are answered in an acceptable manner.

System Analysis and Corrective Action. The CASS manual should contain procedures (1) to analyze findings to determine root causes, and (2) to ensure the root cause of each discrepancy is corrected to prevent recurrence. The air carrier also should have procedures that require audit summaries to be used to conduct trend analysis of discrepancies.

Identification of Trends. The air carrier should have a monthly report that is adequate for decisionmaking. The report should contain, but is not limited to (1) findings, (2) the number of audits conducted, and (3) charts or graphs.

RELIABILITY PROGRAM

Objective: To provide improved aircraft, powerplant, and/or systems reliability through data collection, analysis, and corrective action.

Criteria:

- AC 120–17A, Maintenance Control by Reliability Methods;
- Operations Specifications D74 or D75;
- FAA Order 8300.10, volume 2, chapters 66 and 67;
- FAA Order 8300.10, volume 3, chapters 38 and 40;
- Maintenance Steering Group 2 & 3;
- AC 120–42A, Extended Range Operation with Two-Engine Airplanes (ETOPS); and
- AC 120–67, Criteria for Operational Approval of Auto Flight Guidance Systems.

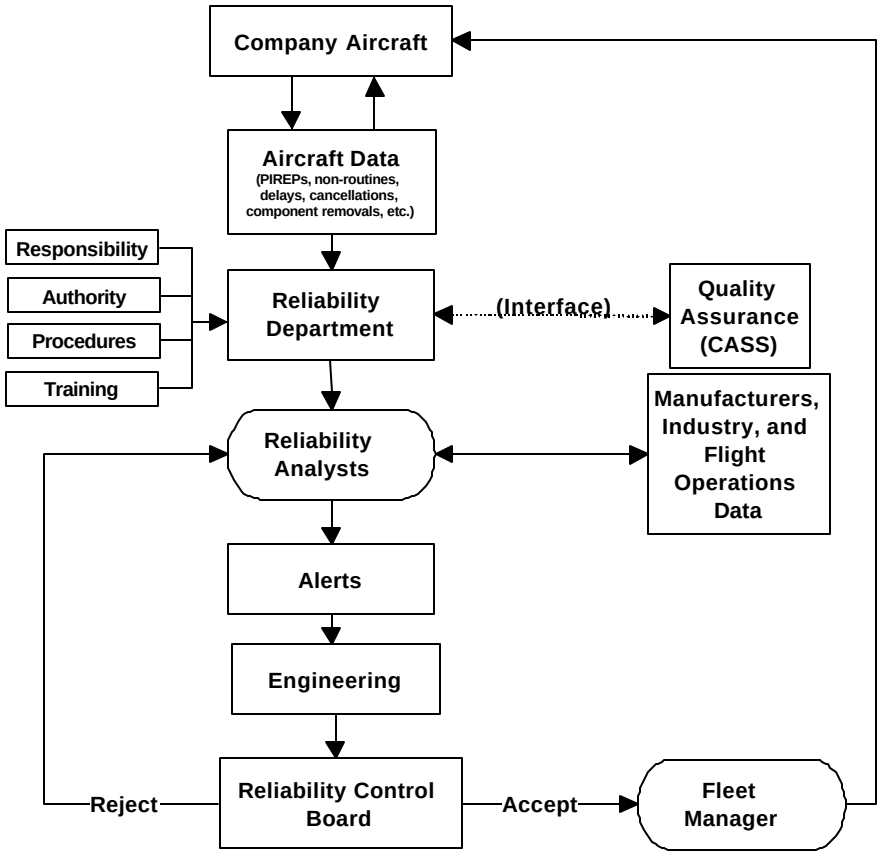
Significant Elements: An air carrier's Reliability Program should include, but is not limited to, the following elements:

- *Program Application*. Includes the air carrier's philosophy towards reliability and the aircraft or systems to be covered by the air carrier's Reliability Program.
- *Organizational Structure*. Details the individual responsibility and authority for the different Reliability Program areas and defines the duties, responsibilities, and activities of the Reliability Control Board (RCB).
- *Data Collection*. Defines the air carrier's data collection system, including the sources of data and how the data will be collected and distributed.
- *Controls*. Describes the air carrier's data analysis system.
- *Performance Standards*. Describes the actions the air carrier takes to establish and revise performance standards.

- *Data Displays and Reporting*. Describes how the air carrier monitors its systems.
- *Corrective Action Programs.* Describes the air carrier's methods for corrective action.
- *Interval Adjustment and Process Change*. Contains the air carrier's procedures for adjusting its maintenance, inspection, and overhaul intervals based on the level of reliability achieved.
- *Program Revision.* Includes the air carrier's procedures for making Reliability Program revisions and distributing changes.
- *Evaluation of Inspection.* Describes the means by which the air carrier evaluates how well its Reliability Program controls its Maintenance Program.

Overview: A sample model Reliability Program is depicted in Figure 2. The FAA notes an air carrier's Reliability Program may be different but should include the same significant elements. The model program assumes that the aircraft is the customer; any change to the aircraft's Maintenance Program should affect the aircraft's dispatch reliability. The Reliability Department gathers data from the aircraft and conducts trend analysis using those data and other data gathered from manufacturers, industry, and flight operations. This analysis enables the air carrier to establish alert levels for problem areas, which are then forwarded to Engineering for the development of corrective action. Quality Assurance interfaces with the Reliability Department to ensure appropriate changes are made within the air carrier's Inspection Program. The corrective actions developed by Engineering are brought to the RCB for approval. If the RCB accepts the corrective action and alert levels, the fleet manager adjusts the Maintenance Program accordingly and necessary changes are implemented. If the RCB rejects the corrective action and/or alert levels, further root cause analysis is conducted by the Reliability Department on the data. Once the corrective action and/or alert levels are applied to the aircraft, the effectiveness of the changes is measured by the same process. If the process is working, a repeat alert will not be generated.

Figure 2 – Model Reliability Program



Description of Elements in Reliability Program Flowchart:

Procedures. The air carrier's reliability documents should contain and/or define—

- The air carrier's philosophy toward reliability;
- The responsibilities and membership of the air carrier's RCB;
- The frequency of RCB meetings and the activities of the RCB during its meetings; and
- Written procedures to—
  - Route data in a timely manner to the proper organizational elements for review;
  - Establish, reevaluate, and revise performance standards;
  - Report repeat alert conditions;
  - Submit the required reliability documents to the FAA;
  - Determine the effectiveness of corrective action;
  - Require root cause analysis;

- Establish escalation limits;
- Change the Maintenance Program;
- Establish initial performance standards when new types of aircraft are added;
- Make program revisions that clearly identify items requiring FAA approval; and
- Distribute changes to the reliability documents.

Company Aircraft. In its reliability documents, the air carrier should define the engines, components, systems, or structures controlled by its Reliability Program or indicate that the program controls the entire aircraft. The air carrier should have procedures to ensure that changes are made to engine, component, systems, or aircraft operating hours or cycles according to the level of reliability experienced.

Aircraft Data. The air carrier's reliability documents should define the operational data it will use to measure the mechanical performance of the programs specified in its reliability documents. These data sources could include, but are not limited to, pilot reports, nonroutines, delays and cancellations, component removals, engine utilization, failure rates, shop findings, structural inspection findings, and ETOPS aircraft operations.

Reliability Department. The air carrier's reliability documents should identify the individuals responsible for (1) compiling and routing data to the responsible person for review, and (2) establishing or revising performance standards. The air carrier should also have documented procedures to assign personnel to find the cause of all areas identified as exceeding performance standards. Furthermore, the Reliability Department should have forms for collecting data that are identified in the air carrier's reliability documents.

Quality Assurance. The air carrier's reliability documents should include procedures for (1) using the data collection system defined in its documents in day-to-day operations; (2) determining whether the analysis of alert rates has been accomplished; (3) determining whether the performance standards were revised by specified personnel; (4) ensuring corrective action was performed through the chain of authority; and (5) evaluating how the Reliability Program controls the Maintenance Program.

Best Practice Observed During Review

One air carrier uses its Fleet Performance Summary to conduct timely and accurate analysis of mechanical performance data to determine the effectiveness of its Maintenance Program.

Reliability Analysts. The reliability documents should identify the individuals responsible for (1) analyzing trend-related information and (2) conducting further analysis for corrective action. In addition, the reliability documents should contain defined procedures to ensure the air carrier (1) uses operational data that are accurate, complete, and current; and (2) reviews previous inspection reports, correspondence, and other documents to determine whether there

are any open items or specific areas identified as needing special attention. The procedures the air carrier uses to identify trends by reviewing reliability reports should be included in the reliability documents.

Best Practice Observed During Review

One air carrier collects extensive data daily using computer systems such as the System for Computerizing Economical Performance, Tracking, Recording, and Evaluation (SCEPTRE), Corporate Flight Time (CFT), and Time Share Options (TSO). The air carrier also captures all pilot reports, logbook pages, flight attendant reports, SDRs, and, after an event, engine teardown reports. Extensive operational data reports are generated in several formats for wide distribution. The air carrier's Reliability Control Department produces over 100 reports controlled through distribution lists.

The reliability analysts also use several computer-based programs that interface with logbook data and Flight Operations dispatch data. The specific ATA coding in logbook pages is of particular importance and is verified to identify discrepancies properly. Several other methods and processes are used to ensure operational data are accurate, complete, and current. For example, the Records Department has an alerting process built into the air carrier's computer system.

The air carrier's data collection system is used in its day-to-day operations, and daily operational data are used in several processes. For example, operational data are discussed at the daily briefing. In addition, the chronic aircraft, component alerting, and Operational Difficulty Index (ODI) processes are a source of real-time activity. The SCEPTRE system is also reviewed daily. The reliability analysts and fleet managers review and disseminate data on a daily basis. The routing of data is defined in the air carrier's reliability document and is directed by the RCB and Technical Groups. Changes are ranked on a scale from 1 to 3, with Level 1 being the least serious, and implementation sheets are used for all Level 3 changes to prioritize routing.

The air carrier has set timeframes for data entry. The Reliability Index is refreshed each quarter; the RCB is scheduled every week to process and consider data; and the Technical Groups meet at least bimonthly. Fleet (which includes engines and components) and ODI briefings are planned regularly. Implementation sheets include default times for processing, and a computer program is used to track data change requests. Briefings include a report of cycle times for processing changes.

The air carrier also uses trend analysis to develop changes through corrective action. Trend analysis is a fundamental process and is used for comparative analysis to help the air carrier understand emerging trends and verify successful implementations. The air carrier has 21 reliability analysts dedicated to its Reliability Program who conduct trend analysis. (Several other air carriers also have dedicated Reliability Program staff.) Fleet and ODI briefings include the top Reliability and ODI subjects with trend data, which are considered by the RCB.

Flight Operations. The air carrier should have procedures that define how it will make changes in its operating procedures and techniques according to the level of reliability experienced.

Alerts. The air carrier should have a documented method in its reliability documents for (1) reviewing items identified as exceeding performance standards and requiring analysis; and (2) determining whether there has been an increase in aircraft delays and cancellations, premature component removal rates, engine shutdown rates, inspection scheduled adjustments (short-term escalations), deferred maintenance items or MEL items, and pilot reports.

Engineering. The air carrier should have documented procedures to conduct trend analysis and develop changes through corrective action. Furthermore, the air carrier should have defined procedures to ensure the following actions are taken appropriate to the level of reliability experienced: (1) actuarial or engineering studies to determine a need for change; (2) Maintenance Program changes involving inspection frequency or content, functional checks, overhaul procedures, and time limits; and (3) aircraft system or component modifications or repairs. Additionally, the air carrier should have documented methods for (1) evaluating critical failures as they occur; (2) determining whether the reliability documents provide for data displays that summarize the previous month's activities in sufficient depth to enable the company or other report recipient to evaluate the effectiveness of the entire Maintenance Program; (3) ensuring data displays and reports highlight systems that have exceeded established performance standards and include proposed corrective actions; and (4) ensuring all different airplane types/models in which a unit or component can be installed are evaluated before interval adjustments are made.

Best Practice Observed During Review

At one air carrier, time limits do not vary between fleets; the air carrier maintains the same interval for components across fleet lines. The only exception is when the air carrier establishes a more restrictive hard time to improve reliability. The powerplant portion of the air carrier's Reliability Program has a prorating formula that it uses when moving components from one type of engine to another. The air carrier's program exceeds industry standards by placing self-imposed hard times on components to improve overall reliability.

Reliability Control Board. The air carrier should have documented methods for instituting corrective actions that definitively describe when corrective action will be taken, and for assigning time limits to complete corrective actions.

Fleet Manager. In its reliability documents, the air carrier should identify the individual responsible for implementing corrective action.

Example of Reliability Program Success Observed During Review: One air carrier initiated changes to its Maintenance Program a total of 143 times in the past 9 months. Some of the most significant changes are described below.

For one fleet, the Reliability Department—

- Shortened the inspection intervals on 20 percent of its required inspection areas.
- Identified 12 new inspection areas for its aircraft structural inspection program.
- Revised the maintenance manual to include a procedure needed during a brake change. Specifically, the airplanes were suffering from systematic brake overheat problems. The Reliability Department determined that the maintenance manual did not require a brake bleed after the brakes were changed because the airplane's brake line cannot be bled. Therefore, the maintenance manual was revised to require a flushing procedure.
- Changed the specifications on 13 components.

For one fleet, the Reliability Department—

- Revised the maintenance manual on wing and body overheat, door seals, and pressurization. For example, the maintenance manual repair limits were too lenient as to the number of repairs that could be made to the door seal. The air carrier reduced the number of repairs allowed; therefore, once the seal was repaired a specified number of times, it would be replaced rather than repaired, which resulted in a decreased number of pilot reports.
- Changed the specifications on 22 components.

For one fleet, the Reliability Department—

- Revised the maintenance manual eight times for major program changes on brake bleed, main landing gear "Coke bottle" fitting, placards, and pneumatic leaks.
- Changed the specifications on six components.

For one fleet, the Reliability Department—

- Revised the maintenance manual six times for major program changes on flap transmissions, bleed air, water, and waste systems.
- Changed the specifications on nine components.

INTERNAL EVALUATION PROGRAM

Objective: To detect and address potential findings and improve system effectiveness.

Criteria:

- 14 CFR § 119.65
- FAA Order 8300.10, chapter 4
- FAA Order 8400.10
- AC 120–59, Air Carrier Internal Evaluation Programs

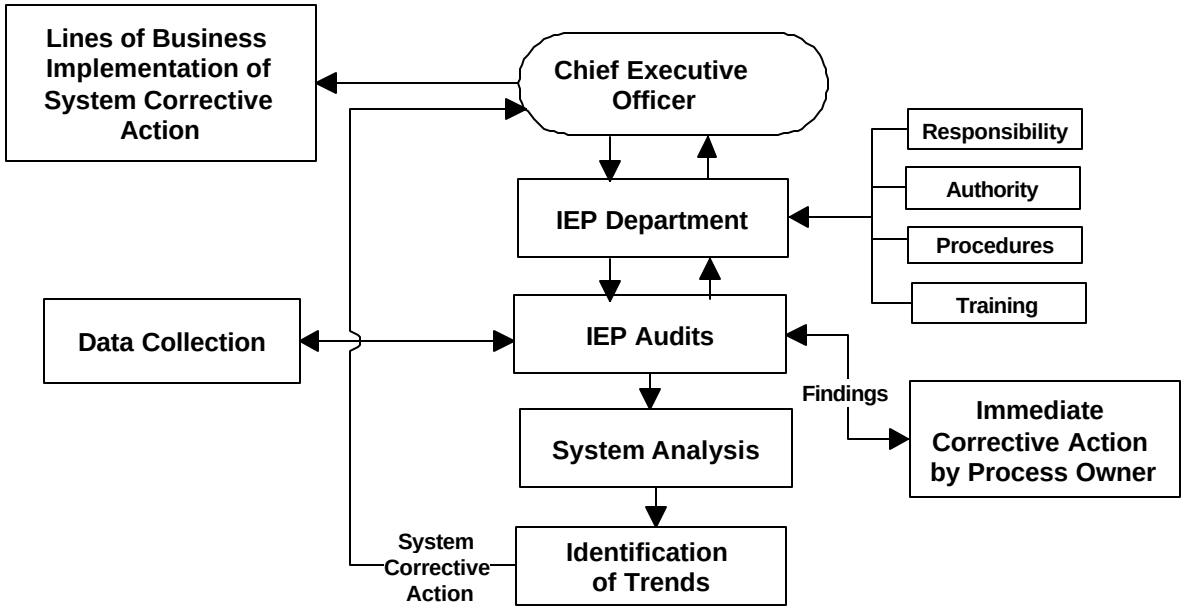
Significant Elements: An air carrier's IEP should include, but is not limited to, the following elements:

- *Responsibility*. Defines the duties and responsibilities of personnel involved in the IEP.
- *Authority*. Ensures each air carrier has an individual with authority to establish and modify the air carrier's policies and procedures.
- *Guidance*. Defines the IEP audit, including the audit areas, audit schedule, audit objectives, and audit frequencies. Includes procedures for all facets of the audits.
- *Independent Responsibility.* Contains an organizational chart depicting the IEP's reporting authority.
- *Top Management Review*. Defines top management's involvement in the IEP.

- *Continual Process*. Contains procedures to schedule audits and reviews of time-sensitive areas on a continual basis.
- *Schedule*. Contains the IEP's formal schedule, including areas audited, audit due dates, and follow-up activities.
- *Corrective Action Plans*. Contains the procedures to identify overdue audits and close audits after findings are answered acceptably.
- *Analysis*. Defines the process to conduct root cause and trend analysis.
- *Records*. Includes the provisions to maintain files on all completed audits.
- *Training*. Defines each air carrier's formal training program, including on-the-job and recurrent training.
- *Resources*. Contains the procedures for the IEP to maintain adequate resources.

Overview: Depicted in Figure 3 is a sample model program. The FAA notes an air carrier's IEP may be different but should include the same significant elements. The individual responsible for the IEP Department should report directly to the Chief Executive Officer. This individual is responsible for implementing the program and has the authority to amend or modify the IEP. He or she is also responsible for maintaining the IEP procedures, ensuring all IEP personnel are trained and qualified, and scheduling the IEP audits. The IEP auditors conduct the audits and collect data. The auditors should report their findings to the process owners, who will implement immediate corrective action and report back to the IEP Department. If the corrective action is rejected by the IEP Department, the data go back to the process owners for re-evaluation. If the corrective action is accepted by the IEP Department, the data are entered into a data base for system analysis and identification of system trends. System corrective action recommendations are forwarded to the Chief Executive Officer for ultimate implementation by the process owners. If the system corrective action is implemented, the IEP Department conducts follow-up audits through the process to verify that the corrective actions eliminated the problems. The FAA notes that the IEP should apply equally to all areas within the air carrier, such as Maintenance, Flight Operations, Ground Operations, and In-Flight Operations.

Figure 3 – Model IEP



Description of Elements in IEP Flowchart:

Procedures. The IEP manual should contain written procedures to—

- Modify the IEP,
- Control documents,
- Document findings,
- Forward findings to the appropriate areas of responsibility for corrective actions,
- Track findings and ensure discrepancies are resolved,
- Schedule follow-up audits to verify the elimination of deep-rooted problems and ensure corrective action plans are effective,
- Schedule audits and reviews of time-sensitive areas on a continual basis,
- Identify overdue audits,
- Identify overdue audit responses, and
- Ensure audits are not closed until all findings are answered acceptably.

The IEP manual should also include a definition of unique terms.

Chief Executive Officer. The air carrier should have a procedure for top management to review, and document its review of, the IEP and its products.

Lines of Business. A format for response to findings should be defined in the IEP manual. The air carrier should have a written process for corrective action plans and timelines to be developed when deficiencies cannot be resolved quickly.

IEP Department. Each carrier should have an established IEP that reports to the highest-level individual in the company. Management's involvement in the IEP should be depicted in an organizational chart included in the IEP manual. The organizational chart should indicate that the IEP manager reports directly to the top manager. The duties and responsibilities of the personnel involved in the IEP should be defined in the IEP manual and in individual job descriptions. Each air carrier should define its auditor qualifications. Each air carrier should have an individual who has the authority to establish and modify the air carrier's policies and procedures. In addition, each air carrier should have a management representative who has the responsibility for ensuring the IEP is properly maintained. Finally, each air carrier should have written policies or processes for (1) obtaining and maintaining adequate resources for the IEP and (2) dedicating staff to the IEP.

Best Practices Observed During Review

One air carrier has developed a sophisticated data base system to track and monitor all its IEP audits. An open item report is generated on a weekly basis to aid in tracking findings. The data base also automatically triggers follow-up audits. When an audit is closed in the data base, a follow-up audit is automatically scheduled within 60 to 90 days to evaluate the implementation and effectiveness of the corrective action and the degree of assimilation of changes.

Two air carriers do not permit findings to be closed with no action.

One air carrier dedicates significant resources to its IEP. It has a dedicated IEP staff of 15, which includes 1 general manager, 1 secretary, 3 senior auditors, and 10 evaluators.

Audits. Each air carrier's IEP manual should define the areas to be audited, specific audit objectives, and required audit frequencies. Each air carrier should have focused audit checklists for each audit area. The IEP's formal schedule should outline all areas to be audited, audit due dates, and required follow-up activities. Each air carrier should have a system to track audit accomplishment, monitor discrepancies, and highlight necessary follow-up activities. Additionally, each air carrier should have a written process to maintain files on all accomplished audits and to include the following in the files: (1) most recently completed audit report, (2) previous audit report, (3) audit checklist with findings identified, and (4) documentation of discrepancy resolution. Each air carrier's IEP manual should define a format for audit reports.

Training. Each air carrier should have a documented training program for its IEP auditors that includes on-the-job and recurrent training. The duties and responsibilities of each air carrier's IEP auditors should be defined in the training program. The IEP should require training records to be kept that document IEP training.

Best Practice Observed During Review

One air carrier's IEP auditors receive formal, comprehensive quality systems training and maintain various certifications in industry programs such as ISO 9000, ASQ Certified Quality Auditor, Six Sigma Process Quality Management, and CASE Auditor authorization. Each auditor receives 999 hours of on-the-job training and is required to complete recurrent training to maintain industry certifications.

Corrective Action. The IEP manual should define a format for responses to findings and contain a written process for corrective actions and timelines to be developed when deficiencies cannot be resolved quickly. Each air carrier should have written procedures that ensure the root cause of each discrepancy is corrected to prevent recurrence.

System Analysis. Each air carrier's IEP should contain a process for the analysis of findings to determine root causes. Each air carrier should have written procedures to ensure the root cause of each discrepancy is corrected to prevent recurrence.

Best Practice Observed During Review

Two air carriers conduct extensive root cause analysis and drill down to the lowest-level root cause.

Identification of Trends. Each air carrier should require that audit summaries be used to conduct trend analysis of discrepancies.

Best Practice Observed During Review

Two air carriers produce detailed, comprehensive audit reports that follow a consistent format.

Examples of IEP Success Observed During Review: One air carrier's code-share operational review was instrumental in developing the industry standards outlined in the Department of Transportation (DOT) Code Share Safety Program Guidelines, and exceeds the Department of Defense (DOD) requirements. The air carrier's auditors receive extensive quality auditor training, and, through the use of analytical skills training such as Six Sigma Process Quality Management and root cause analysis, the air carrier ensures that foreign air carriers' quality systems meet DOT and DOD requirements. Through a detailed assessment, the air carrier can determine and score the health of a foreign air carrier's quality system. An internal report is produced that details the strengths and opportunities for improvement identified at the foreign air carrier. Any quality systems at the foreign air carrier deemed benchmarks or best practices are identified and communicated to the air carrier as opportunities to strengthen its own program.

Another air carrier's fueling audit program is exceptional. The air carrier has already conducted 25 audits in 2000, and each area related to fuel is tracked and reviewed for completeness and accuracy. In addition, the air carrier keeps digital photographs on file of all findings.

Trend analysis conducted by IEP personnel at one air carrier contributed to a reduction in the number of fuel spills, which were a chronic problem. The air carrier's objective was to identify the root cause of the fuel spills and make changes to prevent spills from occurring. The air carrier captured data on fuel spills from every reporting station, broke the data down into

category by aircraft type, looked at the identified causes, and charted the causes to look for trends. The trend analysis indicated that the major causes of fuel spills were failed Volumetric Top Offs (VTOs), fuel venting, and inoperative fuel gauges, which accounted for 90 percent of the fuel spills. The analysis also indicated that over 80 percent of the fuel spills were on thin-winged aircraft. The air carrier then conducted an experiment that indicated there was a 2 percent expansion of fuel occurring during the summer months in the wing tanks of thin-winged aircraft. These data were used by the air carrier's fuel load planning group to reduce the fuel load in the wing tanks of the thin-winged airplanes. In most cases, the wing fuel load was reduced by 2 percent, with the offset placed in the center tank. As a result of these efforts, the into-plane fuel spills were reduced by more than 75 percent from the prior year over the same 5-month period.

SAFETY PROGRAM

Objective: To motivate safe behavior through the establishment of a dynamic corporate safety culture.

Criteria:

- 14 CFR § 119.65
- FAA Order 8300.10, chapter 4
- FAA Order 8400.10
- HBAT 97–03, Aviation Safety Action Program
- HBAT 99–19, 14 CFR Part 121 and 135 Air Carrier Safety Departments, Programs, and the Director of Safety

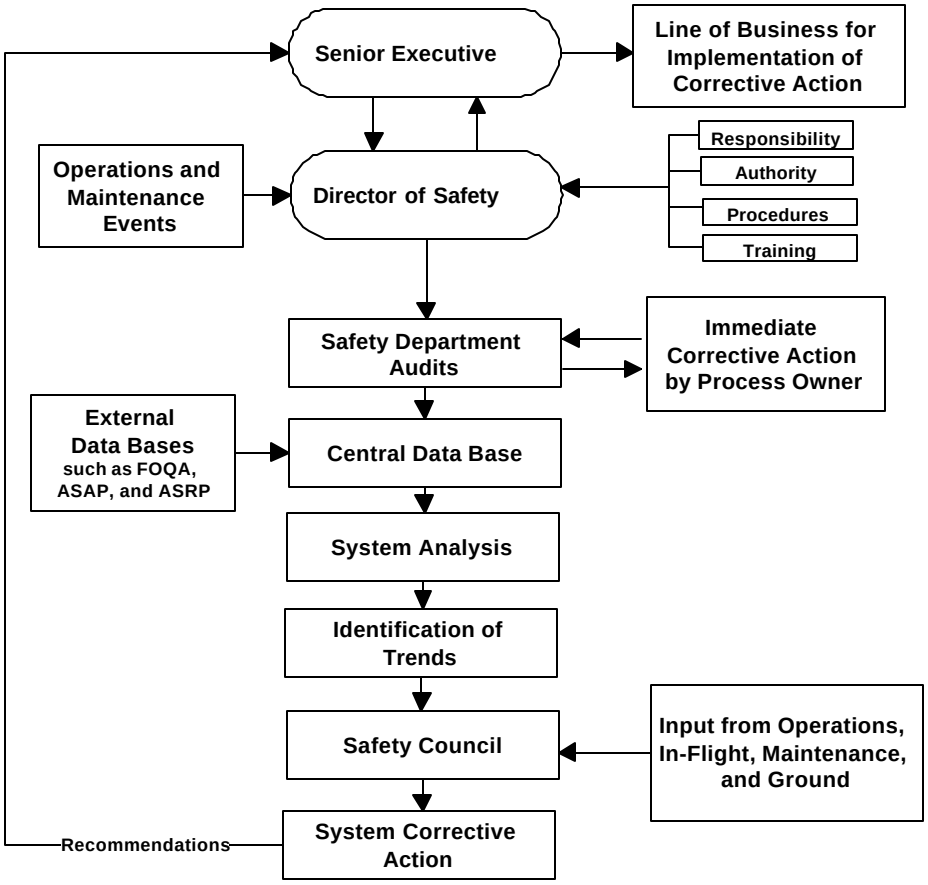
Significant Elements: An air carrier's Safety Program should include, but is not limited to, the following elements:

- *Overall*. Identifies the Director of Safety and defines each air carrier's Safety Program.
- *Senior Management Commitment.* Defines the Director of Safety's reporting authority and contains the duties and responsibilities of the Director of Safety and the personnel involved in the Safety Program.
- *Establishment of Safety Action Group.* Defines the safety action group and its activities.
- *Hazard Identification and Risk Management.* Defines the air carrier's review and use of safety data.
- *Ongoing Hazard Reporting Systems.* Contains procedures for the air carrier's investigation and reporting on potential hazards.
- *Positive Safety Culture*. Contains the air carrier's safety awareness program.
- *Schedule*. Defines the Safety Program's audit system.

- *Corrective Action Plan.* Includes a process for root cause analysis.
- *Regular Evaluation.* Defines the format for audit documents.
- *Emergency Response Plan.* Contains the air carrier's emergency response plan.

Overview: Depicted in Figure 4 is a sample model Safety Program. The FAA notes an air carrier's Safety Program may be different but should include the same significant elements. The Director of Safety is responsible for maintaining the Safety Program and should have the authority to amend or modify the program. The Director of Safety is also responsible for ensuring the Safety Program's procedures are current and the personnel in the Safety Department are trained and qualified. The Safety Department conducts all scheduled and event-based audits and gathers the data. The findings are sent to the process owners for immediate corrective action. If the Safety Department accepts the process owners' corrective action, the data are entered into a central data base. The central data base receives information from external sources, such as FOQA, ASRP, and ASAP. If the Safety Department rejects the corrective action, the data are reevaluated and presented to the process owners for corrective action. System analysis is conducted on the data to identify root causes. The information also is compared with existing data to identify trends, which are brought to the Safety Council. The Safety Council is made up of individuals from within all the air carrier's groups, such as Maintenance, Flight Operations, In-Flight, and Ground Operations. The Safety Council makes recommendations for system corrective action, which are presented to the Senior Executive for implementation by the process owners. The Safety Department schedules follow-up audits to evaluate the effectiveness of the corrective action.

Figure 4 – Model Safety Program



Description of Elements in Safety Program Flowchart:

Senior Executive. Each air carrier should have a procedure for top management to review the Safety Program.

Best Practices Observed During Review

One air carrier's top management receives staff meeting briefings and reviews aircraft damage reports and weekly quality reviews and activity reports. Top management is also involved in the air carrier's biannual and annual Safety Program reviews.

Another air carrier has a corporate culture of open communication among everyone in the company at all levels, from the Chief Executive Officer down. This practice permits and encourages the free flow of critical information and encourages the employees to be innovative and creative in the performance of their jobs.

Director of Safety. Each air carrier should have a documented Safety Program and identify an individual as the Director of Safety on its Operations Specifications. The Director of Safety should have the responsibility for ensuring the Safety Program is properly established, implemented, and maintained. The safety manual should contain a written policy that identifies

how to obtain and maintain adequate resources for the Safety Program. The Director of Safety should report directly to top management. Each air carrier should define the Director of Safety's qualifications and duties. In addition, the duties and responsibilities of the personnel involved in the Safety Program should be defined in company documents. Each air carrier should have written policies and procedures for developing a safety awareness program. Unique terms should be defined in the safety documents. Each air carrier should have a documented emergency response plan that has formal written procedures. The emergency response plan should be practiced and checked. In addition, each air carrier should have written procedures for the control of documents.

Best Practices Observed During Review

At four of the air carriers, the Director of Safety reports directly to the President or Chief Executive Officer, who is kept informed on the progress and impact of the Safety Program through formal and informal meetings.

One air carrier's Emergency Response Manual contains policies and procedures that include specific plans in case of accidents, incidents, bomb threats, and other emergencies. The air carrier has a well-staffed Emergency Response Department. The scenarios practiced by the air carrier are in-depth and thorough.

Another air carrier has a complete accident and incident program. The Safety Department identifies events that are to be investigated using established risk assessments. An investigation team is assembled using expertise from other divisions. The audit history, activities, findings, actions, and recommendations are entered into a data base, and when the initial investigation is finished, a computerized audit report is created. The data base also tracks the recommendations until the agreed-upon corrective action has been taken.

Safety Department Audits. Each air carrier should have a documented process or system to conduct internal and external safety audits, plan audits, track audit accomplishments, and highlight necessary follow-up actions. The safety manual should describe all the areas to be audited and define a format for audit reports, findings, checklists, and responses to findings. Each air carrier's Safety Program should include a requirement to maintain files on all accomplished audits.

Central Data Base. Each air carrier should have written procedures for developing and maintaining a data base of safety information, and investigating and reporting on company events and potential hazards that can affect safety.

System Analysis. Each air carrier should have written procedures that encourage the review of the following data: ASRP, ASAP, SDR, MIS, accident/incident investigation, safety audit and inspection, IEP, and FOQA. Each air carrier should also have written procedures that encourage the review of safety committee data. The safety manual should include a process for the analysis of findings to determine root causes.

Identification of Trends. Each air carrier should have written procedures that encourage the integration of the following data: ASRP, ASAP, SDR, MIS, accident/incident investigation, safety audit and inspection, IEP, and FOQA.

Safety Council. Each air carrier should have a safety action group and written procedures to record the results of the safety action group meetings. Each air carrier's safety manual should contain procedures for the solicitation and processing of safety-improvement suggestions.

Best Practice Observed During Review

One air carrier's senior management is required to meet corporate safety goals determined by its safety committee. The air carrier has three safety action groups: the Safety and Security Standing Committee, the Corporate Compliance Committee, and the Safety Communication and Awareness Committee. The air carrier's Maintenance Department also has a Safety Event Team. The air carrier has numerous other safety group activities in which the employees regularly participate. The air carrier maintains two hotlines, the Flight Safety Communications System and the Crew Operations Report System. All safety issues are identified and directed to the division with responsibility. Furthermore, the employees are encouraged to be part of the Continuous Improvement Teams, which allows them to participate in problemsolving.

System Corrective Action. Each air carrier should have a documented system to monitor discrepancies.

Examples of Safety Program Success Observed During Review: One air carrier's Corporate Safety Department and Regulatory Compliance Department track issues and resolution of safety committee agenda items. These departments evaluate the safety committee data to ensure appropriate integration into their systems. The review team reviewed this process and found two examples of issues the Safety Program has addressed. In one, the air carrier had been faced with an ongoing cabin slide deployment problem. The Corporate Safety Department determined that a special flagging pin should be used. Once this recommendation was made, all sections of the company complied. Another example was the replacement of aircraft towing bar shear pins every 6 months. In spite of these examples, the council is used primarily for information exchange rather than for action.

The review teams found that two air carriers (A and B) flying DC–9 airplanes experienced brake failures on these airplanes during landing. During the review of air carrier A, the team noted that the DC–9 brake problem was currently the top reliability problem; however, the review of air carrier B indicated that the chronic DC–9 brake problem was virtually eliminated. The review team noted that air carrier A viewed the brake problem as a maintenance issue alone. On the other hand, air carrier B's Safety Program conducted root cause and trend analysis of the brake problem, and because air carrier B's Safety Program interfaces with the entire company, the air carrier reviewed maintenance and operations data when it addressed its DC–9 brake problems. By examining FOQA data, air carrier B identified the use of incorrect speeds on approach and during the use of thrust reversers, which is an operational issue, not a maintenance issue. Once air carrier B reduced its operating speeds through the application of proper operating procedures, DC–9 brake failures were virtually eliminated. The FAA points out that this highlights the importance of the interfaces between the Safety Program and the rest of the company. Because air carrier B saw the problem as more than just a maintenance issue, they were able to get to the root cause, which was an operational issue, and were able to eliminate the problem.