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

Advisory Circular

Subject: Development of Transport Category Airplane Electrical Wiring Interconnection Systems Instructions for Continued Airworthiness Using and Enhanced Zonal Analysis Procedure

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1. Purpose.

a. This advisory circular (AC) describes parts of the compliance process for the "Enhanced Airworthiness Program for Airplane Systems/Fuel Tank Safety (EAPAS/FTS)" rule. That rule requires design approval holders (DAHs) and applicants to develop instructions for continued airworthiness (ICA) consisting of maintenance and inspection tasks, intervals, and procedures for the representative airplane's electrical wiring interconnection systems (EWIS) for each affected type design. The DAH must also review any fuel tank system ICA it has developed in compliance with Special Federal Aviation Regulation No. 88 (SFAR 88) in order to ensure compatibility with the EWIS ICA, including minimizing redundant requirements. The DAH must then submit the EWIS ICA to the Federal Aviation Administration (FAA) oversight office for review and approval.

b. This AC provides guidance for developing maintenance and inspection instructions for EWIS using an enhanced zonal analysis procedure (EZAP). For the purposes of this AC, the term "maintenance" encompasses both "maintenance" and "preventive maintenance," as those terms are defined in Title 14, Code of Federal Regulations (14 CFR) 1.1. For airplane models whose maintenance programs already include a zonal inspection program, the logic described here provides guidance on improving those programs. For airplanes without a zonal inspection program, use of this logic will produce zonal inspections for wiring that can be added to the existing maintenance program. This AC contains information that can be used by operators to improve EWIS maintenance practices. It stresses the importance of inspecting EWIS and promotes a philosophy of "protect and clean as you go" when performing maintenance, repair, or alterations on an airplane.

2. Applicability and Explanation of Requirements.

a. Applicability.

(1) The guidance in this document is directed towards design approval holders (DAHs) (type certificate (TC) and supplemental type certificate (STC) holders) and applicants. This guidance can also be used by air carriers and air operators, maintenance providers, and repair stations.

(2) This AC provides the following information and guidance:

(a) Development of EWIS ICA in accordance with 14 CFR part 25, appendix H, paragraph H25.5(a)(1) as required by:

1 Section 25.1729 (paragraph H25.5(a)(1) fulfills part of the requirements of § 25.1729).

2 Section 26.11(b) and (c).

Note: This AC only contains guidance for the requirements of paragraphs H25.5(a)(1) and (b). AC 25.1701-1, *Certification of Electrical Wiring Interconnection Systems on Transport Category Airplanes*, contains guidance for paragraph H25.4(a)(3) (Airworthiness Limitations), and the remaining requirements of section H25.5:

- Paragraph H25.5(a)(2) (standard wiring practices manual),
- Paragraph H25.5(a)(3) (EWIS separation),
- Paragraph H25.5(a)(4) (EWIS identification), and
- Paragraph H25.5(a)(5) (electrical load analysis).

(b) Development of the EWIS ICA source document in accordance with part 25, appendix H, paragraph H25.5(b) as required by:

1 Section 25.1729.

2 Section 26.11(b) and (c).

(c) Explanation of who is required to comply with § 26.11.

(d) Explanation of the § 26.11(e)(4) requirement to make the design approval holder EWIS ICA available to affected persons.

(e) Information on when air carriers and air operators must obtain FAA oversight office approval for changes to EWIS ICA already incorporated into their maintenance program.

Note: Guidance for air carriers and air operators on how to make changes to the FAA-approved EWIS ICA will be contained in AC 120-99, *Incorporation of Electrical Wiring Interconnection System (EWIS) Instructions for Continued Airworthiness into an Operator's Maintenance Program*.

(f) EWIS maintenance practices that can be helpful when identifying and developing EWIS maintenance tasks using an EZAP.

(3) The material in this AC is neither mandatory nor regulatory in nature and does not constitute a regulation. It describes acceptable means, but not the only means, for showing compliance with the applicable regulations. We will consider other methods of showing compliance that an applicant may elect to present. While these guidelines are not mandatory, they are derived from extensive FAA and industry experience in determining compliance with the relevant regulations. If, however, we become aware of circumstances that convince us that following this AC would not result in compliance with the applicable regulations, we will not be bound by the terms of this AC, and we may require additional substantiation or design changes as a basis for finding compliance.

(4) The material in this AC does not change or create any additional regulatory requirements, nor does it authorize changes in, or permit deviations, from existing regulatory requirements.

(5) Except in the explanations of what the regulations require, terms such as "shall" or "must" are used in this AC only in the sense of ensuring applicability of this particular method of compliance when the acceptable method of compliance described here is used.

b. Differing Requirements of §§ 25.1729 and 26.11. The requirements to develop EWIS ICA vary depending on whether the applicant is complying with part 25, subpart H, § 25.1729, or with part 26, subpart B, § 26.11.

(1) Airplane models with § 25.1729 in their type certification basis.

(a) For TCs, amended TCs, and STCs with § 25.1729 in their certification basis, applicants must comply with the requirements of part 25, appendix H, paragraph H25.4(a)(3) and paragraphs H25.5(a) and (b). These rules mandate that the applicant provide, as part of the ICA:

1 Identification of any EWIS mandatory replacement times in the Airworthiness Limitations section of the ICA (paragraph H25.4(a)(3)).

2 EWIS maintenance and inspection requirements developed with an EZAP (paragraph H25.5(a)(1)).

3 EWIS maintenance practices in a standard format (paragraph H25.5(a)(2)).

4 EWIS separation requirements as determined under § 25.1707 (paragraph H25.5(a)(3)).

5 EWIS identification methods and requirements for identifying any changes to EWIS under § 25.1711 (paragraph H25.5(a)(4)).

6 Electrical load data and instructions for updating that data (paragraph H25.5(a)(5)).

7 A document that contains the EWIS maintenance inspection requirements or identifies their location in other ICA documents (paragraph H25.5(b)). This section also requires that the document be in a form appropriate for the information to be presented, and that the EWIS ICA be easily recognizable as such.

Note: The document required by paragraph H25.5(b) is commonly referred to as the source document. This document is considered to be part of the ICA required by section H25.5.

(b) Section 25.1729 applies to all transport category airplanes regardless of passenger- or cargo-carrying capacity.

(c) Guidance for § 25.1729 and, as noted earlier, appendix H, paragraph H25.4(a)(3) and paragraphs H25.5(a)(2) through (a)(5) is located in AC 25.1701-1, *Certification of Electrical Wiring Interconnection Systems on Transport Category Airplanes*.

(d) The EWIS ICA for airplane models with § 25.1729 in their type certification basis must be approved by the FAA aircraft certification office (ACO) or office of the Transport Airplane Directorate. Please note that this differs from the ICA requirements contained in § 25.1529, which requires that ICA be prepared that are acceptable to the Administrator.

(2) Airplane models required to comply with part 26, subpart B.

(a) For airplane models that must comply with part 26, the requirement for preparing EWIS ICA is § 26.11(b) or (c), depending on whether the DAH holds or is applying for a type certificate (§ 26.11(b)) or an amended or supplemental type certificate (§ 26.11(c)). Section 26.11(b) and (c) states that EWIS ICA must be prepared in accordance with paragraphs H25.5(a)(1) and (b). Therefore, DAHs complying with § 26.11 must produce EWIS ICA developed with an EZAP (paragraph H25.5(a)(1)), and the ICA must be in an appropriate form and easily recognizable as EWIS ICA (paragraph H25.5(b)). The DAHs must make the ICA available to affected persons (operators and others required to comply with requirements of § 26.11, § 25.1729, § 121.1111, or § 129.111). The EWIS ICA for airplane models required to comply with part 26, subpart B, must be approved by the FAA oversight office. The FAA oversight office is defined in § 26.3 as “the aircraft certification office or office of the Transport Airplane Directorate with oversight responsibility for the relevant type certificate, supplemental type certificate, or manufacturer, as determined by the Administrator.”

(b) Section 26.11 applies to transport category, turbine-powered airplanes with a type certificate issued after January 1, 1958, that, as a result of the original certification or a later increase in capacity, have:

- A maximum type-certificated passenger capacity of 30 or more, or

- A maximum payload capacity of 7,500 pounds or more.

(3) Requirements for Applicants for STCs and amendments to TCs—§ 26.11(c). Section 26.11(c) requires that applicants for STCs or amendments to type certificates evaluate whether the design change for which approval is sought necessitates a revision to the EWIS ICA that have been previously developed and approved in compliance with § 26.11(b). Guidance for how an applicant can make this evaluation is contained in appendix B of this AC.

c. Representative Airplane and SFAR 88 Compatibility Requirements of § 26.11(b).

(1) Representative airplane. Section 26.11(b) requires that EWIS ICA be developed for the "representative airplane." The representative airplane is the configuration of each series airplane model that incorporates all variations of EWIS used in production on that series airplane, and all TC-holder-designed modifications mandated by airworthiness directives (ADs) as of the effective date of § 26.11(b). For example, a particular airplane model may be offered in both passenger and cargo versions. For that airplane model, the resultant EWIS ICA must account for any differences between the two versions. Another example would be the situation where the airplane manufacturer offered various interior configurations of a passenger model. The placement of galleys, lavatories, seats, and other interior furnishings might impact the type and frequency of inspections identified by the EZAP analysis. So the resultant EWIS ICA must reflect any such differences. Also, if any changes mandated by ADs have been incorporated, and those changes impact the EWIS ICA, then the EWIS ICA produced to comply with § 26.11(b) must reflect those changes.

(2) EWIS ICA compatibility with fuel tank system ICA. Section 26.11 requires a review of any fuel tank system ICA developed to comply with SFAR 88. This is to ensure compatibility with the EZAP-generated EWIS ICA and to minimize duplication of requirements between them. It is likely that some of the EWIS on an airplane will be part of the airplane's fuel tank system. In that case, the requirements for their maintenance and inspection might be more specific than those for EWIS in general and might contain additional requirements. For compatibility, it is important that the maintenance and inspections for these EWIS be carefully reviewed. If there are inspection or maintenance requirements for EWIS and for the fuel tank system within the same zone, there should be an effort to align the task interval. The two ICAs should be reviewed to ensure that any maintenance tasks for EWIS do not compromise fuel tank system EWIS requirements, such as separation or configuration specifications. In addition, design holders' existing documents containing EWIS and fuel tank system ICA should be reviewed to either remove or cross-reference redundant information.

d. EWIS ICA Identification Requirements. Part 25, appendix H, paragraph H25.5(b) requires that EZAP-derived EWIS ICA be easily recognizable as such, so there is traceability during future changes to maintenance programs that contain these EWIS ICA. This is intended to prevent inadvertent deletion, changes to the type of task, or escalation of EZAP-derived EWIS ICA without proper consideration of the reason for the task and its interval. Following approval of the EWIS ICA by the FAA oversight office, ACO, or office of the Transport Airplane Directorate, an operator may propose changes to maintenance or inspection program tasks that were based on the approved EWIS and fuel tank ICA. AC 120-99, *Incorporation of Electrical Wiring Interconnection System (EWIS) Instructions for Continued Airworthiness into an*

Operator's Maintenance Program, will contain guidance related to making changes to the approved-ICA-based maintenance and inspection program tasks.

e. Requirements of §§ 121.1111 and 129.111. The EAPAS/FTS rule also requires part 121 certificate holders and part 129 air carriers operating U.S.-registered airplanes to incorporate into their maintenance program tasks based on FAA-approved EWIS ICA. AC 120-99, *Incorporation of Electrical Wiring Interconnection System (EWIS) Instructions for Continued Airworthiness into an Operator's Maintenance Program*, will contain guidance for these regulations.

f. Explanation of Maximum Payload Capacity. For purposes of the requirements in § 26.11, payload capacity is defined by § 119.3. The current text of § 119.3 is found in appendix E of this AC.

3. How this Information was Derived. The guidance in this AC is based on recommendations given to us by the Aging Transport Systems Rulemaking Advisory Committee (ATSRAC). It is drawn from maintenance, inspection, and alteration best practices identified through extensive research by ATSRAC and Federal government working groups.

4. Objective.

a. The objective of this AC is to improve maintenance and inspection programs for all EWIS (as defined by § 25.1701) installed on transport category airplanes. Applying this information will improve the likelihood that EWIS degradation from many causes, including environmental, maintenance-related, and age-related problems, will be identified and corrected. In addition, this information has been reviewed to ensure that maintenance actions, such as inspection, repair, overhaul, replacement of parts, and preservation, do not (1) cause a loss of EWIS function, (2) cause an increase in the potential for smoke and fire in the airplane, and (3) inhibit the safe operation of the airplane. This objective is met through the adoption of the following:

(1) Enhanced zonal analysis procedure (EZAP). The EZAP will allow the user to determine the appropriate general or detailed inspections and any cleaning tasks (also referred to as restoration tasks by some manufacturers) needed to minimize the presence of combustible material. An EZAP can be used to develop new wiring cleaning and inspection tasks for both zonal and non-zonal inspection programs. Using this procedure to develop a maintenance program will help ensure that proper attention is given to wiring installations during maintenance. The EZAP provides a logical procedure for selecting inspections (either general or detailed) and other tasks to minimize combustibles. Examples could be cleaning (or restoration) procedures or the changing of an air filter. For an airplane without a zonal inspection program, an EZAP will identify new wiring inspection tasks. Appendix A of this AC provides step-by-step details of the EZAP process.

(2) Guidance for a general visual inspection (GVI). This AC clarifies the definition of a general visual inspection and provides guidance on what is expected from such an inspection, whether performed as a stand-alone GVI or as part of a zonal inspection.

(3) Protections and cautions. This AC provides guidance for developing actions and cautionary statements to be added to maintenance instructions for the protection of wire and other EWIS components. Maintenance personnel will use these enhanced procedures to minimize contamination and accidental damage to EWIS while working on an airplane.

(4) "Protect and clean as you go" philosophy. This philosophy is applied to airplane EWIS through inclusion in operators' maintenance and training programs. This philosophy stresses the importance of protective measures when working on or around wire bundles, connectors, and other EWIS components. It stresses how important it is to protect EWIS during structural repairs, STC installations, or other alterations by making sure that metal shavings, debris, and contamination resulting from such work are removed. The "protect and clean as you go" philosophy is translated into specifics by the protection and caution recommendations described in section 15 of this AC. More information is contained in section 13 of this AC, *Causes of Wire and Other EWIS Component Degradation*.

(5) Consolidation with fuel tank requirements. The FAA has developed an extensive program to address safety problems associated with fuel tanks. Fuel tank systems contain EWIS that may be routed independently or may be integrated with other airplane systems' EWIS. One part of the Fuel Tank Safety Rule, SFAR 88, requires development of maintenance and inspection instructions to ensure the safety of the fuel tank system. Other sections of the Fuel Tank Safety Rule require operators to include fuel tank safety maintenance and inspection instructions in their maintenance or inspection programs. An objective of this AC is to ensure that fuel tank system ICA developed to comply with SFAR 88 are compatible with the EWIS ICA, including minimizing redundant requirements. See section 2 of this AC for details.

b. To fully realize the objectives of this AC, type certificate holders, STC holders, air carriers, air operators, maintenance providers, and repair stations will need to redefine their current approach to maintaining and altering airplane wiring and systems. This redefinition must reach both overall philosophy and specific maintenance tasks. This may require more than simply updating maintenance manuals and work cards and improving training. Maintenance personnel need to be aware that airplane EWIS must be maintained in an airworthy condition. They also need to recognize that a visual inspection of EWIS has inherent limitations. Small defects such as breached or cracked insulation, especially in small-gage wire, may not always be apparent. Therefore, effective EWIS maintenance combines good visual inspection techniques with improved wiring maintenance practices and training.

c. General Compliance Information. Sections 5 through 12 of this AC provide general information regarding the performance of the EZAP. The EZAP process is described in detail in appendix A and appendix B of this AC.

d. EWIS Degradation and Maintenance Information. Sections 13 through 15 of this AC contain general information on (1) causes of wire and other EWIS component degradation, (2) EWIS maintenance guidance, including the levels of inspection applicable to EWIS maintenance, and (3) protection and caution recommendations. The information in these sections can be used by manufacturers in developing EWIS maintenance guidance and by operators to improve EWIS maintenance practices.

5. Enhanced Zonal Analysis Procedure (EZAP)—General Guidance.

a. The EZAP described in this AC was developed to identify tasks to (1) minimize accumulation of combustible materials, (2) detect EWIS component defects, and (3) detect EWIS installation discrepancies that may not be reliably detected by inspections contained in existing maintenance programs. An EZAP logic diagram and an accompanying step-by-step explanation are contained in appendix A of this AC. The EZAP process outlined in appendix A is to be used by type certificate holders. It is also to be used by modifiers such as STC holders/applicants to determine if the design change requires new EWIS ICA, or revisions to existing EWIS ICA. If the STC applicant/holder does not have access to the data required to perform the EZAP outlined in appendix A, then the process outlined in appendix B of this AC may be used.

b. An EZAP will result in safety improvements for airplanes operated with a maintenance or inspection program that includes a zonal inspection program (ZIP). It is unlikely that ZIPs developed in the past considered wire or other EWIS components, except for the most obvious damage that could be detected by a GVI.

c. For airplane models without a ZIP, the EZAP logic is likely to identify a large number of EWIS-related tasks that will need to be consolidated into the existing systems maintenance or inspection program. DAHs who have airplane models without a ZIP might find it worthwhile to develop a ZIP in accordance with an industry-accepted method, such as Maintenance Steering Group 3 (MSG-3), in conjunction with an EZAP.

d. When performing the EZAP, evaluate items such as plumbing, ducting, control cables, and other system installations located in the zone for possible contributions to wiring or other EWIS component degradation or failures. The results of the analysis will indicate whether a restoration task, a zonal GVI, a stand-alone GVI, or a detailed inspection (DET) is required to inspect the EWIS in the zone. The way to determine the best type of inspection is graphically represented in figure 2, step 8, of appendix A of this AC. The type of inspection is determined by completing EZAP Worksheet 3A or EZAP Worksheet 3B of appendix A of this AC. EZAP Worksheet 3A is used for airplanes with a ZIP. EZAP Worksheet 3B is used for airplanes without a ZIP.

e. New tasks identified by the EZAP logic should be compared against existing tasks in the maintenance program to ensure that they are compatible with each other. Also, existing maintenance task type and frequency should not affect the outcome of the EZAP analysis. The analysis for a particular zone should be completed to identify appropriate EWIS tasks and their frequency. After the analysis is complete, these new EWIS tasks should be compared to existing maintenance program tasks to assess where the new tasks and the existing maintenance program tasks can be logically combined. The EZAP analysis should not be adjusted in order to make the tasks and intervals fit the existing maintenance program just for the sake of aligning tasks. Refer to the description in figure 1, step 9, of appendix A of this AC for a detailed discussion on task consolidation and alignment.

f. Operators may want to use the EZAP logic to identify additional inspection and cleaning tasks for any design changes on their airplanes for which EZAP ICA are not available. EWIS ICA developed by a DAH might not have taken into account modifications made to the airplane by someone other than the DAH who developed the EWIS ICA. Also, when an STC is no longer supported by the STC holder, operators may want to perform an EZAP on the zone(s) affected by the modification.

6. EWIS ICA Developed Using an EZAP.

a. An EWIS ICA task is either an inspection task or a restoration task. The inspection task can be a zonal general visual inspection (GVI), stand-alone GVI, detailed inspection (DET), or a combination of these. A restoration task is usually a cleaning task, but it can also be a task such as replacing an air filter in order to reduce the likelihood of contamination build-up within a zone. EWIS ICA are comprised of all the data required to perform these inspection or restoration tasks. The EWIS ICA can be, and almost always are, comprised of several different data components. It is all of these data components put together that define any particular EWIS ICA. The data components of EWIS ICA can be, and often are, located in multiple documents produced by the applicant or DAH.

b. As an example, EWIS ICA data components can be located in a Maintenance Review Board Report (MRBR), a maintenance planning document (MPD), a maintenance implementation document (MID), an airplane maintenance manual (AMM), a standard wiring practices manual/electrical standards practices manual (SWPM/ESPM), or a stand-alone ICA document produced by a DAH or STC applicant. These data components are items such as:

- Task reference number(s).
- Task type (for example, DET, stand-alone GVI).
- Task interval.
- Task description (for example, perform a DET inspection of the power feeders and connected EWIS components).
- Task procedure (in other words, instructions on how to perform the actual task(s)).

> **Note:** The task procedure should describe how to accomplish the maintenance task. For example, if the task description states to perform a stand-alone GVI of the EWIS in the zone, then the procedure should instruct the maintenance technician to inspect the EWIS within the zone. In the past, some task procedures have instructed the technician to merely inspect the "wires" or "wiring" in the zone. Such a procedure would not be acceptable since wire is only one component of an EWIS. An EWIS includes many components such as clamps, connectors, bundle ties, and stand-offs as defined by § 25.1701. However, in certain cases it may be acceptable for the inspection task to specify a particular EWIS component, such as a wire bundle or high current carrying cable, as being the focus of a specific inspection. For example, service history may show that on a particular airplane model, the power feeders in a specific zone should be the focus of an inspection. Therefore, specifying to perform a DET or stand-alone GVI of the power feeders

and their connected EWIS, instead of a DET or stand-alone GVI of the EWIS in the zone, would be more effective in aiding the maintenance technician to detect possible defects in the power feeder rather than instructing them to inspect all the EWIS within the zone. Such an approach should be considered on a case-by-case basis.

- Task applicability (in other words, model, engine type).

- Airplane zone identification.

  Note: According to Air Transport Association (ATA) iSpec 2200, *Information Standards for Aviation Maintenance*, zones are identified by the airplane manufacturer "to facilitate maintenance, planning, preparation of job instructions, location of work areas and components, and a common basis for various maintenance tasks." ATA iSpec 2200 contains guidelines for determining airplane zones and their numbering. The EZAP process uses these manufacturer-identified zones. The zones are not created uniquely for EZAP.

- Access instructions.

- Supporting procedures as necessary.

c. Both airplane manufacturers and STC holders/applicants produce EWIS ICA but the process they use is different, and each of these DAHs produce the EWIS ICA in different forms. It is not possible to provide a one-size-fits-all answer for what comprises EWIS ICA. The DAH must identify all of the components comprising the EWIS ICA and identify all of these components in a single document. This single document has become known as the source document. The regulatory requirement for the source document is contained in part 25, appendix H, paragraph H25.5(b) and is discussed in section 7 of this AC.

7. EWIS ICA Source Document as Required Part 25, Appendix H, Paragraph H25.5(b).

a. Paragraph H25.5(b) imposes some specific requirements for documentation and identification of EWIS ICA. It requires that the EWIS ICA developed in accordance with paragraph H25.5(a)(1) must be in the form of a document appropriate for the information to be provided, and that they must be easily recognizable as EWIS ICA. This document must either contain the required EWIS ICA, or specifically reference other documents that contain this information. The document required by paragraph H25.5(b) is referred to as the source document (SD). The entire EWIS ICA must be contained or referenced in the SD. However, paragraph H25.5(b) does not prescribe a specific data form for either the EWIS ICA or the SD (if they are not one and the same). The form the EWIS ICA data takes, and the form of the SD, is at the discretion of the DAH or applicant, as long as it meets the requirements of paragraph H25.5(b) and the data it contains (or references) meets the requirements of paragraph H25.5(a)(1). Some airplane manufacturers plan to use existing documents as their SD. This could be an MRBR, MPD, MID, or some other document. Others are planning to develop new forms of documentation to specifically address the new EWIS ICA SD requirement.

Whatever form the DAH uses to document the EWIS ICA, the SD must clearly identify the data that comprise the EWIS ICA or contain the actual data in order to be in compliance with paragraph H25.5(b).

(1) As described above, paragraph H25.5(b) requires that each EWIS ICA be easily recognizable as EWIS ICA. This means that the EWIS ICA will need to be uniquely identified as such. As an example, some DAHs place "(EZAP)" or "(EWIS)" after each task description to signify that the task is a part of the EWIS ICA. Keep in mind that the purpose of this requirement is to enable easy identification of ICA tasks after they have been incorporated into an operator's maintenance program. The requirement is meant to ensure traceability. The identification requirement is not for the benefit of the technician who performs the actual maintenance task, but rather for the people who must keep track of the EWIS ICA, such as personnel at an operator or maintenance facility who track maintenance tasks, or an FAA principal inspector.

(2) There are some unique requirements regarding operator-requested revisions to approved EWIS ICA that necessitate they be easily identifiable. Refer to section 12 of this AC for information regarding operator-requested revisions to EWIS ICA.

b. Future Revisions to the FAA-Approved Source Document (SD). After initial approval of the source document, a DAH will likely need to revise the document at some point in order to account for any new or revised EWIS inspection or restoration procedures developed due to production changes or design changes mandated by ADs. Revisions to EWIS ICA such as task deletion, addition, or interval escalation could also occur due to a request by the Industry Steering Committee (ISC) and can be addressed by a specific airplane model's Zonal Working Group. Any agreed to revisions would be reflected in an update to the MRBR. Proposed revisions to the SD should be submitted to the FAA oversight office, ACO, or office of the Transport Airplane Directorate, as applicable, for review and approval. Upon approval, the FAA oversight office will issue a formal FAA-letter approving the new SD revision. A DAH can then use that approval letter as proof that the EWIS ICA contained in, or referenced by, the SD has been FAA approved. The SD should be revised and submitted for FAA approval when an existing EWIS inspection or restoration task type or task interval is proposed, as well as any proposed task deletions. The revised SD should also be submitted for review and approval if any of the referenced procedures, such as an AMM procedure or procedures referenced within the AMM procedure, is revised such that that any references to that procedure by the SD would no longer be valid. An example of this would be a change to the AMM procedure number or title of the procedure.

8. EWIS ICA Developed by Type Certificate Holders or Applicants. For EWIS ICA data[1] identified in the MRBR, MPD, MID, or other type of SD, the items listed below are considered to constitute EWIS ICA. The FAA oversight office must review this material for its

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[1] The MRBR, MPD, or other document used as the SD may reference the information comprising the actual EWIS ICA. The airplane manufacturer or operators would use this referenced information to develop the task cards (sometimes referred to as job cards) or other documents that are used by maintenance technicians.

acceptability before issuing an approval. The items listed below are also the data that airplane manufacturers and/or operators (or other FAA-approved maintenance providers) will use to develop the task, or job, cards used by the maintenance technician to perform the EWIS inspection or restoration tasks.

a. Controlling reference numbers for the individual EWIS ICA tasks as listed in the MRBR, MPD, MID, or other SD. These reference numbers can be referred to as MRBR reference number, Maintenance Manual (MM)/MPD reference number, Maintenance Significant Items (MSI) reference number, task number, and so forth. The nomenclature and the documents called out by the reference numbers can vary among DAHs. Also, tasks may have been given more than one number by the manufacturer to identify them as parts of different documents. So one task, for example, may have an MPD reference number as well as an MRBR reference number. If more than one number identifies any single EWIS task, then each of those numbers must be considered part of the EWIS ICA. All numbers considered necessary to fully identify and track the EWIS ICA should be considered part of the ICA.

b. Type of task (for example, restoration/cleaning, stand-alone GVI, zonal GVI, and DET as identified in the SD).

c. Task interval (in other words, how often the maintenance task must be accomplished—for example, every 16,000 flight cycles or 3,000 days).

d. Applicability (for example, 767-200, A340, EMB-145) as identified in the SD. Some models within the same family of airplanes may have differing maintenance requirements based on available options (for example, freighter versus passenger version, engine types).

e. Airplane zone identification for airplanes with a zonal program (for example, Zone 201).

f. Task description as given in the SD (for example, Inspect (General Visual) all exposed EWIS in the wheel well. NOTE: Gear extended, doors in open position.)

g. Task procedure(s). These are the actual instruction(s) on how to perform the zonal GVI, stand-alone GVI, DET, and restoration/cleaning tasks that support the task description listed in the SD.

h. Supporting task procedure(s), if any, necessary to perform the task procedure in any other document referenced by the task procedure.

i. Instructions for protections and caution information that will minimize contamination and accidental damage to EWIS. (This can appear in different places, such as in the AMM or in the SWPM/ESPM.) If contained in the SWPM or ESPM (or other similar document), this information will be contained in chapter 20. Sometimes this information is repeated in the standard practices chapter (chapter 20) of the AMM. In any case, it is general caution and protection information, and we do not expect that unique procedures will be developed for individual EWIS ICA for a particular airplane model or even models produced by the same manufacturer. Any protection and caution information specific to EWIS ICA must be referenced in the SD.

9. EWIS ICA Developed by an STC Applicant/Holder or Applicant.

a. Unlike TC applicants/holders, STC applicants do not use the Maintenance Review Board (MRB) process to develop maintenance tasks. However, an STC applicant, like a TC holder, is required to develop EWIS ICA with an EZAP. Therefore, nearly everything that comprises the EWIS ICA for a TC holder's airplane will also comprise the EWIS ICA for an STC applicant's modification. Obviously the volume of EWIS ICA for the STC applicant will be smaller and the tasks will be confined to the modified area of the airplane. The following are considered to constitute EWIS ICA for an STC and, therefore, would need FAA oversight office approval:

(1) Controlling reference number(s) contained in the SD for the individual EWIS ICA tasks if those numbers are used to identify a specific EWIS ICA task. All information referenced in the SD that is considered necessary to fully identify and track the EWIS ICA tasks should be considered part of the ICA.

(2) Type of task (for example, restoration/cleaning, stand-alone GVI, zonal GVI, and DET) as identified in the SD.

(3) Task interval (in other words, how often the maintenance task must be accomplished—for example, every 16,000 flight cycles or 3,000 days).

(4) Applicability as identified in the SD (for example, 767-200, A340, EMB-145). Some models within the same family of airplanes may have differing maintenance requirements based on available options (for example, freighter versus passenger version, engine types).

(5) Airplane zone identification for airplanes with a zonal program (for example, Zone 201).

(6) Task description as given in the SD (for example, Inspect (General Visual) all exposed EWIS in the wheel well. NOTE: Gear extended, doors in open position.)

(7) Task procedure(s). These are the instruction(s) on how to perform the GVI, DET, and restoration/cleaning tasks that support the task description listed in the SD. These will sometimes appear in a referenced document, rather than in the SD itself.

(8) Supporting task procedure(s) (if any) necessary to perform the task procedure in any other document referenced by the task procedure.

(9) Instructions for protections and caution information that will minimize contamination and accidental damage to EWIS—unless the modification is using some unique materials or EWIS components, this information will be the same as that developed by the airplane manufacturer. In this case, the applicant should make a statement, along with the appropriate justification, that the existing protection and caution information is adequate.

b. Applicants may submit actual task cards for FAA oversight office approval. The task card is what the maintenance technicians (in other words, persons actually performing the EWIS ICA task) use on the shop floor to tell them what the task is and how to accomplish it. Refer to section 7 of this AC for further discussion on EWIS ICA documentation.

10. FAA and FAA Oversight Office Approval of EWIS ICA.

a. The requirements for the FAA to approve EWIS ICA are contained in § 25.1729 and in § 26.11(b) and (c). Section 25.1729 requires applicants to prepare EWIS ICA in accordance with part 25, appendix H, sections H25.4 and H25.5, and to have them approved by the FAA. In this case, approval by the FAA means approval by the ACO or office of the Transport Airplane Directorate with oversight responsibility for the company or person requesting the approval. Section 26.11(b) and (c) require that DAHs and applicants prepare EWIS ICA in accordance with paragraphs H25.5(a)(1) and (b) of appendix H. These also must be approved by the FAA, but in this case by the FAA oversight office. In summary, there are three different compliance scenarios that require FAA approval of EWIS ICA:

(1) Section 26.11(b) requirements for TC holders.

(2) Section 26.11(c) EWIS ICA requirements for STC and amended TC holders/applicants.

(3) Section 25.1729 EWIS ICA requirements for TC, amended TC, and STC applicants.

b. The following guidance is related only to paragraphs H25.5(a)(1) and (b) of appendix H to part 25. Guidance for the other EWIS ICA requirements in appendix H may be found in AC 25.1701-1, *Certification of Electrical Wiring Interconnection Systems on Transport Category Airplanes*.

c. The FAA oversight office will approve the SD required by paragraph H25.5(b). Approval of the SD signifies approval of the actual EWIS ICA contained either in the SD itself, or in other documents referenced in the SD. If the SD references data contained in other documents, the FAA oversight office, ACO, or office of the Transport Airplane Directorate must review that data to ensure compliance with paragraphs H25.5(a)(1) and (b). Please note that this includes all task procedures related to the tasks descriptions. This means that approval of the SD also signifies approval of any referenced data. It does not, however, necessarily signify approval of the entire referenced document. For example, EWIS ICA task procedures contained in the AMM will be considered FAA approved, but the entire AMM is not considered FAA approved. This is because the AMM contains maintenance data other than EWIS maintenance data. Once the SD has been submitted by an applicant or DAH and found to be in compliance by the ACO in the case of an ICA developed for § 25.1729, or by the ACO or office of the Transport Airplane Directorate (FAA oversight office) in the case of ICA developed for § 26.11, a letter will be issued signifying approval of the EWIS ICA. The DAH may communicate the approved version of the EWIS ICA (in other words, attach the FAA approval letter to the EWIS ICA source document) to the operators to show that the EWIS ICA are approved.

Note: FAA Aircraft Evaluation Group (AEG) approval of MRBRs that contain EWIS ICA tasks does not signify FAA approval of the EWIS ICA as required by § 25.1729 or § 26.11. The FAA oversight office (ACO or office of the Transport Airplane Directorate) will issue this approval.

d. A DAH located outside of the United States should submit the required regulatory material to the FAA through that DAH's civil aviation authority (CAA). This applies to the draft and final EWIS ICA, as well as to any necessary supporting documentation such as the EZAP for the airplane model or design change for which approval is sought. The FAA oversight office ACO, or office of the Transport Airplane Directorate, will coordinate with the CAA regarding review and approval of the data.

e. The following are meant to represent the general types of activity that may occur when EWIS ICA are developed and approved. These sequences of events are presented as examples and may not necessarily represent the exact order in which these actions will occur every time or all the actions necessary for every situation. However, the actions listed are consistent with the MRB procedures outlined in AC 121-22A, *Maintenance Review Board*.

(1) The following are typical actions for holders of, or applicants for, type certificates as they develop EWIS ICA to comply with the requirements of part 25, appendix H, paragraphs H25.5(a)(1) and (b) (as required by § 25.1729 and § 26.11).

Note: The steps below are focused on the development, review, and approval of the EZAP-derived EWIS ICA. Other EWIS ICA tasks and non-EWIS ICA may also be addressed during the review process, but, for clarity, they are purposely left out of the following sequence of events.

(a) The DAH conducts the preliminary EZAP analysis.

(b) The DAH presents the results of the EZAP analysis to the Industry Steering Committee (ISC) working group (WG) assigned to review the analysis. Typically this will be the Zonal WG. FAA personnel from ACO and AEG offices will participate in the WG.

(c) The WG and the DAH agree on any necessary revisions to the analysis, and the DAH updates the analysis based on these agreements.

(d) The DAH presents the revised EZAP analysis results to the ISC.

(e) The ISC reviews the EZAP analysis results and identifies any necessary revisions.

(f) The DAH updates the analysis based on ISC review and prepares the MRB report, which includes EZAP-derived EWIS ICA.

(g) The DAH transmits the MRB report to the applicable FAA AEG office for approval.

(h) The AEG MRB chairperson reviews and approves the MRBR and reviews the acceptability of other relevant EWIS ICA documentation, such as task procedures contained in the AMM, and then transmits the MRBR approval letter to the DAH. This could be an iterative process if the MRB chairperson identifies any additional changes he or she believes are necessary.

Note: The MRB chairperson's signature does not indicate approval of compliance with the requirements of §§ 26.11 and 25.1729. Those compliance findings must be issued by the FAA oversight office.

(i) The DAH prepares instructions for continued airworthiness, which include EZAP-derived EWIS ICA based upon the content of the approved MRBR.

(j) The DAH produces the SD (required by paragraph H25.5(b)), which either contains or identifies the location of the EWIS ICA. (The SD can either contain the EWIS ICA or reference its location in other documents—it is the DAH's choice.)

(k) The DAH submits the SD and any referenced ICA documents to the FAA oversight office for approval.

(l) The FAA oversight office, in conjunction with the applicable AEG office, reviews and approves the SD, which indicates approval of the EWIS ICA referenced or contained in that document.

(2) Following are the typical steps that DAHs or applicants will need to go through in determining whether the design change for which they seek approval requires revisions to previously approved EWIS ICA or the development of new EWIS ICA, or both. A design change can be accomplished through an amended TC (including service bulletins describing design changes), an STC, or changes to an existing STC. These actions apply to applicants who must comply with § 25.1729 (in other words, paragraphs H25.5(a)(1) and (b) of appendix H) or § 26.11(c), or both.

Note: The steps below are focused on the development, review, and approval of the EZAP-derived EWIS ICA. Other EWIS ICA tasks and non-EWIS ICA may also be addressed during the review process, but, for clarity, they are purposely left out of the following sequence of events.

(a) The applicant determines whether the proposed design change requires a revision to the existing EWIS ICA or development of new EWIS ICA, or both. Guidance on making this determination is contained in appendix B of this AC. If required, the applicant develops a new or revised EWIS ICA.

(b) If new or revised EWIS ICA are required, the applicant produces a SD (required by paragraph H25.5(b)) containing the EWIS ICA (developed using the procedure outlined in appendix B of this AC) or identifying their location in other documents. (Whether the SD contains the EWIS ICA or references their location in other documents is the applicant's choice).

(c) The DAH submits the SD, any referenced ICA documents, and any supporting documentation to the FAA oversight office for approval.

Note: Supporting documentation may be the result of the procedure as outlined in appendix B, previously approved EWIS ICA applicable to the airplane zone(s) being modified, or other documentation that supports the applicant's position as to the necessity of creating new or revised EWIS ICA.

(d) The FAA oversight office, in conjunction with the applicable AEG office, reviews and approves the SD, which indicates approval of the EWIS ICA referenced or contained in that document.

11. Making EWIS ICA Available to Operators and Other Persons. Section 26.11(e)(4) requires that the compliance plan submitted by the DAH or applicant contains a proposal for how the approved EWIS ICA will be made available to affected persons. Section 26.11(f) requires that the compliance plan be implemented in accordance with § 26.11(e). The rule does not specify the manner in which the DAH must make the EWIS ICA available. It simply requires the DAH to make them available. The "affected persons" that the rule refers to are operators and others required to comply with the requirements of §§ 26.11, 25.1729, 121.1111, and 129.111.

12. Operator Changes to EWIS ICA. Sections 121.1111 and 129.111 require that the EWIS maintenance program be based on EWIS ICA that have been developed in accordance with provisions of appendix H and approved by the FAA oversight office. Guidance for air carriers and air operators on how to make changes to FAA-approved EWIS ICA is contained in AC 120-99, *Incorporation of Electrical Wiring Interconnection System (EWIS) Instructions for Continued Airworthiness into an Operator's Maintenance Program.*

13. Causes of Wire and Other EWIS Component Degradation. The following are considered principal causes of wiring degradation and should be used to help focus maintenance programs.

a. Vibration. High vibration areas tend to accelerate degradation over time, resulting in "chattering" contacts and intermittent symptoms. High vibration of tie-wraps or string-ties can cause damage to insulation. In addition, high vibration will exacerbate any existing wire insulation cracking.

b. Moisture. High moisture areas generally accelerate corrosion of terminals, pins, sockets, and conductors. It should be noted that wiring installed in clean, dry areas with moderate temperatures appears to hold up well.

c. Maintenance. Scheduled and unscheduled maintenance activities, if done improperly, may contribute to long-term problems and degradation of EWIS. Certain repairs may have limited durability and should be evaluated to ascertain if rework is necessary. Repairs that conform to manufacturers' recommended maintenance practices are generally considered permanent and should not require rework. Care should be taken to prevent undue collateral damage to EWIS while performing maintenance on other systems.

(1) Metal shavings and debris have been discovered on wire bundles after maintenance, repairs, modifications, or STC work has been performed. Take care to protect wire bundles, connectors, and all other EWIS components during maintenance, repairs, or modification work.

Work areas should be cleaned while the work progresses to ensure that all shavings and debris are removed. The work area should be thoroughly cleaned after work is complete, and the area should be inspected after the final cleaning.

(2) Repairs should be performed using the most effective methods available. Since wire splices are more susceptible to degradation, arcing, and overheating, the recommended method of repairing a wire is with an environmentally sealed splice.

d. Indirect Damage. Events such as pneumatic duct ruptures or duct clamp leakage can cause damage that, while not initially evident, can later cause wiring problems. When events such as these occur, surrounding EWIS should be carefully inspected to ensure that there is no damage or potential for damage evident. Indirect damage caused by these types of events could be broken clamps or ties, broken wire insulation, or even broken conductor strands. In some cases, the pressure of the duct rupture could cause wire separation from the connector or terminal strip.

e. Contamination. EWIS contamination refers to either of the following situations: (1) presence of a foreign material that is likely to cause degradation of EWIS or (2) presence of a foreign material that is combustible or capable of sustaining a fire after removal of the ignition source. An EWIS contaminant may be in solid or liquid form.

(1) Solid contaminants. Solid contaminants such as the following can accumulate on wiring and other EWIS components and could degrade or penetrate wiring or other EWIS components.

- Metal shavings/swarf
- Debris
- Livestock waste
- Lint
- Dust

(2) Fluid contaminants. Chemicals in fluids such as the following can contribute to degradation of wiring and other EWIS components.

- Hydraulic fluid
- Battery electrolytes
- Fuel
- Corrosion inhibiting compounds
- Waste system chemicals

- Cleaning agents
- De-icing fluids
- Paint
- Soft drinks
- Coffee

(3) Contaminants requiring special consideration.

(a) Special consideration is required for the following:

- Hydraulic fluids
- De-icing fluids
- Battery electrolyte

(b) These fluids, although essential for airplane operation, can damage EWIS components, such as connector grommets, wire bundle clamps, wire ties, and wire lacing, causing chafing and arcing. EWIS components exposed to these fluids should be given special attention during inspection. Contaminated wire insulation that has visible cracking or breaches to the core conductor can eventually arc and cause a fire. Wiring and other EWIS components exposed to, or in close proximity to, any of the above chemicals may need to be inspected more frequently for damage or degradation.

(c) When cleaning areas or zones of the airplane that contain both wiring and chemical contaminants, special cleaning procedures and precautions may be needed. Such procedures may include wrapping wire connectors and other EWIS components with a protective covering prior to cleaning. This would be especially true if pressure washing equipment is used. In all cases, the airplane manufacturer's recommended procedures should be followed.

(4) Waste system contamination. Waste system spills also require special attention. Service history has shown that these spills can have detrimental effects on airplane EWIS and have resulted in smoke and fire events. When this type of contamination is found, all affected components in the EWIS should be thoroughly cleaned, inspected, and repaired, or replaced if necessary. The source of the spill or leakage should be located and corrected.

f. Heat. Exposure to high heat can accelerate degradation of EWIS by causing wire insulation dryness and cracking. Direct contact with a high heat source can quickly damage insulation. Burned, charred, or even melted insulation are the most likely indicators of this type of damage. Low levels of heat can also degrade wiring over a longer period of time. This type of degradation is sometimes seen on engines, in galley wiring such as in coffee makers and ovens, and behind fluorescent lights, especially ballasts.

g. Cold. Exposure to extremely cold temperatures, such as those found at a transport category airplane's typical cruising altitude, or wires exposed to cold temperatures while the airplane is parked in a cold environment, increases the rigidity of wire insulation in those wires that have little or no current flow. Vibration or other types of movement of EWIS during this time could lead to wire faults. This is important to remember when performing maintenance to, or around, these wires in a cold environment. EWIS located outside of the pressurized fuselage, such as those located in landing gear wheel wells, wing leading and trailing edges, and in the horizontal and vertical stabilizers are routinely subjected to these extreme cold temperatures.

14. General EWIS Maintenance Guidance. Areas to be inspected should be clean enough to minimize the possibility that collected dirt, grease, or other contaminants might hide unsatisfactory conditions that would otherwise be detected during inspection. For any cleaning considered necessary, you should use the airplane manufacturer's procedures or other methods, techniques, and practices acceptable to the FAA. The cleaning process itself should not compromise the integrity of EWIS.

a. Preventing Accumulation of Combustibles. Some applicants may set a numerical limit on the amount of contamination that may accumulate in a zone in order to avoid combustion of the contaminants. Other applicants may choose not to set a numerical limit, but rather give instructions that EWIS be cleaned to significantly remove the amount of combustible material. If an applicant has set a limit, EWIS should be cleaned at frequent enough intervals that the accumulation of combustibles never exceeds this limit. If no limit has been set, EWIS should be cleaned at frequent enough intervals that accumulation of combustibles never reaches unacceptable levels. Determining the interval would involve making an estimate of the rate at which combustible material will accumulate in that particular zone and setting intervals to occur with enough frequency so that unacceptable levels are not reached. If at an inspection the contaminants in a zone have not yet accumulated to the level considered excessive, or to the set level that triggers the need for cleaning, a determination must be made about whether the contaminant accumulation will have exceeded the limit or reached excessive levels before the next inspection. If that is expected to be the case, then the EWIS should be cleaned during the current inspection even though the contaminants have not yet exceeded the accumulation limit or reached excessive levels.

b. Levels of Inspection Applicable to EWIS. Though the term "detailed visual inspection" remains valid for a detailed inspection using only eyesight, this may represent only part of the inspection called for in EWIS ICA used to establish an operator's maintenance program. We recommend that the acronym "DVI" not be used because that term may exclude tactile examination, which is sometimes needed. Instead, we provide the following definitions. See figures 1 and 2 for examples of EWIS that are contaminated. Such contamination could cause EWIS component degradation and also prevent an effective GVI or DET inspection if it were not cleaned. Additionally, depending on the type and amount present, contaminants may also be combustible and sustain a fire should electrical arcing occur.

Figure 1: EWIS Contaminated with Dust and Dirt

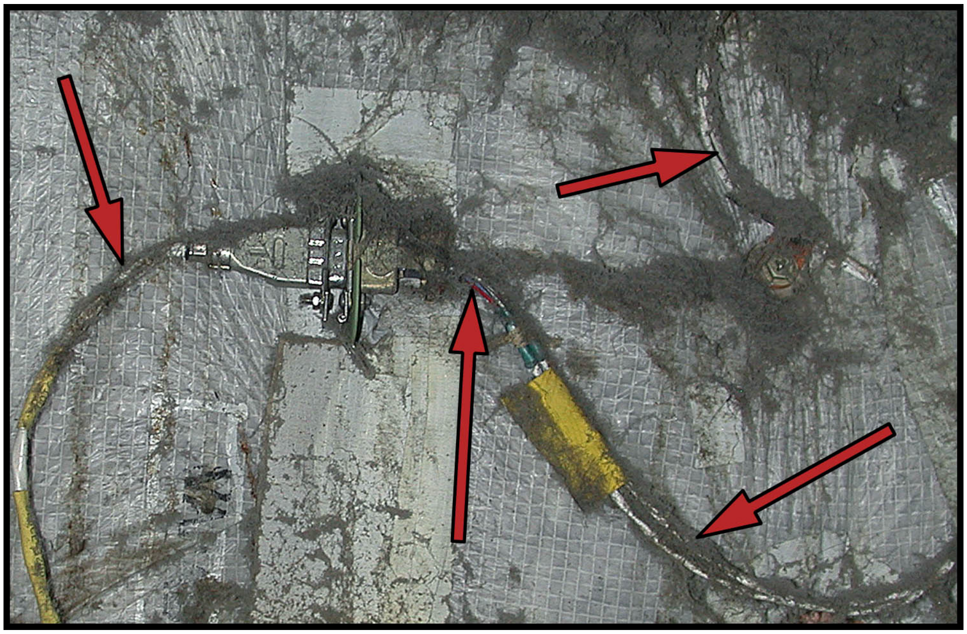
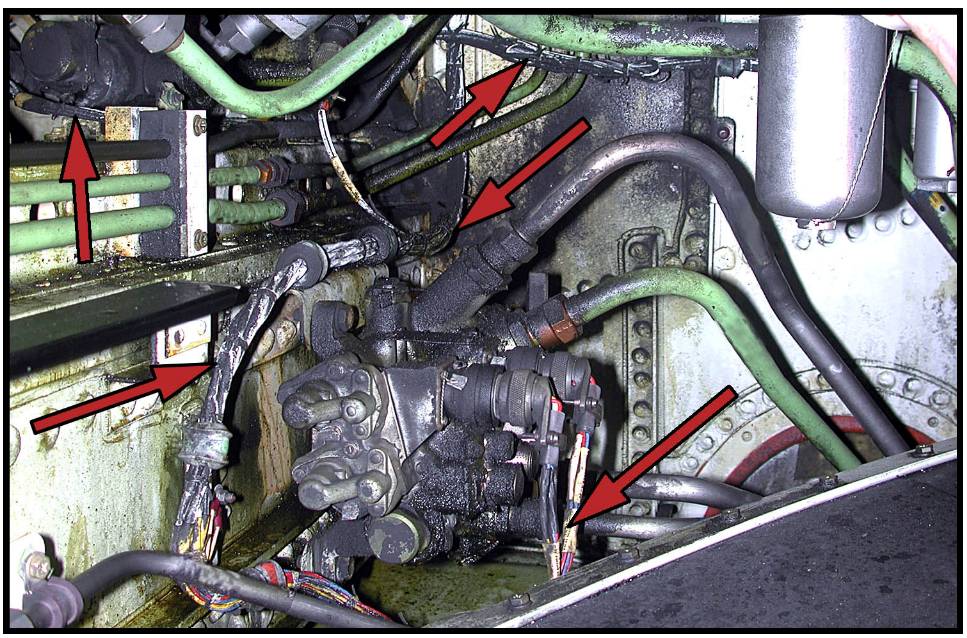


Figure 2: EWIS Contaminated with Grease



(1) Detailed inspection (DET). A DET is an intensive examination of a specific item, installation, or assembly to detect damage, failure, or irregularity. Available lighting is normally supplemented with a direct source of good lighting at an intensity deemed appropriate.

Inspection aids such as mirrors, magnifying lenses, or other means may be necessary. Surface cleaning and elaborate access procedures may be required. A DET can be more than just a visual inspection, since it may include tactile assessment in which a component or assembly is checked for tightness/security. It may require the removal of items such as access panels and drip shields, or the moving of components.

Note: Tactile assessment as used in the context of an EWIS DET does not require the disassembly of wire bundles to inspect individual wires within the bundle.

(2) General visual inspection (GVI). A visual examination of an interior or exterior area, installation, or assembly to detect obvious damage, failure, or irregularity. This level of inspection is made from within touching distance unless otherwise specified. A mirror may be necessary to enhance visual access to all exposed surfaces in the inspection area. This level of inspection is made under normally available lighting conditions such as daylight, hangar lighting, flashlight, or droplight and may require removal or opening of access panels or doors. Stands, ladders, or platforms may be required to gain proximity to the area being checked.

(a) Recent changes to this definition have added proximity guidance (within touching distance) and the allowance of a mirror and flashlight to improve visual access to exposed surfaces when performing a GVI. These changes should result in more consistent application of the GVI. They also support expectations of the types of EWIS discrepancies that should be detected by a GVI.

(b) When performing a GVI, there is usually no need to remove equipment or displace EWIS unless the access instructions specifically call for it.

(c) The area to be inspected should be clean enough to minimize the possibility that collected dirt or grease, or other contaminants, might hide unsatisfactory conditions that would otherwise be obvious. For any cleaning considered necessary, you should use the airplane manufacturer's procedures or other methods, techniques, and practices acceptable to the FAA. The cleaning process itself should not compromise the integrity of EWIS. Avoid using high pressure cleaning and abrasive materials that could damage wire insulation and other EWIS components.

(d) In general, the person performing a GVI is expected to identify degradation from wear, vibration, moisture, contamination, excessive heat, aging, and so forth, and assess what actions are appropriate to address the discrepancy. This assessment should consider potential effects on adjacent system installations, particularly if those systems include wiring. You should address any observed discrepancies, such as chafing, broken clamps, sagging, interference, contamination, and so forth.

(e) An EWIS stand-alone GVI applies the above inspection techniques to wires, cables, and other EWIS components identified in the inspection procedure.

(3) Zonal inspection. This is a collective term comprising selected GVIs and visual checks that are applied to each zone of the airplane, defined by access and area, to check system and powerplant installations and structure for security and general condition. A zonal inspection is essentially a GVI of an area or zone to detect obvious unsatisfactory conditions and discrepancies. Unlike a stand-alone GVI, it is not directed to any specified component or assembly.

c. EWIS-Related Guidance for Zonal Inspections. The following EWIS degradation conditions are typical of what should be detectable and addressed as a result of a zonal inspection (as well as a stand-alone GVI). Maintenance and training documentation should include these items. This list is not intended to be all-inclusive and may be expanded as appropriate.

(1) Wire/wire harnesses.

- Wire bundle/wire bundle or wire bundle/structure contact/chafing
- Wire bundles sagging or improperly secured
- Wires damaged (obvious damage because of mechanical impact, overheat, localized chafing, and so forth)
- Lacing tape and/or ties missing/incorrectly installed
- Wiring protection sheath/conduit deformed or incorrectly installed
- End of sheath rubbing on end attachment device
- Grommet missing or damaged
- Dust and lint accumulation
- Surface contamination by metal shavings/swarf
- Contamination by liquids
- Deterioration of previous repairs (for example, splices)
- Deterioration of production splices
- Inappropriate repairs (for example, an incorrect splice)
- Inappropriate attachments to or separation from fluid lines

(2) Connectors.

- External corrosion on receptacles
- Backshell tail broken
- Rubber pad or packing on backshell missing
- No backshell wire securing device

- Foolproofing chain broken
- Safety wire missing or broken
- Discoloration/evidence of overheat on terminal lugs/blocks
- Torque stripe misaligned

(3) Switches.

- Rear protection cap damaged
- Missing hardware (screws, washers, and so forth)
- Loose hardware
- Improper hardware

(4) Ground points.

- Corrosion
- Loose hardware

(5) Bonding braid/bonding jumper.

- Braid broken or disconnected
- Multiple strands corroded
- Multiple strands broken

(6) Wiring clamps or brackets.

- Corroded
- Broken/missing
- Bent or twisted
- Unstuck/detached
- Attachment faulty (bad attachment or fastener missing)
- Protection/cushion damaged

(7) Supports (rails or tubes/conduit).

- Broken
- Deformed
- Fastener missing
- Edge protection on rims of feed-through holes missing
- Racetrack cushion damaged
- Drainage holes (in conduits) obstructed

(8) Circuit breakers, contactors, or relays.

- Signs of overheating
- Signs of arcing
- Missing hardware (screws, washers, and so forth)
- Loose hardware
- Improper hardware

d. Wiring Installations and Areas of Concern. Maintenance material should address the following installations and areas.

(1) Wiring installations.

(a) Clamping points. Damaged clamps, migration of clamp cushions, or improper clamp installations aggravate wire chafing. Airplane manufacturers specify clamp type and part number for EWIS throughout the airplane. When replacing clamps, use those specified by the airplane manufacturer. Tie wraps provide a rapid method of clamping, especially during line maintenance operations. But improperly installed tie wraps can have a detrimental effect on wire insulation. When new wiring is installed as part of an STC or other modification, the drawings will provide wire routing, clamp type and size, and proper location. Examples of significant wiring alterations are the installation of new avionics systems, new galley equipment, and new instrumentation. Wire routing, type of clamp, and clamping location should conform to the approved drawings. Adding new wire to existing wire bundles may overload clamps, causing wire bundles to sag and wires to chafe. Raceway clamp foam cushions may deteriorate with age, fall apart, and thus fail to provide proper clamping.

(b) Connectors. Worn environmental seals, loose connectors, missing seal plugs, missing dummy contacts, or lack of strain relief on connector grommets can compromise connector integrity and allow contamination to enter the connector, leading to corrosion or grommet degradation. Connector pin corrosion can cause overheating, arcing, and pin-to-pin shorting. Drip loops should be maintained when connectors are below the level of the harness, and tight bends at connectors should be avoided or corrected.

(c) Terminations. Terminations, such as terminal lugs and terminal blocks, are susceptible to mechanical damage, corrosion, heat damage, and contamination from chemicals, dust, and dirt. Over time, vibration can cause high-current-carrying feeder cable terminal lugs to lose their original torque value, resulting in arcing. One sign of this is heat discoloration at the terminal end. Proper build-up and nut torque is especially critical on high-current-carrying feeder cable lugs. Corrosion on terminal lugs and blocks can cause high resistance and overheating. Dust, dirt, and other debris are combustible and could sustain a fire if ignited from an overheated or arcing terminal lug. Terminal blocks and terminal strips located in equipment power centers (EPC), avionics compartments, and throughout the airplane need to be kept clean and free of combustibles.

(d) Backshells. Wires may break at backshells from excessive flexing, lack of strain relief, or improper build-up. Loss of backshell bonding may also occur because of these and other factors.

(e) Sleeving and conduits. Damage to sleeving and conduits, if not corrected, may lead to wire damage. So damage such as cuts, dents, and creases on conduits may require further investigation for condition of wiring within.

(f) Grounding points. You should check grounding points for security (in other words, finger tightness), condition of the termination, presence of corrosion, and cleanliness. Grounding points that are corroded or have lost their protective coating should be repaired.

(g) Splices. Both sealed and non-sealed splices are susceptible to vibration, mechanical damage, corrosion, heat damage, chemical contamination, and environmental deterioration. Power feeder cables normally carry high current levels and are very susceptible to installation error and splice degradation. All splices should conform to the TC or STC holder's published recommendations. In the absence of published recommendations, we recommend use of environmentally sealed splices.

(2) Areas of concern.

(a) Wire raceways and bundles. Adding wires to existing wire raceways may cause undue wear and chafing of the wire installation and inability to maintain the wire in the raceway. Adding wire to existing bundles may cause wire to sag against the structure, which can cause chafing.

(b) Wings. Wing leading and trailing edges are difficult environments for wiring installations. On some airplane models, wing leading and trailing edge wiring is exposed whenever the flaps or slats are extended. Slat torque shafts and bleed air ducts in these areas are other potential damage sources.

(c) Engine, pylon, and nacelle area. These areas experience high vibration, heat, and frequent maintenance, and they are susceptible to chemical contamination.

(d) Accessory compartment and equipment bays. These areas typically contain items such as electrical components, pneumatic components and ducting, and hydraulic components and plumbing. They may be susceptible to vibration, heat, and liquid contamination.

(e) Auxiliary power unit (APU). Like the engine/nacelle area, the APU is susceptible to high vibration, heat, frequent maintenance, and chemical contamination.

(f) Landing gear and wheel wells. This area is exposed to severe external environmental conditions in addition to vibration and chemical contamination.

(g) Electrical panels and line replaceable units (LRUs). Electrical panel wiring is particularly prone to broken wires and damaged insulation when these high density areas are disturbed during troubleshooting activities, alterations, and refurbishments. Tying wiring to wooden dowels to reduce its disturbance during modification can minimize wire damage. For some configurations, use of connector support brackets would be more desirable and cause less wire disturbance than removal of individual connectors from the supports.

(h) Batteries. Wires and other EWIS components in the vicinity of all airplane batteries are susceptible to corrosion and discoloration and should be inspected for those problems. You should inspect discolored wires and other EWIS components for serviceability.

(i) Power feeders. High-current wiring and associated connections have the potential to generate intense heat. Vibration may cause degradation or loosening of power feeder cables, terminals, and splices. If signs of overheating are seen, splices or termination should be replaced. For both galley and engine/APU generator power feeders, depending on the design, service experience may indicate a need for periodic checks of proper torque on power feeder cable terminal ends, especially in high vibration areas.

(j) Under galleys, lavatories, and cockpit. Areas under the galleys, lavatories, and cockpit are particularly susceptible to contamination from such things as coffee, food, water, soft drinks, lavatory fluids, dust, and lint. Proper floor panel sealing procedures can minimize such contamination in these areas.

(k) Fluid drain plumbing. Leaks from fluid drain plumbing could lead to liquid contamination of EWIS. Service experience may show a need for periodic leak checks or cleaning, in addition to routine visual inspections.

(l) Fuselage drain provisions. Some installations include plumbing features designed to catch leakage and drain it to an appropriate exit. Blockage of the drain path can result in liquid contamination of EWIS. In addition to routine visual inspections, service experience may signal a need to check these installations and associated plumbing periodically to ensure the drain path is free of obstructions.

(m) Cargo bay underfloor. Damage to EWIS in the cargo bay underfloor can occur from maintenance activities in the area.

(n) EWIS subject to movement. Wiring and other EWIS components that are subject to movement or bending during normal operation or maintenance access, at locations such as doors, actuators, landing gear mechanisms, and electrical access panels, should be inspected at those areas where movement occurs.

(o) Access panels. EWIS near access panels could be accidentally damaged from repetitive maintenance access and may warrant special attention.

(p) Under doors. Areas under cargo, passenger, and service entry doors are susceptible to fluid entering from rain, snow, and liquid spills. Fluid drain provisions and floor panel sealing in these areas should be periodically inspected and repaired as necessary.

(q) Under cockpit sliding windows. Areas under cockpit sliding windows are susceptible to water entering from rain and snow. Fluid drain provisions in these areas should be periodically inspected and repaired as necessary.

(r) Areas where EWIS is difficult to access. Areas difficult to access, such as flight deck instrument panels and the cockpit pedestal area, could accumulate excessive dust and other contaminants because of infrequent cleaning. In these areas, it may be necessary to remove components and disassemble other systems to facilitate access to the area.

15. Protection and Caution Recommendations. Section 43.13(b) requires anyone performing maintenance or alteration to do the work ". . . in such a manner and use materials of such a quality that the condition of the aircraft, airframe, aircraft engine, propeller, or appliance worked on will be at least equal to its original or properly altered condition (with regard to aerodynamic function, structural strength, resistance to vibration and deterioration, and other qualities affecting airworthiness)." Anyone performing maintenance must use methods, techniques, and practices prescribed in the manufacturer's current maintenance manual or in ICA prepared by the manufacturer, or methods, techniques, and practices referred to in § 43.13(a) as acceptable to the FAA Administrator. Protection and caution recommendations, while not required as part of the EZAP process discussed in this AC, are required by paragraph H25.5(a)(1)(vi) of appendix H to part 25. They are an important part of the "protect and clean as you go" philosophy, which contributes to preserving the integrity of EWIS. Some practices in use today may actually compromise the integrity of EWIS, albeit inadvertently. Therefore, we have identified some specific maintenance and servicing tasks and recommend that air carriers and air operators adopt these more robust practices. Such information may be provided in manufacturer and operator training programs, on job/task cards, or any other documents that the manufacturer or operator use in the administration of their maintenance programs. These maintenance practices will help prevent inadvertent contamination of EWIS with harmful solids (such as metal shavings) or fluids during maintenance, alteration, and repair of airplane structures and components. Training of maintenance and servicing personnel should address potential consequences of their actions to wiring in the work area. AC 120-94, *Aircraft Electrical Wiring Interconnection Systems Training Program*, provides details of EWIS training that could be adopted by air carriers and air operators.

a. Installation, Repair, or Modification of EWIS. Wiring and other EWIS components (for example, protective coverings, connectors, clamping provisions, and conduits) often comprise the most vulnerable and maintenance-sensitive portions of an installation or system. Extreme care and proper procedures should be used during installation, repair, or modification of EWIS components to ensure safe and reliable performance of the EWIS function.

(1) Proper EWIS component selection, routing/separation, clamping configurations, use of splices, repair or replacement of protective coverings, pinning/de-pinning of connections, and so forth, should be performed in accordance with the applicable sections of the AMM, SWPM/ESPM, or other manufacturer's maintenance documents or in accordance with the operator's approved maintenance program.

(2) You should take special care to minimize disturbance of existing adjacent wiring and other EWIS components during maintenance activities. When EWIS is displaced during a maintenance activity, special attention should be given to returning it to its normal configuration in accordance with the applicable maintenance instructions.

b. Structural Repairs and STCs. Structural repairs and STC installations inevitably introduce tooling and residual debris that is harmful to airplane wiring and other EWIS components. They often require displacement or removal of EWIS to provide access to the work area. Even minor displacement of wiring, especially while clamped, can damage its insulation and result in degraded performance, leading to subsequent arcing or circuit failure.

(1) Use extreme care to protect EWIS from mechanical damage by tools or other equipment during structural repairs, installation of STCs, and repairs or alterations. Avoid drilling blindly into the airplane structure. Damage to wire insulation could cause arcing, fire, and smoke. Carefully cover or displace EWIS located adjacent to drilling or riveting operations to reduce the possibility of mechanical damage.

(2) Do not allow debris such as drill shavings, liberated fastener pieces, broken drill bits, and so forth, to contaminate or penetrate wiring, other EWIS components, or electrical components. This can cause damage to insulation and potential arcing by providing a conductive path to ground or a conductive path between two or more wires of different loads. Once wire bundles and other EWIS components are contaminated with this type of debris, it is extremely difficult to remove it. So take precautions to prevent contamination of any kind from entering the wire bundle.

(3) Before beginning structural repair work and STC installation, survey the work area carefully to identify all EWIS and electrical components that may be subject to contamination. EWIS and electrical components in the debris field should be covered or removed. Drills equipped with vacuum aspiration can be used to minimize risk of metallic debris contaminating wire bundles or other EWIS components. When work is completed, clean electrical components, wiring, and other EWIS components in accordance with the applicable maintenance instructions.

c. Airplane De-Icing or Anti-Icing. Exercise care when spraying de-/anti-icing fluids to prevent damage to exposed electrical components and EWIS in areas such as wing leading and trailing edges, wheel wells, and landing gear. Direct pressure spray onto electrical and EWIS components can lead to contamination or degradation, and it should be avoided.

d. Inclement Weather. EWIS in areas below doorways, floors, access panels, and servicing bays are prone to corrosion or contamination from exposure to the elements. Snow, slush, or excessive moisture should be removed from these areas before closing doors or panels. Before loading items into the airplane (for example, cargo containers), remove deposits of snow or slush. Keep doors/panels closed as much as possible during inclement weather to prevent ingress of snow, slush, or excessive moisture.

e. Component Removal/Installation (Relating to Attached EWIS).

(1) Excessive component handling and movement during installation and removal may harm EWIS. Use appropriate connector pliers (for example, soft jawed) to loosen coupling rings that are too tight to be loosened by hand. Alternately pull on the plug body and unscrew the coupling ring until the connector is separated. Do not use excessive force and do not pull on attached wires. When reconnecting, take special care to ensure the connector body is fully seated, the jam nut is fully secured, and no tension is on the wires.

(2) When equipment is disconnected, use protective caps on all connectors (plug or receptacle) to prevent contamination or damage of the contacts. Sleeves or plastic bags may be used if protective caps are not available. Use of sleeves or plastic bags should be temporary because of the risk of condensation. Use of a humidity absorber is recommended with sleeves or plastic bags.

f. Pressure Washing. Exercise care when spraying water or cleaning fluids to prevent damage to exposed electrical components and EWIS in areas such as wing leading and trailing edges, wheel wells, and landing gear. Avoid direct high-pressure spray onto electrical components and EWIS. It can lead to contamination or degradation. When practical, protect EWIS components (for example, wiring and connectors) before pressure washing. Use water rinse to remove cleaning solution residue after washing. Breakdown of wire insulation or material used in other EWIS components may occur with long-term exposure of EWIS components to cleaning solutions. Although these recommendations are good practice and technique, consult the AMM or STC holder’s instructions for additional detailed instructions about pressure washing.

g. Cleaning of EWIS (In Situ). Exercise extreme care and use proper procedures when cleaning to ensure safe and reliable performance of the function supplied by EWIS. Although these recommendations for cleaning of EWIS are considered good practice and technique, consult the AMM or STC holder’s instructions for additional detailed instructions.

(1) Avoid displacing or disturbing EWIS during cleaning of non-aggressive contamination, such as dust, dirt, or swarf. Displacement may be necessary for aggressive contaminants (for example, livestock waste, salt water, battery electrolyte). In those cases, release wiring from its installation in a way that avoids placing undue stress on the wiring connectors and wire bundle support devices. If liquid contamination enters the bundle, remove ties before separating wires.

(2) Clean only contaminated areas and items. Before cleaning, make sure that the cleaning materials and methods will not cause more contamination. Make sure cloths used are clean, dry, and lint-free. Connectors should be completely dry before mating. Fluids left on connectors can have a deteriorating effect on the connector or the system or both.

h. Servicing or Repairing Waste/Water Systems. EWIS in areas adjacent to waste/water systems are prone to contamination from those systems. Use care to prevent fluids from reaching EWIS components while servicing or repairing waste/water systems, and cover exposed EWIS components while working. Operator practice may call for a weak acid solution to be periodically flushed through lavatory systems to improve reliability and efficiency of operation. Because of the effect of acid contamination on systems and structure, confirm that the system is free of leaks before using such solutions.

i. Servicing or Repairing Oil Systems. EWIS in areas adjacent to oil systems are prone to contamination from those systems. Oil and debris in combination with damaged wiring can present a fire hazard. To minimize the attraction and adhesion of foreign material, use care to prevent fluids from reaching EWIS components while servicing or repairing oil systems.

j. Servicing or Repairing Hydraulic Systems. EWIS in areas adjacent to hydraulic systems are prone to contamination from those systems. To minimize the attraction and adhesion of foreign material, use care to prevent fluids from reaching EWIS components while servicing or repairing hydraulic systems.

k. Gaining Access (Entering Zones). When entering the airplane or working on it, use care to prevent damage to adjacent EWIS components, including wiring or other EWIS components that may be hidden from view (for example, covered by insulation blankets). Use protective boards or platforms for adequate support and protection. Avoid using wire bundles as handholds, steps, and supports. Do not use wiring to hang or support work lights. If wiring must be displaced or removed for work area access, it should be adequately released from its clamping or other restraining provisions to allow movement without damage, and it should be returned to position after work is completed.

l. Applying Corrosion Prevention Compounds (CPC). When applying CPC in airplane zones containing EWIS, use care to prevent CPC from contacting it. Dust and lint are more likely to collect on wire that has CPC on it. Apply CPCs according to the airplane manufacturer's maintenance instructions.

/s/

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Appendices

Appendix A. The Enhanced Zonal Analysis Procedure (EZAP)

Appendix B. Evaluating Whether a Design Change Impacts Previously Approved EWIS ICA and Developing any Necessary New or Revised EWIS ICA as Required by § 26.11(c) or § 25.1729

Appendix C. Definitions

Appendix D. FAA Oversight Offices for the Purposes of Part 26

Appendix E. Applicable Regulations and Relevant Preamble Discussion

Appendix F. Background

Appendix G. Related Regulations and Documents

Appendix H. EZAP Worksheets for Use by Applicants

Appendix A

1. The Enhanced Zonal Analysis Procedure (EZAP). The figures and explanations on the following pages describe the EZAP process. Before you begin using this logic, you should be thoroughly familiar with the contents and philosophy of this AC and the results the AC and the EZAP seek to achieve.

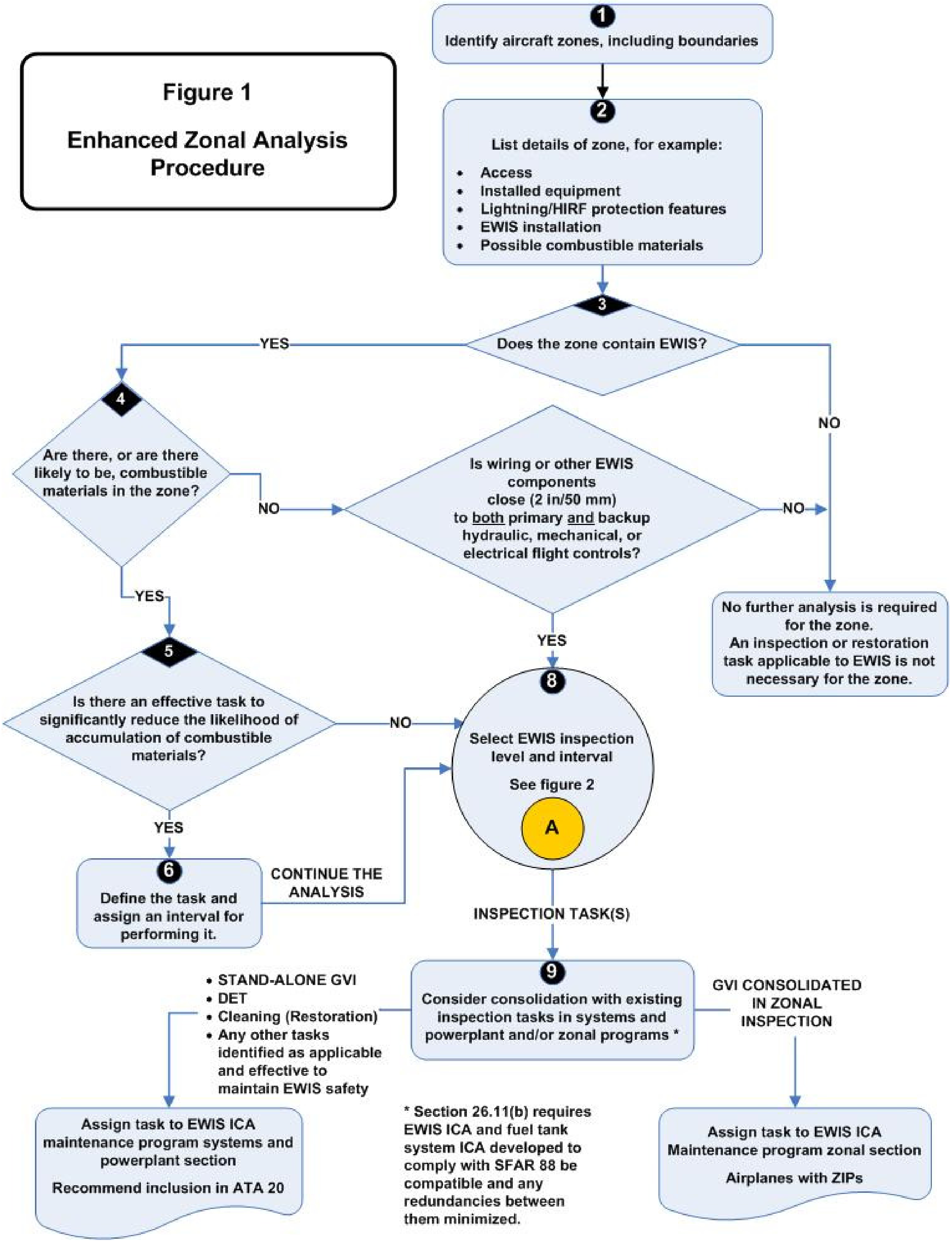
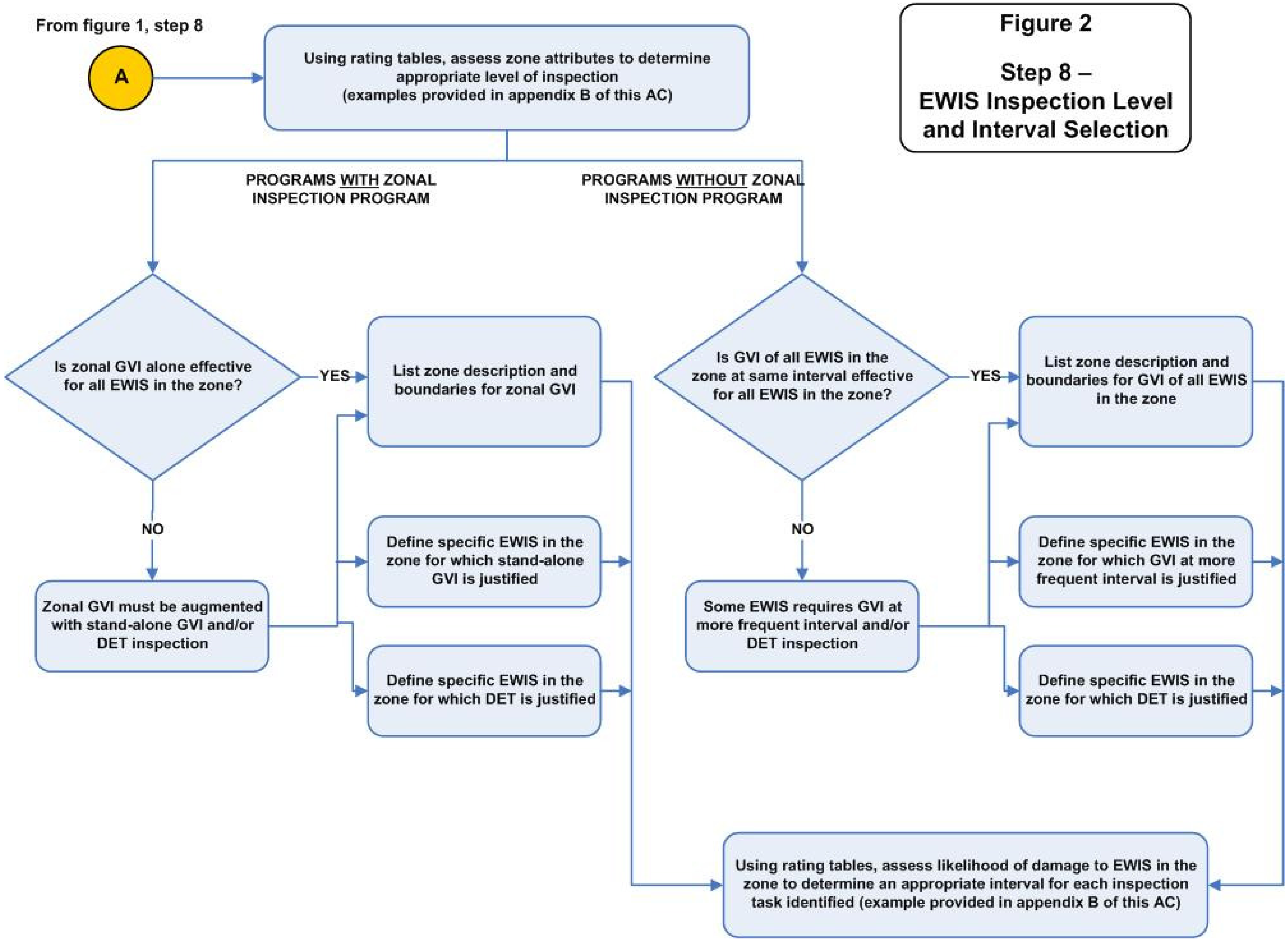


Figure 1
Enhanced Zonal Analysis Procedure
1 Identify aircraft zones, including boundaries
2 List details of zone, for example:
• Access
• Installed equipment
• Lightning/HIRF protection features
• EWIS installation
• Possible combustible materials
3 Does the zone contain EWIS?
YES
NO
4 Are there, or are there likely to be, combustible materials in the zone?
NO
YES
Is wiring or other EWIS components close (2 in/50 mm) to both primary and backup hydraulic, mechanical, or electrical flight controls?
NO
YES
No further analysis is required for the zone.
An inspection or restoration task applicable to EWIS is not necessary for the zone.
5 Is there an effective task to significantly reduce the likelihood of accumulation of combustible materials?
NO
YES
8 Select EWIS inspection level and interval
See figure 2
A
6 Define the task and assign an interval for performing it.
CONTINUE THE ANALYSIS
INSPECTION TASK(S)
9 Consider consolidation with existing inspection tasks in systems and powerplant and/or zonal programs *
• STAND-ALONE GVI
• DET
• Cleaning (Restoration)
• Any other tasks identified as applicable and effective to maintain EWIS safety
GVI CONSOLIDATED IN ZONAL INSPECTION
Assign task to EWIS ICA maintenance program systems and powerplant section
Recommend inclusion in ATA 20
* Section 26.11(b) requires EWIS ICA and fuel tank system ICA developed to comply with SFAR 88 be compatible and any redundancies between them minimized.
Assign task to EWIS ICA Maintenance program zonal section
Airplanes with ZIPs

Figure 2

Step 8 – EWIS Inspection Level and Interval Selection



2. Explanation for Steps in EZAP Logic Diagrams. The following paragraphs provide further explanation of each step in the enhanced zonal analysis procedure (EZAP) logic (figures 1 and 2 of this appendix). If you are developing EWIS ICA because you are required to do so by § 26.11(b), then you must use the "representative airplane" as required by that section. (See paragraph 2c of this AC.) All applicants should, whenever possible, verify the results of the analysis using an actual aircraft (typical airplane that has not been cleaned) to ensure that they fully understand the zones being analyzed. Using an actual airplane will help in determining density, size, types and levels of contaminants or combustible materials, and environmental and accidental damage issues for each zone.

STEP 1: Identify aircraft zones, including boundaries.

According to Air Transport Association (ATA) iSpec 2200, *Information Standards for Aviation Maintenance*, zones are identified by the airplane manufacturer "to facilitate maintenance, planning, preparation of job instructions, location of work areas and components, and a common basis for various maintenance tasks." ATA iSpec 2200 contains guidelines for determining airplane zones and their numbering. The EZAP process uses these manufacturer-identified zones. The zones are not created uniquely for EZAP.

However, if the design approval holder or operator has not already established aircraft zones, we recommend that this be done. Wherever possible, the definition of zones should follow a consistent method such as ATA iSpec 2200 (formerly ATA Spec 100), varied only to accommodate particular design constructional differences.

Define the zones, wherever possible, by actual physical boundaries such as wing spars, major bulkheads, cabin floor, control surface boundaries, skin, and so forth, and include access provisions for each zone.

STEP 2: List details of zone.

Within the zone, identify system installations, significant components, lightning and high intensity radiated field (L/HIRF) protection features, typical power levels in any installed wiring bundles, combustible materials (present or with the potential for accumulation) and any other features that may affect EWIS integrity or accumulation of combustibles.

With respect to power levels, the person performing the EZAP analysis should know whether the wire bundle consists primarily of main generator feeder cables, low voltage instrumentation wiring, or standard bus wiring. This information will be used in determining potential effects of deterioration.

Identify any locations where both primary and back-up flight controls are routed within 2 inches/50 mm of a wiring harness or other EWIS components. This information is required to answer the question in step 7.

STEP 3: Does zone contain EWIS? This question eliminates from the EZAP those zones that do not contain EWIS.

STEP 4: Are there, or are there likely to be, combustible materials in zone? This question requires evaluating whether the zone might contain combustible material that could cause a fire to be sustained in the event of an ignition source arising in adjacent wiring. Examples include the presence of fuel vapors, dust/lint accumulation, and contaminated insulation blankets.

- With respect to commonly used liquids (for example, oils, hydraulic fluids, and corrosion prevention compounds) refer to the product specification to assess potential for combustibility. The product may be readily combustible only in vapor mist form. If so, an assessment is required to determine if conditions might exist in the zone for the product to be in this state. You should consider hydraulic fluid to be combustible in a mist form even if the product specification states that it is not combustible in its liquid state.

- Liquid contamination of wiring by most synthetic oil and hydraulic fluids (for example, skydrol) may not be considered combustible. It is a concern, however, if it occurs in a zone where dust and lint are present, because wet or oily surfaces attract dust and lint.

Assess what sources of combustible products may contaminate the zone following any single failure considered likely from in-service experience. For example, consider unshrouded pipes with connections within the zone to be potential contamination sources. Forced air ventilation in a zone tends to blow dust and lint through the air, causing it to lodge on the surfaces of wiring and other EWIS components. Wet or oily surfaces attract more dust and lint. This needs to be considered when you are assessing the possibility of a buildup of combustibles in the zone.

- Avionics and instruments located in the flight compartment and equipment bays tend to attract dust, dirt, and other contamination. Because of the heat generated by these components and their relatively tightly packed installations, you should consider that these zones have the potential for accumulating combustible material. Forced air ventilation is often used in these areas, causing lint and dust to be blown about the area and often resulting in a buildup of dust and lint on the surfaces of wiring and other EWIS components. Always use the EZAP logic for these zones. For flight compartment and equipment bays, the answer to the question in step 4 should be "yes."

Although moisture (whether clean water or otherwise) is not combustible, its presence on wiring, or other current carrying EWIS components increases the probability of arcing from small breaches in the insulation. This could cause a localized fire in the wire bundle. The fire could spread if there are combustibles in close proximity. The risk of a sustained fire caused by moisture-induced arcing is mitigated in step 5 by identifying a task to reduce the likelihood of accumulation of combustible material on or adjacent to the wiring and other EWIS components.

STEP 5: Is there an effective task to significantly reduce the likelihood of accumulation of combustible materials? Most operator maintenance programs have not included tasks directed towards removing combustible materials from EWIS components or adjacent areas or preventing their accumulation. Evaluate whether accumulation on or adjacent to the EWIS can be significantly reduced.

Though restoration tasks such as cleaning are the most likely applicable tasks, the possibility of identifying other tasks is not eliminated. For example, a detailed inspection of a hydraulic pipe might be appropriate if high-pressure mist from pinhole corrosion could impinge a wire bundle and the inherent zone ventilation is low. Task effectiveness criteria should include considering the potential for damaging EWIS components.

STEP 6: Define the task and assign an interval for performing it.

This step will define an applicable EWIS ICA task to reduce accumulation of combustible materials and an effective interval for performing that task. The defined task should be included as a dedicated task in the systems and powerplant section of the maintenance program. Within maintenance review board reports (MRBRs), it may be introduced under the standard practices section (ATA chapter 20 of the MRBR) with no failure effect category assigned.

Restoration tasks should not be so aggressive that they damage wiring, but should be performed at a level that significantly reduces the likelihood of combustion.

STEP 7: Is wiring close to both primary and backup hydraulic, mechanical, or electrical flight controls? This question is asked to ensure that step 8 logic is applied where wiring is close (in other words, within 2 inches/50 mm) to both primary and backup hydraulic, mechanical, or electrical flight controls, even in the absence of combustible materials in the zone.

For zones where combustible materials are present (as determined in step 4), proximity is addressed in the inspection level definition portion of step 8, and this question need not be asked.

This step addresses the concern that segregation between primary and back-up flight controls may not have been consistently achieved. Even in the absence of combustible material, a localized wire arcing could prevent continued safe flight and landing if hydraulic pipes, mechanical cables, or wiring for fly-by-wire controls are routed in close proximity (within 2 inches/50 mm) to a wiring harness. In consideration of the redundancy in flight control systems, this question should be answered "yes" if both the primary and back-up system might be affected by wire arcing.

On all aircraft type designs, regardless of TC date, alterations performed by an STC holder or a field-approved repair or alteration may not have taken into account the TC holder's design criteria. We recommend that STC holders assess whether their design changes route wires within 2 inches or 50 mm of both primary and back-up hydraulic, mechanical, or electrical flight control cables and lines. Similarly, air carriers and air operators should assess any field-approved repairs or alterations or other modifications that have been made to their airplanes to identify any added or altered wiring that may be close to flight control cable and lines.

STEP 8: Select EWIS inspection level and interval (Figure 2).

a. Inspection Level. At this point in the analysis, it is already confirmed that EWIS is installed in a zone where the presence of combustible materials is possible and/or the wiring is in close proximity to primary and backup hydraulic or mechanical flight controls. Therefore, some level of inspection of the EWIS in the zone is required. This step details how to select the proper level of inspection and interval.

The inspection level and its interval are determined by using ratings tables, which rate characteristics of the zone and how the EWIS is affected by, or can affect, those attributes. The type of inspection is determined by using the rating tables of EZAP Worksheet 3A (or 3B for airplane models without a dedicated zonal inspection program (ZIP)), whereas the interval for performing the inspection is determined using the rating tables of EZAP Worksheet 4.

Worksheets 3A and 3B use zone size, zone density, and the potential effect of fire in the zone to determine the type of inspection that is necessary.

- **Zone size—**Zone size determination is based on comparing all the zones in a given airplane model and assessing them in relation to each other. For the purposes of the EZAP analysis, zone sizes are identified as small, medium, or large. For example, the aft cargo bay on a large transport category airplane would be considered a large zone, but the radome on the same airplane would be considered a small zone. The smaller the zone and the less congested it is, the more likely it is that wiring degradation will be identified by a general visual inspection (GVI).

- **Zone density**—The density of installed equipment, including wiring and other EWIS components, within the zone is assessed in relation to the size of the zone. For the purposes of the EZAP analysis, zone density is identified as low, medium, or high. Typical factors to consider are the number of components, their relative closeness to one another, and the complexity of these components (for example, multiple electrical, mechanical, or hydraulic connections). For example, the electrical and electronics compartment located in the forward nose section, below the flight deck of most large transport category airplanes, could be considered a high density zone. This is because the relatively small physical area is crowded with avionics equipment and a large number of wires and other EWIS components. An example of a low density zone on some airplanes is the cargo compartment (as defined by the cargo compartment walls and forward and rear bulkheads). Although this is a large zone relative to other zones on the airplane, it has relatively few systems or EWIS components installed in it.

- **Potential effects of fire on adjacent EWIS or systems—**This question should be answered from the point of view that a fire has occurred. So the question to be answered is what is the effect on the safe operation of the airplane should a fire occur. This assessment should include consideration of the potential for loss of multiple functions and the resulting effect on continued safe operation of the airplane. The presence of flammable fluids should also be considered, although design features such as shrouds over the fuel line can be considered to mitigate the likelihood that the fuel will be a source of fuel for a fire. Base the determination of potential effects of a fire on adjacent wiring and systems on knowledge of what airplane systems are in the area under analysis (in other words, what is in the zone) and how loss or degradation of these systems could affect safe operation. The rating system developed should take these potential effects into account.

  If a zone does not have mitigating design features that would reduce the adverse effects of a fire, then the potential effects of a fire should be rated higher (for example, medium or high). Credit for fire mitigation capability can be given to zones that contain a fire detection and suppression system, or a zone that is designated a "fire zone." Potential effects of a fire in such zones could then possibly be rated at a lower level. Consideration can also be given to whether the fire could be easily detected by crewmembers or passengers and to whether, if there was a fire, it could be extinguished or controlled by available means. Fire can result in severe outcomes, such as wire-to-structure or wire-to-wire shorting and arcing, in areas such as the cockpit, electrical power centers, and those that contain power feeder cables, which are subject to chafing, if they have flammable materials close by. A fire in these areas could present a high risk to continued safe flight and landing.

Potential effects of fire must also be considered when wiring is in close proximity (within 2 inches/50 mm) to both primary and backup flight controls. A GVI alone may not be adequate if a fire caused by failure of the wiring poses a risk to aircraft controllability.

At minimum, all EWIS in the zone will require a GVI at a common interval. For operators with a ZIP, this may be defined as a zonal GVI. For operators without a ZIP, it is a GVI of all EWIS in the zone.

The logic in figure 2 begins by asking a question:

- For airplane models with a ZIP, the logic asks: "Is zonal GVI alone effective for all EWIS in the zone?"
- For airplane models without a ZIP, the logic asks: "Is a GVI of all EWIS in the zone at the same interval effective for all EWIS in the zone?"

This step calls for consideration of whether there are specific items or areas in the zone that are more vulnerable to damage or contamination than others and thus may warrant a closer or more frequent inspection.

Such a determination could result in selection of a more frequent GVI, a stand-alone GVI (for operators with a zonal inspection program), or even a detailed inspection (DET). The intent is to select a DET of EWIS only when it is determined that a GVI will not be adequate. The person performing the EZAP should avoid unnecessarily selecting DET where a stand-alone GVI is adequate. Over-use of DET dilutes the effectiveness of the inspection.

The level of inspection required may be influenced by tasks identified in step 5 and step 6. For example, if you have selected a cleaning task in step 5 and step 6 that will minimize accumulation of combustible materials in the zone, this may justify selecting a stand-alone GVI instead of a DET for the wiring in the zone.

b. Selecting an Inspection Interval. The inspection interval is determined by using a rating system that rates the likelihood of accidental damage and the hostility of environmental factors.

The rating tables are designed to define increasing inspection frequency based on increasing risk of accidental damage and increasing severity of the local environment within the zone. Refer to EZAP Worksheet 4 in this appendix.

The example "Interval Determination" table on EZAP Worksheet 4 provides a range of intervals you can choose from. Please note that these intervals are only an example. The particular intervals chosen should be compatible with the interval framework used in the existing maintenance or inspection program as detailed in the current MRBR. Your choice of interval should be based on the reasons for assigning specific rating values for hostility of environment and likelihood of accidental damage. You should also use your knowledge of the types of EWIS components to be inspected.

As an example, for a hostility of environment rating of 3 and a likelihood of accidental damage rating of 3, the table gives a range of inspection intervals. It says that the inspection should occur as frequently as every A check but the interval could be as long as once every 1C check. You should base your choice on the reasons that a 3 rating was assigned.

- The importance of assessing likelihood of accidental damage is that the higher the likelihood of accidental damage from multiple sources, the more frequent the inspection task should be. If, on the other hand, all of the factors except one have been rated as a 1, then the inspection interval could be somewhat longer.

- The choice of the inspection interval should also be based on what type of environment the EWIS is located in. Just as with the ratings for likelihood of accidental damage, the more the EWIS is exposed to various harsh environmental conditions, the more frequent the inspection interval should be. You should consider the assigned ratings from both of these tables—"Hostility of Environment" and "Likelihood of Accidental Damage"—and use sound maintenance judgment to assign the inspection task interval.

The selection of inspection tasks possible in this step is specific to whether the maintenance program includes a zonal inspection program (ZIP) or not.

For ZIP programs, the possible inspection tasks are:

- Zonal GVI

- Stand-alone GVI

- DET

For non-ZIP programs, the possible inspection tasks are:

- GVI

- DET

At the conclusion of this step you will have determined the required inspection level and interval for wiring in the zone. Task consolidation in step 9 allows consideration of whether an inspection selected as a result of this analysis can be considered accomplished as part of the existing maintenance program.

STEP 9: Consider consolidation with existing inspection tasks in systems and powerplant and/or zonal programs.

This step in the procedure examines the potential for consolidation between the tasks derived from the EZAP and inspections that already exist in the maintenance program. Consolidation would require that the inspections in the existing maintenance program are performed in accordance with the inspection definitions provided in this AC. Consolidation with the fuel tank ICA is required by § 26.11(b) where possible. Compare new tasks identified by the EZAP logic against existing tasks in the maintenance program to ensure that:

a. Tasks are compatible with each other. Existing maintenance tasks and EZAP-generated inspection or maintenance tasks (such as restoration tasks) should not compromise or negate each other. For example, an EZAP-generated task should not compromise existing fuel tank system wire maintenance requirements (for example, those generated by SFAR 88) such as separation or configuration specifications.

b. Task intervals are aligned to the maximum extent possible so undue disturbance of EWIS and other systems located within the zone does not occur. However, the inspection interval you choose must ensure that the intent and reason for the EWIS inspection is not compromised. The EZAP-generated task interval is determined by completing EZAP Worksheet 4 in this appendix.

Example:
Results of the EZAP for a particular zone indicate that using an existing zonal GVI is an effective inspection task for all of the EWIS in the zone. The analysis should be continued to determine the appropriate inspection interval (EZAP Worksheet 4). If the results of the analysis contained on EZAP Worksheet 4 indicate that the EWIS inspection interval is greater than the interval for the existing zonal GVI, the existing zonal GVI interval should be used for the EZAP-identified inspection task. The existing zonal GVI interval cannot be escalated solely based on results of the EZAP analysis. The EZAP only analyzes the need for inspection type and frequency for EWIS within a zone. It does not analyze all of the systems in the zone. Therefore, its results cannot be used as the sole reason to escalate an existing zonal inspection task.

c. Redundant (or duplicate) tasks are consolidated into a single task.

For inspection programs that include a zonal inspection program (ZIP):

- You should not adjust the interval of the stand-alone inspection to match the interval of the existing zonal inspection solely for the purposes of aligning the separate task intervals. Task intervals should only be aligned if the interval will ensure that the safety objectives of identifying the stand-alone GVI in the first place can be met. One of the criteria for considering task interval alignment is access requirements for the zone. Task intervals should be aligned to the maximum extent possible so undue disturbance of EWIS and other systems located within the zone does not occur. If a task is aligned with an existing zonal inspection, it must be identified as an EZAP-related task to prevent the possibility that it could be deleted or inappropriately escalated.

- Stand-alone GVIs and DETs identified by the EZAP should not be consolidated into the ZIP. They must be introduced and retained as dedicated tasks in the scheduled maintenance program under ATA 20 (the ATA category for electrical wiring), or ATA 28 in the case of combined SFAR 88 and EWIS inspection tasks. These tasks, along with tasks identified to reduce accumulation of combustible materials (known as cleaning or restoration tasks), should be uniquely identified to ensure they are not consolidated into the zonal program or deleted during future program development. Within Maintenance-Steering-Group-3-based MRBRs, these may be introduced under ATA 20 with no failure effect category assigned. While a stand-alone GVI and a DET cannot be combined with existing zonal inspections, the intervals for performing them should be aligned with other maintenance tasks in the zone, such as zonal GVIs, to the extent possible.

Note:

In the past, there has been some confusion about using existing zonal GVIs in lieu of EZAP-identified stand-alone GVIs. However, a zonal GVI does not satisfy the intent of a stand-alone GVI. Although on the surface it may appear that the zonal GVI would accomplish the same inspection of the EWIS within a zone that a stand-alone GVI would, it does not. This is because the stand-alone GVI forces the maintenance technician to pay particular attention to the EWIS that is identified as being necessary to inspect. It is this particular attention that will help ensure that EWIS degradation issues are identified and corrected before a potential safety issue arises. While a zonal GVI is a recognized and effective inspection technique, it does not focus particular attention on EWIS or any other system or structural component within the zone and, therefore, cannot be used in lieu of a stand-alone GVI when the EZAP identifies a stand-alone GVI as necessary.

For programs without a ZIP:

Although some non-zonal inspection programs may already include some dedicated inspections of EWIS that may be equivalent to new tasks identified by an EZAP, it is expected that a significant number of new EWIS inspections will be identified for introduction as dedicated tasks in the system and powerplant program. All new tasks identified by an EZAP should be uniquely identified to ensure they are not deleted during future program development.

For programs with or without a ZIP:

The following guide can be used for programs with or without a ZIP to determine proper consolidation between EZAP-derived inspections and existing inspections of the same item or area. When an EZAP task is selected for consolidation, the documentation should include a record identifying it for traceability purposes.

- If the EZAP inspection interval and existing inspection interval are equal, but the inspection levels are different, the more detailed inspection takes precedence (for example, a 1C DET takes precedence over a 1C GVI).
- If the EZAP inspection interval and existing inspection interval are different, but the inspection levels are equal, the more frequent inspection interval takes precedence (for example, a 1C GVI takes precedent over a 2C GVI).
- If the EZAP inspection interval and level are different than the existing inspection interval and level, these tasks may be consolidated using the more frequent inspection and at the more detailed level (for example, a 1C DET takes precedent over a 2C GVI). When the more frequent inspection is less detailed, the tasks should not be consolidated.

For EZAP-developed STC tasks, it may not be possible for the STC holder to determine whether a ZIP exists on specific airplane that will use the STC. If a ZIP exists, consolidation of EZAP-derived STC tasks into an operator's ZIP will be the responsibility of the operator and should be approved by the operator's FAA principal inspector or cognizant Flight Standards District Office (FSDO). AC 120-99, *Incorporation of Electrical Wiring Interconnection System (EWIS) Instructions for Continued Airworthiness into an Operator's Maintenance Program*, will contain guidance related to this.

Note:

The more frequent inspection at the more detailed level should be used, unless it is judged that performing the more detailed inspection too frequently can result in stressing/disturbance of EWIS components.

In cases where the STC holder determines a requirement for a GVI that should not be consolidated into a ZIP, this stand-alone GVI should be specifically identified as such in the EZAP-derived ICA for the STC.

3. Examples of Typical EZAP Worksheets.

a. For Anyone Required to Conduct an EZAP Evaluation. The following pages contain worksheets you can use to conduct an EZAP. The first six worksheets contain notes to assist you in proper use of the worksheet. There are blank worksheets in appendix H of this AC that you can copy and use to conduct the analysis.

- EZAP Worksheet 1: Enhanced Zonal Analysis – Details of Zone
- EZAP Worksheet 2: Enhanced Zonal Analysis – Assessment of Zone Attributes
- EZAP Worksheet 3A – For Airplane Models with a Dedicated Zonal Inspection Program (ZIP): Enhanced Zonal Analysis – Inspection Level Determination Based on Zone Size, Density, and Potential Impact of Fire
- EZAP Worksheet 3B – For Programs without a Dedicated Zonal Inspection Program (ZIP): Enhanced Zonal Analysis – Inspection Level Determination Based on Zone Size, Density, and Potential Impact of Fire
- EZAP Worksheet 4 – Intervals Based on "A" and "C" Checks: Enhanced Zonal Analysis – Interval Determination Based on Hostility of Environment and Likelihood of Accidental Damage
- EZAP Worksheet 5: Enhanced Zonal Analysis – Task Summary

EZAP WORKSHEET 1

Enhanced Zonal Analysis – Details of Zone

(steps 1 and 2 of figure 1)

Zone Number: ☐ **Zone Description:** ☐

- ☐ Hydraulic plumbing
- ☐ Hydraulic component (valves, actuators, pumps)
- ☐ Pneumatic plumbing
- ☐ Pneumatic components (valves, actuators)
- ☐ EWIS – power feeder (high voltage, high amperage)
- ☐ EWIS – motor driven devices
- ☐ EWIS – instrumentation and monitoring
- ☐ EWIS – data bus
- ☐ Electrical components
- ☐ Primary flight control mechanisms
- ☐ Secondary flight control mechanisms
- ☐ Engine control mechanisms
- ☐ Fuel system components
- ☐ Insulation
- ☐ Oxygen system components
- ☐ Potable water system components
- ☐ Waste water system components

Comments

Use this area to describe the zone location, access, and boundaries. List the content of the zone such as installed equipment, wiring, other EWIS components, plumbing, components. Also note significant EWIS related items. Examples: "Wire bundle routed within 2 inches of high-temperature anti-ice ducting." or "Zone contains IDG, RAT, APU and forward galley power feeder cables."

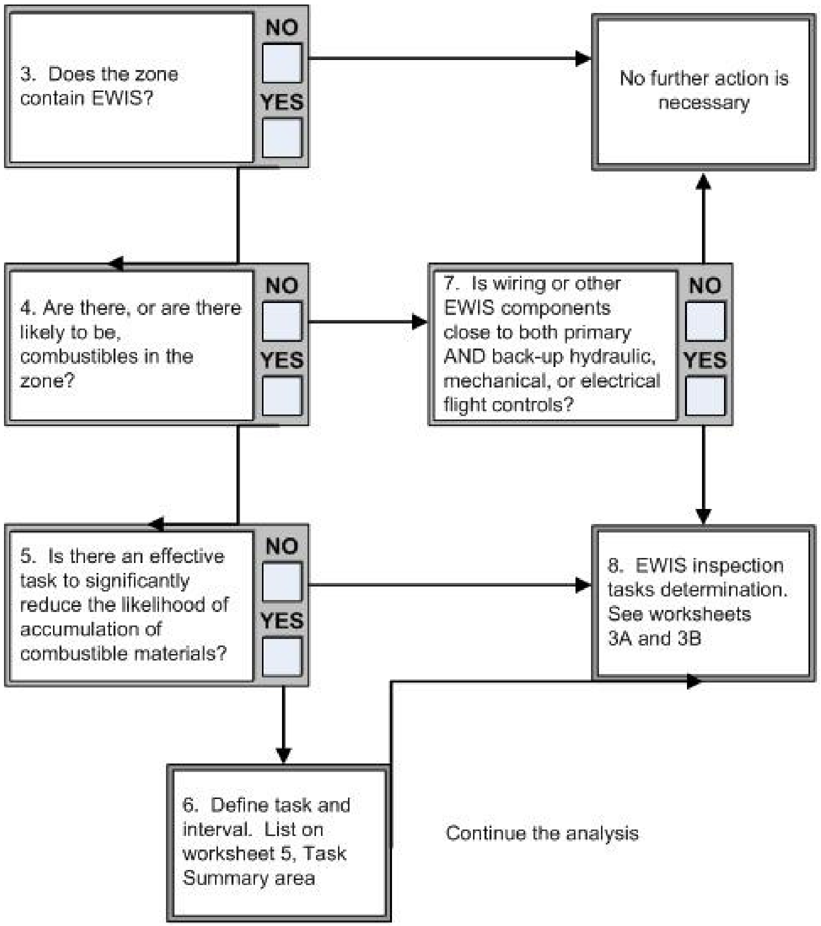
The intent of the description is to provide the analyst with a clear understanding of what is in the zone and how it could potentially affect wiring and other EWIS components within the zone.

EZAP WORKSHEET 2

Enhanced Zonal Analysis – Assessment of Zone Attributes

(steps 3 through 7 of figure 1)

Zone Number: ______ **Zone Description:** ______



Answers and Explanations
(Notes: Steps 1 & 2 Completed on worksheet 1)

3.

4.

5.

6.

7.

If the answer to the questions contained in step 3 and step 7 is "NO," then no further analysis is necessary.

If the answer to question 5 is "YES" and a task is identified that can significantly reduce the likelihood of accumulation of combustible materials, the task and interval must be defined in step 6. If the task identified is a cleaning (restoration) task to remove dust/lint accumulation from wiring, other EWIS components, and/or other items within the zone, the interval for the task must be frequent enough to keep the zone, including the EWIS, relatively clean based on the expected rate of accumulation of dust/lint on the EWIS and other components components within the zone.

In all cases, after step 5 and/or step 6, the analysis is continued to step 8.

EZAP WORKSHEET 3A – For Airplane Models with a Dedicated Zonal Inspection Program (ZIP)

Enhanced Zonal Analysis – Inspection Level Determination Based on Zone Size, Density, and Potential Impact of Fire

(step 8 of figure 1, refer to figure 2)

Zone Number: ______ **Zone Description:** ______

Density / Zone Size → ↓ Assessment		Zone Size: Small	Zone Size: Medium	Zone Size: Large
Density	Low	1	2	3
	Medium	2	2	3
	High	2	3	3

Circle appropriate result & insert below

RESULT ______

Inspection Level Determination Based on Potential Effect of Fire in the Zone

Size / Density Factor		1	2	3
Potential Effects of Fire in the Zone	Low	Zonal GVI	Zonal GVI	Zonal GVI
	Medium	Zonal GVI	Zonal GVI + stand-alone GVI of some EWIS	Zonal GVI + stand-alone GVI of some EWIS
	High	Zonal GVI + stand-alone GVI of some EWIS	Zonal GVI + stand-alone GVI and/or DET of some EWIS	Zonal GVI + stand-alone GVI and/or DET of some EWIS

Circle appropriate result and answer questions in the boxes below

1. Is a Zonal GVI alone effective for the entire zone?* YES → 2 / NO → 2, 3, 4

2. List zone description and boundaries for Zonal GVI

Zonal GVI must be augmented with a stand-alone GVI and/or a DET inspection

3. Define specific items/areas in the zone for which a Stand-alone GVI is justified

4. Define specific items/areas in the zone for which a DET is justified

* If answer to box 1 is "**YES**," answer box 2 only and then continue the analysis on worksheet 4 in order to determine the task interval.

If answer to box 1 is "**NO**," answer boxes 2, 3, and 4 and then continue the analysis on worksheet 4 in order to determine the task interval.

Answers and Explanations

1 The tables on this worksheet are used to select the appropriate level of inspection for the EWIS in the zone based on an assessment of zone size, density, and potential effects of fire in the zone.

This worksheet assumes the existing maintenance program already includes a dedicated zonal inspection program. It is assumed that an existing ZIP already includes a zonal GVI of all zones that contain wiring and other EWIS components, and that the inspection of the EWIS is included in the zonal GVI.

2 If existing zonal GVI is an effective inspection task for all of the EWIS in the zone, the analysis must be continued to determine the appropriate inspection interval (worksheet 4). During task consolidation after completion of the analysis, the most frequent zonal GVI interval for the zone will take precedent.

3 If the results of the analysis contained on worksheet 4 indicate that the EWIS inspection interval is greater than the interval for the existing zonal GVI, the existing zonal GVI interval cannot be escalated based solely on the results of the EZAP analysis.

4 If a zonal GVI is not adequate for the EWIS in the zone, in addition to identifying the zonal GVI, the analyst must also identify the specific items/areas in the zone where a stand-alone GVI and/or DET inspection is necessary.

EZAP WORKSHEET 3B – For Programs without a Dedicated Zonal Inspection Program (ZIP)

Enhanced Zonal Analysis – Inspection Level Determination Based on Zone Size, Density, and Potential Impact of Fire

(step 8 of figure 1, refer to figure 2)

Zone Number: ______ **Zone Description:** ______

Density / Zone Size → ↓ Assessment		Zone Size: Small	Medium	Large
Density	Low	1	2	3
	Medium	2	2	3
	High	2	3	3
	Circle appropriate result & insert below			
		RESULT		

Inspection Level Determination Based on Potential Effect of Fire in the Zone

Size / Density Factor		1	2	3
Potential Effects of Fire in the Zone	Low	GVI of all EWIS in zone at same interval	GVI of all EWIS in zone at same interval	GVI of all EWIS in zone at same interval
	Medium	GVI of all EWIS in zone at same interval	GVI of all EWIS in zone at same interval + GVI of some EWIS at more frequent interval	GVI of all EWIS in zone at same interval + GVI of some EWIS at more frequent interval
	High	GVI of all EWIS in zone at same interval + GVI of some EWIS at more frequent interval	GVI of all EWIS in zone at same interval + GVI of some EWIS at more frequent interval and/or DET of some EWIS	GVI of all EWIS in zone at same interval + GVI of some EWIS at more frequent interval and/or DET of some EWIS

Circle appropriate result and answer questions in the boxes below

1. Is a GVI alone effective for all EWIS in the zone at the same interval?*

YES → 2. List zone description and boundaries for GVI of all EWIS in the zone

NO → Some EWIS requires GVI at more frequent interval and/or DET inspection

3. Define specific items/areas in the zone for which GVI at more frequent interval is justified

4. Define specific items/areas in the zone for which a DET is justified

* If answer to box 1 is "**YES**," answer box 2 only and then continue the analysis on worksheet 4 in order to determine the task interval.

If answer to box 1 is "**NO**," answer boxes 2, 3, and 4, and then continue the analysis on worksheet 4 in order to determine the task interval.

Answers and Explanations

1

2

3

4

The tables on this sheet are used to select an inspection level based on zone size, density, and potential effect of fire in the zone. These factors are used to determine if a GVI of all EWIS in the zone at the same interval is adequate, or if some EWIS requires a more frequent GVI, or even a DET.

This worksheet is designed for operators whose existing maintenance program does not include a dedicated zonal inspection program. The minimum outcome of this analysis will always be a GVI of all EWIS in any zone where the presence of combustible materials is possible and/or wiring is located in close proximity to both primary and backup hydraulic or mechanical flight controls.

If a GVI of all EWIS in the zone at the same interval is adequate, the analyst must identify the inspection requirement as "GVI of all EWIS in the zone" (box 2) and proceed to worksheet 4 to determine the GVI interval.

If a GVI of all EWIS in the zone at the same interval is not adequate, then the analyst must identify the specific items/areas in the zone where a more frequent GVI (box 3) and/or a DET (box 4) is justified.

EZAP WORKSHEET 4 – Intervals Based on "A" and "C" Checks

Enhanced Zonal Analysis – Interval Determination Based on Hostility of Environment and Likelihood of Accidental Damage

(step 8 of figure 1, refer to figure 2)

Zone Number: ______ **Zone Description:** ______

Hostility of Environment	
1 – Passive / 2 – Moderate / 3 – Severe	Enter Number Here
Temperature	
Vibration	
Chemicals (toilet fluids, de-icing fluid, etc.)	
Humidity	
Contamination	
Other	
Enter the Highest Number Here →	

Likelihood of Accidental Damage	
1 – Passive / 2 – Moderate / 3 – Severe	Enter Number Here
Ground handling equipment	
Foreign object debris (FOD)	
Weather effects (hail, rain, etc.)	
Frequency of maintenance activities	
Fluid spillage	
Passenger Traffic	
Other	
Enter the Highest Number Here →	

Interval Determination		Likelihood of Accidental Damage 1	2	3
Hostility of Environment	1	4C – 6C 14, 400 – 21,600 FH 60 – 90 M	2C – 4C 7,200 – 14,400 FH 30 – 60 M	1C – 2C 3,600 – 7,200 FH 15 – 30 M
	2	2C – 6C 7,200 – 21,600 FH 30 – 90 M	1C – 4C 3,600 – 14,400 FH 15 – 60 M	A – 1C 450 – 3,600 FH 1 – 15 M
	3	1C – 6C 3,600 – 21,600 FH 15 – 90 M	1C – 4C 3,600 – 14,400 FH 15 – 60 M	A – 1C 450 – 3,600 FH 1 – 15 M
RESULT Upon completion, enter all task and interval selections onto worksheet 5, Task Summary				

Examples of task interval ranges

Interval selection is specific to each task identified on worksheet 3A or 3B. For GVI of entire zone, consider overall zone environment and likelihood of damage. For stand-alone GVI or DET, consider environment and likelihood of damage only in respect to the specific item/area defined for inspection.

NOTE: Interval ranges are quoted in the rating table to explain a typical arrangement of values. For a particular application, these must be compatible with the interval framework used in the existing maintenance or inspection program (as detailed in the current MRBR). They may be expressed in terms of usage parameter (for example, flight hours or calendar time) or in terms of letter check.

The inspection frequency should be based on increasing risk of accidental damage and increasing severity of the local environment within the zone. In other words, the more ratings identified as moderate and severe should drive the inspection towards the lower end of the interval.

EZAP WORKSHEET 5

Enhanced Zonal Analysis – Task Summary

Zone Number: | **Zone Description:**

TASK SUMMARY			
Task Number	Access	Task Interval	Task Description and Applicable Comments/Rationale/Assumptions

Appendix B

1. Evaluating Whether a Design Change Impacts Previously Approved EWIS ICA and Developing any Necessary New or Revised ICA as Required by § 26.11(c) or § 25.1729.

a. Section 26.11(c) requires that applicants for amendments to type certificates (TCs), supplemental type certificates (STCs), and changes to STCs evaluate whether the design changes for which approval is sought require revisions to previously approved EWIS ICA.

b. Section 26.11(c) applies to all design changes (provided the design change is related to an affected airplane model as determined by § 26.11(a)), not just those that include EWIS modifications. For example, if an applicant proposes to modify stow bin latches, it should be relatively easy for the applicant to make a statement that the EWIS ICA are not impacted. On the other hand, if an applicant introduces a new hydraulic line, or creates a hole in a zone that previously did not have one, some of the previously developed EWIS ICA may be impacted. For example, the modification may introduce new sources of contamination that were not previously addressed by the EWIS ICA.

c. This appendix provides guidance to help the applicant determine whether the proposed modification impacts previously approved EWIS ICA. It also provides guidance to help applicants meet the compliance plan requirements of § 26.11(e) if no EWIS ICA additions or revisions are necessary. Section 26.11(e) requires applicants for amended TCs, STCs, and changes to existing STCs to submit a compliance plan to the FAA for approval if the date of application for the modification was prior to the effective date of § 26.11 and the certificate was issued on or after the effective date. If following the logic in flowchart 1 results in a determination that the previously approved EWIS ICA must be revised because of the modification, guidance for developing and submitting a compliance plan to the FAA oversight office may be found in AC 26-1, *Part 26, Continued Airworthiness and Safety Improvements*.

> **Note:** Each person (applicant) identified in § 26.11(d)(1), (d)2), and (d)(4) must comply with the requirements of § 26.11(e) no matter what the nature of the modification for which they are seeking approval—even if the modification does not require a revision to previously approved EWIS ICA.

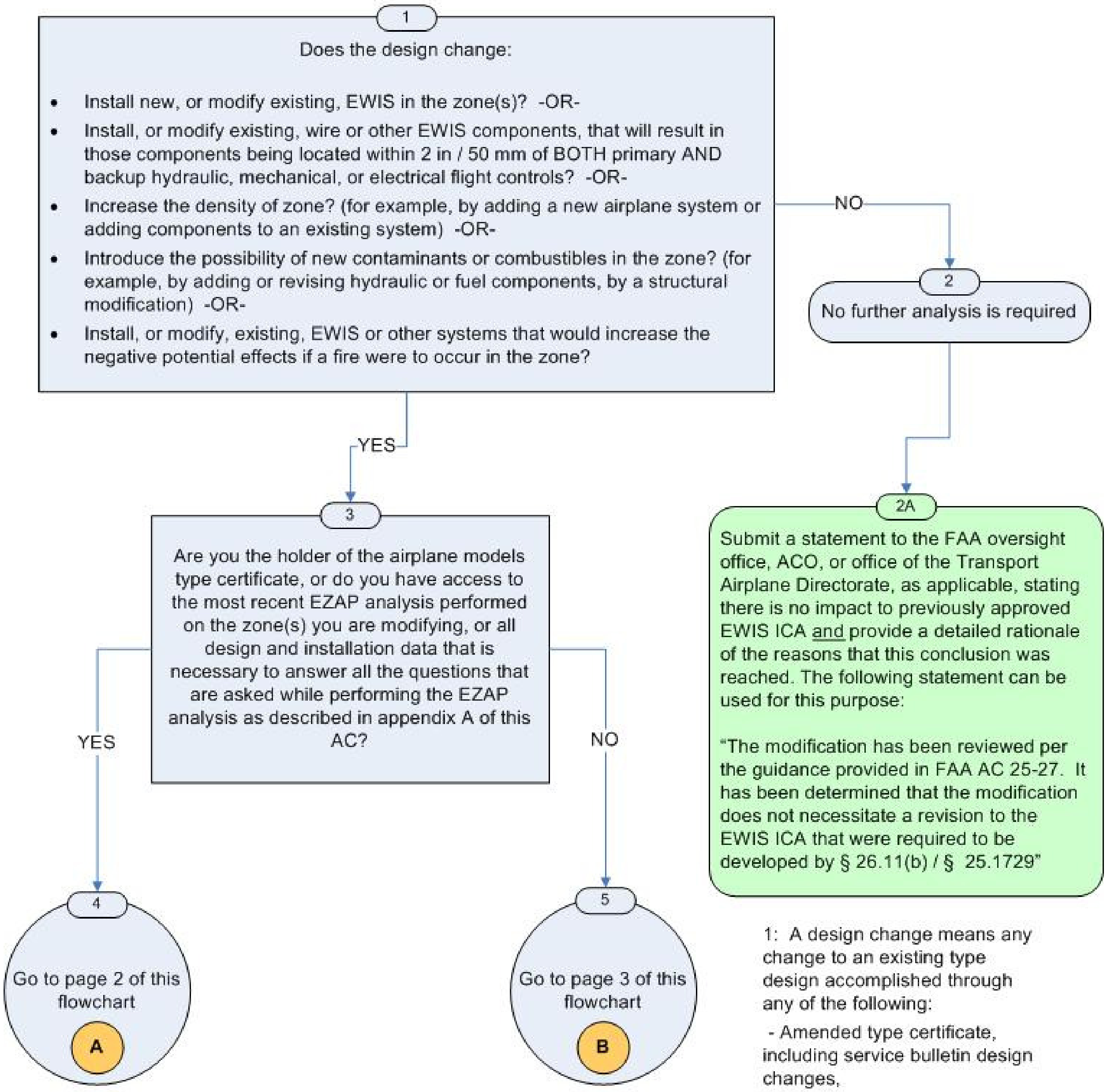
d. You can determine whether an amended TC, STC, or changes to an existing STC (referred to in this appendix as a “modification”) requires revision to previously approved EWIS ICA by following the process outlined in flowchart 1 of this appendix.

e. When using flowchart 1 of this appendix, you should refer to the guidance in the body of the AC, and appendix A for additional help, in understanding the questions being asked and the assumptions you should make while following the various logic steps of flowchart 1.

f. This appendix should also be used for design change proposals for which § 25.1729 is included in the certification basis.

Flowchart 1

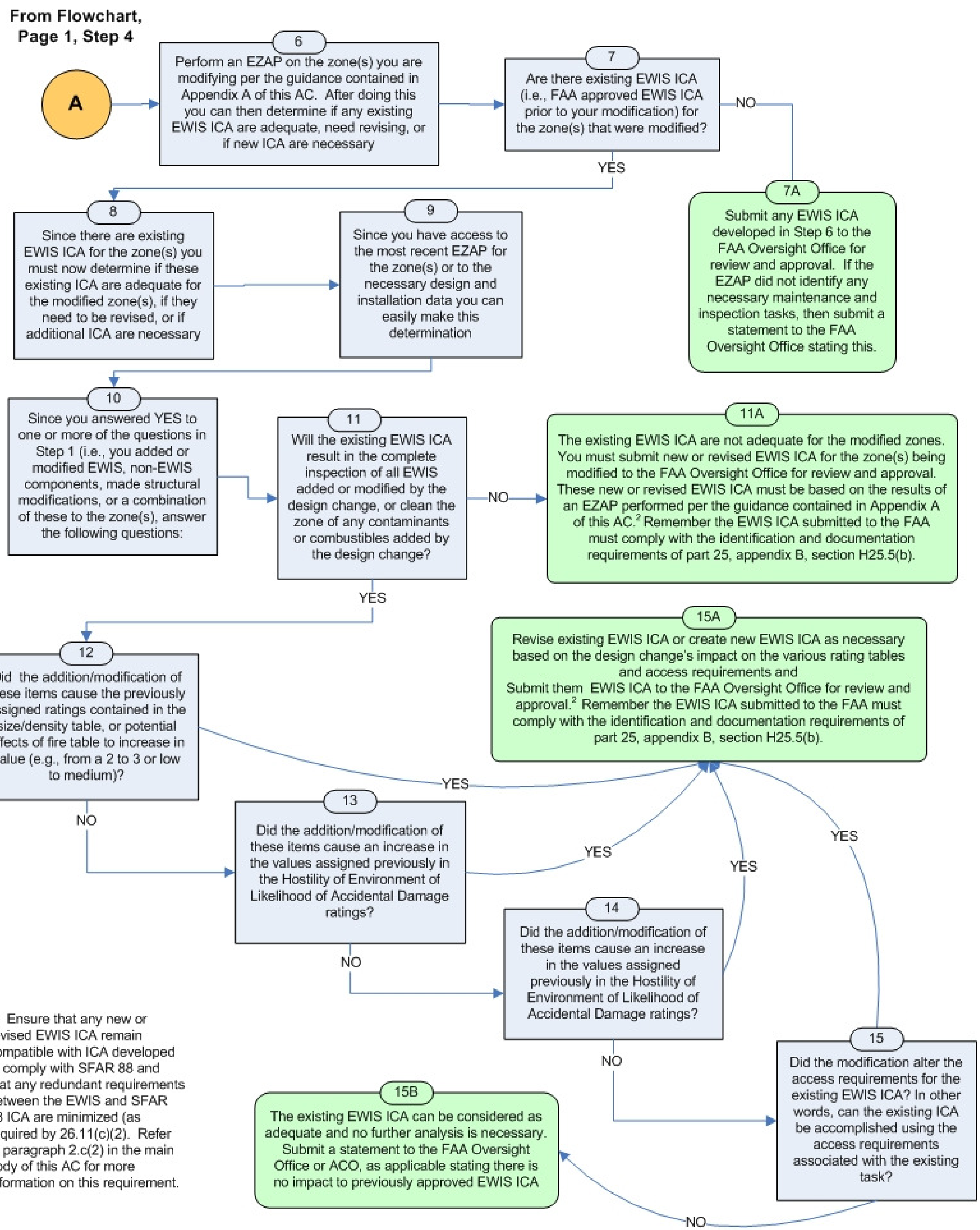
Development of EWIS ICA for Design Changes [1]



1: A design change means any change to an existing type design accomplished through any of the following:

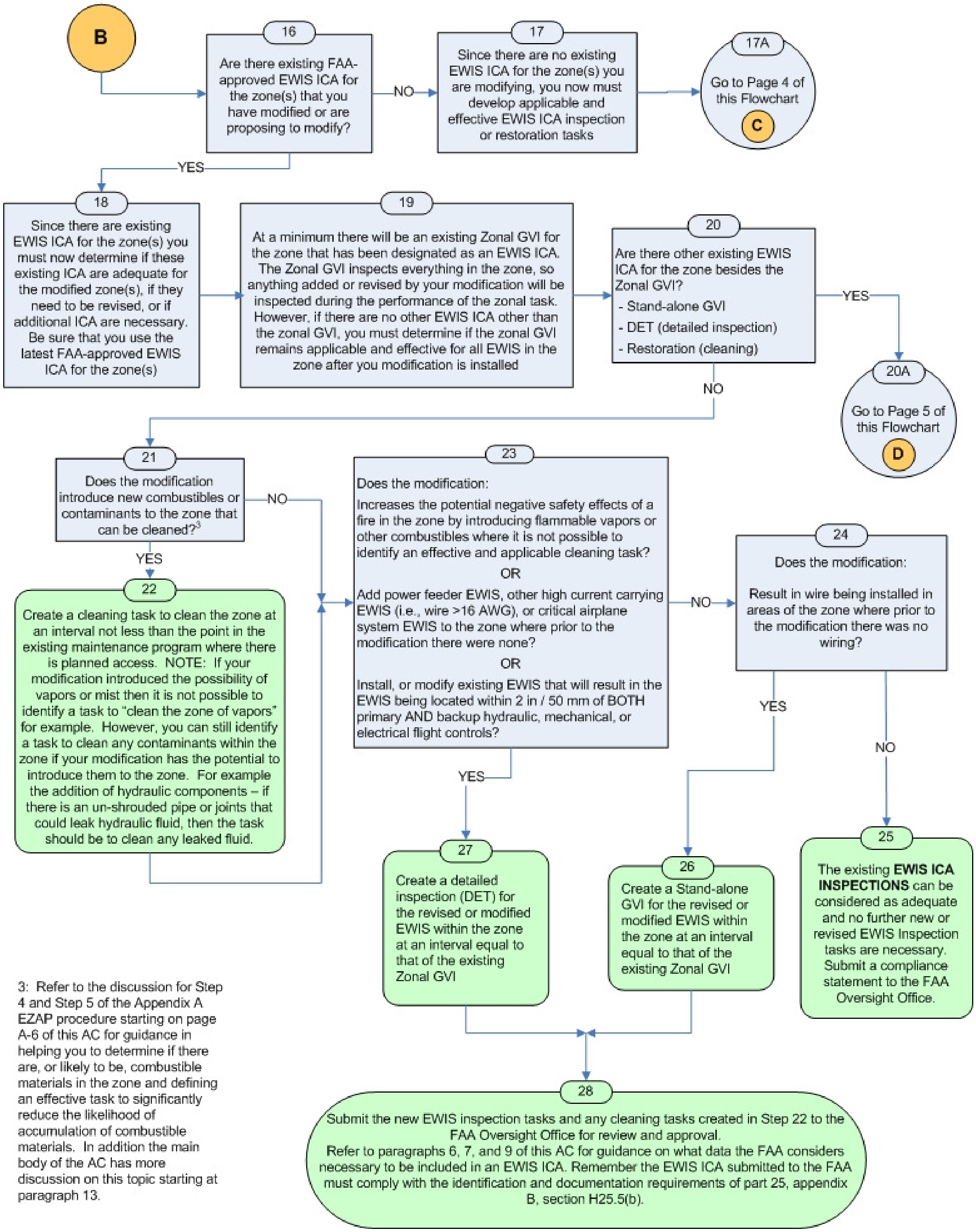
- Amended type certificate, including service bulletin design changes,
- Supplemental type certificate (STC)
- Changes to an existing STC

Flowchart 1, Page 2



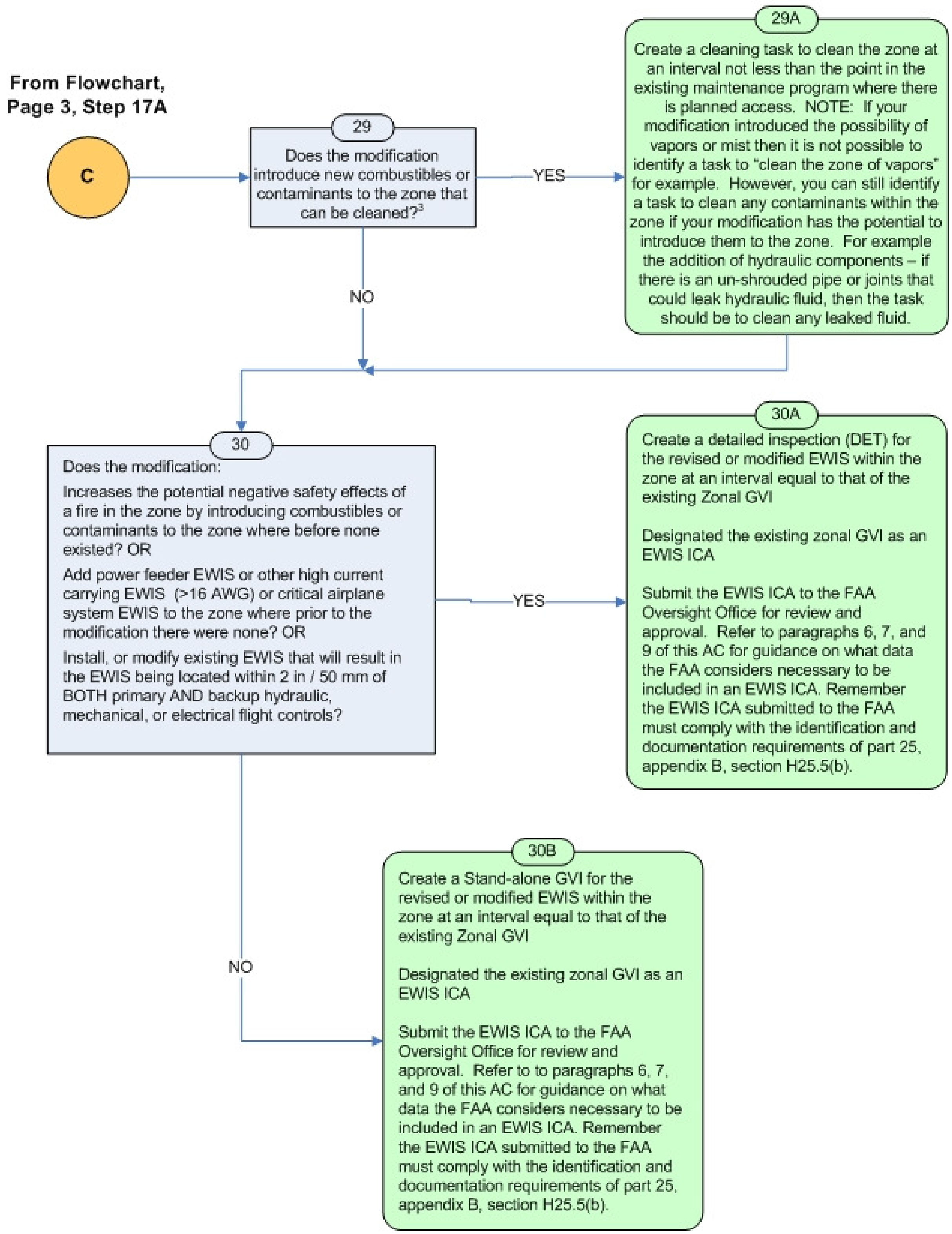
2: Ensure that any new or revised EWIS ICA remain compatible with ICA developed to comply with SFAR 88 and that any redundant requirements between the EWIS and SFAR 88 ICA are minimized (as required by 26.11(c)(2). Refer to paragraph 2.c(2) in the main body of this AC for more information on this requirement.

Flowchart 1, Page 3

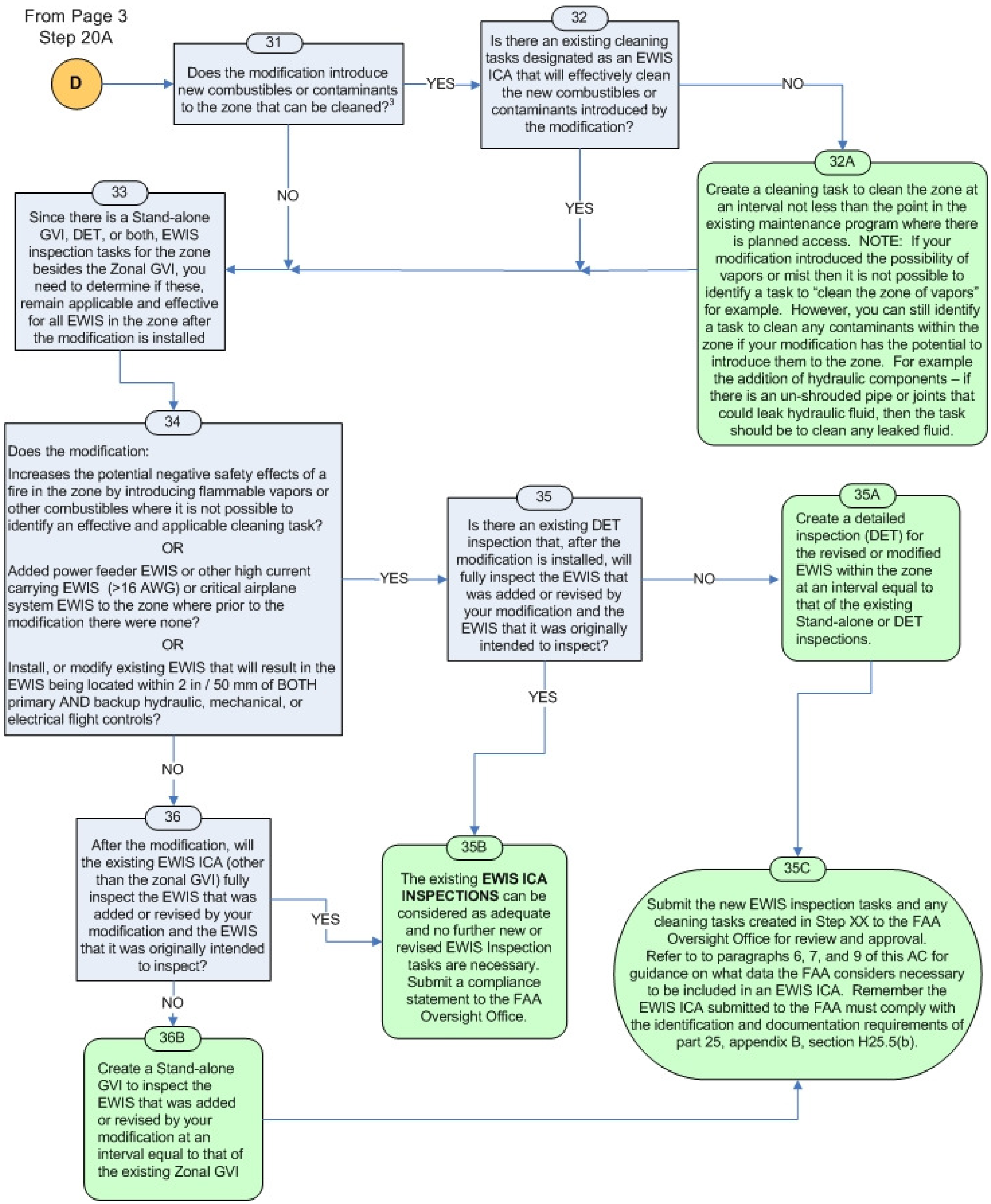


3: Refer to the discussion for Step 4 and Step 5 of the Appendix A EZAP procedure starting on page A-6 of this AC for guidance in helping you to determine if there are, or likely to be, combustible materials in the zone and defining an effective task to significantly reduce the likelihood of accumulation of combustible materials. In addition the main body of the AC has more discussion on this topic starting at paragraph 13.

Flowchart 1, Page 4



Flowchart 1, Page 5



Appendix C

Definitions

1. Aging Transport Systems Rulemaking Advisory Committee (ATSRAC)—The ATSRAC was an aviation rulemaking committee, chartered under 49 USC § 106(p)(5) and tasked with providing public recommendations to the FAA. The committee was chartered on January 19, 1999, by FAA Order 1110.127, which stated "The committee's primary task is to propose such revisions to the Federal Aviation Regulations and associated guidance material as may be appropriate to ensure that non-structural systems in transport airplanes are designed, maintained, and modified in a manner that ensures their continuing operational safety throughout the service life of the airplanes." The FAA sent a formal sunset letter to the ATSRAC on April 11, 2006.

2. Aircraft Evaluation Group (AEG)—Flight Standards Service (AFS) representatives who know the operational and maintenance aspects of a certification project and are responsible for helping to determine their operational suitability. This role includes providing support to the cognizant ACO in the review and approval of the initial ICA and later changes to it related to the safety initiatives referenced in this AC.

3. Aircraft Maintenance Manual (AMM)—A manual developed by the manufacturer of a particular airplane that contains information necessary for the continued airworthiness of that airplane.

4. Arc Tracking—A phenomenon in which a conductive carbon path forms across an insulating surface on electrical wiring. This carbon provides a short circuit path through which current can flow. Arc tracking is normally a result of electrical arcing. Arc tracking is also referred to as "carbon arc tracking," "wet arc tracking," or "dry arc tracking."

5. Auxiliary Tanks—Fuel tanks installed in an airplane that make additional fuel available for increasing the flight range of that airplane. The term "auxiliary" means that the tank is secondary to the airplane's main fuel tanks. Auxiliary tanks have been installed in various locations, including center wing structure, horizontal stabilizers, wings, and cargo compartments.

6. Combustible—For the purposes of this AC, the term combustible refers to the ability of any solid, liquid, or gaseous material to cause a fire to be sustained after removal of the ignition source. The term is used in place of inflammable/flammable. It should not be interpreted as identifying material that will burn when subjected to a continuous source of heat as occurs when a fire develops.

7. Contamination—For the purposes of this AC, wiring contamination refers to either of the following:

- Presence of a foreign material likely to cause degradation of wiring.
- Presence of a foreign material that is combustible, or capable of sustaining a fire after removal of ignition source.

8. Design Approval Holder (DAH)—The holder of any design approval, including type certificate, amended type certificate, supplemental type certificate, amended supplemental type certificate, parts manufacturer approval, Technical Standard Order (TSO) authorization, letter of TSO design approval, and field approvals. In particular contexts, the term DAH may also refer to applicants for design approvals.

9. Detailed Inspection (DET)—An intensive examination of a specific item, installation, or assembly to detect damage, failure, or irregularity. DET is discussed in greater detail in section 14b(1) of this AC.

10. Effective Task/Task Interval—An "effective" task is an inspection or maintenance task, performed at defined intervals, that will ensure that the desired outcome of the task is achieved. To be effective the task must reduce the risk of wire failure, to ensure safe operation. For example, a cleaning task to remove contaminants that have accumulated on a wire bundle would be considered effective if it cleaned the bundle sufficiently to minimize the potential of contaminant-induced failure of the bundle, and allow an inspection for wire defects to be performed. The methods and intervals for performing an effective task are developed using a combination of standard industry practices, expert opinion, and engineering judgment from operators, manufacturers, and regulatory authorities. The criteria for the effectiveness of a task should include safety and operational, as well as economic, considerations. Tasks should, at a minimum, be such that they will effectively accomplish all of the following:

- Make identification of failures possible.
- Detect wire degradation with frequent and consistent inspection intervals.
- Reduce the risk of failures.

11. Electrical Wire Interconnection Systems (EWIS)—An EWIS is defined by 14 CFR 25.1701. As defined by that section, EWIS means any wire, wiring device, or combination of these, including termination devices, installed in any area of the airplane for the purpose of transmitting electrical energy between two or more intended termination points. The complete regulatory definition appears in appendix E to this AC.

12. Enhanced Airworthiness Program for Airplane Systems (EAPAS)—A broad initiative designed to enhance the continued safety of airplane wiring systems from their design and installation until their retirement. The initiative is a result of an intensive data-gathering effort on airplane wiring systems done in cooperation with industry. It combines a variety of near- and long-term actions into a plan to increase awareness of wiring system degradation, to implement improved procedures for wiring maintenance and design, and to spread that information throughout the aviation community.

13. Environmentally Sealed Splice—A wire splice that ensures that moisture or fluid will not penetrate the spliced area.

14. Enhanced Zonal Analysis Procedure (EZAP)—A logical process for developing maintenance and inspection instructions for Electrical Wiring Interconnection Systems (EWIS).

15. FAA Oversight Office—The FAA oversight office is defined by 14 CFR 26.3 as “the aircraft certification office or office of the Transport Airplane Directorate with oversight responsibility for the relevant type certificate, supplemental type certificate, or manufacturer, as determined by the Administrator.”

16. Flammable Fluid Leakage Zone—Any area where flammable liquids or vapors are not intended to be present, but where they might exist due to leakage from flammable-fluid-carrying components (for example, leakage from tanks, lines). These zones are typically identified by the airplane manufacturer. Examples of such areas include:

- Wing leading and trailing edges (including any adjacent compartment such as the strut)
- Farings located below the fuel tanks
- Wheel wells
- Fuel pump enclosures
- Unpressurized areas of the fuselage surrounding fuel tanks
- Areas containing flammable fluid lines or tanks

17. Flight Standards Service (AFS) Offices—Offices located in FAA headquarters responsible for developing guidance and policy for Aircraft Evaluation Group (AEG) personnel and AFS field personnel (maintenance, avionics, and operations aviation safety inspectors) in the conduct of their responsibilities.

18. Fuel Tank Safety (FTS)—FTS, as used in the context of the EAPAS/FTS rule, refers to the operational requirements of 14 CFR parts 91, 121, 125, and 129 that were first issued in the 2001 FAA final rule “Transport Airplane Fuel Tank System Design Review, Flammability Reduction, and Maintenance and Inspection Requirements,” Docket No. FAA-1999-6411. The EAPAS/FTS final rule revised and renumbered these requirements.

19. Functional Failure—Failure of an item to perform its intended function within specified limits.

20. General Visual Inspection (GVI)—A visual examination of an interior or exterior area, installation, or assembly to detect obvious damage, failure, or irregularity. This level of inspection is made from within touching distance unless otherwise specified. A mirror may be necessary to enhance visual access to all exposed surfaces in the inspection area. This level of inspection is made under normally available lighting conditions such as daylight, hangar lighting, flashlight, or droplight and may require removal or opening of access panels or doors. Stands, ladders, or platforms may be required to gain proximity to the area being checked.

21. Instructions for Continued Airworthiness (ICA)—The information documented in accordance with 14 CFR 25.1529, 25.1729, or 26.11 that includes the applicable methods, inspections, processes, procedures, and airworthiness limitations required to keep the airplane airworthy throughout its operational life.

22. Lightning/High Intensity Radiated Field (L/HIRF) Protection—The protection of airplane electrical systems and structure from induced voltages or currents by means of shielded wires, raceways, bonding jumpers, connectors, composite fairings with conductive mesh, static dischargers, and the inherent conductivity of the structure; may include airplane specific devices, for example, radio frequency (RF) gaskets.

23. Maintenance—As defined in 14 CFR 1.1, "maintenance means inspection, overhaul, repair, preservation, and the replacement of parts, but excludes preventive maintenance." For the purposes of this advisory circular, maintenance also includes preventive maintenance, as described in both § 1.1 and paragraph (c) of appendix C to 14 CFR part 43. Section 1.1 of 14 CFR provides the following definition: "Preventive maintenance means simple or minor preservation operations and the replacement of small standard parts not involving complex assembly operations." Paragraph (c) of appendix A to 14 CFR part 43 lists the tasks that are considered preventive maintenance.

24. Maintenance Instructions—Information that provides recommended periods for cleaning, inspection, adjustment, testing, lubrication, degree of inspection, applicable wear tolerances, and recommended work necessary for each part of the airplane and its engine auxiliary power units, propellers, accessories, instruments, and equipment to provide for continued airworthiness of the airplane. Recommended overhaul periods and necessary cross-references to the Airworthiness Limitations section of the maintenance manual are also included.

25. Maintenance Significant Item (MSI)—Items (system or component) identified by the manufacturer whose failure could have one or more of the following results or characteristics:

- Could affect safety (on ground or in flight).
- Is undetectable during operations (on ground or in flight).
- Could have significant operational impact.
- Could have significant economic impact.

26. Maintenance Review Board Report (MRBR)—A report intended for use by air carriers that contains the initial minimum scheduled maintenance and inspection requirements for a particular transport category airplane maintenance program. Air carriers use the MRBR and its associated requirements to develop maintenance programs. See AC 121-22A, *Maintenance Review Board Procedures*, for more information.

27. Maintenance Steering Group 3 (MSG-3)—MSG-3 is a document issued by the ATA that addresses the development of scheduled maintenance using an analytical procedure contained within the document. As stated in the document, its objective is ". . . to present a means for developing the scheduled maintenance tasks and intervals which will be acceptable to the regulatory authorities, the operators, and the manufacturers. The scheduled maintenance task and interval details will be developed by coordination with specialists from the operators, manufacturers, and the regulatory authority of the country of manufacture. Specifically, this document outlines the general organization and decision processes for determining scheduled maintenance requirements initially projected for the life of the aircraft and/or powerplant."

28. Needling—The puncturing of a wire's insulation to make contact with the core to test the continuity and presence of voltage in the wire segment.

29. Special Federal Aviation Regulation No. 88 (SFAR 88)—SFAR 88 was issued in 2001 as part of FAA final rule "Transport Airplane Fuel Tank System Design Review, Flammability Reduction, and Maintenance and Inspection Requirements," Docket No. FAA-1999-6411. SFAR 88 requires the design approval holder to perform a safety review of the fuel tank system to show that fuel tank fires or explosions will not occur on airplanes of the approved design. In conducting the review, the design approval holder must demonstrate compliance with the new standards adopted for § 25.981(a) and (b) and the existing standards of § 25.901.

30. Source Document (SD)—A single document required by paragraph H25.5(b) to appendix H of 14 CFR part 25, which identifies all of the components comprising the EWIS ICA. The SD must either contain all of the required EWIS ICA, or reference other documents that contain that information.

31. Stand-Alone GVI—A general visual inspection that is not performed as part of a zonal inspection. Even in cases where the interval coincides with the zonal inspection, the stand-alone GVI remains an independent step on the work card.

32. Structural Significant Item (SSI)—Any detail, element, or assembly that contributes significantly to carrying flight, ground, pressure, or control loads and whose failure could affect the structural integrity necessary for the safety of the airplane.

33. Swarf—British term used to describe the metal particles generated from drilling and machining operations. Such particles may accumulate on and between wires within a wire bundle.

34. Standard Wiring Practices Manual (SWPM) (may also be known as the Electrical Standards Practice Manual (ESPM))—A manual (either in book or electronic form) produced by an airplane manufacturer containing information detailing procedures and practices for the universal repair and maintenance of electrical wire, cable bundles, and coaxial cables. Standard practices include procedures and practices for the inspection, installation, and removal of electrical systems components or other EWIS components, including methods of bundle attachment, wire splices, connectors and electrical terminal connections, and bonding/grounding.

35. Transport Airplane Directorate (TAD)—The FAA's directorates (Engines and Propellers, Rotorcraft, Small Airplanes, and Transport Airplane) develop and implement national regulatory requirements, policy and procedures for continued operational safety, and type, production, and airworthiness certifications for their designated products. Each directorate also has responsibility for overseeing certification activities (field office operations, certification programs, and projects) within its geographic area. TAD has oversight responsibility for transport category airplane design approvals and modifications worldwide, as well as oversight responsibility for over 900 production approval holders. TAD works closely with other FAA offices throughout the country and with foreign regulatory authorities to accomplish this mission.

36. Zonal Inspection—A collective term comprising selected general visual inspections and visual checks that are applied to each airplane zone, defined by access and area, to check system and power plant installations and structure for security and general condition. Zonal inspections are discussed in greater detail in section 10 of this AC.

37. Zonal Inspection Program (ZIP)—A part of an airplane model's overall maintenance program where the whole of the airplane is divided into zones. For each zone of the airplane, applicable maintenance instructions are identified.

Appendix D

1. FAA Oversight Offices for the Purposes of Part 26. Table 1 lists the FAA oversight offices, as currently determined by the Administrator, that oversee issuance of type certificates and amended type certificates for manufacturers of transport category airplanes with a passenger capacity of 30 passengers or a payload capacity of 7,500 pounds or greater.

Table 1. FAA Oversight Offices for Issuance of TCs and Amended TCs

Airplane Manufacturer	FAA Oversight Office
Aerospatiale	Transport Airplane Directorate, International Branch, ANM-116
Airbus	Transport Airplane Directorate, International Branch, ANM-116
BAE	Transport Airplane Directorate, International Branch, ANM-116
Boeing Puget Sound	Seattle Aircraft Certification Office
Boeing Long Beach	Los Angeles Aircraft Certification Office
Bombardier	New York Aircraft Certification Office
CASA	Transport Airplane Directorate, International Branch, ANM-116
deHavilland	New York Aircraft Certification Office
Dornier	Transport Airplane Directorate, International Branch, ANM-116
Embraer	Transport Airplane Directorate, International Branch, ANM-116
Fokker	Transport Airplane Directorate, International Branch, ANM-116
Lockheed	Atlanta Aircraft Certification Office
McDonnell-Douglas	Los Angeles Aircraft Certification Office
SAAB	Transport Airplane Directorate, International Branch, ANM-116

Appendix E

1. Applicable Regulations and Relevant Preamble Discussion.

a. The text of the regulations referred to in this AC is reproduced here for easy reference. This information is provided as reference only. If any deviation exists between the reference material provided here and the regulations contained in the Code of Federal Regulations (CFR), it is the regulations in the CFR that must be complied with. We have also included here the applicable preamble discussions from the EAPAS/FTS Notice of Proposed Rulemaking (NPRM) issued on October 5, 2005 (70 FR 58508). The preamble discussion for a particular regulation follows the text of that regulation. You should refer to the NPRM and the final rule for a complete discussion of the requirements. Only the most relevant text from those discussions has been reproduced here.

b. Comments received about the NPRM are summarized and discussed in the final rule. You can download a copy of the Final Rule from the Internet at http://www.gpoaccess.gov/cfr/. Mail, telephone, and fax request information is given in appendix G.

2. Part 25

a. Section 25.1701.

"**§ 25.1701 Definition.**

(a) As used in this chapter, electrical wiring interconnection system (EWIS) means any wire, wiring device, or combination of these, including termination devices, installed in any area of the airplane for the purpose of transmitting electrical energy, including data and signals, between two or more intended termination points. This includes:

(1) Wires and cables.

(2) Bus bars.

(3) The termination point on electrical devices, including those on relays, interrupters, switches, contactors, terminal blocks and circuit breakers, and other circuit protection devices.

(4) Connectors, including feed-through connectors.

(5) Connector accessories.

(6) Electrical grounding and bonding devices and their associated connections.

(7) Electrical splices.

(8) Materials used to provide additional protection for wires, including wire insulation, wire sleeving, and conduits that have electrical termination for the purpose of bonding.

(9) Shields or braids.

(10) Clamps and other devices used to route and support the wire bundle.

(11) Cable tie devices.

(12) Labels or other means of identification.

(13) Pressure seals.

(14) EWIS components inside shelves, panels, racks, junction boxes, distribution panels, and back-planes of equipment racks, including, but not limited to, circuit board back-planes, wire integration units, and external wiring of equipment.

(b) Except for the equipment indicated in paragraph (a)(14) of this section, EWIS components inside the following equipment, and the external connectors that are part of that equipment, are excluded from the definition in paragraph (a) of this section:

(1) Electrical equipment or avionics that are qualified to environmental conditions and testing procedures when those conditions and procedures are—

(i) Appropriate for the intended function and operating environment, and

(ii) Acceptable to the FAA.

(2) Portable electrical devices that are not part of the type design of the airplane. This includes personal entertainment devices and laptop computers.

(3) Fiber optics."

b. Section 25.1729.

(1) Regulation.

"**§ 25.1729 Instructions for Continued Airworthiness: EWIS.**

The applicant must prepare Instructions for Continued Airworthiness applicable to EWIS in accordance with Appendix H sections H25.4 and H25.5 to this part that are approved by the FAA."

(2) NPRM Preamble Discussion (70 FR 58526, October 6, 2005). (§ 25.1729 was proposed as § 25.1739).

"**Section 25.1739 Instructions for Continued Airworthiness: EWIS.**

Proposed § 25.1739 would require that applicants prepare EWIS ICA in accordance with the requirements of Appendix H to part 25. The proposed EWIS ICA requirements are discussed in the next section of this document."

c. Part 25, Appendix H, Section H25.5.

(1) Regulation.

"H25.5 *Electrical Wiring Interconnection System (EWIS) Instructions for Continued Airworthiness.*

(a) The applicant must prepare Instructions for Continued Airworthiness (ICA) applicable to EWIS as defined by § 25.1701 that are approved by the FAA and include the following:

(1) Maintenance and inspection requirements for the EWIS developed with the use of an enhanced zonal analysis procedure that includes:

(i) Identification of each zone of the airplane.

(ii) Identification of each zone that contains EWIS.

(iii) Identification of each zone containing EWIS that also contains combustible materials.

(iv) Identification of each zone in which EWIS is in close proximity to both primary and back-up hydraulic, mechanical, or electrical flight controls and lines.

(v) Identification of—

(A) tasks, and the intervals for performing those tasks, that will reduce the likelihood of ignition sources and accumulation of combustible material, and

(B) procedures, and the intervals for performing those procedures, that will effectively clean the EWIS components of combustible material if there is not an effective task to reduce the likelihood of combustible material accumulation.

(vi) Instructions for protections and caution information that will minimize contamination and accidental damage to EWIS, as applicable, during performance of maintenance, alteration, or repairs.

(2) Acceptable EWIS maintenance practices in a standard format.

(3) Wire separation requirements as determined under § 25.1707.

(4) Information explaining the EWIS identification method and requirements for identifying any changes to EWIS under § 25.1711.

(5) Electrical load data and instructions for updating that data.

(b) The EWIS ICA developed in accordance with the requirements of H25.5(a)(1) must be in the form of a document appropriate for the information to be provided, and they must be easily recognizable as EWIS ICA. This document must either contain the required EWIS ICA or specifically reference other portions of the ICA that contain this information."

(2) NPRM Preamble Discussion for Section H25.5 (70 FR 58532, October 6, 2005).

"**Appendix H to Part 25—Instructions for Continued Airworthiness**

As previously noted, improper maintenance, repair, and modifications often hasten the "aging" of EWIS. To properly maintain, repair, and modify airplane EWIS, certain information must be available to the designer, modifier, and installer. This information should be part of the ICA as required by current § 25.1529 and the proposed § 25.1739.

This proposal would amend Appendix H by adding a new section, H25.5, to require TC applicants to develop maintenance information for EWIS as part of the ICA as a requirement for getting a design approval. The proposed rule would also apply to applicants for design change approvals (supplemental TCs and amended TCs).

The proposal would require applicants for TCs to prepare ICA for EWIS that are approved by the FAA Oversight Office, in the form of a document that is easily recognizable as an EWIS ICA. To prepare these instructions, they must use an EZAP such as the one described in AC120-XX, "Program to Enhance Aircraft Electrical Wiring Interconnection System Maintenance" to perform a review of their representative airplane covering all areas, including the flightdeck (also known as the cockpit), electrical power center, fuel tank wiring and powerfeeder cables, as well as the engine. Applicants for design change approvals would have to perform a similar review for their proposed design changes.

A zonal analysis procedure is an assessment of the structures and systems within each physical zone of the airplane. It is used to develop an inspection program to assess the general condition and security of attachment of all system components and structures items contained in the zone, using general visual inspections (GVI). An enhanced zonal analysis procedure (EZAP) is an enhanced version of the zonal analysis procedure. It focuses on EWIS components. An EZAP-generated inspection program might call for the use of stand-alone GVI and detailed inspections (DET). A stand-alone GVI is one that is performed separately from the regularly scheduled GVI (typically more frequently) and is focused on a particular area or component. In this case, the focus would be wiring. So while the zonal analysis procedure would result in a regularly scheduled GVI for the entire zone, in which each of its systems and structures are inspected at the same time, the EZAP could result in additional GVIs or DETs for the EWIS in that zone, which occur more frequently. These inspection techniques are discussed later in this section.

An EZAP identifies the physical and environmental conditions contained in each zone of an airplane, analyzes their effects on electrical wiring, and assesses the possibilities for smoke and fire. From such an analysis, maintenance tasks can be developed to prevent ignition sources and to minimize the possibilities for combustion by minimizing the accumulation of combustible materials. Such a procedure would involve dividing the airplane into physical areas, or zones, including actual physical boundaries such as wing spars, bulkheads, and cabin floor, and access provisions for the zone, and identifying which of those zones contain EWIS components. For those zones with EWIS components, characteristics and components of all systems installed in the zone would be listed. The EWIS in the zone would be described, including information on the full range of power levels carried in the zone. And the presence or possibilities for ignition sources or accumulation of combustibles would be noted.

Combustibles are any materials that could cause a fire to be sustained in the event of an ignition source. Examples of combustible materials would be dust or lint accumulation, contaminated insulation blankets, and fuel or other combustible liquids or vapors. Wire contaminants are foreign materials that are likely to cause degradation of wiring. Wire contaminants can also be combustibles. Some commonly used airplane liquids, like engine oils, hydraulic fluids, and corrosion prevention compounds, might be readily combustible, but only in vapor or mist form. In that case, an assessment must be made of conditions that could exist within the zone that would convert the liquid to that form. Combustibles appearing as a result of any single failure must be considered. An example would be leaks from connection sites of unshrouded pipes. For the purposes of this new requirement, the term combustible does not refer to material that will burn when subjected to a continuous source of heat as occurs when a fire develops. Combustibles, as used here, will sustain a fire without a continuous ignition source.

An EZAP must address:

- Ventilation conditions in the zone and the density of the installations that would affect the presence and build-up of combustibles and the possibilities for combustion. Avionics and instruments located in the flightdeck and equipment bays, which generate heat and have relatively tightly packed installations, require cooling air flow. The air blown into the area for that cooling tends to deposit dust and lint on the equipment and EWIS components.

- Liquid contamination on wiring. Most synthetic oils and hydraulic fluids, while they might not be combustibles by themselves, could be an aggravating factor for accumulation of dust or lint. This accumulation could then present fuel for fire. Moisture on wiring may increase the probability of arcing from small breaches in the insulation, which could cause a fire. Moisture on wires that contain insulation breaches can also lead to “arc tracking.” As discussed previously, arc tracking is a phenomenon in which an electrical arc forms a conductive carbon path across an insulating surface. The carbon path then provides a short circuit path through which current can flow. Short circuit current flow from arc tracking can lead to loss of multiple airplane systems, structural damage, and fire.

- EWIS in close proximity to both primary and back-up hydraulic, mechanical, or electrical flight controls.

- The type of wiring discrepancies that must be addressed if they are identified by general visual or detailed inspections. A listing of typical wiring discrepancies that should be detectable during EZAP-derived EWIS inspections is given in AC120-XXX, Section B “Guidance for Zonal Inspections.”

- Proper cleaning methods for EWIS components.

Once information about such contaminants and combustibles within an airplane zone is collected, each identified possibility for combustion would then be addressed to determine whether a specific task could be performed to reduce that possibility. An example of a specific task to reduce build-up of combustibles on EWIS components is the use of temporary protective covers (such as plastic sheeting) over EWIS components in a zone where corrosion prevention fluids are being used. This would minimize the amount of fluid contamination of the EWIS components. Preventing fluid contamination reduces the probability of other contaminants, like dust and dirt, accumulating on the EWIS components. If no task can be developed to prevent accumulation of combustibles in a zone, such as the dust blown through the air by cooler fans, then tasks must be developed to minimize their buildup, such as scheduled cleaning.

Developing an ICA to define such tasks would include assessing whether particular methods of cleaning would actually damage the EWIS components. Although regular cleaning to prevent potential combustible build-up would be the most obvious task for an EWIS ICA, other procedures might also be called for. A detailed inspection of a hydraulic pipe might be appropriate, for instance, if high-pressure mist from a pinhole caused by corrosion could accumulate on a wire bundle in a low ventilation area, creating a possibility for electrical arcing.

Proximity of EWIS to both primary and back-up hydraulic, mechanical, or electrical flight controls within a zone would affect the criticality of inspections needed, their level of detail, and their frequency. Even in the absence of combustible material, wire arcing could adversely affect continued safe flight and landing if hydraulic pipes, mechanical cables, or wiring for fly-by-wire controls are routed close to other wiring.

The EZAP-generated ICA must be produced in the form of a single document, easily recognizable as EWIS ICA for that specific airplane model. The single document is relevant to the maintenance and inspection aspects of the ICA, and not the standard wiring practices manual or electrical load analysis, etc.

The ICA must define applicable and effective tasks, and the intervals for performing them, to:

- Minimize accumulation of combustible materials.
- Detect wire contaminants
- Detect wiring discrepancies that may not otherwise be reliably detected by inspections contained in existing maintenance programs.

As noted earlier, among the types of tasks to be developed from an EZAP are general visual inspections (GVI) and detailed inspections (DET). A GVI is defined as a visual examination of an interior or exterior area, installation, or assembly to detect obvious damage, failure, or irregularity. This level of inspection is made from within touching distance of the inspected object unless otherwise specified. It is made under normally available lighting conditions such as daylight, hangar lighting, flashlight, or droplight and may require removal or opening of access panels or doors. It may be necessary to use a mirror to improve visual access to all exposed surfaces in the inspection area. Stands, ladders, or platforms may be required to gain proximity to the area being checked. It is expected that the area to be inspected is clean enough to minimize the possibility that accumulated dirt, grease, or other contaminants might hide unsatisfactory conditions that would otherwise be obvious. It is also expected, as an outcome of the EZAP applied to EWIS, that any cleaning considered necessary would be performed in accordance with procedures that minimize the possibility of the cleaning process itself introducing anomalies. The EZAP must identify guidelines to assist personnel performing a GVI in identifying wiring discrepancies and in assessing what effect such discrepancies, if found, could have on adjacent systems, particularly if these include wiring. As discussed previously, a list of typical wiring discrepancies that should be addressed is contained in proposed AC120-XX, Section B, "Guidance for Zonal Inspections."

A DET is an intensive examination of a specific item, installation, or assembly to detect damage, failure, or irregularity. Available lighting is normally supplemented with a direct source of good lighting at an intensity considered appropriate. Inspection aids, such as mirrors, magnifying lenses, or other means, may be necessary. Surface cleaning and elaborate access procedures may be required. A DET can be more than just a visual inspection. It may include tactile assessment to check a component or assembly for tightness and security. Such an inspection may be needed to ensure the continued integrity of installations such as bonding jumpers, terminal connectors, etc.

A DET would be required when the developer of the EZAP determines that a GVI is inadequate to reliably detect anomalies or degradation of EWIS components. Any detected discrepancies must be corrected according to the operator's approved maintenance procedures. It is not intended that the EZAP ICA identify how to correct detected discrepancies.

To prevent improper modification and repair of existing EWIS or the improper installation of a new EWIS, modification designers and modification personnel must know the applicable standard wiring practices, EWIS identification requirements, and electrical load data for the airplane undergoing modification. The proposed Appendix H25.5 would also require that the following information be included in ICA applicable to EWIS:

- Standard wiring practices data.

- Wire separation design guidelines.

- Information to explain the airplane's EWIS identification method required by the proposed § 25.1711.

- Electrical load data and instructions for updating that data. Such information will help ensure that those modifying, repairing, or installing new EWIS will not perform any action that will adversely affect previously certified systems and unintentionally introduce potential hazards.

Standard wiring practices are defined as standards developed by the specific airplane manufacturer or industry-wide standards for the repair and maintenance of EWIS. They include procedures and practices for the installation, repair, and removal of EWIS components, including information about wire splices, methods of bundle attachment, connectors and electrical terminal connections, bonding, and grounding. Although a standard wiring practices manual is not a design manual, and those designing a new EWIS modification for a specific model airplane should not use it as such, it does provide the designer with insight into the types of EWIS components used by the TC holder and the procedures recommended by the manufacturer for maintenance or repair that supports continued airworthiness of the components.

EWIS separation guidelines are important for maintaining the safe operation of the airplane. Maintenance and repair personnel need to be aware of the type certificate holders' separation requirements so they do not compromise separation in previously certified systems. In fuel tank systems, the separation of certain wires may be critical design configuration control items and therefore qualify as an airworthiness limitation. Maintenance personnel need to be aware of these guidelines and limitations because many times wire bundles must be moved or removed to perform necessary maintenance. They must be able to readily identify EWIS associated with systems essential to the safe operation of the airplane.

Similarly, those who design and install new EWIS need to be aware of separation requirements so they can use the same methods to develop the required separation for the EWIS they are adding to the airplane. This would help to ensure both that newly added EWIS is adequately separated from other EWIS, airplane system components, and structure so they do not damage the added EWIS, and that the addition of the new EWIS does not invalidate separation for previously certified EWIS.

Electrical load data and the instructions for updating that data are necessary to help ensure that future modifications or additions of equipment that consume electrical power do not exceed the generating capacity of the onboard electrical generation and distribution system. The existing § 25.1351(a)(1) mandates that the required generating capacity, and the number and kinds of power sources, must be determined by an electrical load analysis. Typically, after an airplane is delivered and enters service, it is modified numerous times throughout its service life. Each addition or deletion of an electrical-power-consuming system changes the electrical load requirements. The only way to ensure that the capacity of the overall generating and distribution system, as well as individual electrical buses, is not exceeded is to have an up-to-date electrical load analysis. The best way to ensure that an up-to-date electrical load analysis is maintained is for the type certificate holder to include such data in the ICA provided with the airplane when it is first delivered to a customer, along with recommended practices for keeping it updated as electrical loads are deleted and added."

3. Part 26

a. Section 26.3.

"**§ 26.3 Definitions**

For the purposes of this part:

FAA Oversight Office is the aircraft certification office or office of the Transport Airplane Directorate with oversight responsibility for the relevant type certificate, supplemental type certificate, or manufacturer, as determined by the Administrator."

b. Section 26.11.

"§ 26.11 Electrical wiring interconnection systems (EWIS) maintenance program

(a) Except as provided in paragraph (g) of this section, this section applies to transport category, turbine-powered airplanes with a type certificate issued after January 1, 1958, that, as a result of the original certification, or later increase in capacity, have—

(1) A maximum type-certificated passenger capacity of 30 or more or

(2) A maximum payload capacity of 7,500 pounds or more.

(b) Holders of, and applicants for, type certificates, as identified in paragraph (d) of this section must develop Instructions for Continued Airworthiness (ICA) for the representative airplane's EWIS in accordance with part 25, Appendix H paragraphs H25.5(a)(1) and (b) of this subchapter in effect on [effective date of this final rule] for each affected type design, and submit those ICA for review and approval by the FAA Oversight Office. For purposes of this section, the "representative airplane" is the configuration of each model series airplane that incorporates all variations of EWIS used in production on that series airplane, and all TC-holder-designed modifications mandated by airworthiness directive as of the effective date of this rule. Each person specified in paragraph (d) of this section must also review any fuel tank system ICA developed by that person to comply with SFAR 88 to ensure compatibility with the EWIS ICA, including minimizing redundant requirements.

(c) Applicants for amendments to type certificates and supplemental type certificates, as identified in paragraph (d) of this section, must:

(1) Evaluate whether the design change for which approval is sought necessitates a revision to the ICA required by paragraph (b) of this section to comply with the requirements of Appendix H, paragraphs H25.5(a)(1) and (b). If so, the applicant must develop and submit the necessary revisions for review and approval by the FAA Oversight Office.

(2) Ensure that any revised EWIS ICA remain compatible with any fuel tank system ICA previously developed to comply with SFAR 88 and any redundant requirements between them are minimized.

(d) The following persons must comply with the requirements of paragraph (b) or (c) of this section, as applicable, before the dates specified.

(1) Holders of type certificates (TC): [insert date 24 months after effective date]

(2) Applicants for TCs, and amendments to TCs (including service bulletins describing design changes), if the date of application was before [effective date of final rule] and the certificate was issued on or after [effective date of final rule]: [insert date 24 months after effective date], or the date the certificate is issued, whichever occurs later.

(3) Unless compliance with § 25.1729 of this subchapter is required or elected, applicants for amendments to TCs, if the application was filed on or after [effective date of final

rule]: [insert date 24 months after effective date], or the date of approval of the certificate, whichever occurs later.

(4) Applicants for supplemental type certificates (STC), including changes to existing STCs, if the date of application was before [effective date of final rule] and the certificate was issued on or after [effective date of final rule]: [insert date 30 months after effective date], or the date of approval of the certificate, whichever occurs later.

(5) Unless compliance with § 25.1729 of this subchapter is required or elected, applicants for STCs, including changes to existing STCs, if the application was filed on or after [effective date of final rule], [insert date 30 months after effective date], or the date of approval of the certificate, whichever occurs later.

(e) Each person identified in paragraphs (d)(1), (d)(2), and (d)(4) of this section must submit to the FAA Oversight Office for approval a compliance plan by [insert date 90 days after effective date of final rule]. The compliance plan must include the following information:

(1) A proposed project schedule, identifying all major milestones, for meeting the compliance dates specified in paragraph (d) of this section.

(2) A proposed means of compliance with this section, identifying all required submissions, including all compliance items as mandated in part 25, Appendix H paragraphs H25.5(a)(1) and (b) of this subchapter in effect on [effective date of this final rule], and all data to be developed to substantiate compliance.

(3) A proposal for submitting a draft of all compliance items required by paragraph (e)(2) of this section for review by the FAA Oversight Office not less than 60 days before the compliance time specified in paragraph (d) of this section.

(4) A proposal for how the approved ICA will be made available to affected persons.

(f) Each affected person must implement the compliance plan, or later approved revisions, as approved in compliance with paragraph (e) of this section.

(g) This section does not apply to the following airplane models:

(1) Lockheed L-188

(2) Bombardier CL-44

(3) Mitsubishi YS-11

(4) British Aerospace BAC 1-11

(5) Concorde

(6) deHavilland D.H. 106 Comet 4C

(7) VFW-Vereinigte Flugtechnische Werk VFW-614

(8) Illyushin Aviation IL 96T

(9) Bristol Aircraft Britannia 305

(10) Handley Page Herald Type 300

(11) Avions Marcel Dassault - Breguet Aviation Mercure 100C

(12) Airbus Caravelle

(13) Lockheed L-300"

b. NPRM Preamble Discussion (70 FR 58526, October 6, 2005). Part 26 was proposed as a new Subpart I to Part 25. The placement of these requirements was changed in the final rule.

"**B. Part 25 Subpart I—Continued Airworthiness and Related Part 25 Changes**

As discussed below, the following proposals are applicable to holders of existing TCs for transport category airplanes and applicants for approval of design changes to those certificates. On July 12, 2005, we issued policy statement PS-ANM110-7-12-2005, "Safety – A Shared Responsibility – New Direction for Addressing Airworthiness Issues for Transport Airplanes" (70 FR 40166). The policy states, in part, "Based on our evaluation of more effective regulatory approaches for certain types of safety initiatives and the comments received from the Aging Airplane Program Update (July 30, 2004), the FAA has concluded that we need to adopt a regulatory approach recognizing the shared responsibility between design approval holders (DAH) and operators. When we decide that general rulemaking is needed to address an airworthiness issue, and believe the safety objective can only be fully achieved if the DAHs provide operators with the necessary information in a timely manner, we will propose requirements for the affected DAHs to provide that information by a certain date."

We believe that the safety objectives contained in this proposal can only be reliably achieved and acceptable to the FAA if the DAHs provide the operators with the EWIS- and fuel-tank-system-related maintenance information required by the proposed operational rules for Parts 91, 121, 125, and 129. Our determination that DAH requirements are necessary to support the initiatives contained in this proposal is based on several factors:

- Developing EWIS and fuel tank system ICA is complex. Only the airplane manufacturer, or DAH, has access to all the necessary type design data needed for the timely and efficient development of the required EWIS and fuel tank system maintenance tasks.

- FAA-approved EWIS and fuel tank system ICA need to be available in a timely manner. Due to the complexity of these ICA, we need to ensure that the DAHs submit them for approval on schedule. This will allow the FAA Oversight Office having approval authority to ensure that the ICA are acceptable, are available on time, and can be readily implemented by the affected operators. Additionally, accurate and timely information is necessary to ensure alignment with the requirements of the Fuel Tank Safety Rule (FTSR). The compliance deadline for the operational requirements of the FTSR was extended to facilitate this alignment, as stated in the Federal Register notice "Fuel Tank Safety Compliance Extension (Final Rule) and Aging Airplane Program Update (Request for Comments)" (69 FR 45936).

- The proposals in this NPRM affect a large number of different types of transport airplanes. Because the safety issues addressed by this proposal are common to many airplanes, we need to ensure that technical requirements are met consistently and the processes of compliance are consistent. This will ensure that the proposed safety enhancements are implemented in a standardized manner.

- The safety objectives of this proposal need to be maintained for the operational life of the airplane. We need to ensure that future design changes to the type design of the airplane do not degrade the safety enhancements achieved by the initial incorporation of EWIS and fuel tank system ICA. We need to be aware of future changes to the type designs to ensure that these changes do not invalidate the maintenance tasks assigned to a particular type design when the ICA are first developed under the requirements of this proposal.

Based on the above reasons and the stated safety objectives of FAA policy PS-ANM110-7-12-2005, we are proposing to implement DAH requirements applicable to EWIS and fuel tank system ICA.

In the past, we have issued a similar requirement in the form of a special federal aviation regulation (SFAR). But SFARs appear in various places in the CFR and are difficult to reference as a whole. The FAA believes that placing these types of requirements in a new subpart of part 25, which contains the airworthiness standards for transport category airplanes, would provide a single, readily accessible location for this type of requirement. Therefore, we are proposing new subpart I to part 25 to contain these requirements.

In preliminary discussions with foreign airworthiness authorities of the concept of this new subpart, they have expressed concerns that their regulatory systems may not be able to accommodate these types of requirements in their counterparts to part 25. While agreeing on the need for these types of requirements, they have suggested that it may be more appropriate to place them in part 21 or another location. As discussed below, because we expect these new subpart I requirements to be similar to new part 25 airworthiness standards, we have tentatively decided to place them in part 25. However, we specifically request comments on the appropriate location of these requirements, particularly from the foreign authorities. If, based on comments received, we conclude that another location is more appropriate, we may move them in the final rule. Because such a move would not affect the substance of the requirements themselves, we would not consider this to be an expansion of the scope of this rulemaking that would require additional notice and comment procedures.

Section 25.1 Applicability.

As stated in § 25.1, part 25 currently prescribes airworthiness standards for issuance of TCs, and changes to those certificates, for transport category airplanes. As discussed in more detail above, with this NPRM the FAA is proposing to expand the coverage of part 25 to include a new subpart I containing requirements that must be complied with by current holders of these certificates. Therefore, we are proposing to amend § 25.1, "Applicability," to state that part 25 also includes requirements for holders of these design certificates. As discussed in the FAA's final rule, "Fuel Tank Safety Compliance Extension and Aging Airplane Program Update" (69 FR 45936), this NPRM is one of several proposals for adoption of these kinds of requirements for current holders of type certificates.

A theme common to this and other possible subpart I proposed rules is that the rulemaking projects include proposals for changes to operational rules to require operators to implement programs or take other actions that the FAA has determined are necessary for safety. In several recent rules we have adopted operational requirements without a corresponding requirement for design approval holders to develop and provide the necessary data and documents to support the operators' compliance. The difficulty encountered by operators in complying with these rules has convinced us that the corresponding design approval holder requirements are necessary to enable operators to comply by the regulatory deadlines.

Section 25.2 Special retroactive requirements.

Section 25.2 currently contains "special retroactive requirements." These requirements are "retroactive" in the sense that they require applicants for changes to TCs to comply with requirements that were not applicable to the original TC. As discussed below, proposed subpart I would have a similar effect, in that it would impose new requirements on both existing design certificate holders and applicants for changes to those certificates. Therefore, we are proposing to amend § 25.2 to make reference to proposed subpart I.

Section 25.1801 Purpose and Definition.

Paragraph (a) of this section states that this subpart would establish requirements for holders of TCs to take actions necessary to address particular safety concerns or to support the continued airworthiness of transport category airplanes. Such actions may include, but are not limited to, performing assessments, making design changes, developing revisions to ICA, and making necessary documentation available to affected persons.

The specific applicability of each subpart I rule will be established as part of the rulemaking adopting each rule. Generally this subpart would also apply to applicants for type certificates and changes that are pending as of the effective date of this rule. It would also apply to future applicants for changes to existing type certificates. Under § 21.101, the FAA may determine that it is not appropriate to require such applicants to comply with new airworthiness standards, such as proposed new subpart H. However, it is appropriate for them to comply with the same requirements as existing certificate holders. Otherwise, the safety improvements that result from type certificate holder compliance with these requirements could be undone by later modifications.

For example, in the case of this proposed rule, as discussed below, operators would be required to revise their maintenance programs based on EWIS ICA developed by the type certificate holder. Unless future STC applicants are required to provide similar ICA for their modifications, the TC holder's ICA could become obsolete or, in some cases, even provide incorrect and potentially unsafe information as applied to the STC holder's modification. In other cases, because subpart I rules accompany corresponding operating requirements, failure of an STC applicant to comply with a subpart I rule could make it impossible for an operator to comply with the corresponding operating requirement. Subpart I does not apply to future applicants for TCs, because those applicants will be covered by other proposed changes to part 25, including Appendix H.

Therefore, adoption of a new subpart I rule would also necessitate new requirements for certification of changes to TCs that are in addition to the requirements that are specified under § 21.101. Under that section, if a change is "significant" and certain other criteria are met, the applicant would have to show compliance with the latest airworthiness requirements. For example, an applicant applying for such a change after this final rule becomes effective would have to comply with the proposed EWIS requirements in subpart H. Even if we determine that these broader regulations do not apply, the applicant for a change must still comply with the subpart I rule.

Paragraph (b) of this section provides a definition of the term "FAA Oversight Office." The FAA Oversight Office is the aircraft certification office or office of the Transport Airplane Directorate with oversight responsibility for the relevant TC or STC, as determined by the Administrator. As stated later in the discussion of the proposed operating rules, the primary means for operators to comply with those requirements would be by implementing programs or taking other actions developed by the TC and STC holders under this proposed subpart. In each case, to ensure compliance with the relevant subpart I rule, the TC and STC holder's compliance documentation (for example, in this case, EWIS ICA) must be submitted to the FAA Oversight Office. Because we expect this will be a standard approach to compliance with the requirements of this subpart, we are including this definition in this section to avoid having to repeat it in each section within this subpart.

25.1805 Electrical Wiring Interconnection Systems (EWIS) Maintenance Program.

This proposal would apply to holders of TCs and to applicants for new TCs, amended TCs, and supplemental TCs if the application was filed before the effective date of this rule and the certificate was issued on or after the effective date of this rule. It would also apply to future applicants for approval of changes to existing TCs.

Paragraph (a) states that this rule would apply, with some exceptions, to transport category turbine-powered airplanes with a maximum type-certificated capacity of 30 or more passengers, or a maximum payload capacity of 7500 pounds or more resulting from the original certification of the airplane or later increase in capacity. This would result in the coverage of airplanes where the safety benefits and the public interest are the greatest.

The reference to the originally certificated capacity, or later increase in capacity, is intended to address two situations:

- In the past, some designers and operators have tried to avoid applying requirements mandated only for airplanes over specified capacities by getting a design change approval for a slightly lower capacity. By referencing the capacity resulting from original certification, this proposal would remove this possible means of avoiding compliance.

- It is also possible that an airplane design could be originally certified with a capacity slightly lower than the minimum specified in this section, but through later design changes, the capacity could be increased above this minimum. The reference to later increases in capacity would ensure that, if this occurs, the design would have to meet the requirements of this section.

Compliance is not proposed for airplanes with a certificated passenger capacity of fewer than 30 passengers, or having a maximum capacity of less than 7500 pounds payload resulting from original certification, because it is not clear at this time that the possible benefits for those airplanes would be proportionate to the cost involved. The FAA intends to evaluate the merits of applying these requirements to those airplanes. We are currently working with ATSRAC to assess how these issues might be addressed in those transport category airplanes. We request comments on the feasibility and benefits of requiring holders of TCs for those airplanes to comply with these requirements.

This proposed rule, as it applies to EWIS, is not applicable to holders of existing (already issued) STCs. Often, the wire design for STC installations of EWIS was based on operator or repair station standard practices and therefore details of the installation are not available. In the cases where such information is available, it would usually indicate that the wiring for the modification follows the same path, or is in the same airplane zone, as the wiring in the original type design. We anticipate that operators would inspect those areas while performing the TC holder's EZAP program. We also expect that any possible discrepancies will be further mitigated by operators incorporating applicable EWIS maintenance tasks into the maintenance program for that zone. Accordingly, the FAA has decided not to require compliance with this section for existing STCs. However, if an existing STC is amended, this section would apply to the amendment.

TC holders, who design EWIS on airplanes, are the technical experts who possess information about those systems. This proposal would apply to the following:

- TC holders.

- Applicants for TCs and for approval of design changes to existing TCs whose applications are pending when this rule becomes effective.

- Future applicants for approval of design changes to existing TCs.

Section 25.1805(b) would require TC holders to complete a comprehensive assessment of the EWIS of each "representative" airplane for which they hold a TC, develop inspection and maintenance instructions for them, and incorporate those instructions into the airplane's ICA. The "representative" airplane is defined as the configuration of each model series airplane that incorporates all the variations of EWIS used on that model, and that includes all TC-holder-designed modifications mandated by AD, as of the effective date of this rule.

For example, for the Boeing Model 737, the representative airplane would be the configuration of each of the airplane series, 737-100 through 737-900 that incorporates all the variations of EWIS used in producing each airplane series. The purpose of this definition is to ensure that the TC holder considers the full range of EWIS configurations that may affect the results of the EZAP. Further, AD 99-03-04 applies to all Boeing Model 737-100, -200, -300, -400, and -500 series airplanes. It requires installation of components to provide shielding and separation of the fuel system wiring from adjacent wiring. It also requires installation of flame arrestors and pressure relief valves in the fuel vent system. Boeing would be required to develop ICA for each of those series airplanes as modified by installation of these components and all other modifications mandated by ADs.

The purpose of including these mandated design changes is to ensure that the TC holder's EZAP addresses the existing configuration of airplanes in the operating fleet, rather than just the configuration produced and delivered by the manufacturer.

Applicants for approval of design changes would be required to evaluate the effect of their proposed change on the EWIS ICA developed by the TC holder for the representative airplane and to develop EWIS ICA to address those effects. For TC holders, this requirement would apply to any design changes that may affect the ICA for the representative airplane. This includes service bulletins describing such design changes. Under § 21.113, these design changes are amendments to the TC.

A description of what must be included in those ICA, and the EZAP that must be used to develop them, is contained in the section of this preamble discussing the proposed revision to Appendix H, part 25.

The requirement for ICA was effective on January 28, 1981. TC holders whose application was dated before that date are not subject to that requirement. This proposal would require TC holders who do not have ICA for specific airplane models to create EWIS ICA for them. As discussed below, air carriers and operators of those airplanes would then be required to revise their maintenance or inspection programs based on the new ICA for EWIS and fuel tank systems.

As discussed earlier, SFAR 88 requires TC holders to develop maintenance and inspection instructions to assure the safety of the fuel tank system. Proposed § 25.1805(b) would require that TC holders align the fuel tank system instructions with the results of the EZAP applied to EWIS to ensure compatibility and minimize redundancies. All EWIS would be subject to review in developing the EWIS ICA, and the appropriate instructions for their maintenance and inspection would be required. But some EWIS are also part of the fuel tank system. The requirements for their maintenance and inspection might be more specific than those for wiring in general, and might contain additional requirements. That is why the two must be reviewed for compatibility.

As discussed later in this section, the ICA for fuel tank system electrical wiring required by SFAR 88 will be determined in accordance with guidance provided by Policy Statement ANM100-2004-1129, "Process for Developing Instructions for Maintenance and Inspection of Fuel Tank Systems Required by SFAR 88" (a copy of which may be found in the docket), or other acceptable process. Compliance with Subpart I will require ICA for the same wire to be determined using an EZAP. While these processes have similarities, they may result in identification of different tasks and intervals. The ICA maintenance tasks and intervals that result from these determinations are expected to be additive. If there is a conflict in the task or interval, for purposes of this section, the FAA Oversight Office will resolve the conflict.

The ICA should be reviewed to ensure that any maintenance tasks for EWIS do not compromise fuel tank system wire requirements, such as separation or configuration specifications. If there is an inspection or maintenance requirement for EWIS and the fuel tank system within the same zone, there must be an effort to align the task interval. In addition, design certificate holder's existing documents containing EWIS and fuel tank system ICA should be reviewed to either remove or cross-reference redundant information.

The compliance plan required by this proposal must include identification of those common locations in the airplane where EWIS and fuel tank ICA apply. The considerations for compatibility and minimization of redundancy for the two systems will be reviewed and approved by the FAA Oversight Office. The plan for documenting the required ICA for EWIS and fuel tank system will also be reviewed as part of the compliance plan. These documents are critical to the effort that will be required of operators to show compliance with the operational rules contained in this proposal. We intend that the ICA information, both in content and format, will be readily usable by the affected operators for developing proposed changes to their maintenance or inspection programs. Generally, the information contained in the ICA for the fuel tank system required by SFAR 88 would include:

- The location of the fuel tank system components to be maintained or inspected and any access requirements.

- Any unique procedures required, such as special, detailed inspections or dual sign-off of maintenance records.

- Specific task information, such as inspections defined by pictures or schematics.

- Intervals for any repetitive tasks.

- Methods, techniques, and practices required to perform the task.

- Criteria for passing inspections.

- Any special equipment or test apparatus required.

- Critical Design Configuration Control Limitations—for example, wire separation or pump impeller material specifications—that cannot be altered, except in accordance with the applicable limitation.

The information for EWIS ICA would generally include:

- Identification of each zone of the airplane.

- Identification of each zone that contains EWIS.

- Identification of each zone containing EWIS that also contains combustible material.

- Identification of each zone in which EWIS is in close proximity to both primary and back-up hydraulic, mechanical, or electrical flight controls and lines.

- The location of the EWIS components to be maintained or inspected and any access requirements.

- Any unique procedures required, such as special, detailed inspections, or a dual sign-off of maintenance records.

- Specific task information, such as inspections defined by pictures or schematics.

- Intervals for any repetitive tasks.

- Methods, techniques and practices required to perform the task.

- Criteria for passing inspections.

- Any special equipment or test apparatus required.

- Instructions for protection and caution information that will minimize contamination and accidental damage to EWIS during performance of maintenance, alterations, or repairs.

- Guidelines for identifying wiring discrepancies and assessing what effect such discrepancies, if found, could have on adjacent systems, particularly if these include wiring.

- Critical Design Configuration Control Limitations—for example, wire separation specifications—that cannot be altered, except in accordance with the applicable limitation.

Policy Statement No. PS-ANM100-2004-10029 provides guidance on acceptable processes for developing fuel tank system ICA as required by SFAR 88. The FAA expects that engineers from aircraft certification offices or from the Transport Airplane Directorate will review and approve the results of the EZAP.

The three groups whose compliance with this proposal would be required, and their required compliance dates, indicated in paragraph (c), are as follows:

- Existing TC holders: No later than December 16, 2007.

- Current applicants for TCs and amendments to TCs (including service bulletins describing design changes) whose applications are pending and future applicants for TC amendments: No later than December 16, 2007, or the date of approval of their application, whichever is later.

- Pending and future applicants for STCs: No later than June 16, 2008, or the date of the approval of their application, whichever is later.

Future applicants for changes to TCs that comply with proposed § 25.1739 would not be required to comply with this section. As discussed previously, under § 21.101, applicants for "significant" changes that meet certain criteria must comply with the latest airworthiness requirements. If this NPRM is adopted as a final rule, such a future applicant would have to comply with § 25.1739. Because the proposed requirements of that section are more extensive than the proposed requirements of § 25.1805, requiring compliance with this section would be redundant.

In determining the compliance schedules for the requirements covered in this proposal, the FAA balanced the safety-related reasons for the rule against the need to give industry enough time to comply with it. Therefore, before setting the proposed compliance times for the TC holders to complete their analysis of their representative type design, the FAA considered the following:

- Input from industry.

- Current or planned compliance periods of several aging-related rulemakings, such as the pending Aging Airplane Safety proposed rule, Fuel Tank System safety initiatives (69 FR 45936, 66 FR 23086), and the pending Widespread Fatigue Damage proposal.

- Safety improvements that will result from compliance with this rule.

- Industry's current efforts to incorporate some of these safety initiatives.

ATSRAC recommended a compliance time of 24 months for TC holders to develop these ICA. To align this proposal with other rules in the aging airplane program, the FAA has adjusted the time frame to that of other rules discussed earlier, so that operators can more efficiently comply with requirements to revise their maintenance programs. To support this realignment, compliance dates that allow an 18-month time frame for TC holders to develop the EWIS ICA and 12 months for operators to implement them were determined to be appropriate and were included in this proposal. We believe these time frames are supported by the experience gained from the EZAPs already performed. Since ATSRAC made its recommendation, several manufacturers have applied an EZAP to their type design airplanes and have completed those reviews.

When we initially drafted this proposal, we assumed the final rule would be adopted by mid-2006. As a result, we set the compliance dates in the proposal using the mid-2006 time frame as the baseline. However, the proposed rulemaking process took longer than we had anticipated. Consequently, we expect that the time frame for adoption of the final rule will be sometime after mid-2006. We recognize that this delay will adversely impact the compliance dates we propose for TC holders and operators and we may need to adjust them. Therefore, we request and will consider your comments on revising the proposed compliance dates. Once the ICA are approved by the FAA Oversight Office, the submitter must make the ICA available to affected persons as required by § 21.50.

Because this proposal sets a precedent in introducing part 25 requirements for holders of existing TCs, it is the FAA's expectation that they will work closely with the FAA Oversight Office in putting together a compliance plan for developing the required ICA. Proposed section

25.1805(d) would require that the compliance plan be approved by the FAA Oversight Office as sufficient basis for showing compliance with the proposed § 25.1805.

Development of a compliance plan is necessary to ensure that TC holders thoroughly understand the requirements of this proposal and produce on time appropriate ICA that are acceptable in content and format in addressing the maintenance and inspection tasks for EWIS and the fuel tank system. Integral to the compliance plan will be the inclusion of procedures to allow the FAA to monitor progress towards compliance. These aspects of the plan will help ensure that the expected outcomes will be acceptable and on time for incorporation by the affected operators in accordance with the operational rules contained in this proposal.

To help ensure that TC holders are fully informed of what is necessary to show compliance with these requirements, as previously discussed, we are issuing AC 120.XX, and have issued a policy statement that describes an acceptable means, but not the only means, of complying with these requirements for developing EWIS ICA and the fuel tank system ICA required by SFAR 88. AC 120-XX, "Program to Enhance Transport Category Airplane Electrical Wiring Interconnection System Maintenance," provides an enhanced zonal analysis procedure (EZAP) for completing a review of the representative airplane covering all areas, including the flight deck (or cockpit), electrical power center, fuel tank wiring, and powerfeeder cables. Policy Statement ANM100-2004-10029, "Process for Developing Instructions for Maintenance and Inspection of Fuel Tank Systems Required by SFAR 88," provides guidance for identifying ICA, including any airworthiness limitations, as a result of the fuel tank system review required by SFAR 88 and compliance with Amendment 102 to part 25 Appendix H and § 25.981.

Proposed § 25.1805(d) is intended to provide TC holders, applicants with pending TC-amendment or STC applications, and the FAA with assurance that they understand what means of compliance are acceptable and have taken necessary actions, including assigning sufficient resources, to achieve compliance with this section. This paragraph is based substantially on "The FAA and Industry Guide to Product Certification," which describes a process for developing project-specific certification plans for type certification programs. A copy of this guide may be found in the docket. This planning requirement would not apply to future applicants for TC amendments or STCs because, as described in the guide, this type of planning routinely occurs at the beginning of the certification process.

The guide recognizes the importance of ongoing communication and cooperation between applicants and the FAA. Section 25.1805, while regulatory in nature, is intended to encourage establishment of the same type of relationship in the process of complying with this section. In particular, in addition to other necessary information, paragraph (d)(3) makes it clear that, to the extent that they intend to use means of compliance different from those already identified as acceptable by the FAA, it is imperative that they identify those differences at the earliest possible stage so any compliance issues can be resolved without risk of unnecessary expenditure of resources or, ultimately, noncompliance.

Proposed § 25.1805(d) would require TC holders and applicants to submit to the FAA Oversight Office the following within 90 days after the effective date of the rule:

- A proposed project schedule, identifying all major milestones, for meeting the compliance dates of this rule.

- A proposed means of compliance with this section, identifying all required deliverables, including all compliance items and all data to be developed to substantiate compliance. If any affected person has already initiated compliance, the FAA Oversight Office will review the results of those efforts to ensure that the results are acceptable.

- A detailed explanation of how the proposed means will be shown to comply with this section if the affected person proposes a means of compliance that differs from that described in FAA advisory material.

- A proposal for how the approved ICA will be made available to affected persons.

It should be noted that this section applies not only to domestic TC holders and applicants, but also to foreign TC holders and applicants. In this sense, this section is different from most type certification programs, where foreign applicants typically work with their responsible certification authority, and the FAA relies on that authority's findings of compliance under bilateral airworthiness agreements. Since this rulemaking is not harmonized in all cases, the FAA will make all the necessary compliance determinations, and where appropriate we may accept findings of compliance made by the appropriate foreign authorities using procedures developed under the bilateral agreements. The compliance planning provisions of this section are equally important for domestic and foreign TC holders and applicants, and we will work with the foreign authorities to ensure that their TC holders and applicants perform the planning necessary to comply with the requirements of this section.

One of the items required in the plan is, "If the proposed means of compliance differs from that described in FAA advisory material, a detailed explanation of how the proposed means will comply with this section." FAA advisory material is never mandatory because it describes one means, but not the only means of compliance. In the area of type certification, applicants frequently propose acceptable alternatives to the means described in advisory circulars. But when an applicant chooses to comply by an alternative means, it is important to identify this as early as possible in the certification process to provide an opportunity to resolve any issues that may arise that could lead to delays in the certification schedule.

The same is true for this requirement. As discussed earlier, TC holder compliance with this section on time is necessary to enable operators to comply with the operational requirements of this NPRM. Therefore, this item in the plan would enable the FAA Oversight Office to identify and resolve any issues that may arise with the TC holder's proposal without jeopardizing the TC holder's ability to comply with this section by the compliance time.

As of the date of this proposal, certain TC holders have voluntarily started to develop the EWIS EZAP that would be required by proposed § 25.1805. An EZAP has been completed on certain transport category airplanes. Although the EZAP used by those TC holders may not be the version outlined in AC120-XX, it is similar. The FAA would expect that after issuance of the final rule, these TC holders would either submit a plan proposing revisions to the EZAP for those model airplanes to be consistent with the guidance given in AC120-XX, or use the planning process to show that their EZAP complies with this section. The FAA Oversight Office will then review the results of those efforts to ensure that the results are acceptable for compliance with this section.

Section 25.1805(e) requires that TC holders and applicants correct a deficient plan, or deficiencies in implementing the plan, in a manner identified by the FAA Oversight Office. Before the FAA formally notifies a TC holder or applicant of deficiencies, however, we will have communicated with them to try to achieve a complete mutual understanding of the deficiencies and means of correcting them. Therefore, the notification referred to in this paragraph should document the agreed corrections.

Because operators' ability to comply with the applicable operational rules will be dependent on TC holders' and applicants' compliance with § 25.1805, the FAA will carefully monitor their compliance and take appropriate action if they fail to achieve compliance. Failure to comply within the specified time would constitute a violation of the requirements and may subject the violator to certificate action to amend, suspend, or revoke the affected certificate in accordance with 49 U.S.C. § 44709. In accordance with 49 U.S.C. § 46301, it may also subject the violator to a civil penalty of not more than $25,000 per day per TC until § 25.1805 is complied with."

3. Operating Requirements.

a. Part 119.

(1) § 119.3 Definitions

Maximum payload capacity means:

(1) For an aircraft for which a maximum zero fuel weight is prescribed in FAA technical specifications, the maximum zero fuel weight, less empty weight, less all justifiable aircraft equipment, and less the operating load (consisting of minimum flightcrew, foods and beverages, and supplies and equipment related to foods and beverages, but not including disposable fuel or oil).

(2) For all other aircraft, the maximum certificated takeoff weight of an aircraft, less the empty weight, less all justifiable aircraft equipment, and less the operating load (consisting of minimum fuel load, oil, and flightcrew). The allowance for the weight of the crew, oil, and fuel is as follows:

(i) Crew—for each crewmember required by Federal Aviation Regulations—

(A) For male flight crewmembers—180 pounds.

(B) For female flight crewmembers—140 pounds.

(C) For male flight attendants—180 pounds.

(D) For female flight attendants—130 pounds.

(E) For flight attendants not identified by gender—140 pounds.

(ii) Oil—350 pounds or the oil capacity as specified on the Type Certificate Data Sheet.

(iii) Fuel—the minimum weight of fuel required by the applicable Federal Aviation Regulations for a flight between domestic points 174 nautical miles apart under VFR weather conditions that does not involve extended overwater operations.

Appendix F

1. Background.

a. Over the years there have been a number of in-flight smoke and fire events where contaminants ignited by electrical faults allowed the fire to be sustained and spread. The FAA and the National Transportation Safety Board (NTSB) have conducted aircraft inspections and found wiring contaminated with items such as dust, dirt, metal shavings, lavatory waste water, coffee, soft drinks, and napkins. Sometimes wire bundles and surrounding areas have been found to be completely covered with dust.

b. In recent years Federal government and industry groups have realized that current maintenance practices may not be enough to address aging non-structural systems. Over time, insulation can crack or breach, thus exposing the conductor. While age is not the sole cause of wire degradation, the likelihood of EWIS damage from inadequate maintenance, contamination, improper repair, or mechanical damage increases over time. Examples include the practice of needling wires to test the continuity or voltage, and using a metal wire or rod as a guide to feed new wires into an existing bundle. These practices could cause a breach in the wiring insulation that can contribute to arcing.

c. Research has shown that maintenance work on other aircraft systems can cause collateral damage to nearby wiring. Normal maintenance actions, even using acceptable methods, techniques, and practices, can, over time, contribute to wire degradation. A person inspecting an electrical power center or avionics compartment, for example, may inadvertently cause damage to wiring in a nearby area. Zones of an airplane subject to a high level of maintenance activity display more deterioration of wiring insulation. Undisturbed wiring will have less degradation than wiring that is disturbed during maintenance.

d. Typical analytical methods used for developing maintenance programs have not provided a focus on wiring. As a result, most operators have not adequately addressed EWIS deterioration in their programs. We have reviewed current inspection philosophies to identify improvements that could lead to a more consistent application of inspection requirements, whether for zonal, stand-alone GVI, or DET inspections, as they relate to airplane wiring.

e. We believe it would be valuable to provide guidance on the type of deterioration a person performing a GVI, DET, or zonal inspection could expect to discover. Though it may be assumed that all operators provide such guidance to their affected personnel, it is evident that significant variations exist, and a significant enhancement to wiring inspection could be obtained if standardized guidance material existed. Achievement of the objectives of this AC is dependent on each operator conducting GVI and DET inspections as defined in this document. These definitions should be incorporated in operators' training material and in the introductory section of maintenance planning documentation.

Appendix G

1. Related Regulations and Documents.

a. Title 14, Code of Federal Regulations (14 CFR) parts and specific regulations.

(1) You can download an electronic copy of 14 CFR from the Internet at http://www.gpoaccess.gov/cfr/. A paper copy can be ordered by sending a request to the U.S. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402-0001, or by calling telephone number (202) 512-1800; or by sending a request by facsimile to (202) 512-2250.

(2) Part 21—Certification Procedures for Products and Parts.

(a) Special Federal Aviation Regulation No. 88—Fuel Tank System Fault Tolerance Evaluation Requirements

(3) Part 25—Airworthiness Standards: Transport Category Airplanes.

(a) Subpart H—Electrical Wiring Interconnection Systems (EWIS)

(b) Appendix H to Part 25—Instructions for Continued Airworthiness

(4) Part 43—Maintenance, Preventive Maintenance, Rebuilding, and Alteration.

(a) § 43.13 Performance rules (general).

(5) Part 119—Certification: Air Carriers and Commercial Operators.

b. Advisory Circulars (ACs).

(1) The following advisory circulars also provide information that may support the method of compliance established by this AC. They are stored on the Internet in the FAA's Regulatory & Guidance Library (RGL), a set of searchable databases containing regulatory, guidance, and aviation product information. The RGL contains certain Federal Aviation Regulations and Special Federal Aviation Regulations (SFAR) from 14 CFR in their current versions as well as historical versions.

(2) You can download an electronic copy of the latest version of the following ACs and policy from the Internet at http://www.faa.gov/regulations_policies/advisory_circulars/.

- 25-8, *Auxiliary Fuel System Installation*
- 25-16, *Electrical Fault and Fire Prevention and Protection*
- 25.981-1B, *Fuel Tank Ignition Source Prevention Guidelines*

- 25.1701-1, *Certification of Electrical Wiring Interconnection Systems on Transport Category Airplanes*

- 26-1, *Part 26, Continued Airworthiness and Safety Improvements*

- 43-12A, *Preventive Maintenance*

- 43.13-1B, *Acceptable Methods, Techniques, and Practices—Aircraft Inspection and Repair*

- 43-204, *Visual Inspection for Aircraft*

- 43-206, *Inspection, Prevention, Control, and Repair of Corrosion on Avionics Equipment*

- 65-15A, *Airframe & Powerplant Mechanics Airframe Handbook, Chapter 11, Aircraft Electrical Systems*

- 120-16D, *Air Carrier Maintenance Programs*

- 120-94, *Aircraft Electrical Wiring Systems Training Program*

- 120-97, *Incorporation of Fuel Tank System Instructions for Continued Airworthiness into Operator Maintenance or Inspeciton Program*

- 120-99, *Incorporation of Electrical Wiring Interconnection System (EWIS) Instructions for Continued Airworthiness into the Operator's Maintenance Program* (EAPAS AC 120-99 was not yet final at the time this AC was issued.)

- 121.22A, *Maintenance Review Board Procedures*

c. Policy and Orders.

(1) You can download an electronic copy of the latest version of the following policy and order from the Internet at http://www.faa.gov/regulations_policies/orders_notices/:

- FAA Policy Statement ANM112-05-001, "Process for Developing SFAR 88-related Instructions for Maintenance and Inspection of Fuel Tank Systems" (69 FR 60170)

- FAA Order 8110.104, "Responsibilities and Requirements for Implementing Part 26 Safety Initiatives"

d. Reports.

- "Transport Aircraft Intrusive Inspection Project, (An Analysis of the Wire Installations of Six Decommissioned Aircraft), Final Report," The Intrusive Inspection Working

Group, Aging Transport Systems Rulemaking Advisory Committee, December 29, 2000, http://www.mitrecaasd.org/atsrac/intrusive_inspection.html.

- FAA Aging Transport Non-Structural Systems Plan, July 1998, http://www.faa.gov/aircraft/air_cert/design_approvals/transport/Aging_Aircraft/media/aging_transport_plan.pdf.

- National Transportation Safety Board Safety Recommendations A-00-105 through -108, September 19, 2000, http://www.ntsb.gov/recs/letters/2000/A00_105_108.pdf.

- Wire System Safety Interagency Working Group, National Science and Technology Council Committee on Technology, "Review of Federal Programs for Wire System Safety, Final Report" (2000), http://www.ostp.gov/html/wire_rpt.pdf.

- Aging Systems Task Force, Aging Transport Systems Task 1 & 2 Final Report, August 1, 2000, http://www.mitrecaasd.org/atsrac/final_reports/Task_1&2_Final%20_August_2000.pdf.

- Aging Transport Systems Rulemaking Advisory Committee Task 3 Final Report, March 26, 2001, http://www.mitrecaasd.org/atsrac/final_reports/Task_3_Final.pdf.

- Aging Transport Systems Rulemaking Advisory Committee Task Group 4 Final Report, Standard Wiring Practices, September 28, 2000, http://www.mitrecaasd.org/atsrac/final_reports/Task_4_Final_Report_Sept_2000.pdf.

- Aging Transport Systems Rulemaking Advisory Committee (ATSRAC) Task 5 Final Report, Aircraft Wiring Systems Training Curriculum and Lesson Plans, March 9, 2001, http://www.mitrecaasd.org/atsrac/final_reports/Task_5_Final_March_2001%20.pdf.

- ATA Specification 117, Wiring Maintenance Practices/Guidelines, http://www.iasa.com.au/folders/Safety_Issues/Aircraft_Wire/ATAonwiring.html.

e. Other Documents.

- Operator/Manufacturer Scheduled Maintenance Development, Revision 2009.1, ATA Maintenance Steering Group (MSG-3). (May be obtained from the Air Transport Association of America; Suite 1100, 1301 Pennsylvania Ave, NW, Washington, DC 20004-1707.)

Appendix H

1. EZAP Worksheets for Use by Applicants.

- EZAP Worksheet 1: Enhanced Zonal Analysis – Details of Zone

- EZAP Worksheet 2: Enhanced Zonal Analysis – Assesment of Zone Attributes

- EZAP Worksheet 3A – For Airplane Models with a Dedicated Zonal Inspection Program (ZIP): Enhanced Zonal Analysis – Inspection Level Determination Based on Zone Size, Density, and Potential Impact of Fire

- EZAP Worksheet 3B – For Programs without a Dedicated Zonal Inspection Program (ZIP): Enhanced Zonal Analysis – Inspection Level Determination Based on Zone Size, Density, and Potential Impact of Fire

- EZAP Worksheet 4: Enhanced Zonal Analysis – Interval Determination Based on Hostility of Environment and Likelihood of Accidental Damage

- EZAP Worksheet 5: Task Summary

EZAP WORKSHEET 1

Enhanced Zonal Analysis – Details of Zone

(steps 1 and 2 of figure 1)

Zone Number: ☐ **Zone Description:** ☐

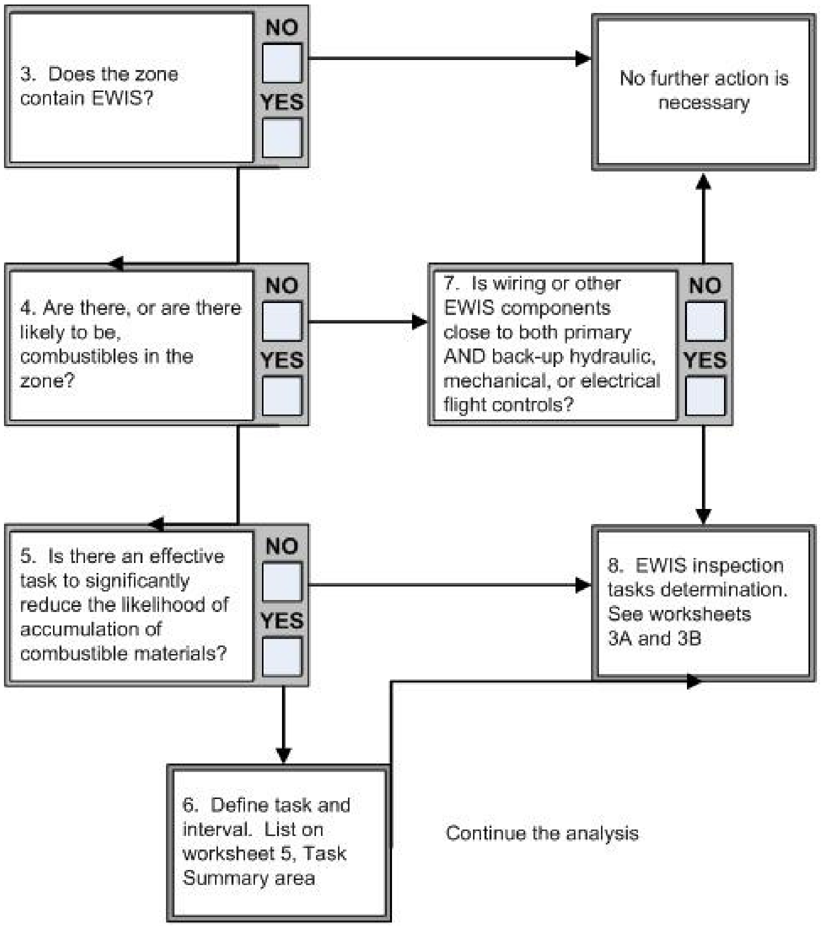
- ☐ Hydraulic plumbing
- ☐ Hydraulic component (valves, actuators, pumps)
- ☐ Pneumatic plumbing
- ☐ Pneumatic components (valves, actuators)
- ☐ EWIS – power feeder (high voltage, high amperage)
- ☐ EWIS – motor driven devices
- ☐ EWIS – instrumentation and monitoring
- ☐ EWIS – data bus
- ☐ Electrical components
- ☐ Primary flight control mechanisms
- ☐ Secondary flight control mechanisms
- ☐ Engine control mechanisms
- ☐ Fuel system components
- ☐ Insulation
- ☐ Oxygen system components
- ☐ Potable water system components
- ☐ Waste water system components

Comments

EZAP WORKSHEET 2

Enhanced Zonal Analysis – Assessment of Zone Attributes
(steps 3 through 7 of figure 1)

Zone Number: ____ **Zone Description:** ____



Answers and Explanations
(Notes: Steps 1 and 2 completed on worksheet 1)

3.

4.

5.

6.

7.

EZAP WORKSHEET 3A – For Airplane Models with a Dedicated Zonal Inspection Program (ZIP)

Enhanced Zonal Analysis – Inspection Level Determination Based on Zone Size, Density, and Potential Impact of Fire

(step 8 of figure 1, refer to figure 2)

Zone Number: [ ] **Zone Description:** [ ]

Density / Zone Size Assessment		Zone Size: Small	Medium	Large
Density	Low	1	2	3
	Medium	2	2	3
	High	2	3	3

Circle appropriate result & insert below

RESULT [ ]

Inspection Level Determination Based on Potential Effect of Fire in the Zone				
Size / Density Factor		1	2	3
Potential Effects of Fire in the Zone	Low	Zonal GVI	Zonal GVI	Zonal GVI
	Medium	Zonal GVI	Zonal GVI + stand-alone GVI of some EWIS	Zonal GVI + stand-alone GVI of some EWIS
	High	Zonal GVI + stand-alone GVI of some EWIS	Zonal GVI + stand-alone GVI and/or DET of some EWIS	Zonal GVI + stand-alone GVI and/or DET of some EWIS

Circle appropriate result and answer questions in the boxes below

1. Is a zonal GVI alone effective for the entire zone?* YES [ ] NO [ ]

Zonal GVI must be augmented with a stand-alone GVI and/or a DET inspection

2. List zone description and boundaries for zonal GVI

3. Define specific items/areas in the zone for which a stand-alone GVI is justified

4. Define specific items/areas in the zone for which a DET is justified

* If answer to box 1 is "**YES**," answer box 2 only and then continue the analysis on worksheet 4 in order to determine the task interval.

If answer to box 1 is "**NO**," answer boxes 2, 3, and 4 and then continue the analysis on Worksheet 4 in order to determine the task interval.

Answers and Explanations

1	
2	
3	
4	

EZAP WORKSHEET 3B – For Programs without a Dedicated Zonal Inspection Program (ZIP)

Enhanced Zonal Analysis – Inspection Level Determination Based on Zone Size, Density, and Potential Impact of Fire

(step 8 of figure 1, refer to figure 2)

Zone Number: | **Zone Description:**

Density / Zone Size → ↓ Assessment		Zone Size: Small	Medium	Large
Density	Low	1	2	3
	Medium	2	2	3
	High	2	3	3

Circle appropriate result & insert below

RESULT

Inspection Level Determination Based on Potential Effect of Fire in the Zone				
Size / Density Factor		1	2	3
Potential Effects of Fire in the Zone	Low	GVI of all EWIS in zone at same interval	GVI of all EWIS in zone at same interval	GVI of all EWIS in zone at same interval
	Medium	GVI of all EWIS in zone at same interval	GVI of all EWIS in zone at same interval + GVI of some EWIS at more frequent interval	GVI of all EWIS in zone at same interval + GVI of some EWIS at more frequent interval
	High	GVI of all EWIS in zone at same interval + GVI of some EWIS at more frequent interval	GVI of all EWIS in zone at same interval + GVI of some EWIS at more frequent interval and/or DET of some EWIS	GVI of all EWIS in zone at same interval + GVI of some EWIS at more frequent interval and/or DET of some EWIS

Circle appropriate result and answer questions in the boxes below

1. Is a GVI alone effective for all EWIS in the zone at the same interval?* — YES / NO

If NO: Some EWIS requires GVI at more frequent interval and/or DET inspection

2. List zone description and boundaries for GVI of all EWIS in the zone

3. Define specific items/areas in the zone for which GVI at more frequent interval is justified

4. Define specific items/areas in the zone for which a DET is justified

* If answer to box 1 is "**YES**," answer box 2 only and then continue the analysis on worksheet 4 in order to determine the task interval.

If answer to box 1 is "**NO**," answer boxes 2, 3, and 4, and then continue the analysis on Worksheet 4 in order to determine the task interval.

Answers and Explanations

1

2

3

4

EZAP WORKSHEET 4

Enhanced Zonal Analysis – Interval Determination Based on Hostility of Environment and Likelihood of Accidental Damage

(step 8 of figure 1, refer to figure 2)

Zone Number: ____ **Zone Description:** ____

Hostility of Environment	
1 – Passive / 2 – Moderate / 3 – Severe	Enter Number Here
Temperature	
Vibration	
Chemicals (toilet fluids, de-icing fluid, etc.)	
Humidity	
Contamination	
Other	
Enter the Highest Number Here →	

Likelihood of Accidental Damage	
1 – Passive / 2 – Moderate / 3 – Severe	Enter Number Here
Ground handling equipment	
Foreign object debris (FOD)	
Weather effects (hail, rain, etc.)	
Frequency of maintenance activities	
Fluid spillage	
Passenger Traffic	
Other	
Enter the Highest Number Here →	

Interval Determination		Likelihood of Accidental Damage		
		1	2	3
Hostility of Environment	1			
	2			
	3			
RESULT Upon completion, enter all task and interval selections onto worksheet 5, Task Summary				

Interval selection is specific to each task identified on worksheet 3A or 3B. For GVI of entire zone, consider overall zone environment and likelihood of damage. For stand-alone GVI or DET, consider environment and likelihood of damage only in respect to the specific item/area defined for inspection.

NOTE: Interval ranges are quoted in the rating table to explain a typical arrangement of values. For a particular application, these must be compatible with the interval framework used in the existing maintenance or inspection program (as detailed in the current MRBR). They may be expressed in terms of usage parameter (for example, flight hours or calendar time) or in terms of letter check.

The inspection frequency should be based on increasing risk of accidental damage and increasing severity of the local environment within the zone. In other words, the more ratings identified as moderate and severe should drive the inspection towards the lower end of the interval

EZAP WORKSHEET 5

Enhanced Zonal Analysis – Task Summary

Zone Number: ____ **Zone Description:** ____

TASK SUMMARY			
Task Number	Access	Task Interval	Task Description and Applicable Comments/Rationale/Assumptions