U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: DETERMINING THE CLASSIFICATION OF A CHANGE TO TYPE DESIGN.

Date: DRAFT **AC No:** 21.93-1
Initiated by: AIR-110

This advisory circular (AC) is intended as a guide for determining the classification of a change to type design to comply with Title 14 of the Code of Federal Regulations (14 CFR) § 21.93. This AC provides a system safety approach to determine if a change in type design is major or minor in accordance with 14 CFR § 21.93.

Dave Hempe
Manager, Aircraft Engineering Division
AIR-100

Table of Contents

Paragraph *Page*

Chapter 1. Introduction 1

1. Purpose. 1
2. Who this AC is For. 1
3. Applicability. 1
4. Regulatory Foundation. 1
5. What is a Change to Type Design and How is It Substantiated? 2
6. Classification of a Change to Type Design. 2

Chapter 2. Overview of System Safety Approach 4

1. System Safety Approach. 4
2. Change Analysis. 5
3. Severity Assessment. 6

Chapter 3. Classification of Change in Type Design Using a System Safety Approach 8

1. Who May Use This Process. 8
2. Preparing to Conduct an Assessment of a Change in Type Design. 8
3. Conducting an Assessment of a Change in Type Design. 8

Chapter 4. Documenting The Assessment 15

1. Minimum Requirements for Documenting a 14 CFR § 21.93 Compliance Package. 15
2. Submittal of Completed 14 CFR § 21.93 Compliance Package. 16

Appendix 1. Definitions 1

Appendix 2. Related Publications and Administrative Information 3

1. References and Related Publications. 3
2. How to Get Publications. 3
3. Administrative Information. 3

Table of Figures

Figure *Page*

Figure 1. System Safety Approach for 14 CFR § 21.93 5

Figure 2. Assessment of Change in Type Design 9

Figure 3. A Causal Chain 12

Deleted: Chapter 1. Introduction . 1¶
1. Purpose. . 1¶
2. Who this AC is For. . 1¶
3. Applicability. . 1¶
4. Regulatory Foundation. . 1¶
5. Classification of a Change to Type Design. . 2¶
Chapter 2. Overview of System Safety Approach . 3¶
1. System Safety Approach. . 3¶
2. Change Analysis. . 4¶
3. Severity Assessment. . 5¶
Chapter 3. Classification of Change in Type Design Using a System Safety Approach . 7¶
1. Who May Use This Process. . 7¶
2. Preparing to Conduct an Assessment of a Change in Type Design. . 7¶
3. Conducting an Assessment of a Change in Type Design. . 7¶
Chapter 4. Documenting The Assessment . 14¶
1. Minimum Requirements for Documenting a 14 CFR § 21.93 Compliance Package. . 14¶
2. Submittal of Completed 14 CFR § 21.93 Compliance Package. . 15¶
Appendix 1. Definitions . 1¶
Appendix 2. Related Publications and Administrative Information . 3¶
1. References and Related Publications. . 3¶
2. How to Get Publications. . 3¶
3. Administrative Information. . 3¶

Formatted: Do not check spelling or grammar

Figure 4. Severity Scale 13

Chapter 1. Introduction

1. Purpose.

a. This advisory circular (AC) provides guidance for determining the classification of a change to type design. This AC is not mandatory and does not constitute a regulation. This AC describes an acceptable means, but not the only means, of compliance with Title 14 of the Code of Federal Regulations (14 CFR) Subpart D. Title 14 CFR § 21.93 (a) distinguishes changes to a type design as either minor or major. This distinction leads to the subsequent approval process of either 14 CFR § 21.95 (minor change) or 14 CFR § 21.97 (major change). In this AC we discuss and explain the criteria of 14 CFR § 21.93(a) and its application using a system safety approach. We explain how to conduct a change analysis coupled with a severity assessment of a proposed change to type design to determine if it is minor or major.

Deleted: § 21.93

Deleted: requires that

Deleted: be classified

Deleted:

Deleted: establish

b. The regulatory objective of 14 CFR § 21.93 is to maintain the level of safety of a type design by assessing any particular change to that type design and classifying it accordingly. The classification of the change, as minor or major, triggers the applicable approval process which reflects the timing and level of the Federal Aviation Administration's (FAA) regulatory involvement. In this AC we explain how to assess the system safety impact of a change to type design in accordance with 14 CFR § 21.93 and in doing so standardize how to classify changes to type design.

c. This AC describes an acceptable means, but not the only means, of compliance with 14 CFR § 21.93. A rigorous analysis may not always be necessary, such as in cases where a change is clearly major (such as a change that clearly has an appreciable effect characteristics affecting on airworthiness), or a change is clearly minor (such as the introduction of an alternate part that is physically identical to the part in the original type design) . Where an analysis is necessary, you may elect to follow an alternate method, provided the alternate method is acceptable to the Administrator. However, if you use the means described in this AC, you must follow it in all important respects. Because the method of compliance presented in this AC is not mandatory, the term "must" used herein applies only to those who choose to follow this particular method without deviation.

Deleted: Y

2. Who this AC is For.

We wrote this AC for applicants who are seeking approval of changes to existing type designs.

3. Applicability.

This AC applies to type design changes, that are not so extensive as to require a new type certificate (TC) under 14 CFR § 21.19. When you proposes a change to an existing type design you must classify the change as minor or major in accordance with 14 CFR § 21.93 and the applicable FAA office will review this classification for concurrence. This AC is an acceptable means, but not the only means, of resolution when your classification decision is in question by the FAA.

4. Regulatory Foundation.

a. As the FAA, we are required to promote safe flight of civil aircraft in air commerce as per Title 49 of the United States Code (49 U.S.C.), section 44701. We do this by prescribing

Formatted: Right

Formatted: Font: 10 pt

minimum standards for the design, material, construction, quality of work, performance, and reliability of aircraft, aircraft engines, propellers, and appliances. We use the airworthiness standards found in 14 CFR as our minimum safety standards.

b. When we find that a product is properly designed and manufactured, complies with the applicable airworthiness standards, we issue a design approval in the form of a TC. A TC, as defined in 14 CFR § 21.41, includes the type design, the type certificate data sheet and any limitations established for the product by the FAA. This ensures the product complies with the certification basis of the type certificate.

c. If you are proposing a change to a type design, you must distinguish the change as per 14 CFR § 21.93 because the change may affect the established safety level of the product. This distinction will help determine the approval process to be used for the change in question. Title 14 CFR § 21.93 provides the standards for classifying a change to a type design as either *minor* or *major*. The means of compliance in this AC is an assessment process utilizing the criteria in 14 CFR § 21.93 and a system safety approach. Using the process in this AC you can assess the impact of a change on characteristics that affect the airworthiness of the product.

d. A minor change is defined as one that has no appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of the product. All other changes are defined as major.

5. What is a Change to Type Design and How is It Substantiated?

Any deviation from type design is a change to type design. Some changes are minor, and some changes are major. Minor changes to type design usually are substantiated using the protocols associated with the approval or acceptability of the data associated with them (this is usually determined based on whether the change represents a major or minor alteration).

A change can reflect a major alteration (requiring approved data) but may still be a minor change to type design. This is because of the differences in the regulatory definitions that define each of these standards. For example, an alteration that cannot be accomplished using accepted practices or elementary operations is a major alteration, but if the result does not appreciably effect the airworthiness conditions listed in 14 C.F.R. § 21.93, then it is still a minor change to type design.

Changes to type design take many forms in the FAA system, and the FAA has developed a wide variety of methods for substantiating such changes, including (but not limited to) Parts Manufacturer Approval, Field Approval, data approval on an 8110-3 form, and Supplemental Type Certificate (STC). An STC is necessary if the change is a major change to type design.

6. Classification of a Change to Type Design.

a. With the ever expanding limits of technology and human experience the aviation industry is in a constant state of flux. Type design holders, repair stations, modification sources and various other applicants are routinely seeking approval of changes to existing type designs. In

Deleted: evaluate

Deleted: evaluation

Deleted: requires that

Deleted: s

Deleted: be classified

Deleted: , and provides the basic criteria for this classification

Deleted: will

Formatted: Style Style Heading 3 + 12 pt + After: 0 pt

Deleted: ***

Formatted: Bullets and Numbering

Formatted: Right

Formatted: Font: 10 pt

performing our regulatory function we, the FAA, must review these changes for regulatory compliance and impact to a previously established level of safety. In this AC we explain a system safety approach intended to help you standardize classifying changes to type design.

b. As outlined in 14 CFR § 21.93 (a), the criteria for the classification of a change to type design highlights fundamental characteristics that can directly affect the airworthiness of the product and therefore, must be considered when evaluating the effect of a change. An assessment of the impact that the change will have on these characteristics helps to determine the classification of the change to type design. The system safety approach assesses the impact of a type design change in terms of severity, or potential level of harm to the system.

c. Chapter 2 discusses the system safety approach and the process applied from an academic viewpoint. Chapter 3 shows how to customize and apply change analysis coupled with severity assessment as a process to show compliance with 14 CFR § 21.93 (a). It is important to note that the process is scalable and therefore, its complexity is directly proportional to the complexity and scope of the proposed change in type design.

Formatted: Right

Formatted: Font: 10 pt

Chapter 2. Overview of System Safety Approach

1. System Safety Approach.

a. A system safety approach uses engineering and management principles, criteria and techniques to optimize the safety of a given system. The objective of this approach is to optimize safety by identifying safety related hazards, and eliminating or controlling them by design and/or procedures.

b. In order to achieve the objectives of the system safety approach this AC employs a change analysis process coupled with a severity assessment. Change analysis identifies any potential hazards presented by the type design change while the severity assessment will help characterize the level of harm caused by the identified hazards. See Figure 1 for a flow chart of the system safety approach used in this AC. This figure shows how the change analysis and severity assessment work together to assess a change in type design and help determine classification as per 14 CFR § 21.93 (a). The overall system safety approach consists of the following generic steps:

(1) Define the system – Describe, in detail, the affected system. A clear understanding of the system is critical to identifying its vulnerabilities.

(2) Identify the differences – Identify the differences that the change will introduce to the system.

(3) Evaluate impact of differences on system safety – Examine each of the differences and determine if there is a potential to impact system safety. Identify the hazard(s) related to each identified difference. When evaluating impact of differences also consider the combined impact of two or more differences. While a single difference may not have a significant impact, when combined with another difference the impact may be significant.

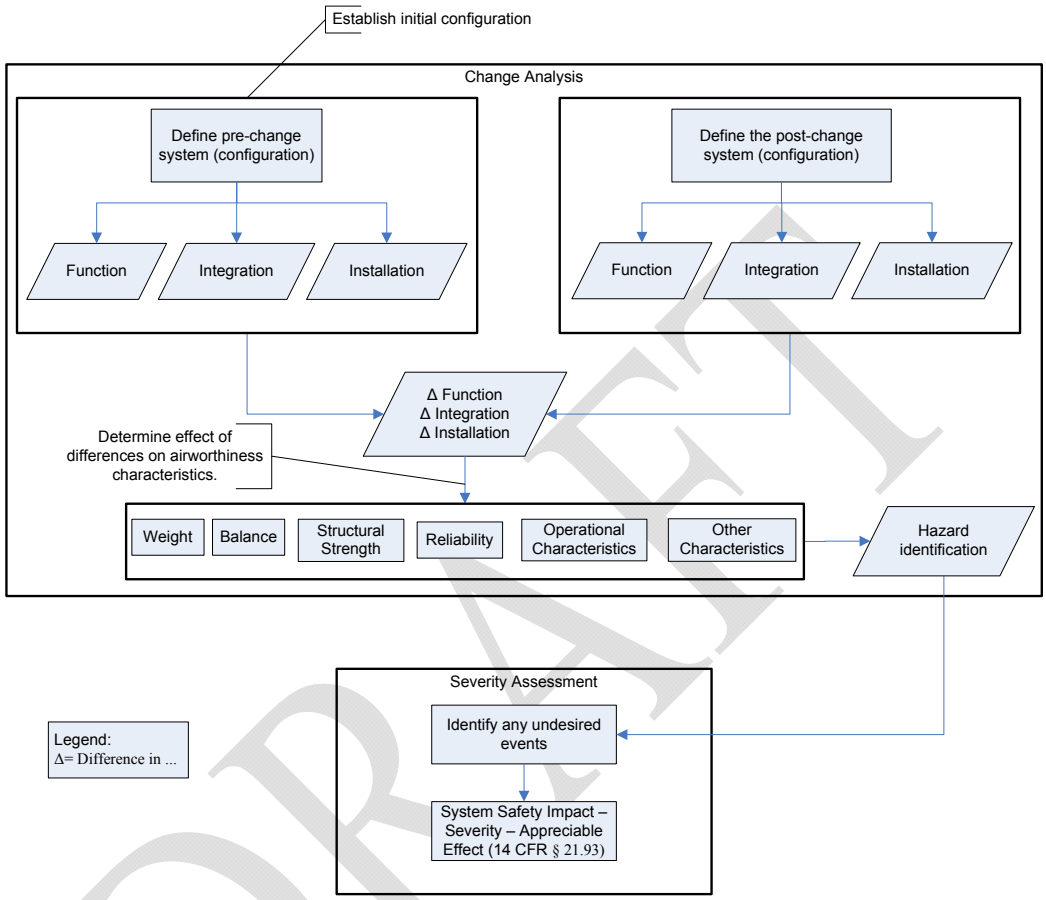
(4) Characterize the system safety impact of differences – Using severity assessment principles assess the impact and related hazards and develop an overall severity profile.

(5) Use the results to manage the severity – Address the identified severity level by applying appropriate mitigating strategies.

Formatted: Right

Formatted: Font: 10 pt

Figure 1. System Safety Approach for 14 CFR § 21.93



2. Change Analysis.

a. This AC employs a change analysis methodology (also known as change impact analysis or impact analysis) with a qualitative approach. Change analysis is very effective for identifying hazards that may develop when proposed changes to a system such as in hardware configuration, software design, operational conditions, or environmental conditions are implemented.

b. Change analysis identifies differences between the initial system configuration and the post-change system configuration and assesses those differences for possible impact on the system. The change analysis methodology assesses identified differences for possible effect on characteristics affecting the airworthiness of a product for the purpose of hazard identification.

c. Change analysis does not provide the final answer but rather identifies the differences which may pose potential hazards. These hazards are then assessed and their severity determined using a severity assessment process.

Formatted: Right

Formatted: Font: 10 pt

d. In order to conduct an effective change analysis you must define the system configuration. When defining the system configuration consider the system's objective and its relationship to the ambient environment. There are three aspects of a system that are used to define a system's configuration. The level of detail required for each of these three aspects depends on the complexity and scope of the affected system.

(1) Function: The particular operation or task the system is intended to perform, this includes system capabilities.

(2) Integration: Interrelationships and interface between the elements of a particular system (for example, data sharing-software, electrical and mechanical) with resident components and other systems within a product.

(3) Installation – The physical incorporation of the system in a higher assembly. This includes size, weight, location, structural aspects (design and construction), and physical orientation.

e. A system that is a part of an approved type design is at its initial (or approved) configuration. A type design is established when you show us and we can determine that all applicable regulations have been complied with for a pre-determined certification basis. The regulatory language found in 14 CFR § 21.93 (a) focuses on the effect of a change in type design on the following characteristics that can affect the airworthiness of a product:

- Weight,
- Balance,
- Structural strength,
- Reliability,
- Operational, or
- Other characteristics affecting the airworthiness of the product.

Therefore, using the change analysis methodology will help determine the effects of going from an initial, approved system configuration to a new changed configuration, on the above characteristics affecting airworthiness. The result will be hazard identification.

3. Severity Assessment.

a. A severity assessment is conducted to characterize hazards for a given system. Therefore, for an effective severity assessment a thorough identification and understanding of any potential hazards is required.

b. We use a severity level scale in order to characterize hazards. In general the severity levels are designed based on the particular system being assessed. The severity scale developed

Formatted: Right

Formatted: Font: 10 pt

for the process in this AC is based on § 21.93 (a) and the product.

c. In the aircraft certification process we automatically think of the severity levels such as *catastrophic* or *hazardous*. For procedural aspects of safety and certificate management, such as 14 CFR parts 21 and 39, *severity* can also be defined by organizational objectives such as achievement of strategic goals (such as certificate issuance). The severity levels we use consider the impact on the airworthiness of the product or the level of safety established by an approved type design.

d. 14 CFR § 21.93 (a) requires that we consider appreciable effect on characteristics affecting airworthiness. It should be noted that the regulatory language does not just stop at considering the appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics but continues on to define these characteristics as those that affect the airworthiness of the product. Therefore, an appreciable effect's final impact on the airworthiness of the product is what determines if the change is major or minor. The ultimate objective being the safety of the product.

> **Note**: Chapter 3 will show how the generic system safety approach is customized for the application in this AC.

Formatted: Right

Formatted: Font: 10 pt

Chapter 3. Classification of Change in Type Design Using a System Safety Approach

1. Who May Use This Process.

a. If you propose a change to a type design you can apply the process in this AC to show compliance with 14 CFR § 21.93 and classify your change to type design accordingly.

b. If your type design change classification decision in accordance with 14 CFR § 21.93, is questioned by the FAA you can apply the process in this AC as an acceptable means, but not the only means, of resolving the issue.

2. Preparing to Conduct an Assessment of a Change in Type Design.

a. It is recommended that an analyst with experience and background in system safety and/or change analysis should lead the assessment process. Based on the scope and complexity of the change you can form a team of subject matter experts (SME) to assist in conducting the assessment but a team lead position must be identified. The project lead need not be a SME if there is a support team of SMEs.

b. The change analysis methodology is highly dependent on the knowledge and experience of the assessor(s). The participants in the analysis (SMEs) must be well versed in the affected system and the proposed change.

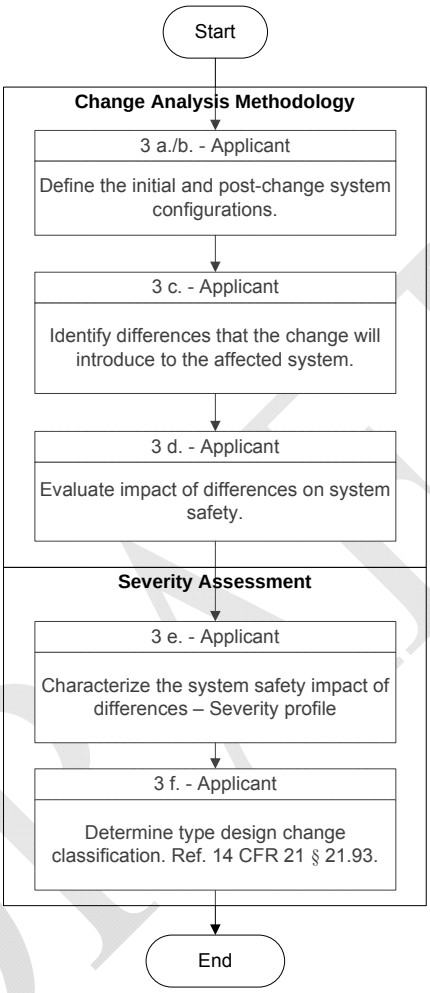
c. Make all necessary type certificated design data and the design change data (such as functional diagrams, schematics, drawings, analysis, component list/function, and IT requirement documents) required for the assessment available to the assessor(s). The assessor(s) must also be aware of the operational and ambient environment of the system and any subsystems. The necessary design data for the pre-change type certificated configuration should be accessible to you.

3. Conducting an Assessment of a Change in Type Design. The following steps describe the process for conducting an assessment using a change analysis and severity assessment process. See Figure 2 for the process flow chart:

Formatted: Right

Formatted: Font: 10 pt

Figure 2. Assessment of Change in Type Design



a. Define the system – It is necessary to define the pre-change (initial) and post-change system for the purpose of identifying differences. The system consists of the affected hardware, software, environment (operational and ambient), and human factors. When you define the system, consider what functions these system elements perform, how they integrate mechanically, electronically, and/or physically, and how they are installed. In order to describe the pre-change system in detail you should have access to the appropriate type certificated design data. The relevance and completeness of the data with respect to the proposed change will be considered by the FAA when reviewing the final compliance package. Describe in detail the affected initial system configuration, and address the following three aspects of a system:

Formatted: Right

Formatted: Font: 10 pt

- Function: What function does the system perform within the product? Consider system functionality (operational capability and reliability) at the product level and consider the system limitations.

- Integration: How do the affected system's elements listed above interface with each other and with other components or systems within the product? Consider mechanical, electrical, software, environmental (ambient and operational), human factors and overall operational integration.

- Installation: How is the system (including its components) installed within the initial configuration? Describe the physical installation including size/weight, location, structural aspects (design and construction), physical orientation, and any other relevant installation feature. Consider this for both the hardware and software elements.

b. Change analysis is the assessment of a change to an existing initial configuration. You must also define the post-change configuration for this assessment. Define the post-change system configuration using the three aspects of a system:

- Function: What function will the changed system perform within the product? Consider system functionality (operational capability and reliability) at the product level and consider the system limitations.
- Integration: How will the elements of the changed system interface with each other and with other components or systems within the product? Consider mechanical, electrical, software, environmental (ambient and operational), human factors and overall operational integration.
- Installation: How will the changed system be installed or implemented in the existing type design? Describe its physical installation including size/weight, location, structural aspects (design and construction), physical orientation, and any other relevant installation feature. Consider this for both hardware and software elements.

c. Identify differences – The next step in change analysis is to compare the post-change configuration to the initial configuration. In conducting this comparison identify any/all differences in function, integration, and installation. Systematically identify all the differences, regardless of how subtle, between the post-change system configuration and the initial system configuration. Identify differences within the three aspects of a system and categorize them as follows:

- Δ Function,
- Δ Integration, and
- Δ Installation.

Formatted: Right

Formatted: Font: 10 pt

d. Evaluate the impact of differences on system safety. While a change to an existing type design is proposed to either improve performance, change functionality, or gain efficiency it may have negative side effects which may cause degradation of the established level of safety. The next step in change analysis is to evaluate the impact of the identified differences resulting from a change applied to a system. The purpose of this step is to determine potential hazards.

(1) Evaluate the impact of each difference in system function, integration, or installation on each characteristic affecting the airworthiness of the product. Conduct this evaluation by utilizing the pre/post-change system definition, subject matter expertise and available test, analysis, computation, comparison, or service history related to the affected system and/or proposed change. While conducting this evaluation, you must also consider the various operating and ambient environments of the product and/or affected system(s).

(2) While a single identified difference may not have an impact, when combined with another noted difference the impact and resulting potential hazard may be significant. Therefore, after evaluating each difference consider the combined affect of any two or more differences within the system function, integration or installation categories and also across these categories. For example, a change in the amperage of an existing wire and its routing when evaluated individually may not pose a threat, however, if the new routing is in close proximity to fuel system wiring or components then the impact to system safety can be significant. The two differences when combined and evaluated result in a better understanding of system safety impact.

(3) The impact that a noted difference may have on the aforementioned characteristics translates into a potential hazard. For example, a difference in the integration aspect of a given system may impact its reliability such that a potential hazard is identified. The following step will assess each identified hazard to determine the level of severity at the product level.

e. Characterize the system safety impact – Develop a severity profile of the potential hazards. This involves identifying the resultant undesired events and assessing their severity. Accomplish this by using available system safety tools (for example, functional hazard assessment or fault hazard analysis) or something as simple as a causal chain (see figure 3). A causal chain is an ordered sequence of events in which any one event in the chain causes the next. Assess the final severity level based on how critical the affected system is to the airworthiness of the product.

(1) Knowledge of any potential hazards leads us to identify related potential undesired events. Identification of any undesired events requires a detailed understanding of the pre/post-change system operation, its integration within the type design, and corresponding system failure modes. Knowledge of failure modes is crucial for identification of undesired events. Knowing how a system fails and the various causes and consequences can assist in identifying the path a potential hazard can take to an undesired event in the causal chain. When developing a causal chain or using another tool to conduct this analysis, identify undesired events as close to product level as possible based on the available data.

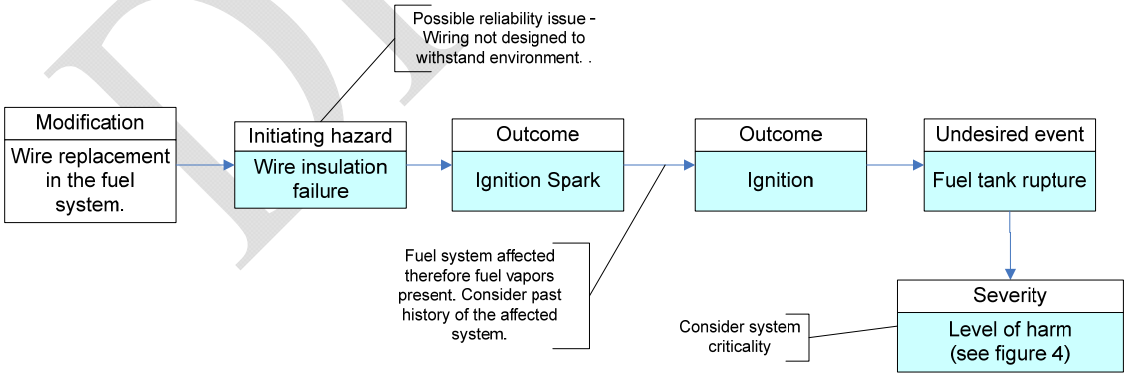
Formatted: Right

Formatted: Font: 10 pt

(2) Conduct a severity assessment of each identified undesired event. After potential undesired events are identified, assess the corresponding severity within the bounds of system criticality. Severity is the level of harm an identified undesired event can cause at the product level. This level of harm is influenced by the criticality of the affected system. System criticality is the significance of a failure within that specific system with respect to the product. A failure in a cabin entertainment system may be less critical to the aircraft than a failure in a fuel system. When determining system criticality consider the integration and installation of the system and/or its components to other systems/components as this may affect system criticality. The location of a failure with the system may also affect its criticality. Consider an entertainment system wiring bundle that is in close proximity to a fuel system component or wiring. A failure in the cabin entertainment system related to the wiring may in this case cause a hazard for the fuel system and therefore, the criticality of the entertainment system in this scenario is affected. When assessing severity of an undesired event use the severity scale in Figure 4.

(3) Figure 3 shows a causal chain example of a scenario when the fuel system wiring is modified. In this example the change is a new wire type. The figure shows various causes and consequences, which line the path to the undesired event. The wire modification is being incorporated in a critical area - the fuel system, and the severity level for a fuel tank ignition/rupture would presumably be high. However, if the wire modification was implemented in a less critical area (such as entertainment system), and if the wire bundle routing was also not critical, then the severity level would presumably be low. This figure only shows one potential initiating hazard and a possible subsequent path. It does not show an exhaustive and detailed assessment of the sample scenario. The level of detail in such an analysis would depend on the complexity and scope of the proposed change.

Figure 3. A Causal Chain



Formatted: Right

Formatted: Font: 10 pt

Figure 4. Severity Scale

Severity level determination:				
This chart describes the severity levels that may be assigned to identified undesired events (failure conditions) at the product level. Use the criticality of the affected system to determine the appropriate severity level for an identified undesired event (failure condition) at the product level.				
Level 1	Level 2	Level 3	Level 4	Level 5
Failure will have LITTLE to NO effect on continued safe flight and other operational phases.	Failure will not prevent continued safe flight and landing; however, resulting consequences MAY reduce the capability of the aircraft or the ability of the crew to cope with adverse operating conditions or subsequent failures.	Failure will not prevent continued safe flight and landing; however, resulting consequences WILL reduce the capability of the aircraft or the ability of the crew to cope with adverse operating conditions or subsequent failures.	Failure MAY prevent continued safe flight and landing. Resulting consequences MAY reduce safety margins, degrade performance, or cause loss of capability to conduct certain flight and/or passenger safety operations	Failure WILL prevent continued safe operation. Resulting consequences WILL reduce safety margins, degrade performance, or cause loss of capability to conduct certain flight and/or passenger safety operations.
Green - Low		**Yellow - Medium**		**Red - High**
Increasing Severity →				

f. Determine type design change classification – The classification of major or minor is assigned based on the assessed severity levels. The system safety assessment process concludes with a severity level for each undesired event. This severity level determination is a measure of the appreciable effect stated in 14 CFR § 21.93 and therefore there is a direct correlation made between these two terms in this AC. Based on Figure 4, if at any point in this assessment a severity level of 4 or 5 is identified, then the subject change is a major change to type design and no further assessment of any remaining identified hazards is required. Changes that are deemed to be level 1 thru 2 are minor. If the assessment results in a severity level 3, the classification, based on other factors, may be major or minor. Some other factors that may affect this decision

Formatted: Right

Formatted: Font: 10 pt

are a part of the reduction in capabilities of the product and/or the crew to cope with 'subsequent failures.' A level 3 severity assessment poses a borderline scenario and may require consultation with the ACO to arrive at the final decision. You may propose a classification of major or minor based on an assessed severity level 3 and your understanding of the change and the affected system. The FAA will review this and may require further discussion and/or clarification from you in order to concur. The severity level definitions in Figure 4 take into account the airworthiness characteristics, including reliability, which are stated in 14 CFR § 21.93 (a).

Formatted: Right

Formatted: Font: 10 pt

Chapter 4. Documenting The Assessment

1. Minimum Requirements for Documenting a 14 CFR § 21.93 Compliance Package. When showing compliance with 14 CFR § 21.93 you may submit the following information to the FAA. The purpose of documenting this data is to support and substantiate the classification of change in type design determined by applying the process in this AC.

Deleted: must

> **Note**: The documentation in accordance with this chapter and the submittal of the compliance package is only required when you are applying this process to show compliance with 14 CFR § 21.93. You may choose to apply this process for your own internal organizational reasons and in this case formal submittal of a compliance package is not required.

a. Names of the project lead and any participants in the assessment and their relevant background/qualifications

b. Provide a listing (as an appendix) of all the necessary type certificated design data and the design change data (for example, functional diagrams, schematics, drawings, component list/function, IT requirements document) used for the assessment. For each item listed provide a brief detail of its content and any reference designation. The actual data are not required for initial submittal; however, the FAA ACO may request the data as necessary to find compliance.

c. Provide an executive summary of the assessment results in the introductory portion of the compliance report.

d. Describe in detail the pre-change configuration of the type design relevant to the affected system, component, or part. At a minimum document the information referenced in chapter 3, paragraph 3.a.

e. Describe in detail the proposed change and document all identified differences from the initial configuration. Categorize the differences under function, integration and installation. At a minimum document the information referenced in chapter 3, paragraph 3.b.

f. Document each identified hazard based on the identified differences in accordance with the process in this AC. Reference chapter 3, paragraph 3.c.

g. Document the identified undesired events based on the identified hazards. Reference chapter 3, paragraph 3.d.

h. Document the assessed severity level for each identified hazard. Reference chapter 3, paragraph 3.d.

Formatted: Right

Formatted: Font: 10 pt

i. Based on the assessed severity levels document the classification of the change to type design (major or minor). Reference chapter 3, paragraph 3.e.

j. Develop and include a glossary (as required) in the compliance report. Include any reference material as appendices to the report.

2. Submittal of Completed 14 CFR § 21.93 Compliance Package. Submit the completed compliance package to your geographic FAA office. However, the review of the package and subsequent compliance finding must be conducted by the ACO (or Engine Certification Office (ECO)) which has certificate management responsibility for the subject product.

> **Note**: The certificating office may delegate this function to the geographic ACO.

Formatted: Right

Formatted: Font: 10 pt

Appendix 1. Definitions

a. Type Design: see 14 CFR § 21.31.

b. Ambient environment: The physical environment of a system, system component or part as installed on a product.

c. Appreciable effect: A significant effect, as opposed to some effect or no effect.

Deleted: The magnitude of impact a change will have on characteristics affecting the airworthiness of a product. The magnitude of impact is appreciable when a proposed change to an existing type design will invalidate previous compliance to certain applicable airworthiness standards

d. Change Analysis: Examines the potential effects of a change on an existing system. This results in the identification of key differences between the initial and the new changed configuration.

e. Criticality: Is an indicator that represents the significance of failure of a system (or component) with respect to the product. A failure in a highly critical system may cause significantly degraded airworthiness of the product.

f. Fault Hazard Analysis: A deductive method of analysis that requires a detailed investigation of a system to determine component hazard modes, causes of these hazards, and resultant effects to the system and its operation.

g. Functional Hazard Assessment (FHA): An analytical technique applied to explore the effects of functional failures of a system or its components (subsystems). The primary objective of applying a FHA is to identify hazardous function failure conditions.

h. Hazard: A condition, occurrence, or circumstance that could lead to or cause an undesired event. Sometimes termed a "threat."

i. Product: An aircraft, aircraft engine, or propeller (14 CFR § 21.1(b)).

j. Qualitative analysis: A review of all factors affecting the safety of a system, operation and/or person and how the sum of these will affect the safety of the product. It involves examination of the design against a predetermined set of acceptability parameters.

k. Quantitative analysis: A process that takes qualitative analysis one logical step further by evaluating more precisely the probability that an accident might occur.

l. Severity assessment: Process of assessing hazards (from change analysis data) and qualifying or quantifying the degree of harm they pose for a given system.

m. Severity profile: Identification and characterization of an undesired event's severity.

n. Severity: The harm that can be expected should an undesired event occur (i.e., loss, consequence, adverse outcome, damage, fatality, system loss, degradation, loss of function,

injury).

o. System: An integrated set of constituent elements that are combined in an operational or support environment to accomplish a defined objective. A generic system is defined as including the following elements - people (human element), procedures (software, symbology), hardware, and environment (operational and ambient). In the context of this AC the highest level system one could reference is the product.

p. System Safety: The application of engineering and management principles, criteria, and techniques to optimize safety within the constraints of operational effectiveness, time, and cost throughout all phases of the system life cycle.

q. Undesired event: Failure condition or malfunction, resulting from a pre-existing hazard, which can cause harm to system elements (for example. human, hardware).

Appendix 2. Related Publications and Administrative Information

1. References and Related Publications.

- 14 CFR part 21, subpart D - Changes to type certificates, and predecessor regulations.
- 14 CFR § 21.113 and predecessor regulations.
- FAA Order 8900.1, *Flight Standards Information Management System (FSIMS)*
- FAA Order VS 8000.1, *Safety Management System Doctrine*
- System Safety Society, *System Safety Analysis Handbook 1999*

2. How to Get Publications.

- Order copies of 14 CFR, parts from the Superintendent of Documents, Government Printing Office, P.O. 979050, St. Louis, MO 63197. For general information telephone (202) 512-1800 or fax (202) 512-2250. You can order copies online at www.access.gpo.gov. Select "GPO Access" then "Online Bookstore." Select "Aviation," then "Code of Federal Regulations."

- Order copies of FAA Orders and Advisory Circulars from the U.S. Department of Transportation, Subsequent Distribution Office, M-30, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785. You can also get copies from our FAA website at www.airweb.faa.gov or www.faa.gov.

3. Administrative Information. If you have questions, or need more information about this AC, contact the FAA Certification Procedures Branch, (AIR-110) at 800 Independence Avenue SW, Washington DC 20591. Telephone (202) 385-6312**.**