U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Developing and Implementing an Air Carrier Continuing Analysis and Surveillance System

Date: 05/17/13 **AC No:** 120-79A

Initiated by: AFS-300 **Change:** 1

1. PURPOSE. This advisory circular (AC) provides information for developing and implementing a Continuing Analysis and Surveillance System (CASS). This AC is also a method of compliance with certain 14 CFR regulatory requirements and provides information about the FAA's expectations regarding your development and implementation of a CASS.

2. PRINCIPAL CHANGES. This change adds a note in Chapter 5, paragraph 5-2, regarding related information that can be found in AC 39-9, Airworthiness Directives Management Process.

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/s/ for

John M. Allen
Director, Flight Standards Service

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Developing and Implementing an Air Carrier Continuing Analysis and Surveillance System

Date: 09/07/10
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FOREWORD

This advisory circular (AC) provides information on methods of developing and implementing a Continuing Analysis and Surveillance System (CASS) required for commercial operators and air carriers certificated under Title 14 of the Code of Federal Regulations (14 CFR) part 119 and conducting operations under either 14 CFR part 121 or 135. A CASS is a system that air carriers and commercial operators use to monitor, analyze, and optimize the performance and effectiveness of their air carrier maintenance programs.

The regulations in part 121, § 121.373 and part 135, § 135.431 that define CASS are written in a performance-based format. Performance-based regulation is a regulatory approach that focuses on measurable outcomes, rather than prescriptive processes, techniques, or procedures. Performance-based regulation leads to defined results without a specific direction or specific instruction in the regulation regarding how to obtain those results.

This AC describes methods of compliance with the performance-based CASS regulatory requirements that the Federal Aviation Administration (FAA) has found to be acceptable. This AC describes processes, techniques, and procedures that will lead to the defined results in the CASS regulation. The information in this AC is not mandatory and does not constitute a regulation. This AC does not include any material that imposes, reduces, or changes a regulatory burden on anyone. Because using the method of compliance presented in this AC is not mandatory, the term “should” used herein applies only if you choose to follow these particular methods. A CASS should be tailored to each particular and specific operation; therefore, this AC cannot provide a single means of compliance that applies to all certificate holders required to develop and implement a CASS.

When “must” or “will” are used in this AC, such use reflects actual regulatory requirements. When “you” or “your” is used in this AC, it refers to an air carrier or commercial operator.

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CHAPTER 1. INTRODUCTION

1-1. PURPOSE.

a. Applicability. This advisory circular (AC) provides information for developing and implementing a Continuing Analysis and Surveillance System (CASS). This AC applies to you if you are a Title 14 of the Code of Federal Regulations (14 CFR) part 119 certificate holder conducting operations under 14 CFR part 121 or 135. For part 135 operations, this AC applies if you conduct your maintenance operations under part 135, § 135.411(a)(2). This AC also applies to each person employed or used by you as a part 119 certificate holder for any maintenance, preventive maintenance, and alteration of your aircraft. Title 14 CFR part 1, § 1.1 defines "person" as "an individual, firm, partnership, corporation, company, association, joint-stock association, or governmental entity. It includes a trustee, receiver, assignee, or similar representative of any of them."

b. Method of Compliance. This AC is a method of compliance with certain 14 CFR regulatory requirements. This method of compliance has been found to be acceptable to the Administrator of the Federal Aviation Administration (FAA). Instead of following this method, you may choose to follow an alternate or a different method. However, before you can use your alternate or different method, the FAA must make a finding that your alternate method is acceptable. Because using the method of compliance presented in this AC is not mandatory for those choosing not to follow this method, the term "should" used herein applies only to those who choose to follow this particular method.

c. FAA Expectations. This AC provides information about the FAA's expectations regarding your development and implementation of a CASS. As required by part 121, §§ 121.373 and 135.431, your CASS monitors your maintenance program for compliance with applicable requirements.

d. Maintenance. As used in this AC, "maintenance" means inspection, overhaul, repair, alterations, preservation, and the replacement of parts. It is important to remember that your inspection functions are an integral part of your maintenance program. They are not separate from your maintenance program. This is consistent with the regulations.

1-2. APPLICABILITY.

a. Certificate Holders. The intended audience of this AC is any certificate holder that develops a CASS, whether required to do so or not. The following table explains which certificate holders must have a CASS and which certificate holders may choose to have one.

If you operate under 14 CFR—	You—
Part 121	must have a CASS as required by § 121.373.
Part 129	must have FAA approval for the maintenance program and may have a CASS if it is consistent with the regulations of the State of the operator.

If you operate under 14 CFR—	You—
Section 135.411(a)(2) applicability	must have a CASS as required by § 135.431.
Section 135.411(a)(1) applicability or part 91, 125, 133, or 137	may be interested in developing a CASS because of the safety, efficiency, and other benefits a CASS affords.

b. Individuals. This AC is useful if you are directly involved in developing and implementing a CASS, or if you hold a senior management position where you exercise any control over maintenance operations.

CHAPTER 2. BACKGROUND ON CASS

2-1. HISTORY OF THE CASS. The CASS is one element of the Continuous Airworthiness Program (CAP) that was introduced in a rulemaking at 29 Federal Register (FR) 6522 on May 20, 1964. The rulemaking responded to safety concerns and discoveries of weaknesses in the maintenance programs of some air carriers revealed during accident investigations and FAA surveillance of air carrier maintenance activities. The CAP was designed to strengthen systemic requirements for safe air carrier operations. With its data collection, corrective action, and followup functions, a CASS is critical to the highest possible degree of safety in air transportation.

2-2. RELEVANT REGULATIONS.

a. Requirement to Have a CASS. This AC addresses certain key concepts in the CASS regulations, portions of which are in the regulatory text quoted here for discussion later in this AC. Title 14 CFR part 121, § 121.373(a), (b), and (c), and 14 CFR part 135, § 135.431(a), (b), and (c) state:

> "(a) Each certificate holder shall establish and maintain a system for the continuing analysis and surveillance of the performance and effectiveness of its inspection program and the program covering other maintenance, preventive maintenance, and alterations and for the correction of any deficiency in those programs, regardless of whether those programs are carried out by the certificate holder or by another person.
>
> "(b) Whenever the Administrator finds that either or both of the programs described in paragraph (a) of this section does not contain adequate procedures and standards to meet the requirements of this part, the certificate holder shall, after notification by the Administrator, make any changes in those programs that are necessary to meet those requirements."

NOTE: The wording of § 135.431(a) and (c) is the same as that in § 121.373(a) and (c). There are slight differences between the text of §§ 135.431(b) and 121.373(b); however, they are substantively identical.

b. Requirement to Have a Maintenance Program.

(1) Regulatory Compliance. If you are a 14 CFR part 119 certificate holder conducting operations under § 121.367 requires you to have a maintenance program that consists of an inspection program and a program covering other maintenance, preventive maintenance, and alterations. In accordance with § 135.425, the same requirement applies if you are a part 119 certificate holder conducting operations under part 135 and operating or choosing to operate under § 135.411(a)(2) applicability.

(2) Elements of Your Maintenance Program. Your air carrier maintenance program includes the following 10 elements:

- Airworthiness responsibility,

- Air carrier maintenance manual,
- Air carrier maintenance organization,
- Accomplishment and approval of maintenance and alterations,
- Maintenance schedule,
- Required Inspection Items (RII),
- Maintenance recordkeeping system,
- Maintenance providers,
- Personnel training, and
- A CASS.

NOTE: You can find additional, more detailed information about the 10 elements of a maintenance program in the current edition of AC 120-16, Air Carrier Maintenance Programs.

2-3. STANDARD DEFINITIONS USED IN CASS.

a. Definitions.

(1) Audit. Scheduled or unscheduled formal reviews and verifications to evaluate compliance with policy, standards, and/or contractual requirements.

(2) Authority. The power to design or change fundamental policy or procedures without having to seek higher level management approval. Authority is permission; it is a right coupled with an autonomous power to accomplish certain acts or to order others to act. Often, one person grants another authority to act as an employer to an employee, a corporation to its officers, or as a governmental empowerment to perform certain functions.

(3) Carried Out by the Certificate Holder or Other Person. This refers to your ability as a certificate holder to accomplish maintenance yourself or to make arrangements with someone else to accomplish maintenance on your behalf. However, you always retain the responsibility for the performance of maintenance, and you must always maintain operational control over any maintenance that any other person performs on your aircraft. Operational control includes independently determining the scope and type of maintenance that may be required, when to accomplish that maintenance, and if the maintenance was done in accordance with your manual and program, regardless of who accomplished the maintenance.

(4) CASS. The elements of the system are always working. For example, continuing surveillance means someone is always looking and collecting information. Continuing analysis means that someone is always analyzing the information that the system is always collecting.

(5) Corrective Action. An action designed to eliminate or mitigate a deficiency that has been identified within your maintenance program.

(6) Deficiency. A condition which is insufficient or incomplete, or where something required is lacking. In a CASS, it is something that is missing from your maintenance program that should be there, or it is something that is there but not producing the desired results. Alternatively, it could indicate that your maintenance program documentation is not being

followed. For example, a program element that has failed and is not working, or a program element that has faults and is not working as it should, are deficiencies.

(7) Effective. Producing or capable of producing a result. The maintenance program is producing the desired results when it realizes the following objectives:

- Airworthy aircraft have been properly maintained for operations in air transportation;
- Personnel are competent;
- Facilities and equipment are adequate; and
- All maintenance, preventive maintenance, and alterations are always performed in accordance with your maintenance program and manual.

(8) Establish and Maintain. To establish means that you develop a CASS that is appropriate for the type and scope of your operation. To maintain means that you keep your CASS current and appropriate in response to changes in the type and scope of your operation.

(9) Maintenance Program. The programs outlined in §§ 121.367 and 135.425 are outlined in other sections of part 121 subpart L and part 135 subpart J, and the current edition of AC 120-16 describes them in some detail.

(10) Maintenance. Inspection, overhaul, repair, preservation, and the replacement of parts, excluding preventive maintenance.

(11) Performance. The act of doing something successfully; the successful execution of an action. In CASS, performance means your maintenance program is being accomplished or executed as outlined in your air carrier manual.

(12) Person. An individual, firm, partnership, corporation, company, association, joint-stock association, or governmental entity. It includes a trustee, receiver, assignee, or similar representative of any of them.

(13) Preventive Action. Action to eliminate or mitigate the cause or to reduce the effects of potential nonconformity or other undesirable situation.

(14) Program. An organized list of procedures.

(15) Responsibility. The obligation to ensure that a task or function is successfully carried out. Responsibility includes accounting for actions related to the task or function. This is a key attribute of operational control.

(16) Risk. Risk is the degree of probability that hurt, injury, or loss will occur over a specific period of time or number of operational cycles. Risk has two elements: severity and likelihood. With regard to air carrier maintenance operations standards, the relationship between these two elements must be inverse.

(a) Severity is the type of harm inflicted if a particular event occurs. For air carrier maintenance programs, severity should be expressed in qualitative terms as a consequence of failure, such as catastrophic, hazardous, etc.

(b) Likelihood is the estimated probability or frequency, in quantitative or qualitative terms, of an occurrence related to the hazard; it is an expression of the probability that a specific unsafe event will occur. Likelihood is always an estimate.

(17) Risk Mitigation. A risk control measure. It refers to the process of modifying the system in order to reduce the risk.

(18) Risk Management. A formal process composed of identifying hazards, analyzing risk, assessing risk, and controlling risk. This process, embedded within the processes used to provide the product/service, is not a separate process.

(19) Root Cause Analysis (RCA). The analysis of deficiencies to determine their underlying root cause.

(20) System. A functionally related group of elements. In CASS, the elements are:

- Surveillance,
- Analysis,
- Corrective action, and
- Followup.

2-4. PURPOSE OF A CASS.

a. High Level Purpose. If you do not accomplish your maintenance program according to your manuals and applicable requirements, or if your maintenance program itself has deficiencies, your aircraft might be approved for return to service (RTS) when it is not airworthy. The high-level purpose of a CASS is to reduce or eliminate the likelihood of your aircraft being approved for RTS when it is not airworthy through the continuous, system safety-based, closed-loop cycle of surveillance, investigation, data collection, analysis, corrective action, monitoring, and feedback of a CASS.

b. CASS Design. The FAA expects you to design your CASS to ensure that you conduct your maintenance program according to regulations and your manuals, and that your program is effective in achieving the desired result of consistently having airworthy aircraft approved for RTS. For the CASS to yield this safety benefit, the FAA expects your senior management to establish safety as its top organizational priority. All personnel need to embrace your organizational goals and act jointly to achieve them.

2-5. STRUCTURE OF A CASS.

a. Overall Objective. The overall objective of the air carrier regulations governing maintenance programs is to ensure that you maintain at least the level of safety originally designed into an aircraft and that each aircraft used in air transportation is always in an airworthy condition.

b. Questions a CASS Addresses. There are two basic questions the regulations require a CASS to address:

(1) Are you following your maintenance program as you have documented in your maintenance manuals and procedures? The CASS of the performance of a maintenance program refers to the process of collecting and evaluating information to determine that the execution of the maintenance program is done according to the regulations, your manuals, and other applicable requirements. This portion of the CASS consists of conducting audits and analyzing audit findings and trends to verify that you are following your maintenance program as you have written it and are properly performing maintenance on your aircraft. The analysis conducted in this area of your CASS should also identify weaknesses, if any, in the systems and procedures used to carry out your maintenance program.

(2) In following your manuals and procedures, are you producing the results that you want? The CASS of the effectiveness of the maintenance program refers to the process of collecting and evaluating operational data that you need to verify that your maintenance program is producing the desired results.

(a) Under the regulations, your primary desired results should be those defined results found in §§ 121.367 and 135.425. There are three:

1. You, or any of your maintenance providers, perform all maintenance, preventive maintenance, and alterations in accordance with your manual.

2. You and your maintenance providers provide competent personnel and adequate facilities and equipment for the proper performance of maintenance, preventive maintenance, and alterations.

3. Each of your aircraft released to service is airworthy and properly maintained for operations in air transportation.

(b) Another desired result is that your aircraft operate with a level of reliability that is consistent with the goals of your maintenance program. “Reliability” is a broad term in this context and is an expression of dependability and the probability that an item, including an aircraft, engine, propeller, or component, will perform its required function under specified conditions without failure, for a specified period of time. Testing for effectiveness usually consists of collecting and analyzing operational performance data, such as:

- Maintenance-related delays and cancellations,
- Failure rates of parts and components after they are approved for RTS,
- Discrepancy rates of aircraft after heavy maintenance, and
- Related trend analysis.

c. Correcting Deficiencies. The regulations require you to include, as part of your CASS, provisions to correct any deficiencies in your maintenance program, regardless of whether your maintenance program or any part of it is actually conducted by you or by your maintenance provider. The regulations also provide authority for the FAA to require you to make necessary changes in the program if you do not make them on your own.

d. Systems Safety. A well-structured CASS can assist you in taking a systems safety approach to your maintenance program through recognition of the interaction of all the elements within your program systems and subsystems. The systems consist of interrelated processes that comprise of personnel, procedures, materials, tools, equipment, facilities, and software operating in a specific environment to perform a specific task or to achieve a specific purpose, support, or mission requirement for an air carrier.

e. Organizational Functions. An unairworthy aircraft can be the result of the actions of a wide variety of organizational functions, in addition to those associated with maintenance. These organizational functions include senior management decisions, flight operations, ground operations, and others. An effective CASS would consider the potential role of these organizational functions through effective surveillance and complete RCA. Chapter 5, paragraphs 5-2 through 5-4 covers these issues in greater detail.

f. System Safety Categories. When performing their surveillance and analysis functions, we encourage individuals responsible for a CASS to use the system safety categories of safety attributes, safety culture, communication, accountability, training programs, and potential problem areas when identifying hazards and managing risks. The FAA defines safety attributes as the following:

(1) Authority. You have a clearly identifiable, qualified, and knowledgeable individual with the authority to establish and modify your CASS or a process within your CASS. Authority means the power to design or change fundamental policy or procedures without having to seek a higher level approval. Authority is permission; it is a right coupled with an autonomous power to accomplish certain acts or order others to act. Often one individual grants another authority to act, such as an employer to an employee, a corporation to its officers, or a governmental empowerment to perform certain functions.

(2) Responsibility. You have a clearly identifiable, qualified, and knowledgeable individual who is accountable for the quality and accomplishment of your CASS or a process within your CASS. Responsibility means the obligation to ensure a task or function is successfully carried out. Responsibility includes accountability for the action to carry out a task or function. There is overall responsibility and direct responsibility.

(3) Procedures. You have documented methods for accomplishing a process. The procedure description should answer the basic questions of who, what, when, where, and why, as appropriate.

(4) Controls. You design checks and restraints into a process to ensure you get the results that you want. Controls may not be necessary for every process; however, if a process is

critical to meeting your overall system goals, specific controls to ensure proper accomplishment of that process generally are indicative of a well-designed system.

(5) Process measurement. This is where you measure and assess your processes to identify and correct problems or potential problems. You should identify specific measures and the data that you require to be collected.

(6) Interfaces. You identify and manage the interactions between processes, and the interfaces between your CASS and other systems or programs, whether within or outside your maintenance organization.

g. Risk Management. System safety and, therefore, CASS functions are built around principles of what is commonly referred to as risk management. Risk has two elements: severity and probability. Risk management includes identifying hazards, evaluating how severe the hazards' consequences would be, and how likely they are to occur (probability). After you do that, you can develop, implement, and evaluate measures to address the identified risks and program deficiencies throughout a system's life cycle to achieve the level of risk that you deem acceptable. All operators currently perform these functions on some level, although the degree of formality and sophistication depends on the size and scope of the operation as well as the level of training your personnel have in risk management. In your CASS, the FAA expects a formal risk management process (system safety) with safety, regulatory, and program compliance as the top priorities. Your formal risk management process should be structured, but not necessarily complex or expensive.

h. Safety Enhancement versus Disciplinary Action. The intention of a CASS is to give you (and the FAA) a realistic picture of the frequency and nature of deficiencies occurring in your maintenance program, and the opportunity to correct them. If your personnel at any level perceive that their jobs are at risk by collaborating in this system, they are likely to withhold information or bias the analysis for self-protection. You should design your CASS to emphasize the end goal of enhancing safety by evaluating and improving your maintenance program. You should not carry out your analysis and surveillance so that others perceive it or its intention as a method of identifying individuals who have committed errors simply to take some sort of disciplinary action. Human error is inevitable, but the question for your CASS to answer is how to better design your maintenance program to preclude errors from encroaching on operational safety or resulting in noncompliance.

i. Complacency. A particular challenge for your CASS is to overcome complacency that may be caused by the high degree of redundancy and dependability in modern aircraft systems. You need to place high priority on the CASS of your maintenance program because the potential consequences of deficiencies in your programs can be very serious.

j. Unique Program. Because of the wide range of size and aircraft types of air carriers, it would be unrealistic to set forth a single means of compliance for all to follow. Just as each of you have your own maintenance procedures manuals, each of you should have your very own unique CASS. You should design your CASS appropriate to the size and sophistication of your operation. This is consistent with the performance-based regulatory approach described in the second paragraph of the Foreword of this AC.

CHAPTER 3. USING THIS AC TO DESIGN A CASS

3-1. TYPES OF OPERATORS THIS AC HELPS.

a. Types of Operators. The CASS applies to many types of operators, ranging from small operators of one or two propeller-driven aircraft, to operators with several hundred turbojet aircraft. Your aircraft may include helicopters or airplanes, and you may provide scheduled or unscheduled service and operate under 14 CFR part 121, part 135, or both. These factors have a significant effect on the size and structure of your maintenance organization. Additionally, if you conduct operations under 14 CFR part 91, 125, 129, 133, 135 (part 135, § 135.411(a)(1) applicability), or 137, you may also find the information in this AC useful if you decide to implement a CASS. If, under your operation, the regulations do not require you to have a CASS, you do not have to obtain FAA approval or authorization to develop or use a CASS as long as the use of a CASS does not conflict with any of the regulations that you must comply with.

b. Personnel Assigned to Accomplish CASS-Related Duties. In addition, you should be aware that a primary difference in CASS design between air carriers involves the number of personnel assigned to accomplish CASS-related duties. If you are a smaller certificate holder, you may assign fewer personnel and may have to draw upon personnel that you normally have assigned to other functions to fulfill CASS functions on a collateral duty basis. You may even need to use outside resources such as contract personnel to supply special expertise or independent review if your organization lacks the necessary special skills or training, or if you have an insufficient number of personnel to fulfill your CASS functions. If you are a larger certificate holder, you may have a significant number of personnel assigned full-time to CASS functions.

3-2. APPROACH OF THIS AC.

a. Main Text. This AC primarily addresses the functions of a CASS. The main text of this AC (chapter 5) presents the basic functions that you should have in any CASS.

b. Appendices 1, 2, and 3. In appendices 1, 2, and 3, we present examples of how three different types of operators might accomplish these CASS functions and satisfy the requirements. The intention of these examples is to show the different ways to comply; they are not a menu from which you may select a CASS. Rather, the intention of the examples is to demonstrate how you might design a CASS suitable for your particular, unique operation. Each appendix contains descriptions of procedures based on likely available resources for a different type and size of certificate holder. For example, if you are a smaller, on-demand air carrier operating under part 135 with two SAAB 340B airplanes, you probably meet the requirements in essentially the same way as a small certificate holder operating one Boeing 737 under part 121. You will need to develop your own procedures and use the terminology (for example, designating the personnel or organizations involved in different aspects of the CASS) that best fit your particular and unique operation. For that reason, any job titles in this AC are for illustration; they are not requirements or even recommendations.

c. Appendices 4 and 5. Appendix 4 is a list of sample CASS manual/document contents. Appendix 5 lists related publications and the publications that we used as reference material or source documents to produce this AC.

CHAPTER 4. CASS IN YOUR ORGANIZATION

4-1. CASS DOCUMENTATION. You should describe your CASS policy and procedures in writing. You can produce these documents in a paper or electronic form, or another comparable record. For example, you could put them in a detailed chapter or section within your general maintenance manual or you could put them in a separate CASS manual associated with your general maintenance manual. In all cases, your policy and procedures should be written and not simply be verbal understandings.

4-2. WRITTEN POLICY AND PROCEDURES. Your CASS policy and procedures should:

a. Recognize CASS as a Coordinated System. You should recognize and treat your CASS as a coordinated system rather than just audit and data collection activities dispersed within your maintenance program. You do not have to contain your CASS personnel within a single department or office. However, your policy and procedures should identify all functions related to your CASS. You should not assume that because an audit or data collection function exists somewhere within your organization, it automatically satisfies your CASS requirement with no further coordination necessary.

b. Identify Major Programs. It should identify any programs, such as an optional reliability program, that you use to satisfy a major portion of your CASS. Your CASS documentation may refer to the documentation for that other program rather than restate the documentation again in another manual. The relationship/interfaces between the CASS and that other program should be clear and address responsibility and feedback issues to ensure that the other program meets CASS objectives.

c. Address Communication and Coordination Needs. It should address the need for fluid communications and coordination among the individuals who you have assigned authority, responsibility, and duties related to your CASS.

d. Address Principles of System Safety. You should base it on principles of system safety.

e. Identify Positions of Authority and Responsibility. It should clearly identify the positions within your maintenance organization with authority and responsibility for the CASS. Remember that authority means permission and responsibility means obligation. Consistent with the system safety attributes, you must identify a position that has autonomous decision-making authority for your overall CASS process. There also must be a position that has, or positions that have, direct responsibility for carrying out the various functions of your CASS. If you have a larger organization, you may have a number of positions that have direct responsibility for carrying out functions of your CASS. However, there should be only one position that has the autonomous decision-making authority to authorize change for any of the CASS procedures for the CASS activities or functions.

(1) Authority. For purposes of this AC, “authority,” with regard to a CASS, means the power to create or modify fundamental policies or procedures without higher level review or approval. The individual with authority for the CASS may design or change the CASS without

having to seek approval from a higher level of management. The CASS procedures should include how to modify the CASS.

(2) Responsibility. For purposes of this AC, "responsibility," with regard to a CASS, means an obligation, with the expected accountability, for ensuring that others successfully accomplish tasks and functions in accordance with applicable policies, procedures, and standards. The person with direct responsibility may directly accomplish this work, or you may delegate the work. The individual with overall responsibility for your CASS has the obligation to carry out the functions of the CASS, including overseeing and managing any personnel to whom you have delegated CASS functions and duties. If your organization is smaller where personnel share duties and only carry out CASS functions part-time, this oversight and management responsibility relates only to those part-time tasks.

(a) You should designate a single person or position within your organization with the overall authority for your CASS, and you should designate an individual, position, or management committee within your organization with overall responsibility for managing and implementing your CASS. If you are a small certificate holder, an individual may have both authority and responsibility for CASS activities. That individual might also have responsibility for other functions as well as the CASS. It would be common for the person with overall responsibility for CASS functions to delegate some or much of this work to others within your organization, depending on the size and staffing of the certificate holder. The FAA expects you to assign clear responsibility for your CASS activities so that you do not end up with a fragmented system with a high risk of confusion over who is responsible for a given task.

(b) You should ensure that personnel with CASS responsibilities and duties are as independent as possible from the day-to-day operations of your maintenance program. Ideally, personnel conducting audits would work in separate departments from the departments performing your actual maintenance activities. However, if you are a small certificate holder, this may not necessarily be feasible. If you are a small certificate holder, personnel performing your CASS functions, particularly audits, may consist of one or more of the following:

1. "Borrowed" personnel from other shops or departments. Your procedures should include ways to avoid having these individuals assigned to audit areas where they normally work.

2. The company owner or chief executive officer (CEO), particularly if there are no other employees and the CASS audits focus on outside vendors and maintenance providers because maintenance providers accomplish all or most of your actual maintenance work.

3. Outside resources that you make arrangements with to perform audits and analysis for you.

4. Others that you have determined are qualified to provide independent audit, operational data collection, and analysis services that fulfill the requirements of a CASS as described in this AC.

CHAPTER 5. MAJOR CASS ACTIVITIES

5-1. SUMMARY OF A CASS. The regulations require that your CASS accomplish surveillance and analysis of all elements of your maintenance program from two perspectives: verifying performance and verifying effectiveness. There are four activities in the CASS process: surveillance, analysis, corrective action, and followup. You can carry out the first two activities (surveillance and analysis) in two different ways. One audit-based, and the other is operational data and collection and analysis-based. The results of the two types of surveillance and analysis feed into the third and fourth major CASS activities: corrective action and followup. Figure 5-1 summarizes the flow of the four basic activities of CASS, which paragraphs 5-2 through 5-5 describe in further detail.

FIGURE 5-1. THE FOUR BASIC CASS ACTIVITIES: SURVEILLANCE, ANALYSIS, CORRECTIVE ACTION, FOLLOWUP

Verify *Performance* of Maintenance Program	**Verify *Effectiveness* of Maintenance Program**
1a. Surveillance: Audit process. - Create an audit plan based on risk assessment. - Perform work-in-progress audits. - Perform transaction audits. - Perform systems audits. - Identify hazards.	**1b. Surveillance:** Data collection process. - Select data sets. - Collect operational data. - Collect failure data. - Identify trends, anomalies, and potential hazards.
2a. Analysis: Identify hazards and accomplish risk analysis and assessment.	**2b. Analysis:** Identify hazards, investigate adverse indicators, and accomplish risk analysis and assessment.
3. Corrective Action: Accomplish Root Cause Analysis (RCA); develop, implement, and monitor a corrective action plan, as appropriate.	
4. Followup (Performance Measurement): Verify the corrective action is effective, and initiate risk-based followup surveillance planning, as appropriate.	

a. Risk Management in CASS.

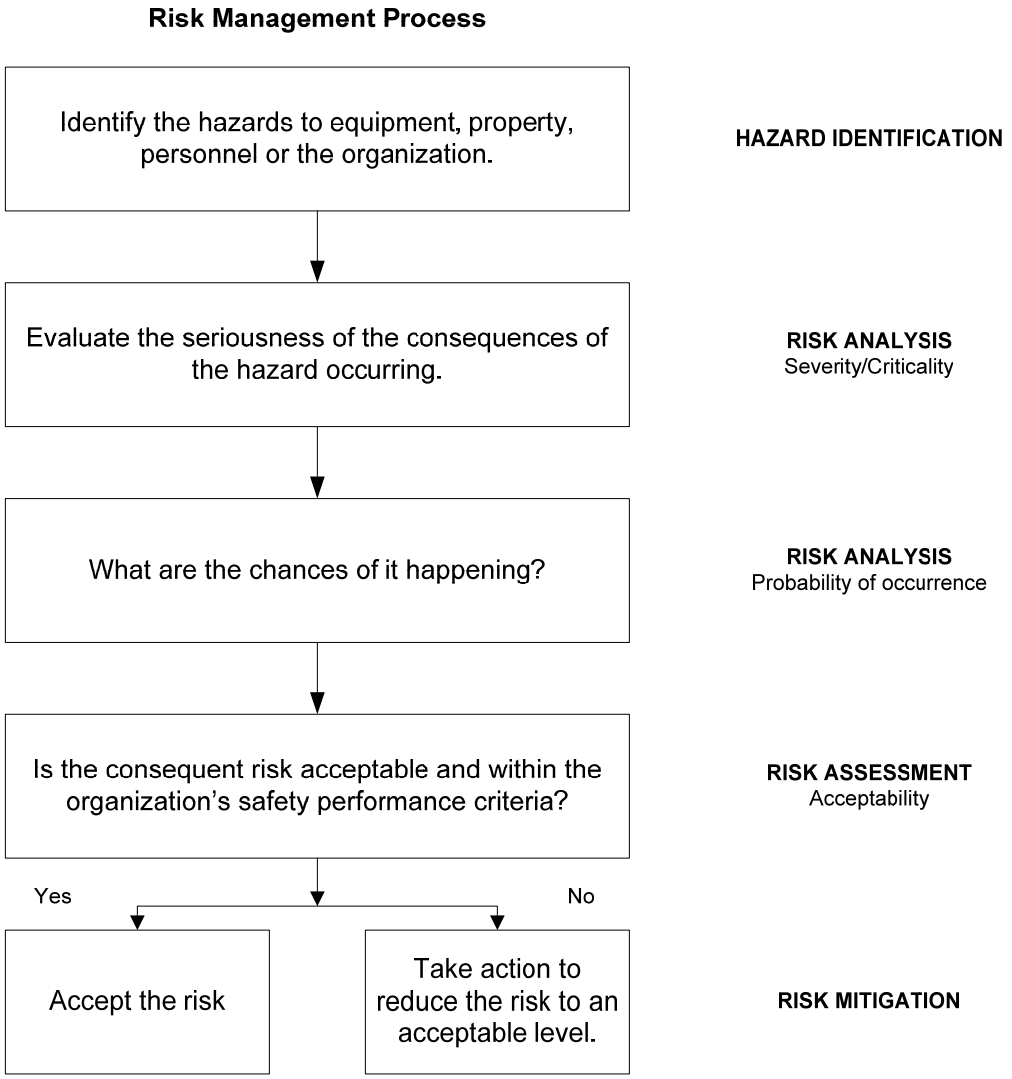
(1) In concert with the attributes of a good organization, you should prioritize personnel and resources for CASS as part of the overall risk management process. Risk management facilitates the balancing act between assessed risks and practical risk mitigation.

(2) Risk management serves to focus safety efforts on those hazards posing the greatest risks. Essentially, any methodology used to prioritize surveillance personnel and resources (as well as to formulate corrective action decisions later in the process) involves principles of risk management.

(3) A formal risk management process is composed of the following elements: identifying hazards, analyzing risk, assessing risk, and controlling risk. This process, embedded within the processes used to provide the product/service; it is not a separate process. The flow

chart in Figure 5-2 summarizes an overview of the risk management process. The elements of a risk management process encompass the four major CASS activities (Figure 5-1).

FIGURE 5-2. RISK MANAGEMENT PROCESS



5-2. VERIFYING PERFORMANCE OF YOUR MAINTENANCE PROGRAM.

a. Surveillance of the Performance of Your Maintenance Program.

(1) Definition of a CASS "Audit." Your main tool for assessing whether you are properly performing (executing) your maintenance program is audits, particularly work-in-progress audits. Work-in-progress audits are consistent with the plain language meaning of "performance" found in 14 CFR part 121, § 121.373 and 14 CFR part 135, § 135.431. The main direction of your audits should address your maintenance program objectives found at §§ 121.367 or 135.425, as appropriate. For purposes of CASS, a CASS audit is a formal examination of the activities of a department or area of your maintenance program based on an established standard such as the regulations or your manual. The intention of work-in-progress

audits is to ensure that your maintenance personnel, as well as your maintenance providers, comply with your manual, program, and all other requirements.

(2) Audit Procedures. You should have written procedures to guide your auditing process, including the scheduling of audits. The CASS addresses both internal audits and external audits. Internal audits are audits that you conduct within your organization. External audits are audits that you conduct of vendors who supply parts and services to you. Your CASS procedures should include a methodology for determining priorities and for establishing and adjusting audit cycles (for example, 12, 18, 24, 36-month cycles) so that you focus your resources on the most pressing issues. This is a risk assessment and risk management process. (See paragraph 5-2(a)(3) for further explanation of risk assessment and risk management.)

(a) Although the majority of the generated inputs to this process are internal, one additional input may be the result of outside audits conducted by entities other than yourself or your maintenance providers. For example, the results of audits or inspections conducted by the FAA or the Department of Defense (DOD) may be useful by providing you with:

- Specific findings requiring RCA and possible corrective action (activities discussed later in this AC), and
- Information useful in focusing your own audits and operational data collection.

(b) You may approach this initial scheduling task in many different ways, ranging from resource allocation based on company experience and very basic analysis to the use of a sophisticated, software-supported risk analysis process. Within this range of possible methodologies, your CASS procedures should contain a process to systematically make those decisions that are compatible with the size and complexity of your operations. The FAA encourages you to make this process as structured as possible. You should place priority first on safety and regulatory compliance, and second on issues of operational efficiency. However, if your CASS is effective, you will meet all three of these objectives.

(3) Prioritizing Surveillance Resources. Essentially, any methodology that you select to prioritize your surveillance resources (as well as to formulate corrective action decisions later in the process) involves principles of risk assessment. Risk assessment is a concept applicable in many aspects of an aviation operation. (See FAA Order 8040.4, Safety Risk Management, for additional information.) Order 8040.4 is an example and is not the only source of risk assessment procedures. However, it provides insight into FAA expectations. The FAA encourages operators to incorporate the principles of this systematic process to:

- Establish a plan, including the scope of the process and priorities (for example, detect and prevent noncompliance);
- Specify the areas of concern for surveillance and analysis (personnel, the maintenance program and organization, operations, aircraft, facilities, and systems);
- Identify hazards or potential threats to the operation;
- Determine how likely the consequences of a hazard will occur and actually cause harm;

- Determine the severity of the consequences, for a realized hazard;
- Express a combination of the likelihood and severity of harm as "risk;" and
- Evaluate the appropriate response to the identified risk.

(a) Your CASS should take into account four principal potential sources of hazards:

1. Personnel (hiring, capabilities, competence, interaction, and human factors),

2. Equipment (design, maintenance, logistics, and technology),

3. Workplace (environment, sanitation, and user friendly), and

4. Organization (safety culture, authority, responsibility, standards, procedures, and controls).

(b) There are a number of quantitative and graphical tools that exist to help you determine the gradations of a risk (high, medium, low) based on the likelihood of an unwanted event occurring and the severity of the consequences if it does occur. In the initial steps of your CASS process, the appropriate response involves setting surveillance priorities based on risk assessments aimed at maintaining compliance and safety in maintenance activities. Your CASS risk assessment, through the feedback loop, helps you to set the audit and data collection priorities that enhance the focus of surveillance. An interdisciplinary team, guided by your CASS management but involving representatives from relevant technical areas, can best accomplish this process.

(c) To identify the areas to audit and in order to set priorities, you should consider factors in outside reports. These could include results of inspections, reports, special studies, or audits conducted by outside entities such as the FAA, DOD, Department of Transportation (DOT), DOT Office of the Inspector General (OIG), or National Transportation Safety Board (NTSB). Outside reports may address:

- Information specific to you or your maintenance providers,
- Information related to the industry as a whole and of interest to you, or
- Relevant information about an accident, incident, or equipment type.

(4) Audit Materials. You should provide your CASS auditors with checklists to ensure consistency and completeness of audits. However, you should permit your auditors that flexibility necessary to ask questions not contained on the checklist if he or she finds an area that requires further investigation.

(5) Areas Requiring Auditing. The CASS monitors all 10 elements of your maintenance program. The following are examples of some, but not all, of the areas within each element of your maintenance program that the CASS looks at. You should note that all of these items are predisposed to surveillance of the maintenance program performance function of the CASS, accomplished through audits.

(a) Airworthiness Responsibility.

1. As an air carrier, you are primarily responsible for the airworthiness of your aircraft as well as the performance of maintenance, including work done by maintenance providers, on your aircraft. You must ensure that all completed maintenance, including work done by outside persons, is in accordance with your maintenance program and maintenance manual.

2. Your air carrier certificate makes you a maintenance entity. Each person who accomplishes maintenance on your aircraft does so as an agent on your behalf. Consistent with the privileges and limitations of your air carrier certificate, you must, through your maintenance organization, execute operational control over any maintenance activities anyone accomplishes on your aircraft or any of its component parts. Such activities include determining when maintenance is required, what maintenance is required, accomplishing the maintenance, determining if the maintenance was done satisfactorily, and approving your aircraft for RTS. Consistent with the regulations, you may not delegate this responsibility to anyone else, including persons that you use for any of your maintenance, preventive maintenance, or alterations.

(b) Manuals.

1. The content of all your manuals, including maintenance manuals and technical content, is your responsibility. You may base your manuals on the Original Equipment Manufacturer (OEM) manuals or other information, but regulations require you to use your own manual, not the OEM manuals.

2. You should ensure that all of your manuals, publications, and forms are useable, current, correct, and readily available to all personnel required to use them.

3. You should ensure that each person who is required to comply with your manual must have access to it during performance of normal duties.

(c) Maintenance Organization.

1. Consistent with the responsibility described above, you must have a maintenance organization that is able to effectively exercise and maintain operational control over all persons performing, supervising, managing, and amending your maintenance program. Your maintenance organization must be able to manage and guide your maintenance personnel and provide the direction necessary to achieve your overall maintenance program objectives.

2. The individual with overall maintenance program authority and responsibility is your Director of Maintenance (DOM), who should function as the accountable manager for the maintenance program. Your organization must clearly identify this individual, and he or she must be qualified in accordance with 14 CFR part 119, §§ 119.65 and 119.67(c) or §§ 119.69 and 119.71(e), as appropriate. While retaining overall authority and responsibility, your accountable manager may delegate direct responsibility for elements of the program as appropriate for the size and structure of your maintenance organization.

3. Your air carrier manual must contain a chart or a description of your maintenance organization showing clear authority and responsibility, including delegated

responsibility, for the overall maintenance program and all of its elements and functions. The regulations also require you to include a description in your maintenance manual of the duties and responsibilities for each position in your maintenance organization so that you do not end up with a fragmented organizational system with high risk of confusion over who is responsible for a given task.

4. In order to be effective, an adequate maintenance organization must be able to demonstrate the following four organizational obligations:

- The obligation to define the environment within which individuals conduct their tasks,
- The obligation to define the policies and procedures that individuals must follow and respect,
- The obligation to allocate the resources that individuals need in order to achieve your safety and production goals, and
- The obligation to investigate system failures and take all needed remedial action to avoid a repetition.

5. Your maintenance organization will be predisposed to failure if you permit the following failures to occur:

- Failure to understand the effect of people on the safety and reliability of aircraft maintenance operations,
- Failure to organize your employees' work,
- Failure to monitor your employees' work effectively, and
- Failure to implement appropriate and effective corrective actions.

6. You must organizationally separate the performance of your RII function(s) from the performance of your other maintenance (including inspection), preventive maintenance, and alteration functions. This organizational separation must be below the level of the individual who has primary responsibility for your RII function, as well as your other maintenance, preventive maintenance, and alterations functions. In simple terms, this means that the part of the maintenance organization that accomplishes your maintenance, preventive maintenance, and alterations functions cannot be the same part of your maintenance organization that accomplishes your RII function. When implementing the organizational separation, do not confuse your maintenance department with your maintenance organization. Your maintenance department and your inspection department are both a part of your maintenance organization. The organizational separation has to occur below the individual in your organization who has primary responsibility for both the maintenance function and the required inspection function. This individual must be qualified to make an airworthiness determination.

(d) Maintenance Schedule. Your maintenance schedule sets out the item, task, and interval of your scheduled maintenance effort. You should ensure that you accomplish your maintenance schedule as stated. The maintenance schedule should be task-based and appropriately modified in accordance with the CASS data collection and analysis findings. Your audits should find that your initial selection and the continuous validation of each scheduled maintenance task and its associated interval is accomplished according to well-defined criteria

throughout the service life of the item, system, or structure. Your maintenance schedule should be primarily proactive and designed to permit the item, system, or structure to do what it is designed to do.

(e) RIIs.

1. You must have specific procedures, standards, and limits necessary for the acceptance or rejection of each your RIIs and for periodic inspection and calibration of precision tools, measuring devices, and test equipment. You should note that the OEM's manuals and procedures do not contain RII procedures, standards, and limits. You must develop and document these aspects yourself.

2. You must ensure that anyone who you authorize to accomplish RII inspections is properly trained and qualified for each RII task that you authorize him or her to perform.

3. You must ensure that any RII inspector understands that if he or she performs an item of work, he or she may not perform a required inspection on that item.

4. You must ensure that the structure of your maintenance organization is designed to organizationally separate the accomplishment of the required inspection function from the accomplishment of the other maintenance, including other inspection, preventive maintenance, and alteration functions.

5. You must ensure that your manual contains procedures to ensure that only supervisory personnel of an inspection unit or the individual who has overall responsibility for the RII function as well as the other maintenance, preventive maintenance, and alteration functions may countermand the decision of any RII inspector regarding an RII.

(f) Maintenance Providers. You must ensure that all of your maintenance providers and your suppliers are qualified and provide services and products according to your maintenance program and manual. Other than location, there should be no difference between the way your own employees and any of your maintenance providers complete work. Before you identify any maintenance provider in your maintenance provider listing as an essential maintenance provider, you should conduct an onsite audit that will permit you to determine that each proposed essential maintenance provider has an adequate organization and provides competent personnel and adequate facilities and equipment for the essential maintenance intended.

(g) Personnel Training.

1. You must have means that you can use to determine that all of your maintenance personnel, including maintenance provider personnel, are competent to accomplish their duties.

2. You must have a training program for maintenance personnel (including inspection personnel and maintenance provider personnel) who determine the adequacy of accomplished maintenance.

3. Part of your maintenance program should ensure that your maintenance personnel are competent to perform their duties.

(h) Accomplishment and Approval of Maintenance.

1. All of your maintenance facilities and equipment, including base and line stations as well as all of your maintenance providers' facilities and equipment, are adequate to perform the maintenance. Other than scope and location, there should be no difference in the standards for facilities and equipment between you and your maintenance providers.

- You properly store, dispense, identify, and handle parts and components.
- You and your maintenance provider properly calibrate your tools and equipment.
- You identify requirements for specialized tools or training and provide the tools and training.

2. You or your maintenance provider perform(s) maintenance and alterations according to the methods, standards, and techniques specified in your manuals.

3. If you use an onsite representative to monitor work at a maintenance provider, you should ensure that you have clear procedures for this individual to report and document deviations from your manual or any of your methods, standards, and techniques specified in your manuals.

4. You or other persons properly document work interruptions and deferred maintenance in shift turnover records and accomplish them according to applicable procedures.

5. Major repairs and major alterations are properly classified, consistent with the 14 CFR part 1, § 1.1 meaning of major alteration or repair, and accomplished in accordance with FAA-approved technical data.

NOTE: During 1953, the Civil Aeronautics Authority (CAA) published a list of repairs to specific parts, as well as specific types of repairs that were considered major repairs in Civil Aeronautics Manual 18. This major repair list was later adopted, unchanged, as part of 14 CFR part 43 appendix A. If you rely exclusively on this standardized list of major repairs to make your major/minor classification, you will end up classifying some minor repairs as major and some major repairs as minor simply because the list has not been updated to include evolving airplane design and construction techniques such as composite structures, damage tolerant design, and the high speed pressurized jet transport that did not exist in 1953.

6. Appropriately certificated mechanics or repairmen whom you have authorized to do so, execute log entries and Airworthiness Release Forms.

7. You, or those you have authorized to do so, complete log entries and Airworthiness Release Forms according to your written policies and procedures.

(i) Maintenance Recordkeeping System.

1. You or other persons generate and retain maintenance records and current status records in accordance with your manual procedures.

2. Maintenance records and current status records are complete and correct.

3. You or other persons appropriately evaluate, accomplish, and track Airworthiness Directives (AD).

4. ADs with an alternative method of compliance (AMOC) and ADs that have been reconfigured (undone) are appropriately evaluated for accomplishment and for other modifications in the affected area (Supplemental Type Certificate (STC), major repairs, and alterations), documentation, and tracked.

NOTE: The current edition of AC 39-9, Airworthiness Directives Management Processes, provides you with additional information and guidance on developing a management process to help you comply with part 39, Airworthiness Directives.

5. The maintenance recordkeeping system identifies life-limited parts and tracks the current status time in service.

(j) CASS.

1. Your CASS ensures that you or other persons properly execute all elements of your maintenance program and that they are consistently effective by design rather than by chance.

2. Senior management reviews CASS issues on a regularly scheduled basis. They hold meetings of CASS or maintenance management committees or boards on a regular basis to discuss findings, analysis, and the progress of corrective actions. These meetings may address events, as well as statistical data and trends.

(6) Objective of CASS Audits. Most of your CASS audits should be primarily proactive, searching out potential problem areas in program execution before they result in undesirable events. However, your CASS procedures may also be reactive when they address how to direct audits in response to events or a series of events. For example, an analysis of rejected takeoffs, unscheduled landings, in-flight shutdowns, or accidents or incidents may indicate the need for special audits or surveillance. One of the activities of a CASS identifies indications of program weaknesses or deficiencies through an analysis of trends. For example, your CASS auditors would not necessarily investigate a single maintenance-related rejected takeoff. A CASS would, however, consider whether that instance, coupled with other instances, indicated a need to focus audits on a particular issue.

(7) Informal Communications Within a CASS. Your auditors and analysts should maintain informal lines of communication with your personnel in the various maintenance departments, so that your maintenance personnel can discuss concerns they may have. Through

this informal communications process, you can learn about potential hazards in your system. For example, you may learn about an event that might have occurred but, because of some intervention, did not. Your shop personnel know of this event, but it is otherwise difficult or impossible to detect in routine audits. If you keep informal lines of communication open to your shop personnel, your CASS may detect this near event. The FAA suggests that your CASS procedures address how to encourage this type of communication and interaction.

b. Analysis of Audits.

(1) RCA. A risk assessment process tells you where to allocate resources and helps you to understand what it finds. Your audit results should undergo risk assessment and preliminary RCA to identify a deficiency or potential deficiency in any element of your maintenance program. This preliminary analysis helps your CASS personnel determine the priority level that the issue merits and what type of additional technical expertise it may need to complete the RCA and to evaluate corrective action options.

(a) RCA treats errors as defects in the system rather than in an individual. RCA looks beyond the symptom to find the organizational defect that permitted an error to occur. The more thorough the analysis, the greater the likelihood you will uncover why the system deficiency could occur, and how your organization can respond definitively. The RCA process starts during the early part of an audit, as your auditors must collect information conducive to later analysis. If your CASS is to uncover a procedural weakness, for example, your auditors must collect information about the procedure. This should be factual and objective information, not premature judgment about root cause. RCA is key to any complete CASS, even though procedures may vary in complexity from certificate holder to certificate holder.

(b) An effective RCA can be as simple as asking and answering a question (five times) about why something happened. For example, if there is a human error in a maintenance process, the scenario could be as follows:

Question	Answer
Why was the error made?	The individual involved was not competent to do the work.
Why?	The training department did not identify a training need for this individual.
Why?	The training needs identification process is very weak.
Why?	The company has not identified the weakness in the training needs process.
Why?	The training department lost two experienced analysts last year and has not replaced them.

(c) The above RCA leads to a training department workload problem. A superficial analysis might have lead to disciplinary action against one individual, which is indicative of a blame culture, and would, most likely, lead to a recurrence of the same error by a different individual.

(d) A CASS should reflect your overall management philosophy and it should avoid or discourage a "blame culture" within your maintenance organization. A blame culture:

- Fixes blame and moves on.
- Focuses on who made the error and their punishment.
- Encourages you to stop short of identifying:
  - Systemic problems, or
  - Root causes.
- Never permits you to fix the problem.
- Allows mishaps and mistakes to recur.

(e) RCA processes can range from the simple "five whys" above to the use of complex commercially available RCA software.

(2) Objective of Audit Analysis.

(a) Analysis Process. The objective of this analysis is to allow you to address the problem in such a way as to avoid a recurrence of the deficiencies. To the extent possible, you should set forth the analysis process in the CASS documentation. Your analysis process should be as objective as possible to avoid any tendency to promote individual or commercial interests. You should also place priority on finding the systemic or root cause of a program deficiency over seeking to assign personal blame, at any level of the organization, for an error. There is a difference between accountability and culpability.

(b) System Deficiencies. While you should design your audits mainly to verify that you are performing maintenance in accordance with your manual, the regulations, and applicable requirements, your auditors and analysts should also be alert for system deficiencies. That is, there may be procedures in your manual that you correctly follow, but which have become outdated, conflict with other manual procedures, or for some other reason are in need of change. You should encourage your auditors and analysts to be inquisitive and to think in terms of "what if?" so that your CASS functions proactively, detecting problem areas or trends before they lead to an accident, incident, or infraction of regulations. For example, what if event *x* occurred in conjunction with observed condition *y*? This inquisitive type approach should permeate your CASS organization, from determining audit priorities and scheduling, through auditing and analyzing, and including monitoring and evaluating corrective actions.

(3) Managing Data from Audit Analysis. Your audit analysis process is not typically as oriented toward quantitative analysis as the operational data analysis discussed below. However, you may find it useful to manage the data through database or quantitative applications. The FAA emphasizes that this approach does not have to be complicated or costly. The level of formality and sophistication should match that of your organization.

5-3. VERIFYING THE EFFECTIVENESS OF YOUR MAINTENANCE PROGRAM.

a. Surveillance of the Effectiveness of Your Maintenance Program.

(1) Collecting Operational Data. The main tool for determining whether your maintenance program is effective is to collect and analyze operational data that shows the availability of the equipment, which should be one of the objectives of your maintenance program. You should collect data that measures the output of your maintenance program. A primary function or output of your air carrier maintenance program is to permit your equipment (aircraft) to continue to do what it is supposed to do. Therefore, any activity (data) that shows that your equipment is not available to do what it is supposed to do would be a prime indicator of the level of maintenance program effectiveness. The level of unscheduled maintenance is such an indicator. Other indicators that may be reflected in a requirement for unscheduled maintenance are maintenance personnel not following the methods, techniques, and procedures in your manual; facilities and equipment not being adequate for the work that is being performed; and an aircraft being released to service when it is not airworthy.

(2) Types of Operational Data. Consistent with the performance-based CASS regulation, the FAA does not intend to mandate the specific data that you should collect. However, the FAA does expect you to have a process to ensure that the data that you do collect is adequate to meet the intent of the CASS requirement and is useful. The FAA expects you to use an effective selection and periodic review process. The FAA does not want you to collect specific data elements that you do not use and that may not fit your particular situation. You can collect operational data from two different activities: routine or unplanned (non-routine) maintenance. However, you should keep any operational data that you collect from any unscheduled work occurring because of planned/routine work separate from the data that is not a result of planned/routine activities. Non-routine/unscheduled maintenance occurring as a result of scheduled, planned maintenance activities is a normal activity. This is the time when you should find discrepancies, and when you should accomplish the identified maintenance, not when your aircraft are in an operational status carrying passengers and/or cargo.

(a) However, you should not consider unscheduled maintenance activities occurring when your airplane is in an operational status carrying passengers and/or cargo as a normal and acceptable activity. After all, a primary function of your scheduled maintenance program is to permit your airplane to be available for operations in air transportation. Logically, a reduction of availability of your aircraft to carry passengers and/or cargo as a result of unscheduled maintenance activities is a primary indicator of the level of effectiveness of your maintenance program.

(b) Some examples of routine operational data are:

- Corrosion prevention and control program findings,
- Repair assessment findings,
- Engine Condition Monitoring (ECM) information,
- Scheduled structural inspection findings,
- Repairs accomplished as a result of scheduled structural inspection findings,
- Scheduled maintenance findings,
- Repairs accomplished as a result of scheduled maintenance findings,
- Vendor or maintenance provider information,
- Component teardown reports, and

- Individual component failure rates.

(c) Examples of non-routine data are:

- Pilot reports, including maintenance deferred in accordance with the minimum equipment list (MEL)/Configuration Deviation List (CDL);
- "Chronic" systems that have repeat write-ups in a specified time period (for example, 10 to 15 days);
- Flight delays and cancellations related to maintenance issues;
- Service Difficulty Reports (SDR); and
- Unscheduled parts replacement or unscheduled maintenance.

(d) Operational data also includes reactive data collection and analysis responding to such non-routine events as:

- Accidents and incidents;
- High-load events such as hard landings, turbulence, etc.;
- In-flight engine and propeller separations and uncontained engine failures;
- In-flight engine shutdowns;
- In-flight propeller featherings;
- Lightning strikes;
- Unscheduled landings caused by mechanical difficulties or malfunctions; and
- Rejected takeoffs caused by mechanical difficulties or malfunctions.

(e) As with reactive audit surveillance, your CASS should generally approach these types of problems from the analytical, systems perspective. For example, in response to one or more rejected takeoffs, a CASS might focus the operational data collection and analysis to determine if a pattern in rejected takeoffs was evident, or if it could examine other types of data or information in relation to the rejected takeoff circumstance.

(f) The above data sets are only examples. Although the data sets focus on equipment, this area of your CASS may also collect other types of data, such as information on types of maintenance errors that you may have experienced.

(3) CASS Documentation. What you should include in your CASS documentation regarding collection of operational data. Your CASS documentation should include a means of identifying data that is relevant and useful for you to use in monitoring the effectiveness of your specific and unique maintenance program. You should periodically review and reevaluate the usefulness of the data that you collect and analyze to accomplish this portion of your CASS.

b. Analysis of Operational Data. Your CASS procedures should:

(1) Provide your analysts with an understanding of the potential significance of each data set and how to process the data to understand its significance. This may require:

- Statistical analysis, such as comparing the frequency of certain events or equipment failures with a determined norm; or
- Qualitative analysis, to evaluate reports of certain types of events.

NOTE: This process is not necessarily the same as that used in an FAA-approved reliability program.

(2) Emphasize that analysis of operational data should consider root causes of negative trends or anomalies. This preliminary RCA, including human factors, may require collaboration with technical personnel in the affected areas or specialists in engineering and reliability departments.

(3) Delineate the roles of your CASS analysts as well as other departments or personnel in the analysis of operational data. You may decide to select a system that uses alerts or warnings if results of your analysis exceed certain predetermined parameters. However, your CASS should not rely completely on such alerts to the exclusion of your analysts' judgment. In addition, the use of alerts has historically been associated with parts and their failure rates, while current maintenance methodology focuses on systems and the loss of function, not part failure rates. The FAA's expectation of your CASS in this regard is that you have a complete, written procedure to review and analyze the operational data collected and to determine when further review is necessary.

5-4. FINAL RCA AND CORRECTIVE ACTION. While the surveillance and analysis steps differ for the verification of *performance* of your maintenance program versus verification of the *effectiveness* of your program, the process merges when you respond to CASS findings. The two types of analysis identify potential deficiencies in your maintenance program. In responding to these findings and analyses, the objective of your CASS is to determine the root causes of your program deficiencies and address them appropriately, regardless of the perspective from which you found the deficiencies. Generally, the organizational area responsible for analysis will present their results to your technical or production area with a preliminary analysis of the collected information and, in some cases, possible underlying causes of the problem. Personnel in your technical or production areas complete the RCA (if necessary) and develop proposed corrective action alternatives.

a. Final RCA.

(1) Preparing for RCA.

(a) Analysis of audit findings or operational data requires you to evaluate mechanical, human performance, or other data generated by your CASS in order to determine the effectiveness of a process, maintenance practice, or equipment. In the case of operational data, analysis begins with comparison of the data to a standard representing acceptable performance. The standard may be in the form of an average or other means of calculating a reference. The standard may be set by the FAA, industry common practice, or by you, the certificate holder, as appropriate.

(b) Your CASS procedures should note that in performing RCA, you should consider all relevant areas, including the role of your maintenance organization, your senior management, and your policies, procedures, and communications.

(2) Applicability of RCA. RCA applies to both audit findings and operational data analysis. For example, either audits or operational data analysis may point to maintenance errors committed because of inadequate training or a confusing work card. Analysis should not stop with simply correcting the work card or determining which mechanics were inadequately trained and then training them. Rather, the analysis should determine why the work card got that way, or why the training breach occurred and consider looking at other areas (including the role of your maintenance organization and senior management), such as communications, staffing, scheduling, or training program design that may be involved.

(3) Principles and Considerations of RCA. Principles and considerations of RCA are closely related to those of risk assessment, particularly in terms of the thoroughness of the analysis. Both processes consider not simply the person involved in an issue (for example, the mechanic made a mistake), but all aspects of the organization and each individual in that organization where that person works. This approach has the premise that human error is a consequence rather than a deliberate action and, as such, proactive measures and continuous reform of different aspects of the processes and organization can address latent conditions in the system and increase the system's resistance to operational hazards. The term "latent conditions" refers to flawed procedures or organizational characteristics capable of creating hazards if the right conditions or actions occur.

(a) Your RCA should consider two major areas:

1. Systems analysis plays an increasingly important role in CASS because of the increasing complexity and variety of air carrier operations, equipment, and organizations. Systems analysis emphasizes a harmonized approach to an enterprise, including specific written procedures and planning for all activities, clearly established authority and responsibilities, communications processes, and methods of measuring results, detecting system errors, and preventing recurrence. This harmonized approach recognizes the wide range of interrelated issues that are potentially associated with a problem in the system, such as management direction and policies, communications, and pilot technique, in addition to the maintenance activities themselves.

2. Human factors analysis begins with your maintenance organization itself. As stated earlier in this AC, your maintenance organization:

- Defines the environment where your employees conduct their tasks.
- Defines the policies and procedures that your employees must follow and respect.
- Allocates the resources that your employees need to achieve your safety and production goals.
- Investigates system failures and takes all needed remedial action to avoid a recurrence.

(b) Within your maintenance organization, human factors analysis looks at how your employees communicate and perform in the work environment and then seeks to incorporate that knowledge into the design of equipment, processes, and organizations. This enhances safety and maximizes the human contribution, partly by designing systems to anticipate the inevitability of human error. Human factors includes basic issues that can be addressed in audit checklists, such as whether there is adequate lighting for maintenance personnel to perform their work and whether schedules permit personnel to be properly rested. However, the human factors discipline addresses a wider range of issues affecting how people interface with technology and the operational system; how people learn about new or changed equipment, technology, and documentation; and how people adapt to the general workplace environment.

(c) You, as an air carrier, should be aware that knowledge gained from human factors can help you avoid maintenance errors, ensure that individuals' initial skill sets match task requirements, ensure that individuals maintain and improve their skills, and enhance the work environment. This knowledge can help your CASS analysts perform RCA. Continuing with the previous example of inadequate training, with insufficient awareness of human factors issues, you might trace a maintenance error to a mechanic or technician who appears to have insufficient training for the task, and determine that the solution is more technical training. However, further analysis may reveal that there are contributing flaws in equipment design, job cards, manuals, work environment, or such organizational procedures as shift turnover reports that more training will not satisfactorily overcome. Or, it may turn out that a different kind of training, perhaps involving decision-making skills, is called for.

(d) The FAA is involved in cooperative efforts with the industry and academia in promoting human factors in aviation. This field is rapidly evolving, particularly in its application to aviation maintenance. According to a study conducted for the FAA, maintenance error contributes to a significant portion of air carrier accidents, with shift-turnover errors and work interruptions standing out as leading types of underlying causes. Based on human factors' growing importance and the human factors information available to the industry, the FAA expects that you will apply concepts of human factors to your CASS surveillance and analysis.

(e) Your CASS surveillance should ensure that an RCA that considers human factors is part of the investigation of individual events by any personnel designated by you to respond to maintenance-related events, such as rejected takeoffs. Otherwise, data reviewed in a CASS could be incomplete.

(f) One challenge presented by the increasing emphasis on human factors is how to balance two seemingly contradictory purposes. On the one hand, the FAA and industry need to encourage personnel to cooperate in addressing system organization and design issues without inhibitions caused by fear of discipline or enforcement. On the other hand, in some cases, individual employees or even senior management may bear a degree of culpability (for example, in deliberately bypassing important controls or committing a serious regulatory infraction in the commission of a maintenance error). In some instances, disciplinary action or even FAA administrative or legal enforcement may be indicated. This is a common issue in the industry. FAA programs designed to promote the greater good of the system, instead of the blame culture described earlier, have become available. These programs encourage voluntary reporting of errors and infractions by aviation personnel and operators without threat of

disciplinary action or penalty. Your specific CASS, in any event, should be concerned specifically with identifying and correcting deficiencies in your maintenance program. You should design your CASS with that objective in mind, rather than specific event resolution, even if your CASS analysts research specific events.

b. Analytical Tools and Processes. While it is not necessary that you implement any specific externally developed system, specific analytical tools or processes are available to assist you in your analysis process. Examples of these follow:

(1) Maintenance Error Decision Aid (MEDA). Developed by the Boeing Human Factors Engineering group in collaboration with the FAA, airlines, and the International Association of Machinists, MEDA analyzes human performance issues related to maintenance errors and trends. MEDA is used to track events, investigate and prevent maintenance errors, and identify contributing factors, corrective actions, and prevention strategies. The group of collaborators has also developed a software analysis package to work with this aid and facilitate analysis of systemic issues.

(2) Managing Engineering Safety Health. Developed by the University of Manchester in collaboration with British Airways (BA) Engineering. It is a system geared toward researching the workplace and organizational environment in aircraft maintenance to find the issues with greatest potential to contribute to human factors problems. The system uses software, diagnostic, and sampling tools. Managing Engineering Safety Health conducts anonymous, survey-like assessments among personnel at the work location, which are then analyzed. This is a more structured, data-intensive approach to determining and monitoring personnel attitudes toward the system than the interview process discussed earlier. The industry has far less practical experience with Managing Engineering Safety Health than with MEDA.

(3) Human Factors Accident Classification System Maintenance Extension. Developed by the U.S. Naval Safety Center in collaboration with the FAA for use in the air carrier industry as well as naval aviation, this comprehensive system incorporates a number of analytical tools and has profiled maintenance errors and contributing conditions, permitting development of potential prevention measures. While the Human Factors Accident Classification System Maintenance Extension may be more sophisticated than many operators would need, it demonstrates principles and techniques of software-aided analysis that could apply to a CASS.

c. Corrective Action Options.

(1) Determining Whether or Not to Proceed with a Corrective Action. Once your CASS auditors and analysts have identified a problem or deficiency, you must determine if a corrective action is warranted and, if so, the details of the corrective action (i.e., the corrective action plan).

(2) CASS Procedures. CASS procedures regarding the determination of whether you should proceed with a corrective action. Your CASS procedures should outline:

- How such a determination will be made,
- Who will make the determination, and

- What levels of review, if any, you will perform. A review is a system safety control.

(3) Developing a Corrective Action Proposal. Your technical area personnel should have primary responsibility for developing the corrective action proposal, as they would be most familiar with the technical workings of the area in question and would be sensitive to the possibility of creating new problems as a result of the corrective action. Your CASS procedures should emphasize a team approach. Team members should include your CASS auditors or analysts, your technical area personnel in the affected maintenance disciplines, and perhaps other affected areas such as training or flight operations.

(4) Types of Corrective Actions. There are several possible types of general corrective actions or responses, depending on the outcome of your risk assessment:

(a) Prevent recurrence through engineering or system changes designed to eliminate the risk.

(b) Accept the underlying cause of a trend or discrepancy, but reduce the risk through implementing controls or countermeasures. Examples are training, policy or procedure revisions, or warning devices. Other countermeasures might be modifying or introducing new equipment or technology.

(c) Accept that under certain conditions a discrepancy may occur, but be prepared to contain or mitigate the results of that situation. Your CASS does not necessarily have to implement corrective actions for every apparently negative trend or finding. Analysis of findings or trends may identify problem areas that do not present safety hazards that you are willing to accept, in accordance with your risk assessment process. For example, you might find that a higher than average number of component removals occur at a particular location with “no fault found” as a consequence of a non-safety-related failure. You might determine that the reason for this situation is that your aircraft spends insufficient time on the ground for line maintenance to completely isolate the fault. You might prefer to continue the brief turn times and simply change components. This would be a business decision for you to make. However, more comprehensive corrective actions would be mandatory if your CASS detects that your maintenance program lacks adequate procedures and standards to meet the requirements of part 121 or 135, as applicable.

d. Written Procedures for Developing and Implementing Corrective Actions. Your CASS should provide relatively detailed written procedures for developing and implementing corrective action. Your written procedures should:

(1) Result in a specific corrective action plan that addresses the following:

- Development and proposal of the corrective action.
- Analysis and final approval level of the corrective action, including who is responsible for approval of the corrective action.
- Who will implement the corrective action.
- How the responsible person will implement the corrective action.

- When the corrective action completion due date is.
- Who will evaluate the outcome and how, including identification of data requiring collection, awareness of the possibility of unintended consequences, and events that should trigger a response.
- Who will monitor the status of the corrective action and how.
- Reporting the status of the corrective action (to whom, with what frequency).

(2) Maintain the appropriate role of auditors in developing responses to findings, so that they continue to remain independent from the corrective actions they may subsequently audit.

(3) Distinguish clearly between your technical area personnel's responsibility for developing and implementing corrective actions, and your CASS personnel's responsibility for producing the findings and analysis and making sure the technical area involved develops and implements appropriate corrective actions.

(4) Designate the position or organization responsible for evaluating and approving proposed corrective actions. Your CASS director or other designated manager may appoint a corrective action team to design and propose a corrective action. The team—which typically represents a cross section of the departments involved in audits, operational data collection, analysis, and production—oversees the implementation of the corrective action. Technical and reliability control boards are most often used in conjunction with FAA-approved reliability programs; however, a similar concept applies to a CASS, even if no FAA-approved reliability program exists.

e. Corrective Action Risk Assessment.

(1) CASS Procedures Regarding Risk Assessment. Your CASS procedures should:

(a) Specify that your personnel will analyze a proposed corrective action carefully before its selection and implementation to ensure that corrective action is necessary and will actually fix the problem and not lead to unintended, negative consequences.

(b) Remind both CASS and technical area personnel of the need to consider the impact of the proposed corrective action on other aspects of your operation. This includes other areas of your maintenance program, such as manuals. The corrective action may require coordination with other areas, such as flight operations, that it could affect.

(2) Personnel Involved in Risk Assessment.

(a) Your technical area personnel play the key role in risk assessment, but the process should include your CASS analysts, who will act as resources in support of your technical area managers and bring risk assessment and systems analysis techniques to the process. Your auditor and analyst should be qualified (through training or experience) in systems analysis and can contribute to the evaluation of a proposed corrective action by determining if the basic system elements have been considered. However, your technical personnel have the expertise to actually develop and implement the corrective action, and to evaluate it in practical

terms. Thus, the corrective action is a result of cooperation between your technical personnel and your CASS personnel.

(b) Personnel working on the proposed corrective actions should ensure they consider issues of a timetable for the corrective action implementation, and the safety attributes of authority, responsibility, procedures, controls, process measurement, and interfaces.

f. Corrective Action Plan.

(1) With the RCA complete, corrective action options identified, and risk assessment performed as appropriate, you can make a final decision on the proposed corrective action plan. The corrective action plan should address all relevant issues, including a timetable for completion of the action, with milestones if appropriate. The appropriate technical department and, if the corrective action goes beyond your maintenance organization, other departments (such as flight operations) should then implement the plan.

(2) Your CASS procedures should identify:

- How this plan will be approved and at what level of your company.
- The parties responsible for implementing, monitoring, and ensuring that all affected parties are notified, both within your maintenance organization and externally, if necessary.

5-5. FOLLOWUP.

a. Corrective Action Followup. Your CASS procedures should:

(1) Specify how you will evaluate your corrective actions for effectiveness. That is, did your corrective action do what you wanted it to do? This may require the following:

- Followup audits of a specific area,
- Regular communication from the affected technical area about the effects of the corrective action and,
- Other forms of verification by your auditors or analysts tracking the implementation.

(2) Identify the person or entity (such as a CASS board) responsible for determining if any changes in the status of a corrective action are acceptable. Your CASS auditors or analysts have the duty of ensuring that the person implementing the corrective action did so in accordance with the established timetable, or, if not, determining why the timetable has changed.

(3) Include responsibilities and guidelines for:

- Tracking the implementation of corrective actions in accordance with the timeline.

- The role of your auditors, managers, management committees, and senior management.
- How your CASS will use automation or computerized systems.
- How your CASS will use risk assessment and systems analysis to guard against unintended consequences.
- Measures to evaluate the effect of the corrective action.
- The affected technical area to communicate the status of the corrective action to the person responsible for monitoring implementation.

b. Getting Help from a Manufacturer. In some cases, you may require data or assistance from a manufacturer in correcting a deficiency detected by your CASS. Manufacturers may not always assign these issues the same priority as you do. You should provide guidance in your CASS procedures, based on your own particular experience, about how your CASS should address assistance or information from manufacturers, and how to proceed in case of unsatisfactory or slow responses. This may include developing a standardized letter citing the need for this information or assistance to satisfy the requirements of § 121.373, § 135.431, or other pertinent regulations. It may also include working with your FAA principal inspector (PI) to find solutions.

c. Followup Surveillance Plan.

(1) Your CASS procedures should include how to determine the level of followup audits for verifying corrective action implementation. For example, based on the risk assessment or the complexity of your corrective action, the designated CASS analyst or team may schedule special or more frequent audits. They may also change the data collection process or institute other means of verification. The FAA expects you to have a well-defined and logical process to design the followup actions.

(2) The information and analysis performed through the closed-loop, continuous cycle of surveillance, investigations, analysis, and corrective action, permits you to refine your audit and data collection priorities through the risk assessment process.

CHAPTER 6. PERSONNEL WHO PERFORM CASS FUNCTIONS

6-1. PERSONNEL MANAGING CASS FUNCTIONS.

a. Decision-making Group.

(1) Your CASS should include a decision-making group at a relatively high organizational level to oversee or carry out your CASS functions. This oversight group could include:

- Technical boards concerned with performance and other technical issues,
- Administrative boards that may have broader decision-making authority to act on technical recommendations, or
- A single board combining both functions.

(2) The key concept is that there is a decision-making group at a relatively high level to monitor your CASS and to make critical decisions in a timely manner. Typically, if you are a smaller certificate holder, this committee or board might be composed of the president of the company, and the DOM and flight operations. If you are a larger certificate holder, participants might be managers from several departments, such as maintenance and engineering, quality assurance (QA), and flight operations.

b. Group Members.

(1) If you use committees or boards as major decision-making groups for CASS issues, members of these groups should:

- Have an appropriate technical background, and
- Be thoroughly familiar with the role and functioning of CASS, systems analysis, and how to evaluate the RCA and proposed corrective actions submitted for their review.

(2) You should consider requiring participants in such committees or boards to receive training or orientation on these issues to ensure that they can provide critical evaluation. The membership of such boards and committees as well as the basic operating procedures and records should be described in your CASS document.

6-2. CASS PERSONNEL TRAINING AND EXPERIENCE.

a. Maintenance. You should determine the precise mix of training and experience your CASS auditors and analysts need. In general, auditors and analysts should:

(1) Have sufficient maintenance background applicable to your program to ensure that they are familiar with maintenance procedures, technical documents, and aircraft systems.

(2) Be able to understand and interpret the data they see, as well as evaluate facilities, equipment, and processes they observe. While they are unlikely to have specialized knowledge in all of the areas over which they conduct surveillance, a foundation of technical expertise is important.

b. Surveillance and Analysis. Your auditors and analysts should have training and experience in the functions they are responsible for looking at and analyzing. However, it is also essential that they have training and experience in the following areas:

- Systems analysis,
- Auditing techniques,
- Risk assessment and risk management (RM),
- RCA, and
- Human factors.

c. Quality Processes and Systems. Additionally, you may seek specialized training in specific quality processes or systems for your CASS personnel, such as:

(1) The International Organization for Standardization (ISO) developed ISO 9000, which is a quality system set of standards that seeks to standardize processes into organized and documented systems.

(2) Six Sigma, which is process-oriented, but from an intensively data-oriented, statistical approach.

d. Technical. Persons who collect and analyze operational data may require specialized technical backgrounds. This will depend on the level of complexity of the operational data that you collect. These personnel may work in the unit conducting an FAA-approved reliability program or in an independent data collection and analysis system. You may also wish to consider auditor certification. There are a number of auditor certifications available such as those under ISO 9001 and the RABQSA International Certification AS9110, Aerospace Auditor.

e. Summary of Experience and Training for Your CASS Personnel. Your CASS document should reflect that you have considered the type of experience and training, initial and recurrent, appropriate to your auditors and analysts in your operation. Areas to consider include those listed in the following table:

Table 6-1. Subject Training

Subject Area	Auditors	Audit Analysts	Operational Data Analysts
Title 14 of the Code of Federal Regulations (14 CFR) part 121/135 (as applicable); operations specifications (OpSpecs).	Initial and recurrent.	Initial and recurrent.	Initial and recurrent.
Systems analysis training.	General training in quality standards.	General training in quality standards, statistics, and/or training in widely used industry courses such as ISO 9000.	General training in quality standards, statistics, and/or training in widely used industry courses such as ISO 9000.
Audit training.	Initial and recurrent. Coordinating Agencies for Supplier's Evaluation (C.A.S.E.) training if applicable.	Experience or training in conducting and reporting results of audits.	Statistical investigation experience or training.
Risk assessment training.	Initial and recurrent.	Initial and recurrent.	Initial and recurrent.
Root cause analysis training, including human factors.	Initial and recurrent.	Initial and recurrent.	Initial and recurrent.
Technical competence.	FAA mechanic certificate, engineering, or other maintenance background.	FAA mechanic certificate, engineering, or other maintenance background.	FAA mechanic certificate, engineering, or other maintenance background.
Educational background.	Related education or training may partially fulfill similar qualification requirements set by you.	Related education or training may partially fulfill similar qualification requirements set by you.	Related education or training may partially fulfill similar qualification requirements set by you.

CHAPTER 7. COMMUNICATIONS BETWEEN YOUR CASS PERSONNEL AND OTHER DEPARTMENTS

7-1. COMMUNICATING SPECIFIC CASS RESULTS AND ACTIONS. The procedures that you would use for communicating CASS information and results to interested parties, internally and, as applicable, externally (for example, vendors, or the FAA) varies depending on factors such as the size and nature of your operation, the level of automation, and your CASS procedures themselves. The number and complexity of the standardized communications processes, such as forms or electronic mail messages with standard distribution, should be appropriate to the overall size and scope of your operation and CASS.

a. Standard Communication Processes. You should develop appropriate standard communication processes for all aspects of your CASS to assist in standardizing procedures, including the following:

(1) Audit checklists and results.

(2) Analysis procedures and results.

(3) Records of audit/analysis findings: internal.

(4) Records of audit/analysis findings: external.

(5) Corrective action forms and corrective action plans. These forms should address system considerations to ensure that there is a clear understanding of when the person implementing the corrective action will do so, who is responsible, and what the impact will be on written procedures.

(6) Information for monitoring and followup of corrective action. The processes should also assist in tracking the implementation of corrective actions once underway.

(7) Periodic status reports to senior management and to the FAA.

b. CASS Description. Your CASS description should address issues such as:

(1) Who is responsible for keeping these standard communication processes up-to-date and available.

(2) Who is responsible for completing the standard communication processes.

(3) Where it sends communications, who must respond, and how it tracks responses.

(4) How, where, and for how long it retains completed records.

7-2. EDUCATING PERSONNEL ON CASS. Your CASS should include procedures and responsibility to create some form of communication between the area responsible for the CASS, other areas of the company, and the FAA. You may accomplish this through training, newsletters, bulletins, meetings, or another format that you determine is suitable. One purpose of

such communication is to educate your mechanics and other departments that feed information and data into the CASS about why these data are necessary, what you do with the data, and how this process benefits the operation.

7-3. COMMUNICATIONS WITH PERSONNEL OUTSIDE THE CASS. The FAA expects a good communication system to meet the objectives in this section. You must determine which system is best for your particular operation.

a. Outside Resources. Your CASS should provide for regular, structured communications within the CASS structure and between your CASS and any other resources involved in decision-making for you. Examples of these other resources include:

(1) Avionics and other shops,

(2) Cabin safety organization,

(3) Engineering department and FAA-approved reliability program department,

(4) FAA certificate management office (CMO) or PI,

(5) Flight operations,

(6) Ground operations,

(7) Inspection department,

(8) Internal Evaluation Program (IEP),

(9) Maintenance control,

(10) Maintenance operations,

(11) Manufacturers' technical representatives,

(12) Purchasing,

(13) QA,

(14) Receiving inspection,

(15) Maintenance recordkeeping department,

(16) Safety program,

(17) Senior management,

(18) Stores department, and

(19) Training departments.

b. Feedback Loop. The communications mechanisms should include a feedback loop designed to ensure that any changes implemented as a result of corrective actions are functioning as intended and improving the process. You may accomplish this level of communications through a variety of means, including the following:

(1) Periodic (weekly, monthly, quarterly) statistical and narrative CASS reports on trends, findings, and the status of corrective actions.

(2) Periodic CASS meetings to discuss trends or specific problem areas. If you are a smaller certificate holder, where your relevant managers work in close proximity, such meetings might be informal but frequent, or if you are a larger certificate holder using more formal and structured meetings, you may designate specific boards or committees.

(3) CASS board or committee meetings, including senior management, possibly on a monthly or bimonthly basis. Even if meetings are somewhat informal, you should keep minutes.

c. Monthly Report. Typically, if you use a program incorporating statistical performance standards (alert-type programs), you develop a periodic (monthly) report with appropriate data displays, summarizing the previous month's activity. To help evaluate the effectiveness of the total maintenance program, the report should cover all aircraft systems controlled by the FAA-approved reliability program. A certificate holder without an FAA-approved reliability program may find that using a similar report can enhance its CASS.

CHAPTER 8. HOW YOUR CASS DIFFERS FROM AND RELATES TO OTHER PROGRAMS

8-1. SUMMARY OF OTHER PROGRAMS. Your description of your CASS should identify other related programs where you participate and explain how your CASS relates to those programs or differs from them. Experience has shown that certain other programs are potential sources of information for your CASS. Some programs have been mistakenly assumed to be so similar to a CASS that you might neglect an important aspect of your CASS. Therefore, your CASS documentation should describe the relationship between your CASS and programs, such as the:

- FAA-approved reliability program,
- IEP,
- Safety program,
- Voluntary Disclosure Reporting Program (VDRP),
- Coordinating Agencies for Supplier's Evaluation (C.A.S.E.),
- Aviation Safety Action Program (ASAP), and
- Aviation Safety Reporting Program.

8-2. DISCUSSION OF INDIVIDUAL PROGRAMS.

a. FAA-Approved Reliability Program. According to the current edition of AC 120-17, Maintenance Control by Reliability Methods, the FAA developed the concept of reliability control to maintain an acceptable level of reliability. The concept evolved based on FAA and airline efforts to develop more responsive methods of controlling scheduled maintenance without sacrificing safety or FAA regulatory responsibility. An FAA-approved reliability program includes systems for data collection and analysis, corrective action, statistical performance standards, data display and reporting, scheduled maintenance adjustments, and process changes. AC 120-17 defines an acceptable level of reliability as maintaining failure rates below a predetermined value. However, AC 120-17 does not address modern-day, task-based scheduled maintenance programs.

(1) Typically, if you are a larger certificate holder, you will have an FAA-approved reliability program, but the operational statistical data collection and analysis requirements of a program that conforms to AC 120-17 usually exceed the resources or requirements of smaller and even most medium-sized operators, and generally are greater than what would be necessary for those operators' CASS. However, if you do have an approved reliability program, you should incorporate it into your CASS as the means of performing operational data collection and analysis to monitor the effectiveness of your maintenance program. Your CASS procedures should describe how you will integrate the approved reliability program into your CASS. You should be aware that an FAA-approved reliability program cannot substitute for a CASS because the reliability program addresses only the scheduled maintenance element and does not include the broader auditing surveillance and analysis of the full range of all 10 elements of your maintenance program, nor the complete processes for developing and implementing corrective actions. An FAA-approved reliability program should be a part of your CASS; however, it cannot replace or substitute for a CASS.

(2) This AC is not intended to describe FAA-approved reliability programs. However, CASS operational data collection needs are typically similar to, but much more comprehensive than, those of an approved reliability program. You should, within your CASS, establish a program similar to an FAA-approved reliability program for the purpose of collecting and analyzing operational data. However, you must ensure its operational data collection program meets the needs of your CASS.

(3) Within the aviation community, it is common to refer to "reliability," in a generic sense, as meaning dispatch availability of equipment or in relation to equipment failure rates. If your CASS manual or document uses this terminology, you should distinguish whether the reference is to an FAA-approved reliability program or generic reliability.

b. IEP.

(1) An IEP is a voluntary program that you can use to provide measurement of your internal processes and procedures to assess whether they are adequate and functioning properly. An IEP should be independent of all of your other programs and systems, and could be a useful tool to evaluate your CASS, as well as other systems or programs, such as your safety program. An IEP is a very high-level review to provide information to your senior management as to how well critical programs, such as your CASS, are working. It is not a substitute for a CASS. An IEP is a broader, system evaluation program and is less "audit-oriented" than your CASS, although both use a system evaluation approach. An IEP would not focus on evaluating the maintenance program, because such a focus would duplicate what the CASS is supposed to do. If management believes they need to have additional evaluation of your maintenance program or certain elements of your maintenance program, they should direct the CASS to accomplish that work. An IEP should produce information to determine if the CASS is being performed and is effective.

(2) The current edition of AC 120-59, Air Carrier Internal Evaluation Programs, describes the IEP. You should not misunderstand the IEP as a program that replaces existing regulatory auditing requirements such as a CASS. Audits are a very minor part of an effective IEP.

c. Safety Program.

(1) According to 14 CFR part 119, § 119.65, if you are conducting operations under 14 CFR part 121, you must have a full-time Director of Safety (DOS) or equivalent position unless you ask for, and the FAA authorizes, a deviation from the management position requirements. Consistent with the objectives of part 119, the DOS is responsible for keeping your highest management officials fully informed about the safety status of your entire operation. Your DOS should oversee a safety program that addresses the wide range of risks involved in operations in air transportation, including flight operations, maintenance operations, and ground operations. The safety program should be a comprehensive program with a variety of elements, such as investigations of and a reporting system for accidents and incidents, safety audits and inspections, operational risk assessment, and trend analysis.

(2) If you conduct operations under 14 CFR part 135, the regulations do not require you to have a DOS position. Nonetheless, the FAA encourages you to designate a company management official or manager to monitor and evaluate your flight, maintenance, and ground safety practices, procedures, and programs and to keep your highest management official fully informed about the safety status of your entire operation.

d. VDRP. The current edition of AC 00-58, Voluntary Disclosure Reporting Program, provides guidance for you on procedures to use when voluntarily disclosing to the FAA violations of Federal aviation regulations. Your participation in the program may reveal important information regarding maintenance issues and lead to the development of comprehensive fixes relevant to the maintenance program that your CASS oversees.

(1) Under this program, you may voluntarily report violations of regulations that you discover and avoid certain enforcement consequences.

(2) While the regulations do not require that your CASS addresses disclosures made under the VDRP, the FAA recommends that you consider whether to include information from voluntary disclosures in your CASS in any fashion. For example, your CASS personnel may be the same personnel as those who handle voluntary disclosures. They may therefore be able to use "de-identified" information from voluntary disclosures to point to areas where additional auditing may be necessary. Your CASS personnel should be aware of comprehensive fixes developed in conjunction with the VDRP. These are, after all, precisely the types of systems or procedural modifications that an effective CASS is seeking to avoid adverse audit findings or unwanted operational performance.

e. C.A.S.E.

(1) C.A.S.E. is a cooperative effort within the airline industry to audit suppliers and vendors and to analyze, control, and determine the acceptability of vendors supplying parts and maintenance services to participating airlines. According to FAA Order 8900.1, Flight Standards Information Management System (FSIMS), the FAA has determined that the use of C.A.S.E. audits satisfies some of the requirements of §§ 121.373 and 135.431. Operations specifications (OpSpecs) must authorize the use of the C.A.S.E. program to satisfy some of these requirements.

(2) If you participate in C.A.S.E., your CASS procedures should address whether or how the CASS will use C.A.S.E. audits and the basis for that decision. If the functions being audited depend on the specifics of your program, a C.A.S.E. audit would probably not suffice. The important point is that you have a written policy and procedures for when and how to use C.A.S.E. audit results in your CASS.

f. ASAPs. The current edition of AC 120-66, Aviation Safety Action Program (ASAP), describes this program for the voluntary reporting of safety issues and events by employees, such as crewmembers and mechanics. ASAPs involve the collection, analysis, and retention of safety data that would otherwise be unobtainable. Such data can be important input to your CASS.

g. Aviation Safety Reporting Program. The current edition of AC 00-46, Aviation Safety Reporting Program, describes the Aviation Safety Reporting Program, which uses the National Aeronautics and Space Administration (NASA) as a third party to receive aviation

safety reports. The Aviation Safety Reporting Program invites crewmembers, maintenance personnel, and others to report to NASA actual or potential discrepancies and deficiencies involving aviation safety. NASA designed and administers the Aviation Safety Reporting System to facilitate the program. These reports may help your CASS personnel identify areas of potential concern within their own company based on industry-wide trends or experiences identified by NASA.

CHAPTER 9. HOW TO DETERMINE IF YOUR CASS IS WORKING PROPERLY

9-1. WHY YOU SHOULD EVALUATE YOUR CASS.

a. Accomplishing its Function. As with any system or program, you should evaluate your CASS (that is, you should accomplish a process measurement) so that any personnel responsible for overseeing your CASS, such as your top management, may be confident that your CASS is accomplishing its function. Verifying that your CASS is working as intended is also a primary oversight task of your FAA PI.

b. Effective by Design. A common misconception is that a certificate holder can evaluate its CASS solely on the basis of the results of its maintenance program. That is, it is common to assume that if your aircraft are consistently airworthy, then your CASS must be doing its job. However, this favorable result may occur for other reasons, such as the extraordinary diligence or memory of a few individuals. The purpose of your CASS is to ensure, with a system-oriented, structured approach that your maintenance program is functioning properly and is effective, consistently and by design rather than good fortune. You should not assume that good maintenance is synonymous with your CASS working properly.

c. Functioning Properly. Thus, personnel with CASS oversight responsibilities (including the FAA) require a different approach to determining if your CASS is indeed working properly. They need to know that you have complete CASS policies and procedures to monitor and evaluate your maintenance program, that it is carrying out these policies and procedures, and that they work. For example, to ensure that your CASS is functioning properly, a senior manager would not analyze component removal rates, but rather verify that your CASS was analyzing component removal rates, detecting trends as appropriate, and implementing corrective actions when necessary. You should have procedures—either in your CASS manual, referenced in your CASS manual, or contained in another document such as its IEP manual—for evaluating your CASS and informing top management as to the effectiveness of your CASS. The regulations not only require a maintenance program to meet many specific standards; they also require a system (CASS) to monitor that program.

9-2. STEPS TO EVALUATE YOUR CASS. The FAA expects you to develop your own method of evaluating that your CASS is working properly, including how you intend to measure whether you have allocated sufficient staffing and resources to the CASS.

a. System Safety Attributes. Determine that your CASS addresses applicable system safety attributes (responsibility, authority, procedures, controls, process measurement, and interfaces). If you have an IEP that follows this format, it would provide your senior management with an appropriate means of evaluating your CASS. That would be one way, but not the only way, to evaluate your CASS.

b. Indicators. The following questions may be useful in indicating whether you properly designed your CASS or that it is working as intended, although you may identify other indicators:

(1) Are your CASS personnel sufficiently independent of the areas they audit? Are they trained specifically in their CASS responsibilities?

(2) Have you allocated resources to your CASS sufficient to permit timely analysis of audits and data, as well as followup to corrective actions? Or are there delays in responding to findings and implementing corrective actions?

(3) Are your CASS personnel able to perform their duties in accordance with reasonable schedules?

(4) How many findings does your CASS produce, and what are the trends?

NOTE: CASS is supposed to produce findings, so absolute numbers—even high numbers of findings—are not necessarily a negative outcome; if combined with effective corrective actions and followup action, numerous CASS findings could be a positive indicator that the CASS is doing its job of detecting deficiencies and yielding appropriate, well-analyzed corrective actions. Trends are important, however. The same types of findings should not recur often once the CASS has addressed those findings.

(5) Have an unusually large number of unplanned maintenance events occurred within a specified time; for example, 21 days after a substantial inspection or other maintenance task? If so, does an investigation indicate that there are deficiencies in your maintenance program that your CASS should have identified and averted, or can the investigation attribute the anomaly to other factors?

(6) Does analysis indicate recurring problems in areas that you previously thought corrective actions had addressed?

(7) Are new problem areas coming to light? (This would be indicative of your CASS working to detect new issues.)

(8) Are your CASS corrective actions resulting in new problem areas, reflecting insufficient root cause, risk, or system analysis before implementing these corrective actions?

(9) How do CASS results compare with outside audit results, such as those conducted by the DOD or the FAA?

(10) Have regulatory violations occurred that your CASS might have averted?

(11) Does your senior management understand and support the CASS?

(12) Are your CASS auditors and analysts encouraged to consider all possible aspects of an issue, including the role of your senior management, when developing corrective actions?

(13) Has your CASS evolved into a punitive process (the blame culture) with the effect of discouraging open participation of company personnel, or do your personnel cooperate actively and offer input to the CASS?

(14) Are all areas of your maintenance program undergoing CASS audits in accordance with a schedule based on a process of risk assessment and prioritization?

(15) Do the depth and quality of the audit reports and analysis reflect that your personnel have sufficient time and resources?

c. Senior Management Review. Your senior management should review CASS issues on a monthly or bimonthly basis. You may hold meetings of this sort, possibly of CASS or maintenance management committees or boards, to discuss findings, analysis, and progress of corrective actions. These meetings may address statistical data and trends, depending on your size, type of operation, and capability of producing comprehensive statistical reports.

CHAPTER 10. THE ROLE OF THE FAA IN RELATION TO YOUR CASS

10-1. THE FAA'S ROLE, IN GENERAL. As with any applicable aviation regulation, you must understand that you hold the primary responsibility for regulatory compliance, not the FAA. The FAA's role is not to design the CASS for each certificate holder, but to ensure that you have satisfactory policies and procedures in place. For example, the FAA will not provide you with an extensive list of data that you should collect and analyze because of the wide variation in the nature and scope of airline operations. However, the FAA expects you to demonstrate that your CASS includes a process for selecting and periodically reevaluating data sets appropriate for your operation and appropriate for monitoring your own unique maintenance program. The FAA also expects you to have a logical and current reason for selecting the data set it collects.

10-2. THE FAA PI'S ROLE. The term FAA PI, as used in this AC, is generally intended to mean the principal maintenance inspector (PMI). However, the principal avionics inspector (PAI) also plays an important role in the oversight of the certificate holder's CASS and shares many of the same responsibilities as the PMI. The FAA PI:

a. Assists in Developing Your CASS. Works with you in developing your CASS, providing guidance and ensuring that your CASS meets the requirements of the regulations.

b. Reviews CASS Records. Reviews your CASS records, such as results of audits and analysis, corrective action, and followup. Therefore, it would be useful for you and your PI to have a common understanding of how long you will retain these records, not only in terms of usefulness to your CASS, but also to facilitate review by your PI to help him or her determine that you are properly executing your CASS.

c. Meets with Maintenance and QA Management. Meets on a regular basis with managers in your maintenance and QA areas, particularly with the person responsible for your CASS. Your CASS should provide one of the best barometers of the overall status of your maintenance program, how you or others are using it, whether it is effective, and whether a change is being effected as necessary.

d. Meets with Senior Management. Meets with your senior management to determine how well they understand and support the CASS.

CHAPTER 11. ADMINISTRATIVE INFORMATION

11-1. HOW TO OBTAIN THIS AND OTHER FAA PUBLICATIONS.

a. AC 00.2 and AC 00-44. The current edition of AC 00.2, Advisory Circular Checklist and Status of Other FAA Publications, contains a listing of all ACs. The current edition of AC 00-44, Status of Federal Aviation Regulations, contains a listing of the Code of Federal Regulations (CFR) and current prices.

b. ACs Online. You can get copies of this and other ACs online at http://www.faa.gov/regulations_policies/advisory_circulars.

c. Regulations Online. You can also obtain a copy of current regulations online at http://www.gpoaccess.gov/ecfr.

d. CFR and ACs by Mail. You can obtain the CFR and ACs for a fee from the following address:

Superintendent of Documents
P.O. Box 371954
Pittsburgh, PA 15250-7954

e. Mailing List. For placement on our mailing list of free ACs, contact:

U.S. Department of Transportation
Subsequent Distribution Office
SVC-121.23
Ardmore East Business Center
3341Q 75th Avenue
Landover, MD 20785

f. FAA Web Site. Our Web site is located at http://www.faa.gov. The FSIMS Web site is located at http://fsims.faa.gov.

APPENDIX 1. SAMPLE CASS FOR A LARGE CERTIFICATE HOLDER

Type of Certificate Holder

Fleet composition	250 turbojet airplanes; B-737, B-757, A-320.
Number of maintenance base and line stations	Base station and 25 line stations.
Proportion of maintenance contracted to third parties	All letter checks, overhauls, and major maintenance performed in-house. Some line maintenance, parts work, and off-wing engine work is contracted.
Scheduled or on-demand	Scheduled (Title 14 of the Code of Federal Regulations (14 CFR) part 121).
Size and structure of the maintenance organization	Engineering and maintenance organizations include extensive engineering capability, quality assurance (QA) department, full range of shops for support, components, electronics, engines, etc.

a. Continuing Analysis and Surveillance System (CASS) Management and Planning.

b. General Priority. This certificate holder prioritizes in the following general manner:

(1) Safe operations (air and ground).

(2) Detect and prevent noncompliance.

(3) Improve operating efficiency.

c. CASS Written Procedures (A System Safety Attribute: Procedures). A separate CASS manual contains the CASS written procedures. The CASS appendix is detailed, including specific procedures for root cause and systems analysis and discussion of how to address human factors.

d. CASS in the Certificate Holder Organization. The senior vice president of engineering and maintenance (14 CFR part 119, § 119.65 Director of Maintenance (DOM)) has overall authority and responsibility for this air carrier's maintenance program, including the CASS. The CASS specifically appears on the functional organizational flowchart.

e. Authority for CASS (A System Safety Attribute: Authority). The director of QA holds the direct authority for the CASS.

f. Responsibility for CASS (A System Safety Attribute: Responsibility). The CASS board has direct responsibility for the CASS. The manager of the CASS chairs the board and reports to the director of QA.

g. Policy for CASS Auditor/Analyst Independence from Production (A System Safety Attribute: Controls). CASS auditors/analysts are in a separate department under QA. Operational data collection and analysis are assigned to the reliability group (within the certificate holder's Federal Aviation Administration (FAA)-approved reliability program) in the engineering department. The reliability group reports CASS information directly to the CASS board.

h. Policy Regarding Personnel Actions Resulting from CASS Findings/Results. The certificate holder's policy is consistent with its participation in Aviation Safety Action Programs (ASAP) and the Voluntary Disclosure Reporting Program (VDRP). Inadvertent errors do not lead to disciplinary action or FAA enforcement action. Full reporting and disclosure are encouraged to facilitate system corrections.

i. Surveillance and Analysis of Performance of Maintenance Program.

Audits

Responsibility	Manager of CASS.
Prioritization	CASS board develops a surveillance plan based on risk assessment.
Cycles	The CASS board assigned each area an onsite audit accomplished semiannually to every 5 years, depending on the risk assessment. Also depending on the risk assessment, some areas never receive an onsite audit assignment. The CASS board updates the annual audit plan quarterly.
Scope	CASS covers all internal and third-party areas of maintenance. Coordinating Agencies for Supplier's Evaluation (C.A.S.E.) audits may indicate the need for followup audits or may be integrated into the CASS.
Process	Full-time CASS auditors use checklists and conduct annual interviews of personnel at all levels of maintenance to uncover concerns or latent problems. The CASS department receives reports of all maintenance-related events, such as rejected takeoffs, for analysis and use in risk assessment for audits. Schedule special audits as needed. The CASS also reviews self-audits from all departments. Some vendors conduct their audits by document reviews, written questionnaires, telephone followup, or combinations of these. Followup is required if preliminary results raise concerns.
Flow	Report the initial results to the manager of CASS. The CASS board reviews summaries of all findings/initial analyses and details of issues as deemed necessary by the manager of CASS.

Analysis

Responsibility	Auditors conduct preliminary analysis based on specific experience and training and internally developed guidelines that channel analysis to system root causes.
Perform preliminary root cause analysis	Auditor/analyst.
Classify hazards/ perform risk assessment	CASS board and analysts.
Flow	The CASS board transmits results to the affected department, which assigns personnel to participate on the corrective action team under direction of the CASS board.

j. Surveillance and Analysis of Effectiveness of Maintenance Program.

Operational Data Collection

Responsibility	Manager of CASS.
Prioritization	The reliability group determines priority based on risk assessment.
Scope	Extensive. Ranges from pilot reports, Engine Condition Monitoring (ECM), mechanical delays, and teardown reports to data from special authorizations such as category II/III, extended range operation with two-engine airplanes, and operations in Reduced Vertical Separation Minimum (RVSM) airspace and minimum navigation performance specifications (MNPS) airspace.
Process	In accordance with the certificate holder's FAA-approved reliability program. Data collection is oriented toward detecting trends, positive or negative, before the occurrence of events. However, data collection (and analysis) may vary based on maintenance-related events. The CASS board formally reviews the list of operational data sets collected by the CASS board every 2 years to determine if it needs to be adjusted. The initial list is based on the current edition of Advisory Circular (AC) 120-17, Maintenance Control by Reliability Methods, and CASS board determinations.
Flow	The reliability group, although located within the engineering department, has a direct reporting relationship to the manager of CASS.

Analysis of Operational Data

Responsibility	Reliability group.
Prioritization	Reliability board.
Process	Technical experts within the reliability group perform the analysis and make preliminary determination of possible root causes.
Flow	Results are reported to the manager of CASS and the CASS board.

k. Corrective Action.

Final Root Cause Analysis (RCA)

Responsibility	Manager(s) of technical area(s) affected.
Procedures	The director of CASS transmits preliminary analysis results to the manager of the affected department, who designates technical personnel to coordinate final RCA with the auditor/analyst. The CASS auditor/analyst oversees the process and ensures that the formal RCA process, including human factors and systems analysis, is followed.
Use of specific analytical systems	Internally developed analytical process and industry tools.
Flow	The auditor/analyst and technical department develop a joint final report and submit it to their respective managers.

Determination of Corrective Action Options

Responsibility	The CASS board appoints a corrective action team to include the CASS auditor/analyst, reliability group, technical area(s) affected, and related areas potentially affected (for example, flight operations).
Procedures	The team leader is from the technical area affected. Perform risk assessment of the problem and develop corrective action options. The CASS auditor/analyst or reliability group representative does not propose corrective actions but reviews options for systems considerations and relevance to RCA.
Flow	The manager(s) of the affected area(s), working with the team, transmits options to the CASS board.

Selection of Corrective Action and Corrective Action Plan

Responsibility	CASS board.
Procedures	Decision based on a priority for safety and regulatory compliance. Risk assessment is the basic tool to support the decision. CASS personnel do not participate in the development of the corrective action but review for systems considerations and relevance to RCA.
Flow	Depends on the level of the problem and the corrective action. Routine issues may be resolved at the team level with direct implementation by the affected area manager; the CASS board is then advised of this action. More significant program changes may require prior review and concurrence from the CASS board. The CASS board may raise highest level decisions to the director of QA or senior vice president of engineering and maintenance.

Followup

Responsibility	Manager of CASS.
Procedures	CASS auditor/analyst or reliability group, as applicable, assigned to develop a followup plan based on the seriousness of the problem. Followup may include communications from technical area verifying effectiveness, followup audits or data collection, and/or a followup evaluation.
Flow	The technical area reports implementation status to the manager of the CASS, who informs the CASS board. The CASS board may inform the director of QA if the problem is sufficiently serious or the implementation plan is not followed.

NOTE: The above tables provide many examples of the system safety attributes: controls and procedures.

l. Communications Between CASS and Other Personnel (A System Safety Attribute: Interfaces).

Communication of Specific CASS Results and Actions

Responsibility	CASS board.
Procedures	Audits based on updated checklists. The CASS collects and stores operational data in computer systems, and some analysis and alerting features are automated. Audit and analysis results communicated through company electronic mail system, with acknowledgements. Corrective action tracking through computerized database system.
Flow	Electronic mail and standard electronic reports of information flow among CASS board, corrective action teams, technical areas, and director of QA, when applicable.

Communications with Maintenance Personnel

Responsibility	CASS board.
Procedures	The CASS initial and recurrent training included for all personnel, including lectures from CASS personnel. Monthly newsletter summary to production areas regarding CASS activities.
Flow	The CASS department works with the training and company communications department, and receives feedback from managers and supervisors, particularly in the maintenance areas.

Interfaces (A System Safety Attribute: Interfaces)

Responsibility	CASS board.
Procedures	
To CASS Board	Reliability group provides regular reports on analysis results, trends, and concerns.
	Auditors/analysts provide regular reports on findings, analyses, trends, and concerns.
	VDRP manager provides summaries of disclosures and proposed comprehensive fixes for CASS review and input.
	Copies of C.A.S.E. audit results.
	CASS auditors review reports from company ASAPs and at least annually review maintenance-related Aviation Safety Reporting Program reports for consideration in setting audit and operational data collection priorities.
From CASS Board	Feedback to technical areas regarding findings, trends, concerns, and followup results.
	Feedback to VDRP manager regarding proposed comprehensive fixes; coordination with manager of CASS.
	Monthly reliability analysis summaries and other CASS summaries for distribution to the vice president of engineering and maintenance, director of QA and other senior management, department managers in maintenance, flight and ground operations, Internal Evaluation Program (IEP), safety office, and FAA principal inspector (PI).
	CASS reports reflect VDRP comprehensive fixes without detailing the initiating circumstances.
	Semiannual summary report to chief executive officer (CEO).
	Copies of reliability reports and CASS summaries to the FAA PI. The FAA PI has online access to CASS reports and documents such as summaries, analysis, trends, and corrective action tracking.
	CASS board meeting minutes.
Flow	Communications channeled through manager of CASS.

m. Personnel Who Perform CASS Functions.

(1) Full-time auditors and analysts; in some cases, an auditor may also be an analyst.

(2) All members of the CASS board who have not participated in specific CASS training receive a total of 16 hours initial training covering CASS, root cause and systems analysis, and human factors.

(3) Company has hired a human factors specialist to address issues across all departments and to participate on the CASS board.

How the Certificate Holder Evaluates Its CASS (A System Safety Attribute: Process Measurement)

Responsibility	Senior vice president of engineering and maintenance.
Procedures	IEP evaluates CASS annually.
Flow	The CASS transmits IEP reports directly to the CEO and to the senior vice president of engineering and maintenance.

APPENDIX 2. SAMPLE CASS FOR A MEDIUM CERTIFICATE HOLDER

Type of Certificate Holder

Fleet composition	75 turboprop and turbojet airplanes; ATR–42, Canadair Regional Jets.
Number of maintenance base and line stations	Base station and five line stations.
Proportion of maintenance contracted to third parties	A, B, and C checks and most major maintenance in-house. Off-wing engine maintenance, avionics, and instrument overhauls contracted.
Scheduled or on-demand	Scheduled (Title 14 of the Code of Federal Regulations (14 CFR) part 121).
Size and structure of the maintenance organization	Engineering and maintenance organizations, including small engineering capability, shops for support, components, electronics, engines, etc.; and quality assurance (QA) department.

a. Continuing Analysis and Surveillance System (CASS) Management and Planning.

b. General Priority. This certificate holder prioritizes in the following general manner:

(1) Safe operations (air and ground).

(2) Detect and prevent noncompliance.

(3) Improve operating efficiency.

c. CASS Written Procedures (A System Safety Attribute: Procedures). An appendix to the general maintenance manual describes CASS. The detailed CASS appendix includes specific procedures for root cause and systems analysis, and discussion of awareness of human factors.

d. CASS in the Certificate Holder Organization. The chief executive officer (CEO) supports the CASS. CASS specifically appears on the functional organizational flowchart.

e. Authority for CASS (A System Safety Attribute: Authority). The senior vice president of engineering and maintenance (14 CFR part 119, § 119.65 Director of Maintenance (DOM)) has overall authority and responsibility for this air carrier's maintenance program, including the CASS. In this case, the senior vice president of engineering and maintenance also has the direct authority for this air carrier's CASS.

f. Responsibility for CASS (A System Safety Attribute: Responsibility). The director of QA heads the CASS board, which includes key department heads in engineering and maintenance, training, and flight operations.

g. Policy for CASS Auditor/Analyst Independence from Production (A System Safety Attribute: Controls). CASS auditor/analysts are in a separate department under QA. Operational data collection and analysis assigned to a "CASS reliability group" that is contained

within the engineering department. The CASS documentation is explicit that this certificate holder's reliability program is not Federal Aviation Administration (FAA)-approved. The reliability group reports CASS information directly to the director of QA.

h. Policy Regarding Personnel Actions Resulting from CASS Findings/Results. Inadvertent errors will not lead to disciplinary action. Encourage full reporting and disclosure to facilitate system corrections. Certificate holder participates in the FAA Voluntary Disclosure Reporting Program (VDRP).

i. Surveillance and Analysis of Performance of Maintenance Program.

Audits

Responsibility	Director of QA.
Prioritization	CASS board develops audit plan based on risk assessment.
Cycles	The CASS board reviews its established audit plan annually. The CASS board completes onsite audits on a semiannual or biannual basis, depending on the risk assessment. Also depending on the risk assessment, some areas never receive an onsite audit assignment.
Scope	All internal and third-party areas of maintenance.
Process	CASS board developed audit checklists for use by auditors. Auditors conduct their audits in accordance with the annual plan. The CASS department receives reports of all maintenance-related events such as rejected takeoffs for analysis and use in risk assessment for audits. The CASS may schedule special audits as needed. Some vendors conduct their audits by document reviews, written questionnaires, and telephone followup, or combinations of these. If preliminary results raise concerns, you must followup.
Flow	Initial reports and summaries to director of QA.

Analysis

Responsibility	Director of QA.
Perform preliminary root cause analysis	Auditor/analyst.
Classify hazards/ perform risk assessment	CASS board and analysts classify hazards and perform risk assessment.
Flow	Director of QA reports summaries of all findings/initial analysis and details of issues to the CASS board for review and concurrence. CASS board transmits results to affected department, which forms corrective action team.

j. Surveillance and Analysis of Effectiveness of Maintenance Program.

Operational Data Collection

Responsibility	Director of QA.
Prioritization	Reliability group.
Scope	Includes pilot reports, Engine Condition Monitoring (ECM), mechanical delays, teardown reports, and other data.
Process	Modeled after FAA-approved reliability programs. Data collection oriented toward detecting trends, positive or negative, before occurrence of events. However, data collection (and analysis) may vary based on maintenance-related events. The CASS board formally reviews collected operational data sets every 2 years; initial list based on Advisory Circular (AC) 120–17, Maintenance Control by Reliability Methods; and CASS board determinations.
Flow	Reliability group, although located within the engineering department, has a direct reporting relationship to the director of QA.

Analysis of Operational Data

Responsibility	Director of QA.
Prioritization	Reliability group.
Process	Analysis performed by technical experts within the reliability group; includes preliminary determination of possible root causes or possible procedural changes.
Flow	Results are reported to CASS board.

k. Corrective Action.

Final Root Cause Analysis

Responsibility	Director of QA.
Procedures	CASS board transmits preliminary analysis results to the manager(s) of the affected department(s), who designates technical personnel to conduct final RCA with CASS auditor/analyst. CASS analyst oversees the process and ensures the RCA process, including human factors and systems analysis, is followed.
Use of specific analytical systems	Internally developed formal analysis process or common industry tools.
Flow	Technical department develops final report and submits it to the director of QA.

Determination of Corrective Action Options

Responsibility	Director of QA designates corrective action team, led by primary affected technical department(s), whose manager(s) designates a team leader.
Procedures	Risk assessment of the problem and the options. The CASS auditor/analyst or reliability group representative does not propose corrective actions but reviews possibilities for systems considerations and relevance to RCA.
Flow	Team presents recommendation to CASS board.

Selection of Corrective Action and Corrective Action Plan

Responsibility	Director of QA.
Procedures	Decision based on a priority for safety and regulatory compliance. Risk assessment is the basic tool to support the decision. CASS board verifies systems considerations and relevance to RCA.
Flow	Depends on the level of the problem and the corrective action. Routine issues may be resolved at the team level with direct implementation by the affected area manager; advise the CASS board of this action. More significant program changes may require prior review and concurrence from CASS board or elevation to vice president of engineering and maintenance.

Followup

Responsibility	CASS board.
Procedures	CASS auditor/analyst or reliability group, as applicable, assigned to develop a followup plan based on the seriousness of the problem. Followup may include communications from a technical area verifying implementation, followup audits or data collection, and/or followup evaluation.
Flow	Technical area manager reports to director of QA, who reports to CASS board.

NOTE: The above tables provide many examples of the system safety attributes: controls and procedures.

l. Communications Between CASS and Other Personnel (A System Safety Attribute: Interfaces).

Communication of Specific CASS Results and Actions

Responsibility	CASS board.
Procedures	Audits based on updated checklists. Operational data are collected and stored in computerized database systems; some analysis and alerting features are automated. Audit and analysis results communicated through paper forms. Corrective action tracking through computerized database system.
Flow	Through electronic mail communications and standard paper reports, information flows among CASS board, corrective action teams, technical areas, and the director of QA.

Communications with Maintenance Personnel

Responsibility	CASS board.
Procedures	CASS training included for all personnel. Initial and recurrent training. The certificate holder's employee newsletter includes a brief monthly report on CASS results.
Flow	CASS board works with training and company communications department, and receives feedback from managers and supervisors, particularly in maintenance areas.

Interfaces (A System Safety Attribute: Interfaces)

Responsibility	CASS board.
Procedures	
To CASS Board	Reliability group provides regular reports on analysis results, trends, and concerns regarding operational data.
	Auditors/analysts provide regular reports on findings, analyses, trends, and concerns.
	VDRP manager provides summaries of disclosures and proposed comprehensive fixes for CASS review and input.
	Designated CASS auditor/analyst reviews reports and at least annually reviews maintenance-related Aviation Safety Reporting Program reports for consideration in setting audit and operational data collection priorities.
From CASS Board	Feedback to technical areas regarding findings, trends, concerns and followup results.
	Feedback to VDRP manager regarding proposed comprehensive fixes; coordination with director of QA.
	Monthly reliability analysis summaries and CASS summaries for distribution to vice president of engineering and maintenance; director of QA and other senior management; department managers in maintenance, flight and ground operations, IEP, and safety office; and FAA principal inspector (PI).
	CASS reports reflect VDRP comprehensive fixes without detailing the initiating circumstances.
	Copies of reliability reports and CASS summaries to FAA PI.
	CASS board meeting minutes.
	Semiannual summary report to CEO; copy to FAA PI.
Flow	Communications channeled through director of QA.

m. Personnel Who Perform CASS Functions.

(1) Full-time auditors and analysts; in some cases, an auditor may also be an analyst.

(2) All members of the CASS board who have not participated in specific CASS training receive a total of 12 hours initial training covering CASS, root cause and systems analysis, and human factors.

How the Certificate Holder Evaluates Its CASS (A System Safety Attribute — Process Measurement)

Responsibility	Vice president of engineering and maintenance.
Procedures	IEP evaluates CASS annually.
Flow	The CASS transmits IEP reports on CASS directly to the CEO and to the vice president of engineering and maintenance.

APPENDIX 3. SAMPLE CASS FOR A SMALL CERTIFICATE HOLDER

Type of Certificate Holder

Fleet composition	Two turbojet airplanes; Gulfstream G-III (12 seats).
Number of maintenance base and line stations	Base station only.
Proportion of maintenance contracted to third parties	A checks in-house; B, C, and D checks, all off-wing engine maintenance and all overhauls of engines, instruments, and avionics contracted out.
Scheduled or on-demand	On-demand (Title 14 of the Code of Federal Regulations (14 CFR) part 135).
Size and structure of the maintenance organizations	Maintenance organizational structure comprises of the Director of Maintenance (DOM) with chief inspector.

a. Continuing Analysis and Surveillance System (CASS) Management and Planning.

b. General Priority. This certificate holder prioritizes in the following general manner:

(1) Safe operations (air and ground).

(2) Detect and prevent noncompliance.

(3) Improve operating efficiency.

c. CASS Written Procedures (A System Safety Attribute: Procedures). CASS chapter in general maintenance manual. The CASS chapter includes specific procedures for root cause and systems analysis, and discussion of awareness of human factors.

d. CASS in the Certificate Holder Organization. Chief executive officer (CEO) actively participates in the CASS. CASS specifically appears on functional organizational flowchart.

e. Authority for CASS (A System Safety Attribute: Authority). The DOM (14 CFR part 119, § 119.65 DOM) has overall authority and responsibility for this air carrier's maintenance program, including the CASS.

f. Responsibility for CASS (A System Safety Attribute: Responsibility). DOM heads CASS committee, which includes the CEO, chief inspector, and director of flight operations.

g. Policy for CASS Auditor/Analyst Independence from Production (A System Safety Attribute: Controls). DOM "borrows" auditors from within or outside the company based on auditor qualifications. Priorities are (1) independence from audited department and (2) experience or familiarity with the area to be audited. Every 5 years the company contracts an independent firm to conduct an outside evaluation of CASS and other certificate holder systems and programs to verify sufficient objectivity in the audits.

h. Policy Regarding Personnel Actions Resulting from CASS Findings/Results. Inadvertent errors will not lead to disciplinary action. Full reporting and disclosure encouraged to facilitate system corrections.

i. Surveillance and Analysis of Performance of Maintenance Program.

Audits

Responsibility	DOM.
Prioritization	CASS committee assigns priorities based on risk assessment.
Cycles	The CASS committee establishes an audit plan and accomplishes onsite audits annually, depending on the risk assessment. Also depending on the risk assessment, some areas never receive an onsite audit assignment.
Scope	All internal and third-party areas of maintenance.
Process	CASS committee developed audit checklists for use by auditors, who may be committee members or personnel drawn from throughout the company. DOM receives reports of all maintenance-related events such as rejected takeoffs for analysis and use in risk assessment for audits. Schedule special audits as needed. Vendors conduct their audits by document reviews, written questionnaires, and telephone followup, or combinations of these. Regulations require followup if preliminary results raise concerns.
Flow	Initial results are reported to the DOM.

Analysis

Responsibility	DOM (conducts preliminary analysis with the auditor).
Perform preliminary root cause analysis	Auditor/analyst.
Classify hazards/ perform risk assessment	CASS committee.
Flow	CASS committee reviews all findings/initial analysis and details of issues as deemed necessary by the DOM. The CASS committee acts as the core corrective action team (as required, other personnel may supplement this).

j. Surveillance and Analysis of Effectiveness of Maintenance Program.

Operational Data Collection

Responsibility	DOM.
Prioritization	DOM.
Scope	Basic. Includes pilot reports, Engine Condition Monitoring (ECM), mechanical delays, cancellations, teardown reports, and other data.
Process	Data collection oriented toward detecting trends, positive or negative, before occurrence of events. The CASS committee formally reviews the list of operational data sets collected every 2 years to determine if it needs to be adjusted. The initial list is based on CASS committee experience at other operations and with this fleet.
Flow	Flight operations and DOM transmit reports to CASS committee.

Analysis of Operational Data

Responsibility	DOM.
Prioritization	CASS committee.
Process	Analysis performed by DOM or chief inspector. Preliminary determination of possible root causes or possible procedural changes.
Flow	Report results to the CASS committee.

Corrective Action

Responsibility	DOM.
Procedures	Designates technical personnel to perform final Root Cause Analysis (RCA) and identify corrective action options. DOM oversees the process and ensures the RCA process, including human factors and systems analysis, is followed.
Use of specific analytical systems	Based on DOM's training and internally developed procedures.
Flow	DOM presents corrective action options to CASS committee.

Selection of Corrective Action and Corrective Action Plan

Responsibility	CASS committee.
Procedures	Decision based on a priority for safety and regulatory compliance. Risk assessment is the basic tool to support the decision. CASS committee verifies systems considerations and relevance to RCA.
Flow	CASS committee makes selection.

Followup

Responsibility	CASS committee.
Procedures	Affected technical personnel report to CASS committee on implementation of corrective action. DOM may independently verify. Followup audit planned for following year cycle of audits.
Flow	Technical area reports to DOM, who informs CASS committee.

NOTE: The above tables provide many examples of the system safety attributes: controls and procedures.

k. Communications Between CASS and Other Personnel (A System Safety Attribute: Interfaces).

Communication Specific CASS Results and Actions

Responsibility	CASS committee.
Procedures	Audits based on updated checklists. The CASS committee collects operational data and stores it in files. Audit and analysis results communicated through electronic mail.
Flow	Electronic mail communications to all company management.

Communications with Maintenance Personnel

Responsibility	CASS committee.
Procedures	DOM conducts initial briefing for all personnel to orient them on CASS.
Flow	DOM to all affected personnel.

Interfaces (A System Safety Attribute — Interfaces)

Responsibility	CASS committee.
Procedures	
To CASS Committee	DOM provides regular reports on analysis results, trends, and concerns regarding operational data.
	Chief inspector reviews reports at least annually and reviews maintenance-related Aviation Safety Reporting Program reports for consideration in setting audit and operational data collection priorities.
From CASS Committee	Feedback to technical areas regarding findings, trends, concerns, and followup results.
	CASS committee meeting minutes.
Flow	Communications channeled through DOM.

l. Personnel Who Perform CASS Functions. Auditors and analysts are only part-time in these functions. They receive some specific CASS training, including on-the-job and formal training.

How the Certificate Holder Evaluates its CASS (A System Safety Attribute: Process Measurement)

Responsibility	CEO.
Procedures	CEO reviews indicators of a properly designed and functioning CASS, including quality of analysis, independence of the audits, and sufficiency of third-party audit procedures.
Flow	The CEO documents his or her review and shares it with CASS committee members and the FAA principal inspector (PI).

APPENDIX 4. CASS MANUAL/DOCUMENT SAMPLE CONTENTS

a. General Information.

(1) Definition of terms.

(2) Purpose of the Continuing Analysis and Surveillance System (CASS).

b. System Organization and Personnel.

(1) CASS organizational chart.

(2) Person/position with authority, including how to determine whether a CASS is functioning properly and policies/procedures for modifying the CASS.

(3) Person/position with responsibility.

(4) Duties and responsibilities of CASS personnel (supervisors, auditors, analysts).

c. Elements Basic to a CASS.

(1) Policies/procedures for scheduling and conducting internal/external audits.

(2) Policies/procedures for identifying and updating the list of operational data sets to be collected, and for collecting data.

(3) Policies/procedures for analyzing audit results.

(4) Policies/procedures for analyzing operational data.

(5) Policies/procedures for developing proposed corrective actions, and analyzing them.

(6) Policies/procedures for approving and implementing corrective actions, including changes to the maintenance program.

(7) Policies/procedures for monitoring and followup of corrective actions.

d. Critical CASS Interfaces.

(1) Policies/procedures for communications within the CASS and between the CASS and other areas of the operation.

(2) Interface documents (audit forms and checklists, corrective action notices, statistical and periodic reports, etc.; including, as applicable, control, storage, retrieval of CASS records and communications).

e. Relationship of the CASS to Other Programs. Policies/procedures to integrate or relate other certificate holder programs to the CASS.

f. Personnel Qualifications.

(1) Policies/procedures regarding qualifications and training of CASS personnel.

(2) Training records.

APPENDIX 5. PUBLICATIONS USED TO DEVELOP THIS AC

a. Related Documents (current editions). See http://www.airweb.faa.gov.

- Advisory Circular (AC) 00–46, Aviation Safety Reporting Program.
- AC 00–58, Voluntary Disclosure Reporting Program.
- AC 120–16, Air Carrier Maintenance Programs.
- AC 120–59, Air Carrier Internal Evaluation Programs.
- AC 120–66, Aviation Safety Action Programs (ASAP).
- AC 120–72, Maintenance Resource Management Training.
- AC 120–92, Introduction to Safety Management Systems for Air Operators.
- AC 129–4, Maintenance Programs for U.S.-Registered Aircraft Under 14 CFR Part 129.
- Federal Aviation Administration (FAA) Order 8040.4, Safety Risk Management.
- FAA Order 8900.1, Flight Standards Information System (FSIMS).

b. Other Documents and Information Used to Prepare This AC. In addition to the references cited above, this AC was prepared using the following documents and information:

- Beyond Aviation Human Factors (1995). Daniel E. Maurino, James Reason, Neil Johnson, and Rob B. Lee. Hants, England: Ashgate Publishing Limited.
- Handbook of Airline Operations (2000). Gail F. Butler and Martin R. Keller, editors. New York: The McGraw-Hill Companies, Inc.
- Handbook of Aviation Human Factors (1999). Daniel J. Garland, John A. Wise, and V. David Hopkin, editors. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Human Factors and Maintenance Resource Management (March 7, 2002). Presented by Yosef Morgan, Applications Manager, Maricopa County Community College. Phoenix, Arizona.
- Human Factors in Aviation (1998). Edited by Earl L. Wiener and David C. Nagel. San Diego: Academic Press.
- Managing the Risks of Organizational Accidents (1997). James T. Reason. Hants, England: Ashgate Publishing Limited.
- Risk Management in Aviation (March 7, 2002). Presented by Jim Hein, Federal Aviation Administration Safety Inspector, Honolulu Flight Standards District Office. Phoenix, Arizona.
- The Limits of Safety: Organizations, Accidents, and Nuclear Weapons (1993). Scott Douglas Sagan. Princeton, NJ: Princeton University Press.