U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Reliability Program Methods—Standards for Determining Time Limitations

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Change:

This advisory circular (AC) provides guidance for developing and maintaining a reliability program as part of a Continuous Airworthiness Maintenance Program (CAMP). The guidance includes information for:

- Collecting and analyzing operational data,
- Developing operational performance standards,
- Identifying and correcting deficiencies,
- A reliability program's data display and reporting function,
- Maintenance Schedule task and interval adjustments, and
- Reliability program management and administration.

This AC applies to you if you are a Title 14 of the Code of Federal Regulations (14 CFR) part 121 air carrier; part 135, § 135.411(a)(2) or § 135.411(b) air carrier; or a part 91 subpart K (part 91K) operator maintaining your aircraft under a CAMP (part 91, § 91.1411), and you choose to use standards for determining your time limitations. Your reliability program is your standard, and provides compliance with 14 CFR part 119, § 119.49(a)(8) and § 91.1015(a)(5), as applicable.

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CHAPTER 1. GENERAL INFORMATION

1.1 Purpose of This Advisory Circular (AC). This publication provides guidance for developing a reliability program, which are your standards for determining time limitations. When accepted by the Federal Aviation Administration (FAA) and after receiving authorization for its use by operations specifications (OpSpecs), your reliability program gives you the authority and the means to adjust your maintenance schedule tasks and intervals without prior approval or acceptance by the FAA. However, these changes are subject to subsequent FAA evaluation for continued acceptability. This autonomous authority granted to operators by the FAA does not relieve the operator or the FAA of their responsibility for the program's effect on safety, and is not without limitation.

1.1.1 Not all maintenance schedule tasks and intervals are subject to the authority granted within your program. Operators should be knowledgeable of the task's source and must operate within each task's restrictions. Examples where restrictions exist include, but are not limited to:

- Airworthiness Directives (AD),
- Certification Maintenance Requirements (CMR),
- Airworthiness limitations (AL),
- Fuel Tank Safety (FTS) tasks,
- *Maximum intervals* for tasks "tagged" in the Maintenance Review Board Report (MRBR) (or equivalent) as precluding a candidate CMR (refer to AC 25-19, Certification Maintenance Requirements),
- Structural sampling periods imposed by the Maintenance Review Board (MRB),
- Critical design configuration control limitations (CDCCL), and
- *Deleting* MSG-3 Failure Effect Code (FEC) 5 and 8 tasks.

1.1.2 Title 14 CFR parts 91, 91 subpart K (part 91K), 119, 121, and 135 are the regulatory basis for this AC. This AC is not mandatory and does not constitute a regulation. This AC describes an acceptable means, but not the only means, of complying with 14 CFR. Because the method in this AC is not mandatory, the term "should" applies only when you choose to follow this method. You may elect to follow an alternative method provided your method is accepted by the FAA. When we use "we," "us," or "our" in this AC, we mean the FAA. When we use "you," "your," or "yours," we mean you, the air carrier or operator. When we use the term "person," it has the same meaning as that in 14 CFR part 1, § 1.1.

1.2 Audience. This AC applies to air carriers conducting operations under part 121; part 135, § 135.411(a)(2) or § 135.411(b); or part 91K operators choosing to maintain program aircraft under a Continuous Airworthiness Maintenance Program (CAMP) who choose to use standards for determining time limitations.

Note: Operators who are not authorized by OpSpecs to use a reliability program may apply the standards in this AC when proposing adjustments to their time limitations. However, these operators must follow established procedures prior to implementing any adjustments to their time limitations.

1.3 Where You Can Find This AC. You can find this AC on the FAA's website at http://www.faa.gov/regulations_policies/advisory_circulars.

1.4 What This AC Cancels. AC 120-17A, Maintenance Control by Reliability Methods, dated March 27, 1978, is cancelled.

1.5 Legal Basis.

1.5.1 Title 49 of the United States Code (49 U.S.C.). Title 49 U.S.C. § 44701 is the primary authority for all Federal aviation regulations. Section 44701 instructs the FAA to promote the safe flight of civil aircraft in air commerce by prescribing regulations and standards in the interest of safety.

1.5.2 Title 14 CFR. The 14 CFR regulatory requirements supported by this AC include:

- Part 91, §§ 91.1015(a)(5) and 91.1109(b)(5).
- Part 119, § 119.49(a)(8), (a)(14), (b)(8), and (c)(8).
- Part 121, § 121.135(a)(1) and (b)(18).
- Part 135, §§ 135.23(s) and 135.427(b).

1.5.3 Methods of Compliance.

1.5.3.1 This AC describes processes, techniques, and procedures that will lead to an effective reliability program, and will help to ensure a level of safety appropriate to the type of operations conducted. None of the information in this AC is mandatory or constitutes a regulation. This AC does not impose, reduce, or change regulatory requirements.

1.5.3.2 Each operator is unique, and therefore a single means of compliance for developing, implementing, and maintaining a reliability program applicable to all cannot be provided.

1.5.3.3 By design, this AC is highly dependent upon the assumption that all elements of your CAMP are established, documented, and effective. The standards described in this AC are in no way intended to account for deficiencies in other areas of your CAMP, and as such, can be considered a minimum standard. The FAA's determination that your proposed reliability program is acceptable may differ from this AC to account for deficiencies in other areas of your CAMP.

1.6 Definitions. For the purposes of this AC, the following definitions are applicable:

1. Acceptable Level of Reliability. Maintaining operational performance equal to or higher than a value determined by the operator that supports the operator's operational and economic objectives. Following MSG guidelines, operational failures or a loss of function having a direct effect on safety are never considered acceptable.
2. Airworthiness Limitation (AL). Instructions for mandatory replacement items, inspection intervals, related inspection procedures, and/or configuration control limitations.
3. Certification Maintenance Requirements (CMR), Candidate Certification Maintenance Requirements (CCMR). Refer to AC 25-19, Certification Maintenance Requirements.
4. Data Quality. In a reliability program, data is generally considered high quality if it is fit for its intended uses in operation, analysis, decision making, and planning. Data Quality also includes form, format, and accuracy standards necessary to enable the program's intended uses.
5. Effective. Capable of achieving the desired result. An indicator of scheduled maintenance effectiveness is the availability of your aircraft for flight or operations.
6. Failure. The inability of an item to perform within previously specified limits.
7. Failure Cause. The fundamental mechanism leading to a failure mode.
8. Failure Condition. The effect on the aircraft and its occupants, both direct and consequential, caused or contributed to by one or more failures, considering relevant adverse operational or environmental conditions.
9. Failure Effect. The result of a functional failure. (See also Failure Condition.)
10. Failure Effect Category (FEC) Code. A scheduled maintenance task classification as defined in the MRBR or equivalent manufacturer's documents. Refer to Air Transport Association of America (ATA) MSG-3, Operator/Manufacturer Scheduled Maintenance Development, paragraph 2-3-6.
11. Failure Mode. The way in which an item ceases to perform its intended function.
12. Function. The operation of an item in an intended or particular way to achieve a desired state or result.
13. Functional Failure. The inability of an item to perform its intended function within specified limits.
14. Hidden Failure Mode. A failure mode which is not detected through routine flightcrew operations or in-flight monitoring systems.

15. Hidden Function.

    - A function that is active when a system is used but where there is no indication to the operating crew when that function ceases to exist.
    - A function that is normally inactive and the state of readiness to perform will not be evident before a demand for use.

16. Inherent Level of Reliability. The theoretical level of reliability established by the design and manufacturing criteria of an item. This is the highest level of reliability that can be expected from a unit, system, or aircraft. Achieving higher levels of reliability generally requires modification or redesign. (Refer to the ATA MSG-3.)

17. Item. Any level of hardware (e.g., a system, subsystem, module, accessory, component, unit, part, appliance, or structure).

18. Limitation. A binding limit (calendar, hours, or cycles) for scheduled maintenance task intervals.

19. Maintenance Program. Refers to the CAMP as described in AC 120-16, Air Carrier Maintenance Programs.

20. Maintenance Schedule. An element of the CAMP as described in AC 120-16; also called Time Limitations.

21. Operational Reliability. The reliability of an item calculated from operational data for a specific set of usage conditions, parameters, or element of exposure, such as number of departures, flight-hours, etc.

22. Operational Data. Any data generated as a result of aircraft operations. Examples of operational data are nonroutine events, Extended Operations (ETOPS) event reports, maintenance log items, delays or cancellations, mechanical interruption summaries, service difficulty reports, repeat items reports, unscheduled parts removals, component “teardown” reports, findings from scheduled maintenance tasks and inspections, etc.

23. Optimization. Substantiated revisions to the maintenance schedule such as a task revision, addition or deletion, or interval adjustment (up or down).

24. Performance Standards. The operational goals or standards developed by an operator to define an acceptable level of operational reliability. A performance standard may be defined within various areas of the operator’s CAMP or business objectives as it relates to fleet performance.

25. Predicted Reliability. The estimated reliability of an item.

26. Reliability. The probability that an item will perform a required function, under specified conditions, without failure, for a specified period of time (calendar, hours, or cycles).

27. Routine Task Findings. Data generated that document failures, defects, or degradation that are identified during the execution of a scheduled maintenance task. This data is usually in the form of nonroutine work cards or

maintenance findings recorded in the aircraft logbook, and may be used to determine the effectiveness of a routine task or to substantiate an interval adjustment.

28. Scheduled Maintenance. The defined set of maintenance tasks performed at stated intervals which, as a whole, comprises the maintenance schedule element of the operator's CAMP. Refer to AC 120-16.
29. Scheduled Maintenance Task. An action performed at defined intervals, with the objective of retaining or restoring an item to a serviceable condition, or to discover a hidden failure, or to ensure a function is available.
30. Serviceable Condition. The subject item is capable of supporting or performing its intended function, resulting in continued airworthiness.
31. Task Interval. The specified parameter between consecutive occurrences of a maintenance task expressed in flight-hours, flight cycles, calendar-time, engine/auxiliary power unit (APU) hours/cycles, or defined opportunities where a specific task scope of work is required to be completed.
32. Task Scope. The defined procedures appropriate for satisfying the objective of an effective scheduled maintenance task.
33. Task Type. Standard MSG process classifications for a specific task scope (e.g., inspection, lube, calibration, detailed visual inspection, or functional check).
34. Task Yield. A measure of the actual interval at which a task is accomplished, relative to the maximum allowed interval as defined in the operator's maintenance schedule. Yield is expressed as a percentage of the task's maximum allowable interval since the task was last performed.

1.7 Background.

1.7.1 Part 121 and 135 Operators. Title 14 CFR requires air carriers operating under part 121 and part 135, § 135.411(a)(2) or 135.411(b) to establish and maintain time limitations or standards for determining their time limitations. These time limitations specify the tasks and intervals for scheduled maintenance: the what, how, and when of your scheduled maintenance effort. In the context of the air carrier's CAMP, this is referred to as the maintenance schedule.

1.7.2 Part 91K Operators. Additionally, 14 CFR also requires part 91K operators who choose to maintain program aircraft under a CAMP to establish and maintain time limitations or standards for determining their time limitations.

1.7.3 Maintenance Schedule. Regardless of the type of operation, the rules are written broadly to allow you to establish and maintain your maintenance schedule by one of two ways:

- You may submit your time limitations to the FAA for review and acceptance, or
- You may develop standards for determining your time limitations and obtain FAA acceptance of those standards.

Note: After the FAA determines your time limitations or standards for determining time limitations are acceptable, you will be issued the appropriate OpSpec/management specification (MSpec) that authorizes its use.

1.7.4 Maintenance Steering Group - 3rd Task Force (MSG-3). The previous version of this AC integrated the Maintenance Steering Group - 2nd Task Force (MSG-2) maintenance program development process, which focused on individual part failure rates and the maintenance processes designed to control them. This revised AC integrates the MSG-3 process, which focuses on maintaining aircraft system functions, while also considering maintenance cost-effectiveness. In addition, the MSG-3 process identifies the consequences of functional failures, and allows a wider selection of maintenance task types than MSG-2. To the extent possible, this revised AC does not identify any specific Maintenance Steering Group (MSG) process as it relates to the operator's processes, methods, and standards specified in a reliability program.

1.7.5 Continuing Analysis and Surveillance System (CASS). A properly designed and effective reliability program is a part of your CASS, and can fulfill a portion of your CASS requirements regarding operational data collection, analysis, and corrective action. As is the case for CASS, your reliability program is not intended to duplicate your 14 CFR part 5 Safety Management System (SMS) Safety Assurance (SA) requirements. Rather, all these systems should be designed to naturally interface and complement each other, resulting in little or no duplication of effort or responsibilities.

CHAPTER 2. RELIABILITY PROGRAM EVALUATION AND REVIEW

2.1 Program Creation and Revisions.

2.1.1 Main Parts of an Operator's Reliability Program. The elements of an operator's reliability program are typically:

- A data collection system,
- A performance standards system,
- Analysis and recommendation,
- Internal approval and implementation, and
- A reporting and display format.

Note: Figure 2-1, Reliability Program Management and Administration, is a closed-loop, process-oriented flow diagram of the reliability process described in this AC.

2.1.2 Documentation Within the Operator's Manual. You should ensure your standards for determining time limitations contain the following:

1. A general description of the reliability program, including definitions of (or reference to) significant terms used in the reliability program.

   Note: You may not use your reliability program as a means to change the meaning or intent of regulatory-based definitions, restrictions, limitations, or reporting requirements. When defining terms, you should be as specific as possible and when applicable, provide qualifying criteria to avoid ambiguity and confusion when executing program requirements.

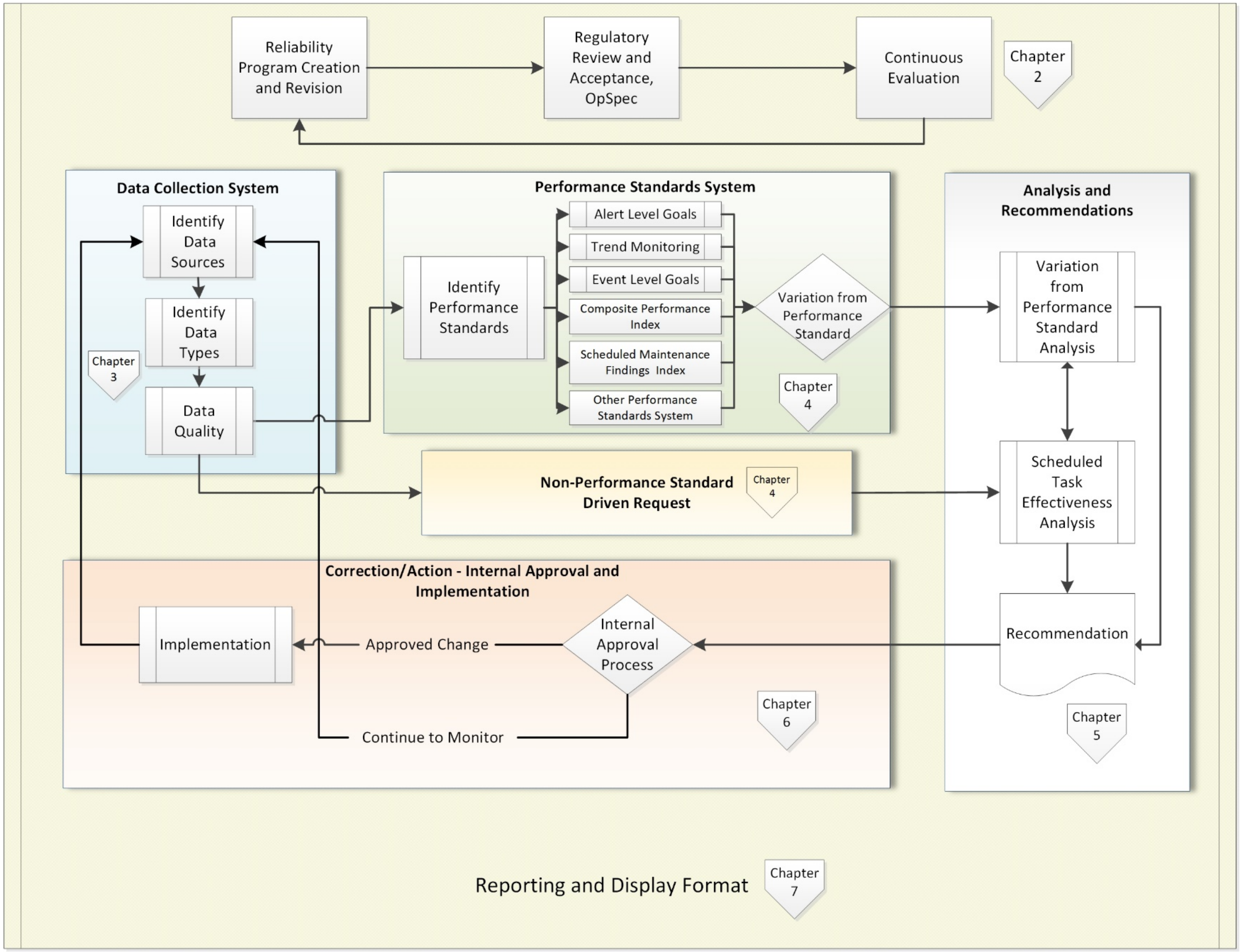
2. The application of the reliability program by aircraft fleet type and model.
3. Procedures and standards for data collection and ensuring applicability/data quality.
4. The organizational responsibilities, training, and experience requirements.
5. Duties and responsibilities for personnel who perform program requirements. This includes personnel such as those who monitor performance standards or alert/event levels, analyze operational data, and board members or personnel who perform decision-making functions.
6. The procedures for monitoring and revising the performance standards.
7. Data analysis methods.
8. The corrective action recommendation process, including approval and implementation.
9. Reports used or generated, and the frequency.

10. Standards and procedures for adjusting time limitations.
11. Description or references to forms unique to the reliability program.
12. Management and administration procedures, including reliability program revision process.
13. Requirements or references to self-audits and other monitoring procedures for the performance and effectiveness of the reliability program.
14. Description or organizational chart of reliability program organizational authority and delegation. The administration of a reliability program generally requires a board or other organizational body within an operator's maintenance organization. This board should be comprised of experienced and competent personnel with decision-making authority to approve changes to the operator's maintenance schedule.

2.1.3 Identifying Participants. You should identify in your manual those participants who have authority and responsibility for your reliability program, including:

1. The Director of Maintenance (DOM) or equivalent who has overall authority and responsibility for the entire program.
2. The person who has direct authority and responsibility for the reliability program process.
3. The individual positions in the operator's organization and their role within the reliability program, including responsibilities and authority.

Figure 2-1. Reliability Program Management and Administration



2.1.4 Reliability Personnel Training/Technical Competency.

2.1.4.1 You should determine your own specialized technical standards and training documentation requirements for persons whose role is to collect, analyze, and compile reliability data or reports. The desired competency and capability standards should be defined and be based on the level of complexity of the operational and scheduled maintenance data you collect (see Table 2-1, Competency Training).

2.1.4.2 You may adjust the content, frequency, and method of training provided to individuals depending on an evaluation of the individual's roles and responsibilities, previous training, hands-on maintenance experience, and/or demonstration of aptitude, and the results being achieved.

2.1.4.3 The FAA expects reliability program participants with approval authority to fully understand their roles and responsibilities relative to the reliability program.

Table 2-1. Competency Training

Subject Training	Reliability Personnel Knowledge Standards
14 CFR part 121/135 operation specifications (OpSpecs); part 91K management specifications (MSpecs)	Familiarization and awareness
Systems analysis training	General training in quality standards and statistical analysis methods
Reliability data training	Experience or training in conducting and reporting analysis results for operational data and other scheduled maintenance findings
Maintenance Steering Group (MSG): current or applicable	Understanding of applicable MSG methodology used in developing the maintenance schedule
Risk assessment training	The ability to assess risk as it relates to a situation, failure, or hazard
Root cause analysis training, including human factors	Method of problem solving that identifies the root causes of faults, failures, deficiencies, or hazards.
Failure Mode and Effects Analysis (FMEA) training	Method of analysis that identifies the failure modes and failure effects related to specific faults or failures
Technical training	Aircraft-specific (make, model, and series (M/M/S))

2.2 Regulatory Requirements. There is no regulatory requirement that an operator must have or maintain a reliability program. However, if an operator elects to use a reliability program, certain regulations, OpSpecs, and requirements must be taken into consideration.

2.2.1 OpSpecs/MSpecs.

- D072, Aircraft Maintenance—Continuous Airworthiness Maintenance Program (CAMP) Authorization.
- D074, Reliability Program Authorization: Entire Aircraft.
- D075, Reliability Program Authorization: Airframe, Powerplant, Systems or Selected Items.
- D079, Reliability Program Contractual Arrangement Authorization.
- D088, Maintenance Time Limitations Authorization.

2.2.2 Reliability Program Submission. Your initial reliability program submission and subsequent revisions do not require FAA approval. However, prior to use, you must submit your initial reliability program and each subsequent revision to the FAA office with oversight responsibility. You may use your program after the principal maintenance inspector (PMI) has notified you that the program is acceptable and has issued the appropriate OpSpec/MSpec authorizing its use.

2.3 Continuous Evaluation. As part of an effective Continuing Analysis and Surveillance System (CASS), you continually monitor the performance and effectiveness of your reliability program, and make revisions as necessary. You should also conduct periodic, documented reviews to determine that your performance standards are realistic and are effective in identifying deficiencies.

CHAPTER 3. DATA COLLECTION SYSTEM

3.1 Identification of Data Sources. An operator should identify data sources from all of these four general categories of an operator's fleet:

- Systems,
- Components/line replaceable units (LRU),
- Structures, and
- Engines/APUs.

3.2 Identification of Data Types. The data collection system should include the identification of data types. Table 3-1, Data Types lists typical types of operational data; however, all of these data types do not need to be included in the reliability program, nor does this list prohibit the use of other types of information.

Table 3-1. Data Types

Data Type	In-Service Data	Routine Task Findings
Aircraft maintenance log (mechanical irregularities)	X	X
Engine in-flight shut down (IFSD)	X	
Operational interruptions (delays, cancellations, diversions, etc.)	X	
Unscheduled component removals	X	
Component maintenance findings	X	X
Sampling inspections	X	X
Special inspections	X	X
Maintenance deferred with minimum equipment list (MEL)	X	X
Chronic systems	X	X
Unscheduled maintenance		X
Integrated Vehicle Health Monitoring a) Aircraft health monitoring b) Engine health monitoring	X	X
Materials usage	X	X

Data Type	In-Service Data	Routine Task Findings
Extended Operations (ETOPS) Event Reports, Reduced Vertical Separation Minimum (RVSM), Category II/III (CAT II/III)	X	
Scheduled maintenance findings	X	X
Accidents or incidents	X	X
Unconfirmed components or part removal		X
Unscheduled engine removal	X	X
Service Difficulty Reports (SDR)	X	X
Mechanical Interruption Summary Report (MISR)	X	
Flight logs	X	

3.3 Data Quality.

3.3.1 General. Data sources and associated data types form the foundation of any reliability program. Data can be considered of sufficient quality when it is accurate, free from substantive recording errors, and comprehensive enough in both scope and detail to facilitate its intended function in operations, analysis, and decision making.

3.3.2 Ensuring Validity and Accuracy of Data. You should develop a process to validate the accuracy of the data used in support of your reliability program. A typical data accuracy/data quality process includes:

- Adopting comprehensive data and maintenance recording standards and instructions;
- Forms and instructions designed to achieve compliance with the data standards;
- Performing and documenting data audits to detect deficiencies and correct data irregularities;
- Establishing a documented method for providing feedback to organizational elements demonstrating deviations from the data standards; and
- A common coding convention or system used to correlate mechanical irregularities in aircraft systems with defects found during routine maintenance tasks, shop teardown reports and other relevant data.

Note: While an electronic means of collecting, storing, retrieving, and analyzing data is not required by rule, limitations in these areas may restrict or preclude you from exercising the requisite responsibilities necessary to implement and maintain an effective reliability program.

CHAPTER 4. PERFORMANCE STANDARDS SYSTEM

4.1 Identification of Performance Standards. A performance standard is expressed numerically, as a number, rate, ratio, or percentage. It may be calculated by the number of events occurring in a specified operating period expressed in flight cycles, flight-hours, operating hours, or calendar-time. Performance standards are used to identify an acceptable measure of reliability in terms of system or component failures, pilot reported mechanical irregularities, operational delays and cancellations, scheduled maintenance findings, or some other event which serves as the basis for the standard. When used to develop your acceptable performance, control limits or alert values should be based on generally accepted statistical methods, such as standard deviation or the Poisson distribution. Other programs may apply an average or baseline method. Additionally, the program should include procedures for periodic review and adjustment of the standards, as well as detailed procedures for monitoring new fleet types until sufficient operating experience is available for computing a performance standard. Acceptable performance standards should be adjustable based on your operational experience, as well as the effects of fleet age, operational, seasonal, and environmental considerations. Performance standards should be associated with the specific aircraft system as related to the data types being measured.

4.2 Techniques for Determining Deviations From Standards. An operator may elect to use one or a combination of the techniques listed in Table 4-1, Techniques for Determining Deviation From Performance Standards, or any another acceptable method that identifies when the operator-defined acceptable performance level is not achieved. Regardless of the method an air carrier chooses, it should be proactive and should be capable of identifying emerging and current operational problems that the carrier may need to correct. The method chosen should not be so liberal that abnormal deviations from an acceptable standard would not be identified as a problem or as an underlying deficiency. Nor should the method be so conservative that it would result in excessive data "noise" from which too many deviations from the standard are identified. An effective method will result in relevant and meaningful data from which potential, emerging, and real-time deficiencies can be identified, analyzed, and addressed.

Table 4-1. Techniques for Determining Deviation From Performance Standards

Technique	Method	Inputs Required for Analysis	Action Driver	Reliability
Alert-Based	Identifies deviations from a defined standard based on previous performance. The alert level is set so an alert is triggered by an increase in failure rate or scheduled findings to a degree beyond normal variation.	Statistical characterization of historical failure rates or scheduled maintenance findings is required to determine the appropriate alert threshold for the system under consideration.	Investigation required when the performance falls outside normal variation.	Identification of data type(s); definition of the method used to calculate the alert level.
Trend Monitoring	Graph or table that tracks current performance to identify out-of-limit conditions or trends of deterioration.	Understanding of the measurement units that have a relationship to system failures (e.g., hours vs. cycles). Aircraft system data is typically supplemented by data from component removals and confirmed failures.	Investigation required when a metric falls outside performance limits or is predicted to do so in the near term based on the current trend.	Identification of data types; timeframes selected for monitoring performance (for example, monthly, quarterly, or yearly averages). Definition of units of measurement and demonstration so they are appropriate to the type and frequency of events being recorded.

Technique	Method	Inputs Required for Analysis	Action Driver	Reliability Program Requirement
Event-Based	An event-based program monitors and develops recommendations in response to specific operational events.	The number and range of inputs must be sufficient to allow data analysis that results in meaningful conclusions. Much of the information that is compiled to assist in the day-to-day operation of the operator's maintenance program may be effectively used as a basis for this type of continuous mechanical performance analysis.	Investigation of: the lowest performing items, AND any item with a significant change in performance rank, AND events of significant operational or safety consequences.	Identification of data types; definition of performance level and rate of change that would drive investigation.
Index-Based	Multiple data types combined to produce an index ranking of performance (e.g., pilot reports, delays/cancellations, or routine task findings).	Knowledge of the parameters and their interactions that can be used to indicate operational reliability drivers.	Investigation of the lowest performing items, AND of any item with a significant change in performance index trend.	Identification of data types; definition of the index calculation method; definition of performance level and rate of change that would drive investigation; individual data types may be weighted to reflect operator's performance goals and philosophy.

4.2.1 Alert-Based Programs. The purpose of an alert level is to identify significant deviations from a previously acceptable standard of performance. The level should not be set so high that a major increase in the failure rate does not produce an alert, nor so low that the normal distribution of failures results in excessive alerts. The actual alert level will therefore normally depend on the distribution or "scatter" observed in the failure rates of the system under review. You should recognize that alert levels are not minimum acceptable airworthiness levels, but rather are a means of readily identifying increases in failure rates that fall outside the parameters of what is considered normal performance variation. In every case, further investigation is warranted but may or may not result in identification of a problem or deficiency. There are several recognized methods of calculating alert levels, any one of which may be used provided that the method chosen is fully defined in the operator's program document.

4.2.2 Trend Monitoring Programs. When data is prepared as a running graphical or tabular display of current performance, these data depict trends as well as out-of-limits conditions. Aircraft systems performance data is usually reinforced by reports of component removals or confirmed failures. The choice of units of measurement is not critical, provided that they are constant throughout the operation of the program and are appropriate to the type and frequency of the events or conditions being recorded. To assess deteriorating performance, the operator should determine timeframes associated with monitoring performance. For example, a program could monitor the performance standards to measure the most current month, 3-month, and 12-month performance.

4.2.3 Event-Based Programs. An event-based program monitors and develops recommendations in response to specific operational events. Event-based programs may be used by any size of organization and applied to any size of fleet. This technique should have sufficient amount of data input in order to have the capability of analyzing the data to arrive at meaningful and actionable conclusions. Much of the information compiled to assist in the day-to-day operation of your maintenance program may be effectively used as a basis for this type of continuous mechanical performance analysis. As a measure of maintenance schedule effectiveness, some data types are better suited for event-based programs than others. Events having safety implications or significant operational impact, regardless of the number of occurrences, should be investigated.

4.2.4 Index-Based Program. This method involves a composite index created and presented using multiple data types. The data should be correlated to a specific aircraft system/subsystem to produce a performance ranking relative to all systems/subsystems being monitored.

4.2.5 Identifying Operational Performance Variations. The following are examples of ways to identify operational performance variations from your performance standards:

1. Alert-Based:
   - Chronic aircraft system alerts.
   - Component removal alerts.
   - Delay and cancellation alerts.
2. Trend Monitoring:
   - Exhaust gas temperature (EGT) exceedances/trends.
   - Aircraft Health Monitoring data.
   - Fuel, oil, hydraulic fluid consumption.
   - Maximum continuous thrust (MCT) margins (Extended Operations (ETOPS) requirement).
3. Event-Based:
   - In-flight shutdowns.
   - Air turnbacks/diversions.
   - Cancellations.
4. Index-Based:
   - Ranking of worst-performing aircraft systems/subsystems.
   - Routine task findings.
   - Minimum equipment list (MEL) management program effectiveness.

4.3 Non-Performance-Standard-Driven Requests. The operator may have other reasons to consider an adjustment to the maintenance schedule which are not related to negative operational performance. For example:

- A review of all or part of the current maintenance schedule to ensure maintenance is not occurring too frequently;
- Aircraft appearance concerns;
- Modification/product improvement response: review of tasks for effectiveness in light of modification/product improvement; or
- Maintenance concerns that originate from other elements of the Continuous Airworthiness Maintenance Program (CAMP), rather than as a deficiency in the maintenance schedule.

4.3.1 Design Approval Holder (DAH) Source Documents. Source document revisions, including Maintenance Review Board Report (MRBR) or Maintenance Planning Document (MPD) revisions are generated to benefit the aircraft operator community and are a function of aggregating in-service operating experience of the aircraft make/model. These revisions address global in-service experience and reflect new design configurations and new rules. While not required, you should perform a documented review of revisions to DAH source documents to determine if a change in your maintenance schedule is warranted. A defined review period or set of timeline criteria should be included in your procedures, and should be based on your:

- Aircraft's performance,
- Operating environment,
- Experience, and
- Program's goals and philosophy.

Note: Use of DAH source documents when determining your time limitations is not mandatory. However, if you choose to use source documents as substantiating data in your program, the data must be used as described in this AC.

4.3.1.1 Since the DAH will have substantiated the task and interval for the global fleet, you may perform an abbreviated analysis appropriate to the level of risk presented. For example, analysis of a revised economic task may consist of merely reviewing current reliability metrics and performance standards. Depending on risk, revisions to operational and safety tasks may warrant a more comprehensive analysis than a simple review of your current performance metrics. Analysis of operational data directly related to the revised task should be used to determine if acceptable levels of reliability are being realized. This process should be well-defined in your manual, and include documentation requirements for the data analysis performed and substantiated conclusions. It should be risk-based, and may be a process separate from your optimization process. Your analysis and criteria for adopting or rejecting the revision should be consistent, regardless of the type of change being evaluated (added task, deleted task, escalation, de-escalation).

4.3.1.2 You may choose to use DAH source documents as supplemental data when substantiating revisions to your time limitations. However, just as you cannot select which individual data points or pieces of your data sets to use and which to discard, you may not select only the source document data that support task escalations and deletions while ignoring task de-escalations and task additions. If you choose to use DAH source document data, your defined processes must include an evaluation of all tasks and intervals that have been revised, as well as defined criteria, which results in a consistent action regardless of the type of change being evaluated. Therefore, the following analysis guidelines should be followed:

1. Evaluate the revised task and determine risk (e.g., determine the task type, Failure Effect Category (FEC) code, task procedures, and targeted failure mode).

2. For DAH source document task deletions or task interval increases:
    - If the analysis of the operator's reliability metrics and performance standards related to the revised tasks show acceptable levels of reliability, you may or may not elect to adopt the change.
    - If the analysis of your reliability metrics and performance standards related to the revised tasks show unacceptable levels of reliability, you should not adopt the change until you develop recommendations to address this variation. The DAH revision may be reconsidered after acceptable performance levels are achieved.
3. For source document task additions or interval decreases:
    - If the analysis of the operator's reliability metrics and performance standards related to the revised tasks show acceptable levels of reliability, the operator may or may not elect to adopt the change.
    - If the analysis of the operator's reliability metrics and performance standards related to the revised tasks show unacceptable levels of reliability, the operator should adopt the change unless it has developed its own recommendations as outlined in this AC for addressing variations from performance standards.
4. The operator may elect to adopt all, some, or none of the DAH source document revisions based on the risk-based analysis of relevant reliability metrics and performance standards.
5. This risk-based analysis process must be defined in the carrier's program, which should include documentation requirements specifying source documents used, the risk assigned, and the data used in the analysis to support the conclusion.
6. DAH source document task revisions not adopted upon initial review should be archived and available for review based on future operational reliability concerns.

CHAPTER 5. ANALYSIS AND RECOMMENDATION

5.1 Root Cause Analysis of Variations From Performance Standard. You should perform and document an analysis in response to the triggers defined in your performance standards system. In addition to the data types you identify, your root cause analysis should also consider other aspects of your operation such as:

1. Associated flight defects and reductions in operational reliability;
2. Timing: defects occurring or discovered at line and main bases; in-flight vs. ground operations;
3. Deterioration observed during routine maintenance;
4. Post-heavy-maintenance findings;
5. Service bulletins and modification evaluations;
6. Adequacy of maintenance equipment;
7. Technical publications and instructions;
8. Staff training (see Table 2-1, Competency Training);
9. Effects of variation in utilization (high/low);
10. Effects of seasonality; and
11. Fleet commonality.

5.1.1 Techniques and Tools. Examples of analytical techniques and tools that may be used include:

1. Comparisons of operational data types from internal and external sources.
2. Interpretation of data type trends.
3. Evaluation of repetitive defects, including:
   - No Fault Found (NFF). NFF occurs when a system is tested after a fault is reported but the fault is not replicated during the test.
   - Rogue Units. A rogue unit is a single serialized line replaceable unit (LRU) which has demonstrated a history of identical system faults which may or may not result in an exceedance of an operator’s defined number of repetitive unscheduled removals within an associated short service life.
   - Chronic Units. A chronic unit is a single serialized LRU which has demonstrated a history of different system faults resulting in an exceedance of an operator’s defined number of repetitive unscheduled removals within an associated short service life.
   - Chronic Systems/Aircraft. A chronic system or aircraft is identified by a specific aircraft serial number which has demonstrated a history of repetitive unscheduled maintenance defects within the same system/subsystem during an operator-defined period of time.

4. Confidence testing of expected and achieved results.
5. Studies of life-bands and survival characteristics.
6. Investigative testing/sampling programs.
7. Structural review/analysis. To monitor and control structural integrity, competent personnel should review structural service bulletins and industry reports for applicability and urgency. Structural discrepancies should be reviewed with an emphasis on major structural discrepancies.
8. Weibull analysis. Weibull analysis determines the failure distribution profile and the predictability of failure, and is used to determine whether a component or system shows signs of deteriorating performance with age. This statistical method helps in determining if a component may benefit from a restoration task or regular preventative maintenance.

Note: When appropriately applied, Weibull analysis methods are not subject to yield limitations as described below.

9. Pareto analysis. Pareto analysis is a simple rank ordering of the number or rate of failures or defects for a given data source. This graphical representation may be effectively used for aircraft out-of-service events, delay and cancellation events, minimum equipment list (MEL) applications/extensions, and other metrics as deemed appropriate. Pareto charts are used to identify the top subjects, which are often targeted for performance improvements.
10. Failure Mode and Effects Analysis (FMEA).
11. Maintenance Steering Group (MSG) analysis methods.
12. Other root cause analysis tools.

5.2 Analysis of Task Effectiveness. You should routinely perform an analysis to determine the applicability and effectiveness of the tasks contained within the maintenance schedule. This is in addition to the analysis of the task and related operational data performed during optimization. The evolution of your maintenance schedule is not necessarily to simply increase individual task intervals, but to substantiate the accomplishment of an effective task at the appropriate interval, without compromising safety or negatively impacting operational performance beyond that which is acceptable.

5.2.1 Data Selection Criteria. An operator should include in its reliability program a defensible method for determining the relevant type and amount of data that adequately represents its fleet with respect to the maintenance task under consideration. The following describes a defensible method for data selection:

- Consistent,
- Measurable,
- Unbiased,
- Factual,

- Accurate, and
- Repeatable.

5.2.2 Data Sampling. In compliance with your Continuing Analysis and Surveillance System (CASS) obligation under part 121, § 121.373 to determine effectiveness of your maintenance schedule, 100 percent of your performance standard data is collected and analyzed. Because of this CASS requirement, the concept of sampling may be applied as an effective and efficient tool when analyzing other data types/sets in support of your program's requirements. Data sampling allows you to analyze a defined portion of data from a relevant data set, rather than analyzing the entire amount of data that may be available. As with any effective data analysis process, the FAA expects you to collect and analyze additional data types and/or different data sets as the particular circumstances dictate.

5.2.2.1 When executing these CASS requirements in the context of data sampling, you will encounter variables where differences between the following aspects of your program become significant. Examples include:

1. The type of task being evaluated.
2. The finding or type of finding considered unacceptable for a given task (see paragraph 1.6).
3. Related vs. unrelated data.
4. Significant vs. nonsignificant findings.
5. Data variables:
   - Discrete data (i.e., can only take on certain values, can be counted);
   - Continuous data (i.e., can take on infinite number of values, must be measured); and
   - Data quality/error rate.
6. Qualitative vs. quantitative analysis.
7. Other differences in analysis methods and tools:
   - Those designed to predict failures or future performance, and
   - Those designed to monitor real-time performance.

5.2.2.2 Due to these variations and the wide range of analysis tools you may choose to employ, it is not possible in this AC to provide prescriptive details or criteria for you to apply when determining what data types/sets to collect and analyze, your data sample set, or which analysis methods you should use.

5.2.2.3 Regarding data sampling specifically, it is likewise not possible to provide a one-size-fits-all sampling method or formula that is effective for every data type and analysis method available. You should not attempt to define or rely on any one method or formula that establishes a sample size to be used in every case. You must respond to the needs of the analysis being performed, which includes performing any additional analyses as discussed above. Therefore, you should design and execute your processes and methods, including your sampling methods, to be agile enough to respond to the specific data and analysis needs of each situation. The keys in executing an effective analysis process are:

1. Recognizing the significance and the effect of variations in your operations and data;
2. Utilizing the appropriate data types/sets, amount of data, and analysis methods and tools for the given situation;
3. Following through with the actions necessary to ensure program goals and objectives are met; and
4. Using competent personnel to perform these functions to ensure a consistent outcome.

Note: Personnel competencies are discussed in paragraph 2.1.4 and in AC 120-79, Developing and Implementing an Air Carrier Continuing Analysis and Surveillance System, Chapter 6, Personnel Who Perform CASS Functions; and in AC 120-16, Air Carrier Maintenance Programs, Chapter 10, Personnel Training.

5.2.2.4 Regardless of the method used to determine your sample data requirements, your sampling process must result in confidence that the sample data is applicable and representative of the population. Your data sampling process should consider data provided by outliers within your population, while preventing the possibility that a decision is inappropriately influenced by data from aircraft that are at the extremes of the data set. The following is provided for reference only, and is not intended to suggest any single method described herein as the recommended method or formula to determine sample size in every situation.

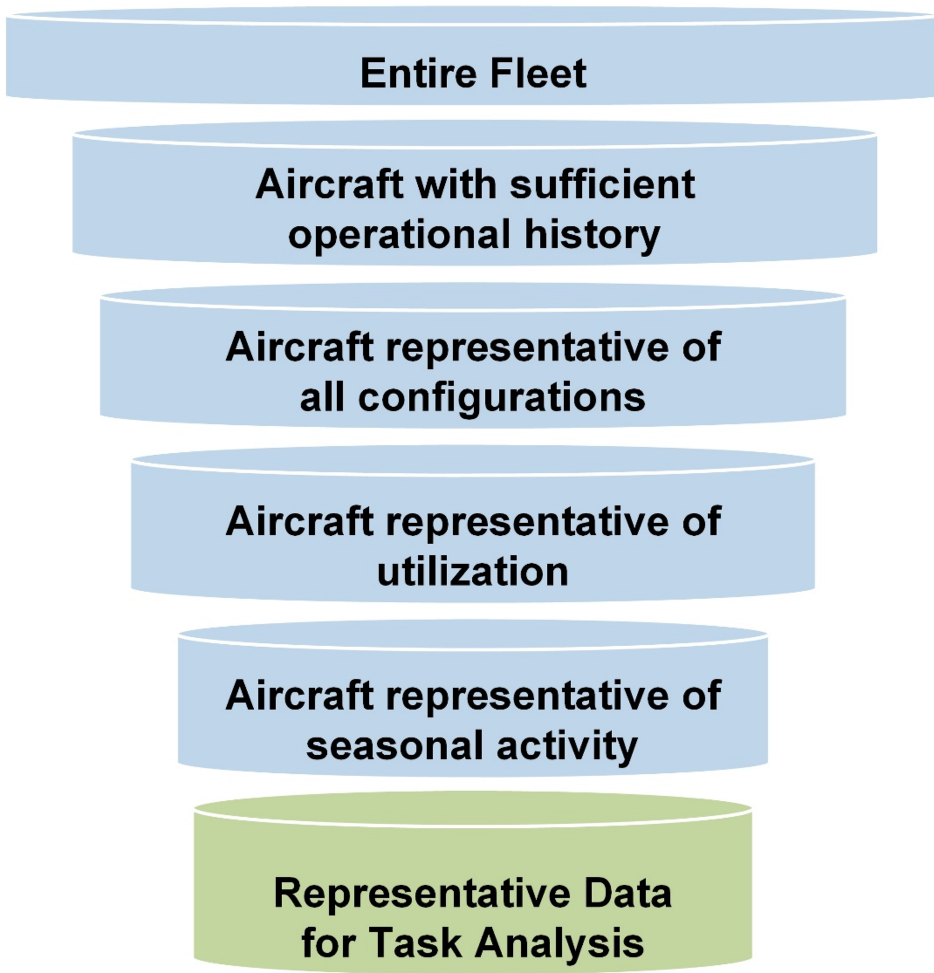
1. The process for selecting a data set that reflects the fleet composition should consider the following criteria:
   - Operational history,
   - Configuration differences,
   - Time elapsed since major conversions or refurbishments,
   - Utilization differences,
   - High time/cycle and low time/cycle aircraft,
   - Seasonality and environmental conditions,

- Sustained storage periods, and
- Task yield.

Note: Aircraft that don't meet minimum task yield standards should not be included in the random sample. Findings from scheduled maintenance tasks actually performed at a lower yield may be an indicator that the published interval is too high. Further analysis will be necessary, including analysis of related in-service data.

2. Include one or more of the following means when defining a data selection method. Data should be selected from the available data pool generated using the criteria above, such as:
   - A defined number of aircraft (typically used with smaller fleets).
   - A percentage of fleet size (e.g., a minimum percentage of randomly selected aircraft), plus outlier aircraft from the criteria applicable under paragraph 5.2.2.4, item 1 (e.g., high utilization and low utilization, high flight-hours and low flight-hours, high cycles and low cycles, etc.).
   - A statistical formula (primarily used for quantitative data analysis).
   - Data collected over a defined period of time. Here, the sample is all data from the data set that is collected during the specified period, rather than all data that may be available or that has been collected (particularly useful when identifying performance trends).
3. Depending on the task being analyzed, your sampling method should allow flexibility to account for benefits in analyzing the task performed repetitively on specified aircraft vs. analyzing tasks performed once on a greater number of aircraft. As stated above, collecting additional data and/or different data sets may be necessary.
4. You should ensure fleet representation is maintained in the data throughout your analysis process (see Figure 5-1, Data Selection Example).

Figure 5-1. Data Selection Example



5.2.3 Task Yield.

5.2.3.1 Any scheduled maintenance task analysis that includes either defects generated or a lack of defects generated, should consider the respective interval yield. This is because the current task interval is established with the intent of detecting degradation or potential failure at that interval. If the task is performed significantly earlier than the specified interval, the data may not be valid to support an evaluation of the specified interval.

Note: Operators should include in their analysis process defects discovered at relatively low yield intervals since this may be an indication that the current task interval is not effective.

5.2.3.2 To arrive at a yield solution, the defined interval and the interval at which the task was actually accomplished must be calculated using the same parameter (flight-hours, flight cycles, or calendar). In some cases, you may need to perform a conversion of values to arrive at the same usage parameter.

The yield calculation divides the interval at which the task was actually accomplished by the defined interval.

- A minimum acceptable value for average yield of all task accomplishments contributing data to the task analysis is 90 percent.
- No single task accomplishment within the data set used for task analysis should have a yield less than 80 percent.

Note: Analysis of consecutive task accomplishments may be useful when evaluating task and interval effectiveness. Failures discovered at a relatively low yield should be considered as such in the overall analysis. However, tasks performed at a relatively low yield with no findings should not be used to determine or analyze *failure rates* at the published interval, or as *zero findings* data when substantiating escalations from that interval. The second or subsequent task, by itself resulting in a higher overall yield, may be useful for these purposes *provided in-service failures are identified and incorporated into the data*.

5.2.3.3 Example:

- Actual task interval: 7,100 flight-hours.
- Task defined interval: 7,500 flight-hours.
- Yield calculation: 7,100 flight-hours/7,500 flight-hours = 94.7 percent task yield.

5.2.4 Data Preparation and Related Considerations. Typically, operational data are collected and consistently coded so correlation to a maintenance schedule task is evident to analysts or engineers performing the analysis (see paragraph 3.3). To ensure comprehensiveness and relevance of data when performing analysis, the operator should ensure all data findings are directly related to the task being analyzed.

5.2.4.1 **Related Data.** Related data is a maintenance defect discovered during scheduled or unscheduled maintenance to which the corrective action is directly associated to the task being analyzed or its consequence of functional failure.

5.2.4.2 **Unrelated Data.** Unrelated data is a maintenance defect discovered during scheduled or unscheduled maintenance for which the corrective action is not directly associated to the task being analyzed or its consequence of functional failure. Depending on risk, it may be necessary to investigate unrelated data findings separately from the evaluation of the given task and interval.

Note: Unrelated findings that would otherwise be considered significant as defined below should be thoroughly investigated to determine overall program effectiveness.

5.2.4.3 Significant Finding. A significant finding is a maintenance record considered directly related to the task being analyzed that indicates a functional failure or significant degradation/wear has occurred. These are primary analysis concerns. Examples of significant findings include:

1. Systems that:
   - Affect airworthiness or safety on the ground or in flight.
   - Are undetectable or unlikely to be detected during operations.
   - Have significant operational impact.
   - Have significant economic impact.
2. Structures that:
   - Affect airworthiness or safety on the ground or in flight.
   - Have reportable defects under the Service Difficulty Reporting (SDR) system.
   - Have Level 2 corrosion.
   - Have Level 1 corrosion found other than at the scheduled maintenance interval.

5.2.4.4 Non-Significant Finding. A non-significant finding is a maintenance defect considered directly related to the task being analyzed that does not indicate a functional failure or significant degradation/wear and which does not fall into an example category for significant finding (e.g., Level 1 corrosion found at the scheduled maintenance interval). Depending on risk, these may or may not be primary analysis concerns.

5.2.5 Summary of Data. Each interval adjustment should include a summary of the data that was used for the analysis. Relevant, accurate, and a sufficient amount of data constitute the foundation for an operator's standards determining their scheduled maintenance time limitations. This data summary should demonstrate that the processes and procedures of the operator's reliability program regarding data selection were followed.

5.2.6 Evaluation of Data Sources. Table 5-1, Data Sources by Task Type, contains recommended data sources that you may use for analysis to determine time limitations for maintenance schedule tasks. The data is divided into primary and secondary sources.

1. Primary data elements should be used as the main data source for analysis by the operator to substantiate an effective task interval.
2. Secondary data sources should be used to further support or validate analysis conclusions, or when further investigation is warranted. This data should not be used as the sole source for determining time limitations of a task. Operators may identify additional data sources for analysis.

Table 5-1. Data Sources by Task Type

Task Type	Primary Data	Secondary Data
Systems tasks[1] (excluding Failure Effect Categories (FEC) 8 & 9)	In-service operational data	Routine task findings
Propulsion tasks[1] (excluding FEC 8 & 9)	In-service operational data	Routine task findings
Structures tasks[4]	Routine task findings[2]	In-service operational data
Zonal tasks	Routine task findings[2]	In-service operational data
FEC 8 & 9 tasks	Routine task findings/sampling at proposed interval[2]	FEC 8 ONLY: MSG-derived functional failure data/expand data set/previous accomplishment of task
Enhanced zonal analysis procedure (EZAP)/electrical wiring interconnection system (EWIS) tasks	Routine task findings[2]	In-service operational data
Lube tasks	Volume of consumables, rates/sampling at proposed interval, and/or degree of wear noted on component teardown reports	Operational reliability data
Filter tasks	Analysis of remaining life at current interval/sampling at proposed interval	Operational reliability data[3]

[1] The primary data source for systems and powerplant tasks (excluding FEC 8 & 9 tasks) is the operator's operational reliability data. The effectiveness of these tasks is measured by the ability of the maintenance schedule task to detect and correct defects in the system before the defect impacts the operational environment.

[2] It is important to note that because failures associated with these tasks are normally found during the accomplishment of the routine task, this data may not be captured as part of an operator's normal reliability data elements. Therefore, some means of capturing those failures for analysis is necessary.

[3] Only for those tasks where failures would be evident to the flightcrew or maintenance personnel and would be recorded in the operational data (such as logbook writeups).

[4] Include any damage (fatigue cracks or corrosion), whether or not it was discovered as a result of a scheduled maintenance task.

5.2.7 Analysis Process. Once the operator has identified and obtained the data, the operator must analyze the data in order to substantiate interval adjustment or task revision. To perform the correct level of analysis, the operator should develop standardized decision logic based on the type of task and data being analyzed, and should be performed by appropriately trained and competent personnel. For examples of this decision logic, see the appendices within this AC.

5.2.8 Result of Analysis. If the analysis shows the impact on operations for a given system is low, the task may be considered effective regardless of the number of scheduled maintenance findings. Conversely, a high degree of operational impact could indicate an ineffective task, even if the number of scheduled maintenance task findings is low. Other combinations are also possible. Table 5-2, Review of Systems/Powerplant Tasks, represents examples of situations that may be identified during the analysis. This table is relative; conclusions should be based on your unique operations. It is not definitive or exhaustive, but is intended to only provide guidance to operators when evaluating tasks and findings. The existence of scheduled maintenance findings by itself is not an indication of an ineffective program.

Table 5-2. Review of Systems/Powerplant Tasks[1]

	Low Number of Unscheduled Maintenance Defects		**High Number of Unscheduled Maintenance Defects**	
	Low Impact on Operations	**High Impact on Operations**	**Low Impact on Operations**	**High Impact on Operations**
Low Number of Scheduled Maintenance Defects	Effective but not optimized	Ineffective	Note 2	Ineffective
High Number of Scheduled Maintenance Defects	Effective and optimized	Ineffective	Effective but not optimized	Ineffective

[1] FEC 8 and 9 tasks are designed to detect failures that are not evident during normal operations. Therefore, these failures do not typically result in an impact to in-service operations.
[2] Additional analysis is required to determine task effectiveness.

5.2.9 Data Standards. You should develop a standard for how to collect, validate, display and archive task data, along with the results of any analysis performed, including conclusions and recommendations to be considered during your internal approval process. You should consider adding a special emphasis task section to your Summary of Data that contains information related to certain tasks that would warrant special analysis or consideration, such as:

1. FEC 5 and 8 tasks,
2. Level 2 or higher corrosion findings,
3. EWIS and fuel tank safety tasks, or
4. Lightning/High Intensity Radiated Field (L/HIRF) tasks.

5.3 Recommendations. You are expected to investigate and develop risk-based recommendations (which may include "no action" recommendations), in response to variations from a performance standard. The results of the investigation, including the data collected and analyzed, root cause(s), the risk assessment, and recommended action should be documented and retained.

5.3.1 Recommended Maintenance Schedule Actions. See Appendix A, Task/Interval Adjustments—Top-Level Chart. The purpose of a reliability program is to allow an operator a means to determine effective time limitations, and authorization to publish and use those time limitations as your maintenance schedule without prior FAA involvement. Unless otherwise restricted, an operator's revisions to the maintenance schedule could include:

1. Escalating (increase) or de-escalating (decrease) the current maintenance schedule interval;

   Note 1: You may not escalate airworthiness limitation items (ALI) using your reliability program.

   Note 2: Except as provided in the Airworthiness Limitation Section (ALS), operators may not escalate tasks that are "tagged" or otherwise identified as precluding a Certification Maintenance Requirement (CMR), beyond the System Safety Assessment (SSA) interval. Refer to AC 25-19, Certification Maintenance Requirements.

2. Deleting an existing task;
3. Adding a new task;
4. Revising task procedures; or
5. Accepting or validating current performance and continue to monitor without further action.

5.3.2 Other Recommendations. Your reliability program is part of your CASS; however, it does not replace or substitute for a CASS. As part of CASS, recommendations resulting from your data collection and analysis may go beyond a maintenance schedule adjustment, and result in an input to the operator's broader CASS. Some recommendation examples are:

1. Changes within other elements of the Continuous Airworthiness Maintenance Program (CAMP):
   - Airworthiness responsibility,
   - Air carrier maintenance manual,
   - Air carrier maintenance organization,
   - Accomplishment and approval of maintenance and alterations,
   - Maintenance schedule,
   - Required inspection items,
   - Maintenance recordkeeping system,
   - Contract maintenance,
   - Personnel training, and
   - CASS.
2. Fleet modifications or configuration changes.
3. Changes to maintenance, operational procedures, or techniques. For example:
   - One-time special maintenance for the fleet,
   - Changes to provisioning of spare parts for maintenance, and
   - Changes to manpower and equipment planning.
4. Requests for support from Original Equipment Manufacturer (OEM).
5. Coordinated efforts with other divisions (Flight Operations, Ground Operations, etc.).

Note: The operator's CASS procedures may be followed for recommendations outside the scope of an adjustment to the maintenance schedule.

CHAPTER 6. MAINTENANCE SCHEDULE CHANGES—INTERNAL APPROVAL AND IMPLEMENTATION

6.1 Approval Process. In addition to the appropriate substantiation data, the operator's maintenance schedule adjustment process should define internal approval and implementation procedures. An approval plan should be comprised of procedures initiated by the competent review and disposition of a recommendation by the designated decision authority. The party responsible for the implementation of the change should be identified and defined. The operator should also develop methods to:

- Resolve nonconcurrence.
- Ensure closure of all proposals.
- Archive the disposition of a recommendation.

6.1.1 <u>Revisions Without Direct FAA Involvement</u>. Unless otherwise restricted (such as airworthiness limitations (AL), Certification Maintenance Requirements (CMR), or Airworthiness Directives (AD)), you may make revisions to the maintenance schedule without direct FAA involvement. However, you should coordinate significant revisions with the principal maintenance inspector (PMI) prior to publishing your revision. Prior coordination with the PMI is recommended for all maintenance schedule revisions. You should be prepared to provide documentation to the FAA demonstrating that the process used to determine maintenance schedule revisions was accomplished in accordance with your standards for determining time limitations.

Note: Your entire process is subject to continual FAA oversight to verify you are executing your process in accordance with your program, and that your data-based decisions are in the interest of safety and program objectives. Therefore, your program should include sufficient documentation and recordkeeping requirements.

6.2 Implementation. Your process should result in a comprehensive plan for implementing changes to the maintenance schedule. The plan should include procedures for notifying FAA representatives assigned to the air carrier that maintenance schedule changes are planned or have been made. The implementation plan should be documented and be included with other information considered during the change approval process. In most cases, any change to the maintenance schedule will require significant coordination with maintenance support organizations such as resource allocation, logistics, and planning groups, especially when the interval for an entire packaged check is revised.

6.2.1 <u>Escalated Intervals and Task Deletions</u>. These changes will normally become effective immediately upon attaining internal approval per the operator's defined task amendment process. The implementation of individually escalated task intervals is relatively straightforward.

Note: Special considerations must be given to time/date check tasks that evaluate remaining life-limits. An in-service, life-limited item near its life-limit that passes the task's evaluation criteria at the original interval may end up exceeding its life-limit before the task is performed at the escalated interval. Prior to implementing the escalation, you must ensure there is sufficient time remaining on life-limited items at the new interval. A life-limited item may not remain in-service past the limit at which it becomes due.

6.2.2 De-Escalated Intervals. Based on the urgency of the reliability concern, the operator should determine when and how to implement the reduced interval. Options could range from:

- Waiting until the next scheduled completion of the task at the original interval,
- A phased-in schedule based on risk or other measure of exposure or desired outcome, or
- Immediate implementation of the reduced interval.

6.2.3 New Tasks. Similarly, the timing for implementation of new tasks should be based on the risk of the concern.

6.2.4 Followup. During implementation, the operator's reliability program should continue to monitor the effectiveness of the overall maintenance schedule. Based on risk, an operator may need to follow up and report on specific changes or phases of implementation to confirm that the change does not adversely impact the affected system, and that the change is achieving the desired results.

CHAPTER 7. REPORTING AND DISPLAY FORMAT

7.1 General. All programs will require a means of displaying and reporting summaries of the collected data, analyses performed, and the status of internally approved recommendations.

7.1.1 Reporting. Reliability program reporting should:

1. Reflect the operator's operational philosophy and economic goals regarding aircraft performance.
2. Develop one or more means of displaying and reporting collected data, including data displays summarizing the activity since the last reporting period.
3. Cover all aircraft systems controlled by the program in sufficient detail to enable recipients of the information to monitor the effectiveness of the maintenance schedule, including changes in maintenance and inspection intervals, and tasks.
4. Include enough data to accurately portray the carrier's particular operation(s).
5. Be frequent enough to identify degrading trends before significant operational impact occurs.
6. Identify areas which have not achieved the established performance standards.
7. List continuing unfavorable performance or deficiencies carried forward from previous reports, and details of the progress of corrective actions taken.
8. Highlight implemented or planned recommendations.
9. Monitor the effectiveness of revisions to the maintenance schedule.

7.1.2 Methods and Frequency. Reliability reporting methods and frequency of reporting may vary by operator and will be dependent upon the complexity of operations.

7.1.3 Display. Operators may choose to incorporate all elements into a single report, or incorporate individual elements into multiple forms and forums, including electronic data displays, structured reports, and/or presentations.

7.1.4 Delivery. Your report distribution and timeline of delivery should be specified in your program, and should be provided to senior management representatives of the maintenance organization and your FAA office with oversight responsibility.

CHAPTER 8. ADMINISTRATIVE

8.1 Regulatory References. Refer to the following 14 CFR parts:

- Part 5.
- Part 91.
- Part 119.
- Part 121.
- Part 135.

8.2 Guidance References (current editions). Refer to the following ACs and orders:

1. AC 00-46, Aviation Safety Reporting Program.
2. AC 00-58, Voluntary Disclosure Reporting Program.
3. AC 20-136, Aircraft Electrical and Electronic System Lightning Protection.
4. AC 20-158, The Certification of Aircraft Electrical and Electronic Systems for Operation in the High-Intensity Radiated Fields (HIRF) Environment.
5. AC 25-19, Certification Maintenance Requirements.
6. AC 26-1, Part 26, Continued Airworthiness and Safety Improvements.
7. AC 120-16, Air Carrier Maintenance Programs.
8. AC 120-42, Extended Operations (ETOPS and Polar Operations).
9. AC 120-59, Internal Evaluation Programs.
10. AC 120-66, Aviation Safety Action Program (ASAP).
11. AC 120-72, Maintenance Human Factors Training.
12. AC 120-77, Maintenance and Alteration Data.
13. AC 120-79, Developing and Implementing an Air Carrier Continuing Analysis and Surveillance System.
14. AC 120-92, Safety Management Systems for Aviation Service Providers.
15. AC 120-93, Damage Tolerance Inspections for Repairs and Alterations.
16. AC 120-97, Incorporation of Fuel Tank System Instructions for Continued Airworthiness into Operator Maintenance and/or Inspection Programs.
17. AC 120-98, Operator Information for Incorporating Fuel Tank Flammability Reduction Requirements into a Maintenance and/or Inspection Program.
18. AC 120-102, Incorporation of Electrical Wiring Interconnection Systems Instructions for Continued Airworthiness into an Operator's Maintenance Program.
19. AC 120-113, Best Practices for Engine Time In Service Interval Extensions.

20. AC 121-22, Maintenance Review Boards, Maintenance Type Boards, and OEM/TCH Recommended Maintenance Procedures.
21. AC 135-42, Extended Operations (ETOPS) and Operations in the North Polar Area.
22. FAA Order 8040.4, Safety Risk Management Policy.
23. FAA Order 8900.1, Volume 6, Chapter 2, Section 31, Safety Assurance System: Inspect Approved Reliability Program.
24. FAA Order 8900.1, Volume 3, Chapter 40, Section 1, Safety Assurance System: Approving Part 121 and 135 Reliability Programs.

8.3 Other Source References. Refer to the following additional sources:

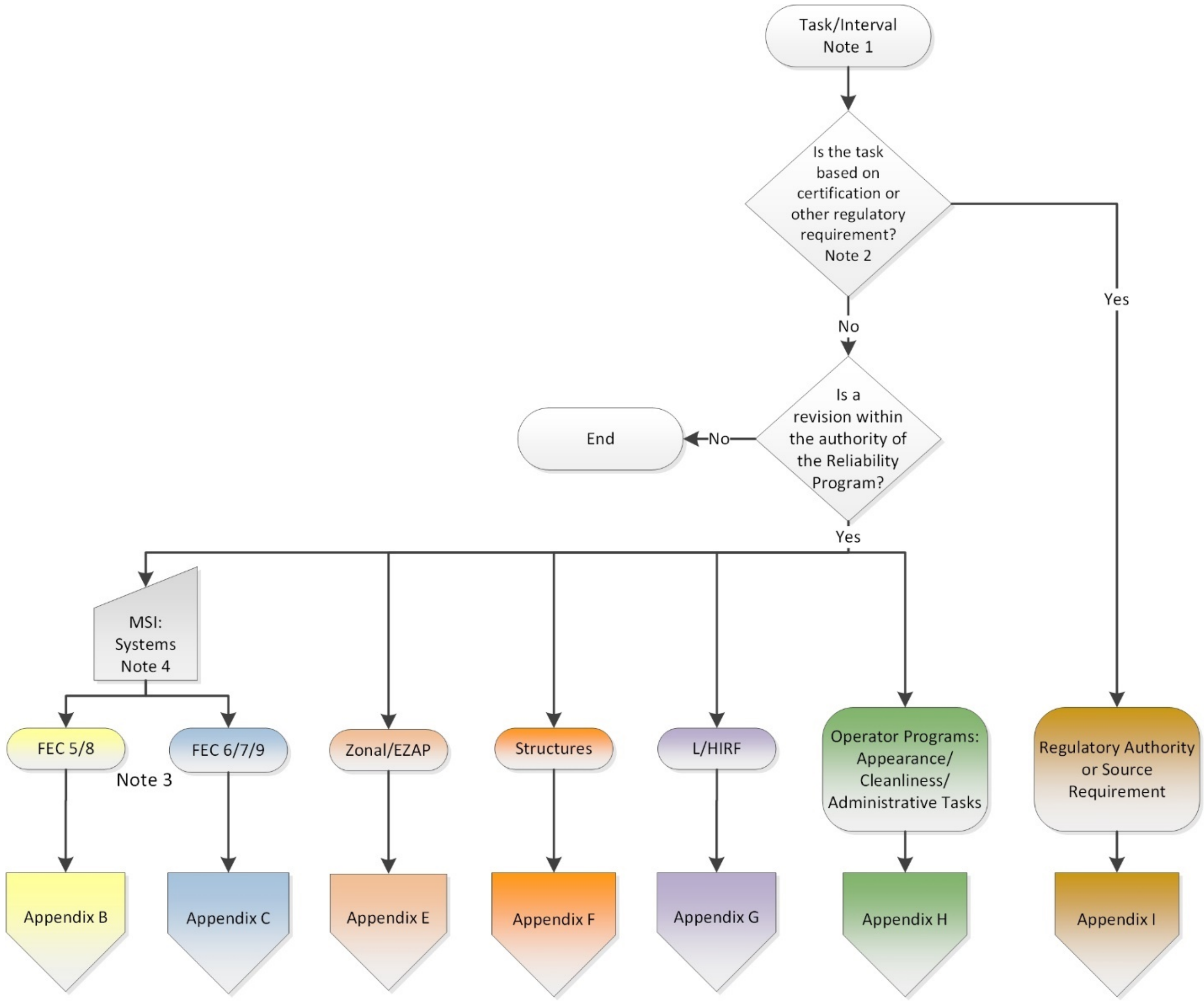
- Air Transport Association of America (ATA) MSG-3, Operator/Manufacturer Scheduled Maintenance Development, current edition available from:

  Airlines for America (A4A)
  1301 Pennsylvania Ave NW, Suite 1100
  Washington, DC 20004-1707
  202-626-4000
  http://www.airlines.org

- "E.M.A.C. Maintenance Program Optimization 1" International Air Transport Association (IATA). January 1985.
- "Reliability-Centered Maintenance" F.S. Nowlan, et al, December 1978 (report number AD–A066–579, DD Form 1473, January 1, 1973).

8.4 AC Feedback Form. For your convenience, the AC Feedback Form is the last page of this AC. Note any deficiencies found, clarifications needed, or suggested improvements regarding the contents of this AC on the Feedback Form.

APPENDIX A. TASK/INTERVAL ADJUSTMENTS—TOP-LEVEL CHART



Notes:

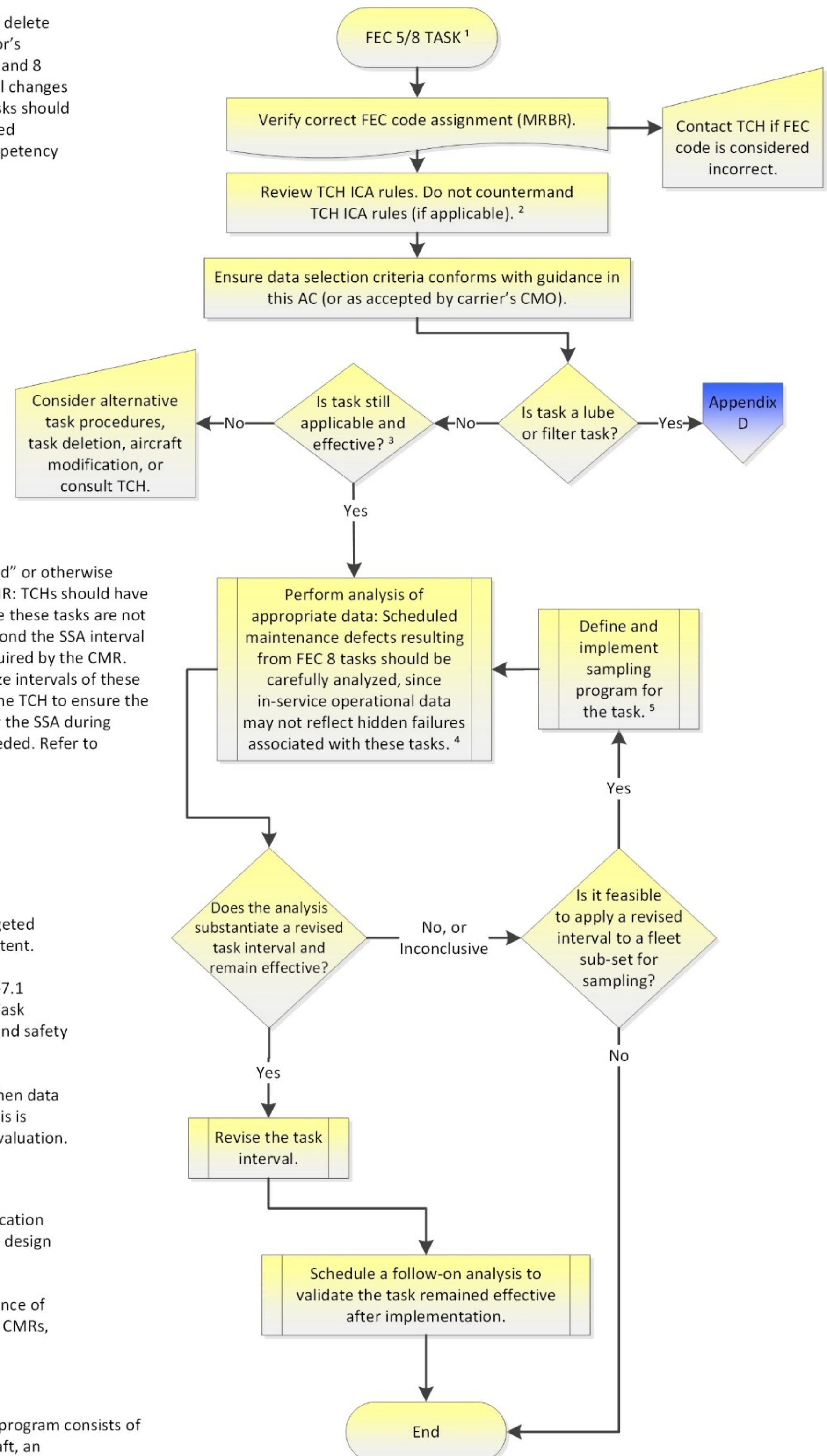
1. Supplemental Type Certificate (STC)-derived instructions for continued airworthiness (ICA) should not be treated any differently than any other task unless the STC holder's ICA documents provide specific instructions for interval management. It is a best practice for operators to coordinate with STC holders by providing product performance feedback during analysis initiatives associated with these designs.

2. Examples include: Airworthiness Directive (AD), Certification Maintenance Requirements (CMR), airworthiness limitation item (ALI), airworthiness limitation (AL) tasks, fuel tank safety (FTS) tasks, Failure Effect Category (FEC) 5 or 8 tasks "tagged" as precluding a CMR, etc.

3. Operators should not rely exclusively on type certificate holder (TCH) assignment of FEC codes. An understanding of the functions under analysis and associated consequences of functional failure is beneficial.

4. Maintenance Significant Item (MSI).

APPENDIX B. FAILURE EFFECT CATEGORY (FEC) 5/8 TASKS



Note 1. Operators may not delete FEC 5 or 8 tasks. An operator's authority to optimize FEC 5 and 8 tasks is restricted to interval changes only. Analysis of FEC 5/8 tasks should be performed by experienced personnel meeting the competency minimum per 2.1.d.

Note 2. FEC 5/8 tasks "tagged" or otherwise identified as satisfying a CCMR: TCHs should have procedures in place to ensure these tasks are not susceptible to escalation beyond the SSA interval that would otherwise be required by the CMR. Operators desiring to optimize intervals of these tasks must coordinate with the TCH to ensure the CCMR interval established by the SSA during certification will not be exceeded. Refer to AC 25-19.

Note 3. Relative to the targeted failure mode and original intent.

Refer to MSG-3 section 2-3-7.1 (Table 2-3-7.1, Criteria for Task Selection) for applicability and safety effectiveness guidance.

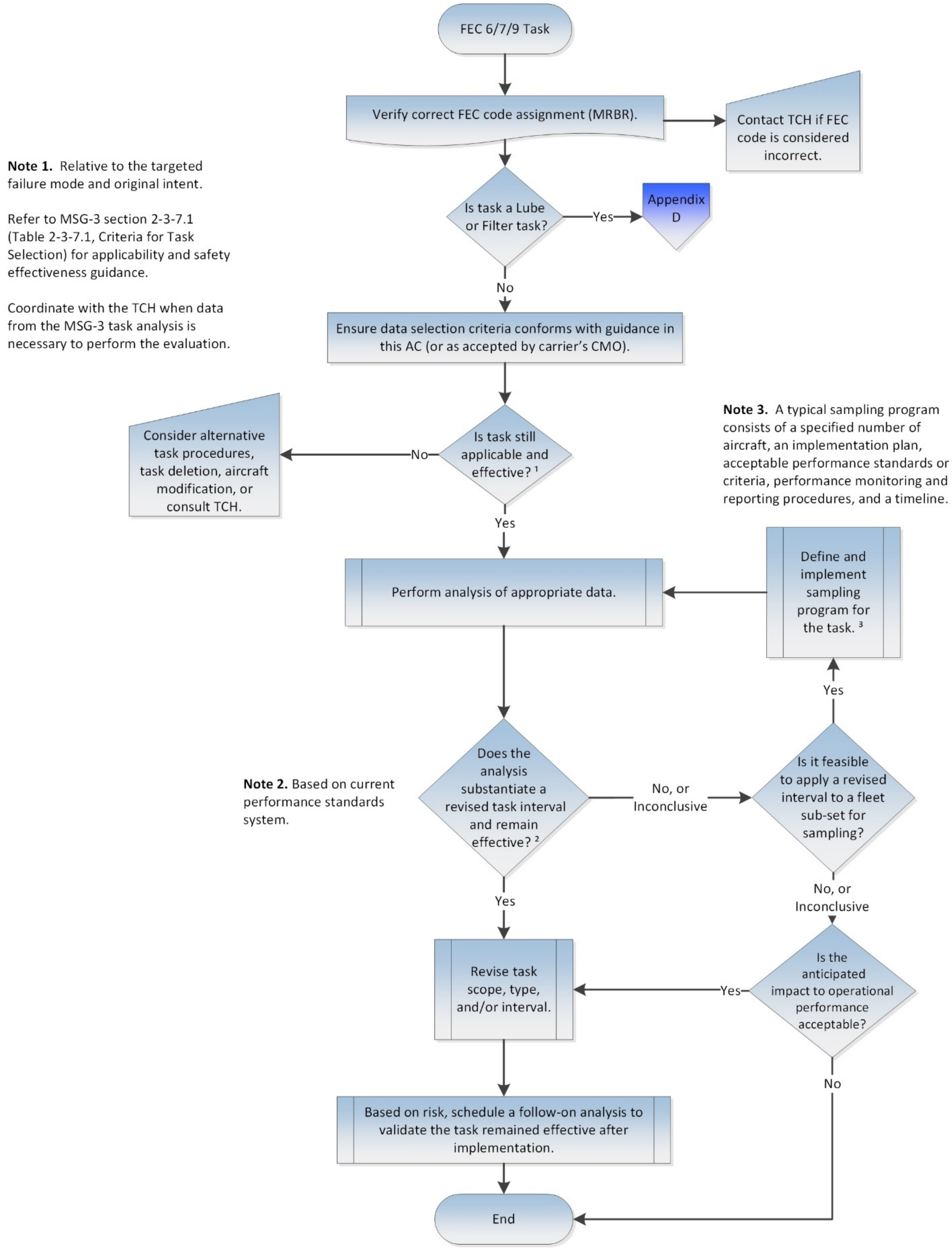
Coordinate with the TCH when data from the MSG-3 task analysis is necessary to perform the evaluation.

Note 4. Consider communication with TCH to ensure fail-safe design limit is not exceeded.

Retain identity and significance of safety-related tasks such as CMRs, ALIs, AL, FEC 5, and FEC 8.

Note 5. A typical sampling program consists of a specified number of aircraft, an implementation plan, acceptable performance standards or criteria, performance monitoring and reporting procedures, and a timeline.

APPENDIX C. FAILURE EFFECT CATEGORY (FEC) 6/7/9 TASKS



APPENDIX D. LUBE/FILTER TASKS

Note 1. Consideration volumes, rates of usage or deterioration, and the unit's ability to perform its intended function. Do not assume variables are constant. It is possible that at some point, rates may accelerate.

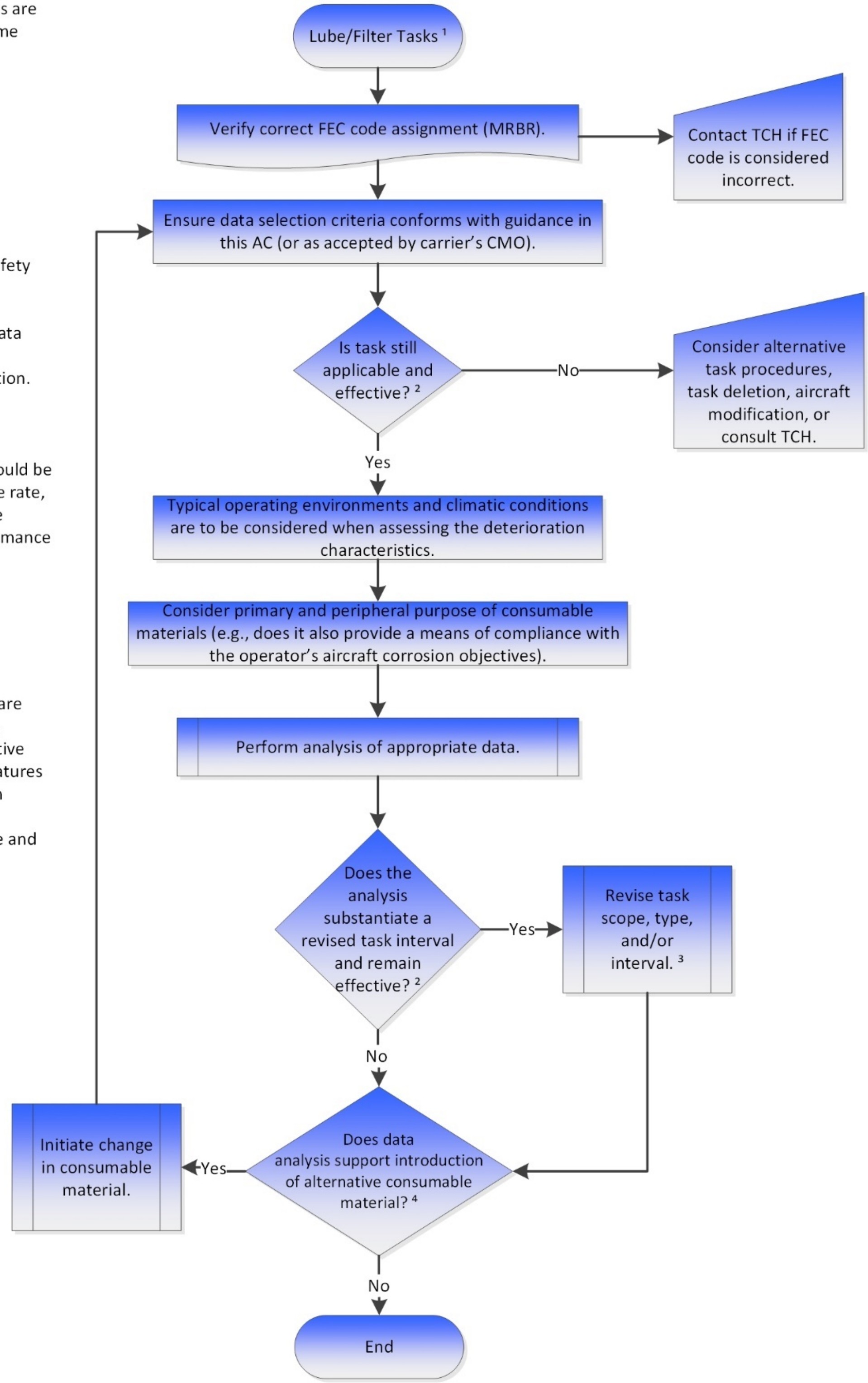
Note 2. Relative to the targeted failure mode and original intent.

Refer to MSG-3 section 2-3-7.1 (Table 2-3-7.1, Criteria for Task Selection) for applicability and safety effectiveness guidance.

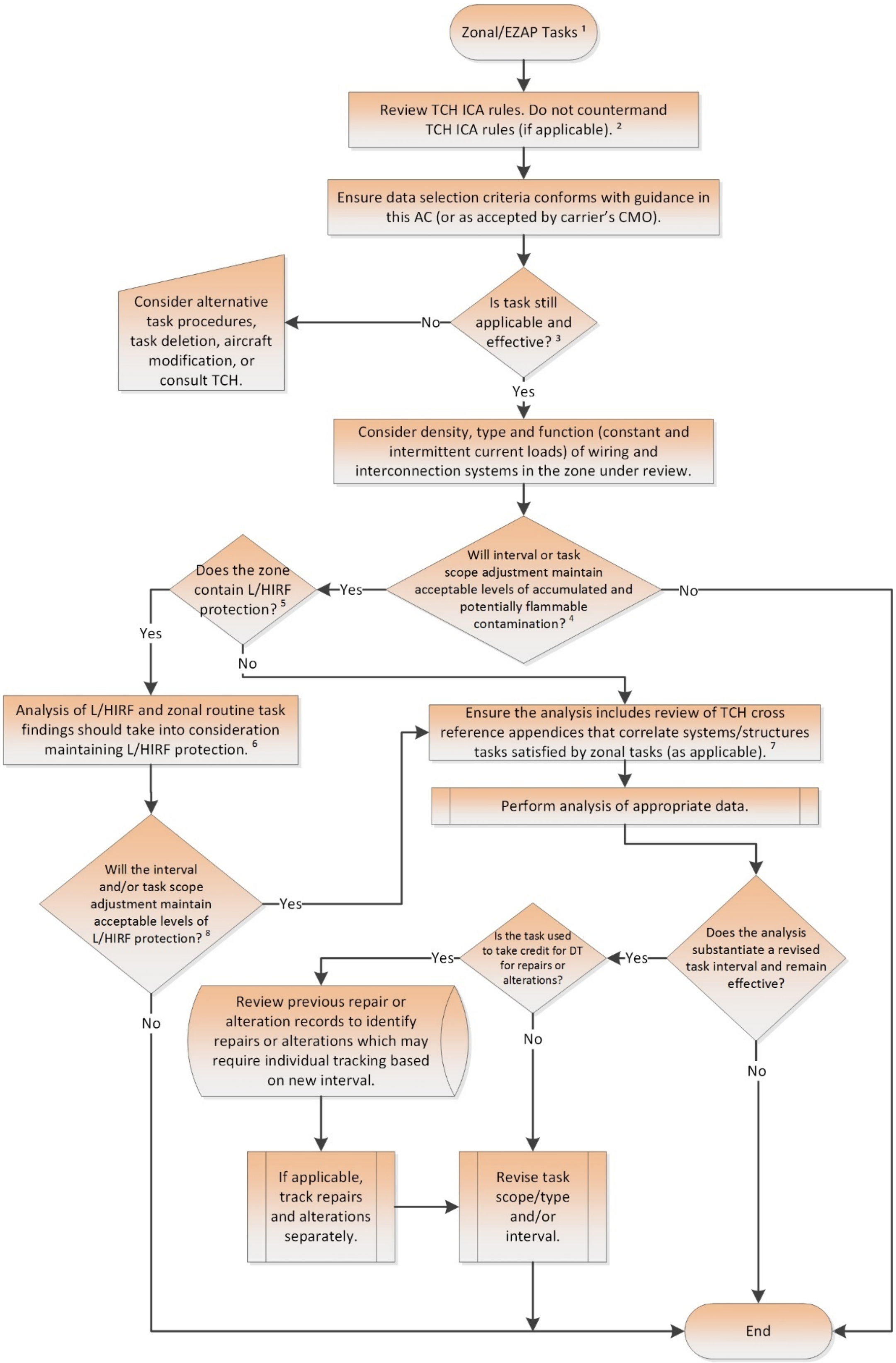
Coordinate with the TCH when data from the MSG-3 task analysis is necessary to perform the evaluation.

Note 3. The selected interval should be based on the consumable's usage rate, the amount of consumable in the system (if applicable), and performance deterioration characteristics.

Note 4. If alternative material (lubricants, filter elements, etc.) are considered to extend an interval, consider compatibility of alternative products with existing system features and design performance. Caution should be exercised for material compatibility (e.g., lithium grease and compatibility).



APPENDIX E. ZONAL/ENHANCED ZONAL ANALYSIS PROCEDURE (EZAP)



Note 1.
- Consider aircraft structure, systems, and installations within the zone to ensure unintended degradation or loss of function will not occur.
- Traceability of revisions to approved electrical wiring interconnection system (EWIS) instructions for continued airworthiness (ICA) to include task, intervals, procedures, protections, and cautions must be maintained.
- As applicable, operators must apply any additional procedures or restrictions based on their compliance document requirements.
- Deletions of EWIS tasks must be approved by the FAA oversight office via the operator's principal maintenance inspector (PMI).

Note 2. Example:
Some zonal tasks may partially satisfy damage tolerance requirements which must be performed at originally-established limits after a certain fatigue threshold. Intervals may be escalated prior to that threshold, but must be adjusted to the original levels at the threshold.

Note 3.
- Relative to the targeted failure mode and original intent.
- Refer to Maintenance Steering Group – 3rd Task Force (MSG-3), volume 1, section 2-3-7.1 (Table 2-3-7.1, Criteria for Task Selection) for applicability and safety effectiveness guidance.

Note 4. This evaluation doesn't necessarily include the concept of actually *measuring* contamination or accumulation rates. However, each task adjustment should be sufficiently substantiated, which includes whether the desired results will continue to be achieved at the revised interval. Refer to AC 25-27, AC 120-94, and AC 120-102 for additional information on contaminants.

Note 5. Lightning/High Intensity Radiated Fields (L/HIRF) protection may include:
- Wires, shields, connectors, bonding straps, raceways between connectors.
- L/HIRF protection within conduit or heat shrink or other covering.
- Non-metallic structure with conductive mesh and/or antistatic coatings.

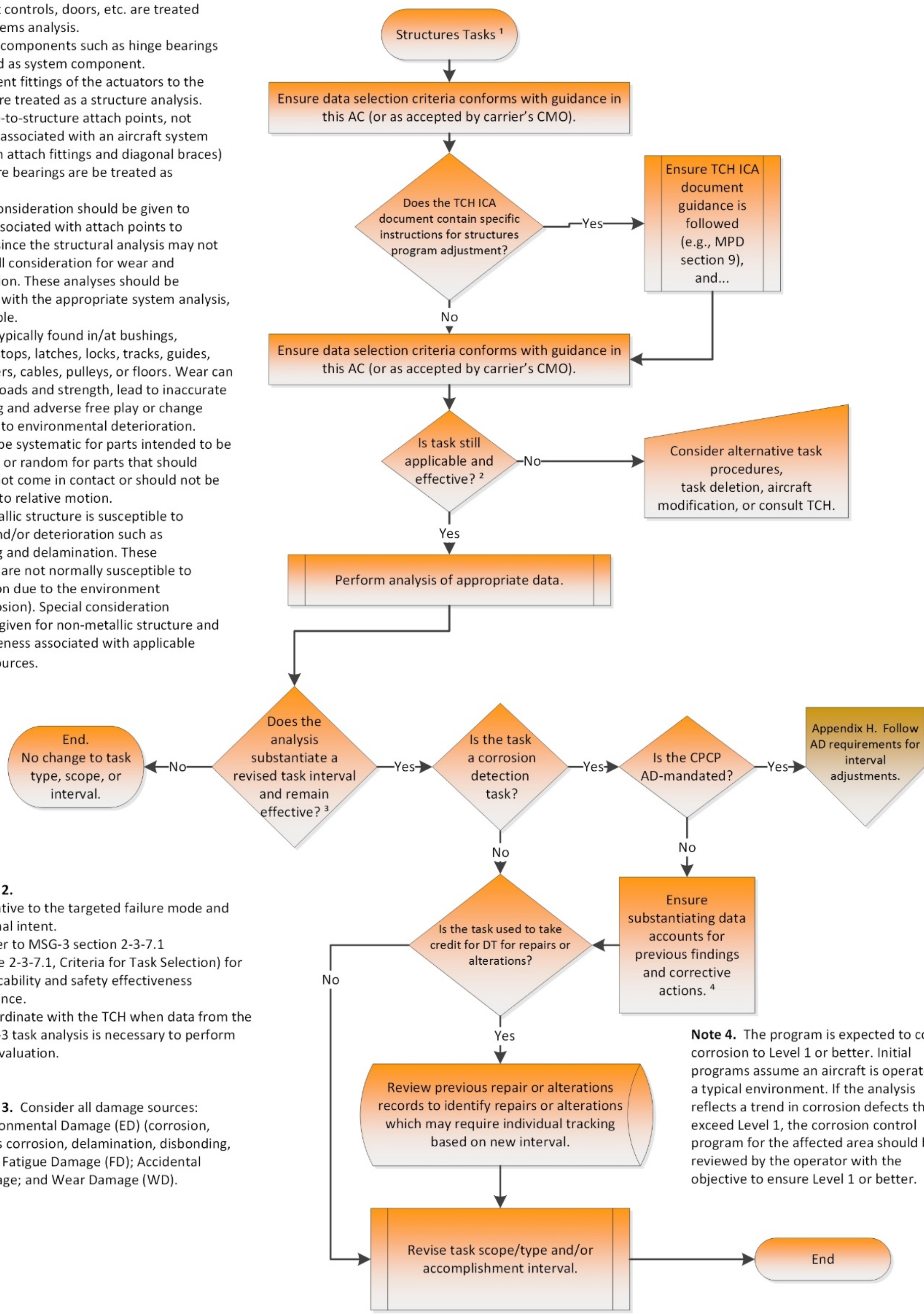
Note 6. Consider:
- The environment and effects of corrosive produces, condensation, temperature, and vibration on the protection.
- Increased susceptibility to damage during maintenance or operations (e.g., where connectors could be stepped on, or effects of deicing fluid on a connectors during winter operations).

Note 7. Awareness of these relationships support a quality analysis. Zonal working groups may have modified zonal intervals to accommodate these interfaces.

Note 8.
- For example, findings associated with bonding straps, lightning wicks, tank plate wiring/connector bonding, etc.
- Ensure unintended consequences such as Environmental Deterioration (ED) or Accidental Damage are not introduced due to frequency of access/egress.

APPENDIX F. STRUCTURE

Note 1. General Information:
- The actuating portions of items such as landing gear, flight controls, doors, etc. are treated under systems analysis.
- Dynamic components such as hinge bearings are treated as system component.
- Attachment fittings of the actuators to the airframe are treated as a structure analysis.
- Structure-to-structure attach points, not otherwise associated with an aircraft system (e.g., pylon attach fittings and diagonal braces) that feature bearings are be treated as structure.
- Special consideration should be given to analysis associated with attach points to structure since the structural analysis may not provide full consideration for wear and deterioration. These analyses should be compared with the appropriate system analysis, as applicable.
- Wear is typically found in/at bushings, bearings, stops, latches, locks, tracks, guides, cams, rollers, cables, pulleys, or floors. Wear can influence loads and strength, lead to inaccurate positioning and adverse free play or change resistance to environmental deterioration. Wear can be systematic for parts intended to be in contact, or random for parts that should normally not come in contact or should not be subjected to relative motion.
- Non-metallic structure is susceptible to damage and/or deterioration such as disbonding and delamination. These structures are not normally susceptible to degradation due to the environment (e.g., corrosion). Special consideration should be given for non-metallic structure and any uniqueness associated with applicable damage sources.



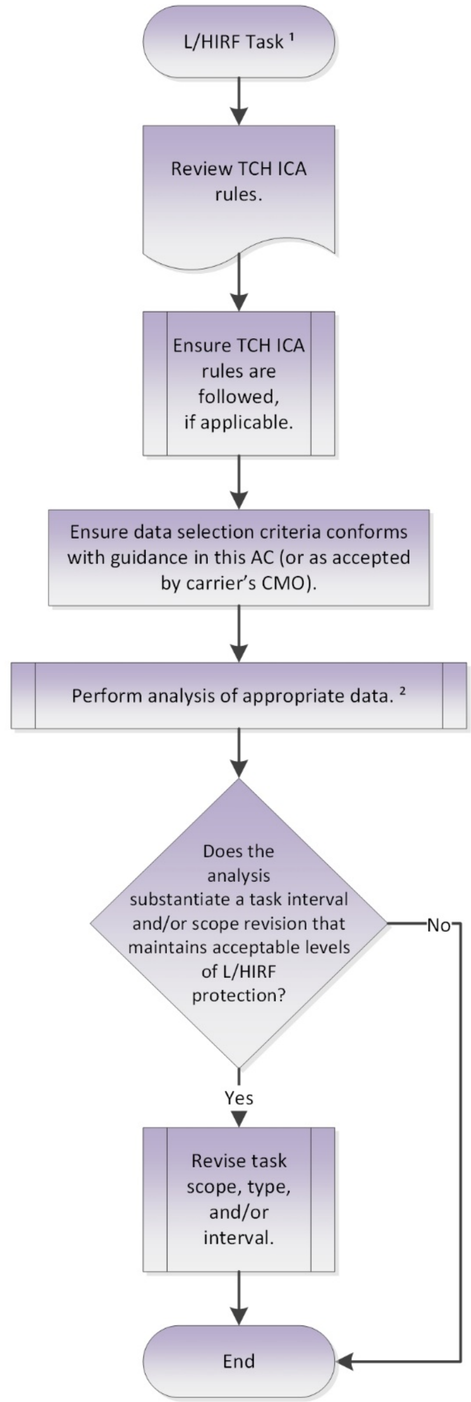
Note 2.
- Relative to the targeted failure mode and original intent.
- Refer to MSG-3 section 2-3-7.1 (Table 2-3-7.1, Criteria for Task Selection) for applicability and safety effectiveness guidance.
- Coordinate with the TCH when data from the MSG-3 task analysis is necessary to perform the evaluation.

Note 3. Consider all damage sources: Environmental Damage (ED) (corrosion, stress corrosion, delamination, disbonding, etc.); Fatigue Damage (FD); Accidental Damage; and Wear Damage (WD).

Note 4. The program is expected to control corrosion to Level 1 or better. Initial programs assume an aircraft is operated in a typical environment. If the analysis reflects a trend in corrosion defects that exceed Level 1, the corrosion control program for the affected area should be reviewed by the operator with the objective to ensure Level 1 or better.

APPENDIX G. LIGHTNING/HIGH INTENSITY RADIATED FIELDS (L/HIRF) TASKS

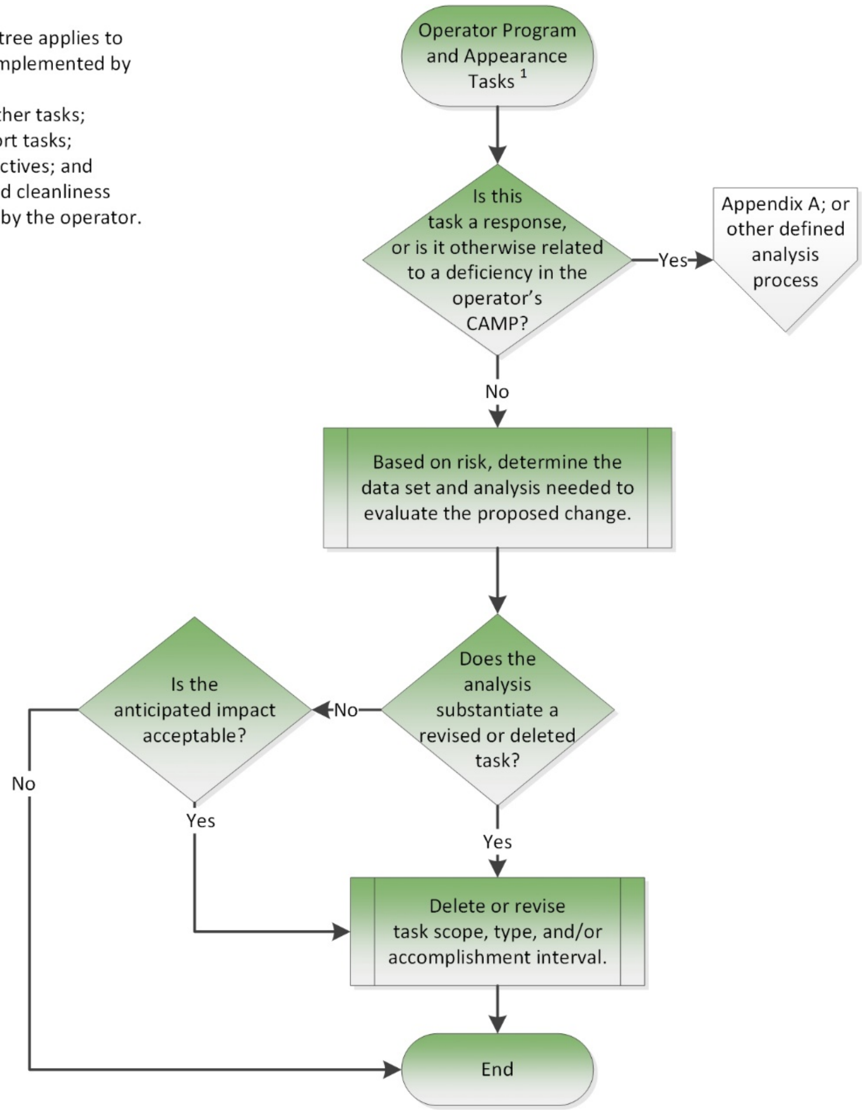
Note 1. Coordination with OEM is recommended. L/HIRF protection may include:
- Wires, shields, connectors, bonding straps, raceways between connectors.
- L/HIRF protection within conduit or heat shrink or other covering.
- Non-metallic structure with conductive mesh and/or antistatic coatings.



Note 2: Analysis should consider:
- The environment and effects of corrosive products, condensation, temperature, and vibration on the protection.
- Susceptibility of damage during maintenance or operations (e.g., where connectors could be stepped on, or effects of deicing fluid on a connector during winter operations.
- Scheduled maintenance findings associated with bonding straps, lightning wicks, tank plates wiring/ connector bonding, etc.

APPENDIX H. OPERATOR PROGRAMS AND APPEARANCE

Note 1. This decision tree applies to tasks developed and implemented by the operator, such as:
- Tasks that support other tasks;
- Administrative support tasks;
- Branding/image objectives; and
- Cabin appearance and cleanliness standards established by the operator.



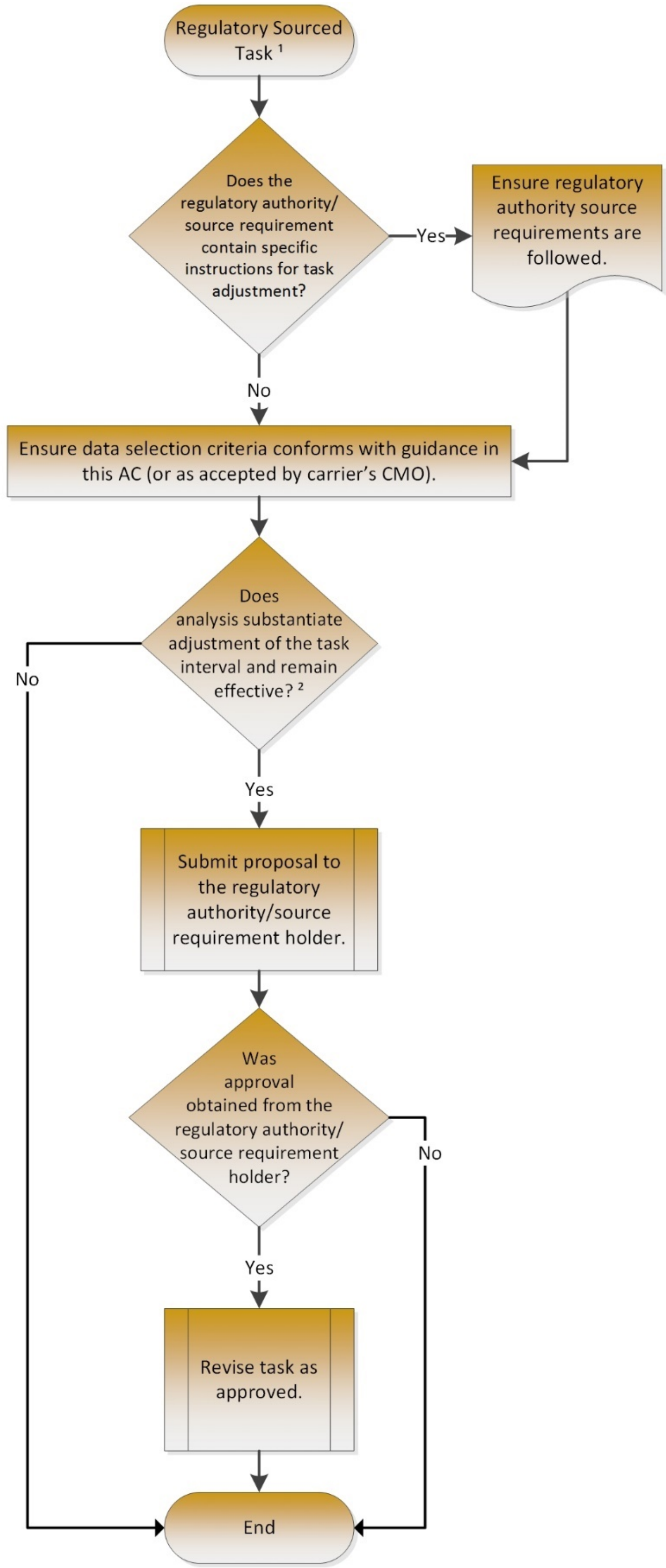
APPENDIX I. REGULATORY SOURCED REQUIREMENTS

Note 1. Examples include:
AD, CMRs, ALI, AL, and FTS tasks.

Note 2. Relative to the targeted failure mode and original intent.

Refer to MSG-3 section 2-3-7.1 (Table 2-3-7.1, Criteria for Task Selection) for applicability and safety effectiveness guidance.

Coordinate with the TCH when data from the MSG-3 task analysis is necessary to perform the evaluation.



Advisory Circular Feedback Form

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by contacting the Flight Standards Directives Management Officer at 9-AWA-AFS-140-Directives@faa.gov.

Subject: AC 120-17B, Reliability Program Methods—Standards for Determining Time Limitations

Date: ____________________

Please check all appropriate line items:

☐ An error (procedural or typographical) has been noted in paragraph ____________ on page _______.

☐ Recommend paragraph _____________ on page __________ be changed as follows:

____

____

☐ In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

____

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☐ Other comments:

____

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☐ I would like to discuss the above. Please contact me.

Submitted by: ______________________________ Date: _____________________