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Advisory Circular

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This advisory circular (AC) explains the Technical Standard Order (TSO) process outlined in Title 14 of the Code of Federal Regulations (14 CFR) part 21, subpart O, for manufacturers producing articles under a TSO authorization (TSOA) or letter of design approval (LODA).

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

CHAPTER 1. GENERAL INFORMATION

1.1 Purpose.

1.1.1 This advisory circular (AC) explains the Technical Standard Order (TSO) process. It also explains the responsibilities of the TSO authorization (TSOA) applicant, the letter of TSO design approval (LODA) applicant, holders of TSO production and design approvals (TSOA holders), and TSO design approval holders (LODA holders).

1.1.2 This AC is not mandatory and does not constitute a regulation. It describes an acceptable means, but not the only means, to comply with the requirements of Title 14 of the Code of Federal Regulations part 21, subpart O. However, if you use the means described in this AC, you must follow it in all important respects.

1.2 Audience.

We wrote this AC for manufacturers of articles who are applying for a TSOA or a LODA, and for manufacturers of articles who are already approved by a TSOA or a LODA.

1.3 Where to Find This AC.

You can find this AC on the Federal Aviation Administration (FAA) website at http://www.faa.gov/regulations_policies/advisory_circulars/.

1.4 Cancellation.

This AC cancels AC 21-46 dated 09/30/2010.

1.5 Explanation of Changes.

This revision:

1.5.1 General: change numbering system within the document to comply with Order 1320.46D (FAA Advisory Circular System).

1.5.2 Revised paragraph 1.1 for a clearer purpose.

1.5.3 Added a paragraph to explain the changes in this revision.

1.5.4 Reworded paragraph 2.1 in defining TSO and TSOA.

1.5.5 Changed wording in paragraph 2.2 to the language used in FAA Order 8150.1D, *Technical Standard Order Program*.

1.5.6 Changed wording in paragraph 2.3 to the language used in FAA Order 8150.1D.

1.5.7 Added paragraph 2.4, which explains deviations using the language in FAA Order 8150.1D.

1.5.8 Changes the explanation of TSO marking in paragraph 2.6 to the language in FAA Order 8150.1D.

1.5.9 Added paragraph 3.2, introducing compliance matrix.

1.5.10 Revised TSOA application requirement, paragraph 3.5, using language in Order 8150.1D.

1.5.11 Added paragraph 3.10 regarding Open Problem Reports (OPR).

1.5.12 Reword paragraph 3.12 to introduce Figure 3-1.

1.5.13 Added Figure 3-1 to summarize the roles of applicant, AIR-100, ACO and MIDO.

1.5.14 Adds paragraphs 4.4.1 and 4.4.2, which contain information about design changes.

1.5.15 Change wording in paragraph 4.4.3, minor change to a design.

1.5.16 Added paragraph 4.4.3.5 regarding marking of changed article.

1.5.17 Added paragraph 4.4.4.2 regarding submitting of application.

1.5.18 Change wording in paragraph 4.4.7 regarding design change.

1.5.19 Corrected typo error in paragraph 4.5.3.

1.5.20 Changes title of paragraph 5.1.

1.5.21 Add detailed information to paragraph 5.5 related to non-TSO functions.

1.5.22 Added Appendix A. - List of Acronyms.

1.5.23 Added Appendix B – Sample of Compliance Matrix.

CHAPTER 2. THE TSO PROGRAM

2.1 Technical Standard Order (TSO) Definition.

A TSO is a minimum performance standard, defined by the FAA, used to evaluate an article. An article can be a material, part, component, process, or appliance. (Refer to Title 14 of the Code of Federal Regulations (14 CFR) 21.1(b)(2)). Each TSO covers a certain type of article intended for use on civil aviation aircraft and provides a baseline standard intended to support compliance with airworthiness or operational requirements. However, compliance with a TSO or multiple TSO cannot ensure the installation of the article will comply with airworthiness requirements. This determination is made during installation. Refer to Advisory Circular (AC) 21-50, *Installation of TSOA Articles and LODA Appliances*, for further information.

2.2 TSO Authorization and Letter of Design Approval.

As used in this AC, the abbreviations TSOA and LODA refer to "Technical Standard Order Authorization" and "Letter of Design Approval" respectively.

2.2.1 Definition of TSOA.

A TSOA is an FAA design and production approval issued to the manufacturer of an article that has been found to meet a specific TSO. A manufacturer is the person who controls the design and quality of the article produced to ensure it meets the TSO. The manufacturer also must control all the suppliers it uses for parts or services in the design and production of the TSO article (refer to 14 CFR § 21.601(b)(5)). The FAA issues TSOA only to U.S. manufacturers. When the FAA issues a TSOA, it finds:

2.2.1.1 The manufacturer's article design meets the applicable TSO.

2.2.1.2 The manufacturer has a quality system (QS) that will produce every article to conform to the approved design.

2.2.1.3 The United States is the State of Design (SOD), as defined by the International Civil Aviation Organization (ICAO), for a TSOA.

2.2.1.4 The United States is the State of Manufacture (SOM), as defined by ICAO, for a TSOA.

2.2.2 Definition of LODA.

A LODA is a finding by the FAA that a foreign manufacturer's article design meets a specific TSO. The manufacturer's ability to manufacture articles that conform to the approved design is overseen by a foreign civil aviation authority (CAA) with which the United States has a bilateral agreement. All articles destined for import into the United States must be accompanied by a certificate of airworthiness for export pursuant to 14 CFR § 21.502. The FAA may issue a letter of TSO design approval for these articles when it finds:

2.2.2.1 The manufacturer's article design meets the applicable TSO.

2.2.2.2 A CAA with which the United States has a bilateral agreement addressing TSOs will oversee the manufacturer's quality system to ensure every article produced will conform to the approved design.

2.2.2.3 The manufacturer's country is the SOD, as defined by ICAO, for a LODA.

2.2.2.4 The manufacturer's country is the SOM, as defined by ICAO, for a LODA.

Note: More information about bilateral agreements can be found at the following FAA website: https://www.faa.gov/aircraft/air_cert/international/bilateral_agreements/

2.2.3 Definition of Data.

For the purposes of this document, two types of data are defined:

2.2.3.1 Descriptive Data. Descriptive data is information used to define the article design, and includes:

2.2.3.1.1 The drawings (or equivalent) and specifications necessary to define the configuration and the design features;

2.2.3.1.2 Information on dimensions, materials, and processes;

2.2.3.1.3 Limitations (if applicable); and,

2.2.3.1.4 Required documents, such as maintenance instructions.

2.2.3.2 Substantiation Data. Substantiation data is information used to show that the descriptive data meets the applicable requirements. For example, substantiation data may include test plans, test reports, and analysis.

2.3 **Limitations of a TSO Authorization.**

2.3.1 A TSO authorization does not approve the article to any airworthiness regulations, requirements, or other standards except the Minimum Performance Standard (MPS) listed in the specific TSO.

2.3.2 A person who wants to install a TSO article in a product must obtain a separate approval under the type certification process (reference § 21.1(b)(1) and § 21.1(b)(4)) or under part 14 CFR § 43.a(2)) to show the article meets the applicable airworthiness requirements for the product. The person approving the installation of the article in the product must evaluate the TSO performance criteria and article installation instructions to determine if they are adequate for meeting the airworthiness requirements of the product (§ 43.2(a)(2)).

Note: Pursuant to 14 CFR § 21.1(b)(6), "product" means an aircraft, aircraft engine, or propeller.

2.4 **Deviation Definition.**

A deviation is any alternative method used to meet performance criteria specified in the TSO. A deviation must have an equivalent level of safety (ELOS) determination instead of literal compliance with the TSO requirement (§ 21.618(a)).

2.4.1 When Do You Need a Deviation?

The FAA requires you, the applicant, to obtain FAA approval for any deviation from the applicable TSO, regardless of the significance of the TSO criteria from which you want to deviate. For example, the FAA requires you to obtain a deviation approval when you propose to use a more recent version of an industry standard than the one referenced in the specific TSO.

2.4.2 How Do You Obtain Deviation Approval from the FAA?

See paragraph 3.11 for detailed instructions. You must request a deviation from the appropriate ACO, and must show that compensating features or factors create an ELOS to the TSO performance requirement(s) from which you propose to deviate.

2.5 **TSOA or LODA Are Not Mandatory.**

TSOA and LODA are not mandatory. Per 14 CFR 21.8(b), TSOAs and LODAs are one way to get an article approved. You may also use the other provisions in § 21.8 to have your article approved.

2.6 **TSO Markings.**

The FAA does not allow anyone to mark an article stating it meets a specific TSO unless the FAA has issued them a TSOA or LODA. The article must be produced pursuant to part 21 subpart O or under the provisions of an agreement between the United States and another country or jurisdiction for the acceptance of products and articles.

2.6.1 A TSO marking on an article made under a TSOA or LODA means:

2.6.2

2.6.2.1 The article's design meets the TSO standards for which it is marked.

2.6.2.2 The article was produced under an approved quality system and conforms to the TSO-approved design.

2.6.3 A TSO marking on an article made under a TSOA or LODA does not mean:

2.6.3.1 The article's design meets airworthiness regulations for the product.

2.6.3.2 The article is approved for installation on a product.

CHAPTER 3. TSOA AND LODA APPLICANT RESPONSIBILITIES

3.1 Certify That Your Article Complies With the Applicable TSO Standard.

As an applicant for a TSO authorization, you certify that the design of your article meets all the requirements of the applicable TSO.

3.1.1 If the TSO specifies a method for substantiation, you must use that method to substantiate your article unless you propose other means of compliance (for example, analysis versus test). Use of a method other than the one specified in the TSO requires a deviation (refer to § 21.618).

3.1.2 All substantiation must be completed (pursuant to § 21.611) before submitting your application for TSO Authorization unless otherwise agreed to by the responsible Aircraft Certification Office (ACO). You should coordinate with the FAA any potential issues with your article before submitting your application.

3.1.3 You are responsible for a process that documents how you conform to the requirements of the current TSO, including the use of a compliance matrix or equivalent procedure to verify the conformance to the requirements of the TSO.

3.2 Compliance Matrix

3.2.1 To help the FAA process applications more efficiently and effectively, an applicant should submit a TSO compliance checklist or matrix. The checklist or matrix is simply a list of each TSO requirement and how the applicant has met the requirement (for example, by documentation, analysis, or test). The compliance matrix is not a regulatory requirement but it provides the ACO a standardized summary of how an applicant shows compliance to the applicable regulations.

3.2.2 Appendix B to this AC provides an example of a compliance matrix. If a compliance matrix is not used, you must have an active system (pursuant to § 21.607, § 21.616) in place that:

3.2.2.1 Defines all the requirements needed to comply with each TSO and part 21, subpart O requirement.

3.2.2.2 Ensures each requirement is met before you submit the letter of conformance to the FAA.

3.2.2.3 Documents the substantiating data for compliance with each requirement.

3.3 **Control the Design and Quality of Your Article.**

You must control both the design and the quality system (pursuant to § 21.607) for the production of the article. This includes controlling the design and quality of any items you receive from a supplier to the extent necessary to ensure the article meets the TSO.

3.3.1 To control the design of the article means you have the responsibility for the development and the management of each component, features, and functions regardless of where that process takes place or with whom you have contracted. Because the FAA issues the TSO authorization to you, we the FAA hold you responsible for ensuring the design met the TSO. This also means each design change to the article or any of its components, features, or functions must also be controlled by you to ensure that, after the change, the article still meets the TSO and all required documentation delivered with each article is updated accordingly (pursuant to § 21.619).

3.3.2 To control the quality of the article means you must build your article in accordance with the approved design. You are responsible for controlling all your suppliers and all changes they implement in their production line for any part, process, or service they are providing you, as needed.

3.3.3 If you integrate a TSO article from a supplier into your TSO design, you must also control the TSO article from the supplier to the extent necessary to ensure your article meets the TSO for which you have the authorization (pursuant to § 21.607 and § 21.137(c)).

3.3.4 You are responsible for notifying the FAA of design changes within the time period agreed to by the ACO at the time of TSOA issuance.

3.4 **Set Up and Maintain a Quality System (QS).**

If you are a TSOA applicant, you must set up and maintain a QS that meets § 21.607. Before we can issue a TSOA we must have evidence that you have a quality system pursuant to § 21.607 that meets § 21.137. AC 21-43A, *Production Under 14 CFR Part 21, Subparts F, G, K, and O,* provides guidance on the type and content of documentation you must submit to allow us to make a determination as to whether you have an acceptable QS.

3.5 **TSOA Application Requirements.**

3.5.1 You must submit a TSOA application to the ACO in your geographical area, pursuant to § 21.603. If your facility has multiple locations, the principal manufacturing facility or the associate facility that controls the design and quality of the article(s) submits the TSO authorization application.

3.5.2 You must use the applicable TSO that is effective on the date of application for that article, pursuant to § 21.603. Otherwise, you must ask for an exemption to § 21.603, as outlined in 14 CFR part 11.

3.5.3 Pursuant to § 21.601, your TSOA application must include a copy of the technical data and other documents required by the TSO and QS. This may include:

3.5.3.1 The TSO number for which the authorization is requested;

3.5.3.2 The manufacturer's name and physical address of the principal facility that controls the design and quality of the article;

3.5.3.3 A statement from the manufacturer certifying that it meets the requirements of part 21, subpart O, and the specific requirements of the applicable TSO;

3.5.3.4 A copy of the technical data required by the TSO;

3.5.3.5 A description of the applicant's organization as required by § 21.605; and

3.5.3.6 A manual describing the applicant's quality system that meets the requirements of § 21.607 as required by § 21.608. Applicants who currently hold TSOAs must submit revisions to the existing quality manual as necessary.

3.5.3.7 Any Non-TSO Functions (NTF) data for which you seek acceptance.

3.5.4 The TSOA will be granted for a specific model and specific part number(s) that define the article configuration. We suggest you include with your application a part numbering methodology pursuant to § 21.603(b) that uses open brackets to define minor changes. The part numbering methodology should include open brackets after the base part numbers to identify specific design configurations as minor changes occur. Refer to the example below for part numbers with open brackets. Refer to paragraph 4.4 of this AC for more information on design changes.

Example:

Initial Part number: 12345[ ]

Part number with change 1: 12345[1]

3.5.5 It is our experience that applications are processed more efficiently when an applicant submits to the FAA a TSO compliance checklist or matrix (see Section 3.2 of this AC).

3.5.6 Discuss with the responsible ACO for an FAA recommended means for TSOA applicant or holder to demonstrate that their organization has and will maintain the capabilities needed to conform to the requirements for each TSO for which they hold an approval.

3.6 **LODA Application Requirements.**

3.6.1 You must submit a LODA application to the Civil Aviation Authority (CAA) for your country. Your CAA must certify that the article has been examined, tested, and found to meet the applicable TSO or the applicable performance standards of the State of Design and any other performance standards the FAA may prescribe to provide an equivalent level of safety to the TSO. Once the CAA determines your LODA application meets all the above mentioned requirements, the authority must make a certifying statement to the FAA that it finds your article meets the TSO and other performance standards the FAA may prescribe (pursuant to § 21.621).

Note: Prior to submitting a LODA application, you should consult the applicable bilateral agreement to determine if the FAA will issue a LODA to an applicant in your country, or if an alternative process exists.

3.6.2 You must use the applicable TSO that is effective on the date of application for that article, pursuant to § 21.603. Otherwise, you must ask for an exemption to § 21.603, as outlined in 14 CFR Part 11.

3.6.3 Your LODA application must include (pursuant to § 21.621):

3.6.3.1 The TSO number for which the approval is requested;

3.6.3.2 The manufacturer's name and physical address of the principal facility that controls the design and quality of the article;

3.6.3.3 A statement of conformance from the CAA certifying it has determined that the applicant's article meets the FAA's applicable TSO pursuant to § 21.621(a)(2)(i);

3.6.3.4 A copy of the technical data and other documents required by the TSO;

3.6.3.5 Any requested deviations from the TSO (refer to paragraph 3.11 of this AC); and

3.6.3.6 Any NTF data for which you seek acceptance, if specifically permitted by the applicable bilateral agreement.

3.7 **Use of Subject Matter Experts in the TSOA Process.**

Any person who has the expertise to review TSO data can assist a TSO applicant in drafting its statement of conformance. However, only the applicant can make the statement of conformance.

3.8 **Provide Installation Instructions and Limitations.**

The TSO installation instructions provide information for proper integration or attachment of the article into the product. Installation instructions are typically

a step-by-step procedure for use by the installer to accomplish this goal. A TSO installation limitation is information that helps an installer determine the applicability (that is, eligibility) of the article to be installed in the product. The TSO installation limitations ensure that the article, when installed according to the installation instructions, continues to meet the requirements of the TSO MPS. Note that since the TSOA does not convey product installation approval, the TSO installation instructions and limitations do not convey what is required to have a compliant installation per the applicable airworthiness requirements of the product.

3.8.1 As an applicant for a TSOA, you must establish and provide installation instructions, limitations, and maintenance instructions to the ACO and the installer (pursuant to § 21.50 and § 43.13).

3.8.2 You must provide enough detail in the installation limitations for the installer to determine if the TSO article is compatible with the product and with all foreseen equipment and systems with which the article is intended to interface. For example, the limitations section for avionics TSO articles should clearly state the software and hardware design assurance levels as well as interoperable versions/revisions so the installer can determine compatibility of the TSO article with the product it is installed in (pursuant to § 21.50).

3.8.3 You may choose to limit the TSO article to interface only with specific components or equipment once installed in the product. Identify and describe any unique aspects of the TSO article, including all NTFs and any incomplete TSO article instructions and limitations, in the limitations section.

3.8.4 If you do not demonstrate by lab or simulator testing and/or by analysis that the TSO article will perform its intended function when installed, list additional testing requirements in the installation instructions or procedures. The additional testing requirements should allow the installer to demonstrate that the article is compatible with the equipment it interfaces with, and will continue to meet the requirements of the TSO after installation.

3.8.5 Typically the TSO also requires that installation instructions, limitations, and maintenance instructions be furnished with each article that is shipped. Generally, if a group of articles is being shipped to one location, it is acceptable to make one set of the documentation available for the entire group of identical articles. This is an acceptable practice unless the recipient wants a copy of the documentation for each article.

3.8.6 You must include in your installation and limitations documentation (pursuant to § 43.13(a)):

3.8.6.1 Basic instructions on how your article is intended to be installed in the product;

3.8.6.2 Specific steps to be followed for the integration of the article into the product;

3.8.6.3 Tests or inspections to help verify that the article is installed correctly;

3.8.6.4 All installation and additional requirements for the installation of your article necessary to ensure that your article will continue to meet the MPS specified in the TSO once installed in a product; and

3.8.6.5 Details of any deviations per para 3.11.7 of this AC, as applicable.

3.8.7 In cases where you know the configuration of the product into which your article will be installed, identify the limitations that need specific attention. Although the installation of the article is not your responsibility, we encourage you to develop a thorough set of installation instructions and limitations to help ensure your article will be installed and operated in a manner that continues to meet the TSO and the anticipated airworthiness regulations.

3.9 **Provide Maintenance Instructions for the Article.**

Most TSO require you to develop and submit maintenance instructions for approval. Instructions for Continued Airworthiness (ICA) are required for all products. You must submit TSO maintenance instructions that will allow the article to continue to meet the TSO requirements after it is installed (for the product to comply with § 43.13(a)). These are not necessarily the same requirements for the product, but your instructions can be used by the type certificate (TC)/supplemental type certificate (STC) applicant as the basis for them to meet their responsibilities for ICA at the product level. You should submit the TSO maintenance instructions to the ACO with the TSO application package. Include in your maintenance and limitation instructions, as appropriate:

3.9.1 Inspection intervals;

3.9.2 Inspection procedures;

3.9.3 Recommended service life;

3.9.4 Wear limits;

3.9.5 Cleaning instructions;

3.9.6 Basic maintenance instructions;

3.9.7 Calibration information;

3.9.8 Information on any special tools required;

3.9.9 Acceptable repairs and repair procedures; and

3.9.10 Any other information necessary to maintain compliance with the TSO while in service.

3.10 **Submit Open Problem Reports (OPR).**

If your TSOA article provides software or Airborne Electronic Hardware (AEH) functionality, you must submit a summary to the ACO of software or airborne electronic hardware problems (or potential problems) that have been identified, but not yet resolved. OPR with a potential safety effect, or which result in noncompliance with the TSO, must be corrected before approval. You should provide an OPR summary with functional impacts to applicants for installation approval of the article:

3.10.1 A sufficient description should be provided for proper assessment;

3.10.2 Any OPRs with potential safety impact should be corrected;

3.10.3 OPR information should be provided in the installation manual or supplemental data;

3.10.4 There should be a means for updating OPR summary if necessary;

3.10.5 The TSOA holder should provide contact information in case installer needs more information;

3.10.6 The TSOA holder should have a means to accept problems reported from the field.

Note 1: This may require the ACO to review your process for classifying OPR or confirm the ACO agrees with each OPR classification.

Note 2: You must have a means for transmitting the summary of OPR to the installation approval holder and facilitate updates in case additional OPR are discovered after the TSOA is issued. You must have a means of entering problems reported from the installation approval holders and operators into a problem reporting system for tracking and disposition, and for providing OPR support to the installation approval holder.

3.11 **Requesting Approval to Deviate From a TSO (§ 21.618).**

3.11.1 A deviation may be granted by the FAA if the applicant demonstrates that factors or design features provide an equivalent level of safety (ELOS) to compensate for the requirement from which a deviation is requested. A deviation request is specific to the article approval and must be re-submitted for new TSOA or LODA applications. For example, the FAA might approve a deviation to your TSOA for one particular article. You cannot use that same deviation approval for another TSOA application without requesting another deviation from the MPS.

3.11.2 As an applicant for a TSOA, if you want to deviate from the TSO you must submit a deviation request to the ACO regardless of the significance of the TSO requirement from which you want to deviate. For example, we require applicants to receive a deviation approval when they propose to use a version of an industry standard later than the one referenced in the specific TSO.

3.11.3 To receive our approval for a deviation, you must show that compensating features or factors provide an equivalent level of safety (ELOS) to the TSO performance requirement(s) from which you propose to deviate.

3.11.4 We evaluate your deviation request, and approve the deviation if an ELOS can be assured. The deviation approval may identify limitations for the approval, which you should consider when making subsequent design changes to ensure the limits continue to be met.

3.11.4.1 We encourage you to discuss and coordinate the deviation proposal with the ACO before you submit your official deviation request. Discuss the application with your ACO to ensure you do not perform testing or analysis that we may not approve as a sufficient means to substantiate the ELOS. These discussions usually help establish agreement on whether your proposal establishes an ELOS and can save you significant time and resources. Do not consider discussions to be binding. We will evaluate your official deviation request once we receive it and we will respond in writing.

3.11.4.2 If you are applying for a LODA, we encourage you to have an unofficial dialogue with the CAA. The CAA can coordinate with the FAA to ensure you do not perform testing or analysis that we may not approve as adequate for substantiating the ELOS. These discussions usually help establish agreement on whether your proposal establishes an ELOS and can save you significant time and resources. Do not consider discussions to be binding. We will evaluate the official deviation request once we receive it.

3.11.5 Substantiating the ELOS.

Ensure your deviation request includes substantiating data that specifically covers the compensating factors or features. The proposed TSO deviation must clearly establish an ELOS to the TSO.

3.11.6 Marking the Article for Approved Deviations (pursuant to § 21.618).

When granted a deviation for your article, you must mark the article in accordance with the instructions in the ACO letter that granted the deviation.

3.11.7 Documenting Details of an Approved Deviation.

When you are granted a deviation you must list the specific details of the deviation in your installation manual. This is necessary to alert installers to evaluate the article installation or operational limitations affected by the deviations. Describe the details of all deviations and document all known impacts to performance and functionality resulting from a deviation.

3.12 **Roles of the FAA and Applicant.**

We coordinate between the ACO and the Manufacturing Inspection District Office (MIDO) to help you, the applicant, produce TSO articles according to the approved design. Approving a TSOA application requires the ACO to approve the design and the MIDO or Manufacturing Inspection Satellite Office (MISO) to approve the production system. A LODA is an FAA design approval only. Approving a LODA application requires the ACO to approve the design of the foreign-manufactured articles. The applicable CAA issues the corresponding production approval and oversees the production system. Figure 3-1 details the basic roles of the FAA and applicant in the TSO process.

Figure 3-1. Basic Roles of the FAA and Applicant in the TSO Process *

Applicant	AIR-100	ACO	MIDO
• Control the design and quality of the article • Show compliance with applicable TSO standard • Set up and maintain a QS that meets § 21.607 or is in accordance with bilateral agreement • Provide a statement of conformance to the applicable TSO(s) • Request approval to deviate from TSO • Establish and provide installation instructions, operational limitations, OPR summary, and maintenance instructions • Provide maintenance instructions and installation limitations to each person who receives articles, to ensure the article continues to meet the MPS of the TSO after installation • Mark each article according to § 45.15(b) and as specified in each applicable TSO • Report service difficulties pursuant to § 21.3 • Submit TSOA's minor changes to the ACO • Submit to the FAA document describing how its organization will ensure compliance • Develop PSP with ACO as applicable	• Administer TSO program policy • Develop and issue new TSO • Determine when TSO require revisions • Cancel obsolete TSO • Determine if all TSOA for a particular TSO must be withdrawn, and publish intentions of withdrawal in the Federal Register before the withdrawal. If it is determined necessary, the process defined in the appropriate paragraph of Order 8150.1 will be followed • Grant/deny deviation requests not delegated to the ACO • Maintain records for TSO, including canceled TSO	• Process TSOA applications and LODA applications from a CAA, if applicable • Recommend approval or denial of deviations to the TSO to AIR-100 • Grant/deny deviations that Order 8150-1D or a specific TSO has delegated to the ACO • Coordinate with MIDO (TSOA) or follow the procedures defined in the bilateral agreement (LODA) before issuing TSOA/LODA letters. • Witness various functions if deemed necessary (refer to § 21.610) • Find that the article design complies with the applicable TSO • Send applicant TSOA, LODA, or denial letter • Investigate reports of service difficulties and noncompliance • Submit enforcement reports when holders do not comply with part 21, subpart O • As applicable, work with applicants to develop Partnership for Safety Plans (PSP)	• Verify production system produces articles that conform to the approved design • Approve the quality system • Issue TSOA article production approval letter to ACO • Conduct surveillance at the TSOA holder's and supplier's facilities, both domestic and foreign, if appropriate. • Investigate service difficulty reports and nonconformities. • Submit enforcement reports when holders do not comply with part 21, subpart O

* Refer to applicable TSO and part 21, subpart O, for further details.

CHAPTER 4. TSOA AND LODA HOLDER RESPONSIBILITIES

4.1 Continue to Meet the Requirements of the TSO.

Pursuant to § 21.616, as the TSOA or LODA holder, you must:

4.1.1 Amend the document required by § 21.605 as necessary to reflect changes in the organization and provide these amendments to the FAA;

4.1.2 Maintain a quality system in compliance with the data and procedures approved for the TSO authorization;

4.1.3 Ensure that each manufactured article conforms to its approved design, is in a condition for safe operation, and meets the applicable TSO;

4.1.4 Mark the TSO article for which an approval has been issued. Marking must be in accordance with 14 CFR part 45, including any critical parts;

4.1.5 Identify any portion of the TSO article (e.g., sub-assemblies, component parts, or replacement articles) that leave the manufacturer's facility as FAA approved with the manufacturer's part number and name, trademark, symbol, or other FAA approved manufacturer's identification;

4.1.6 Have access to design data necessary to determine conformity and airworthiness for each article produced under the TSO authorization. The manufacturer must retain this data until it no longer manufactures the article. At that time, copies of the data must be sent to the FAA.

4.1.7 Retain the TSO authorization and make it available to the FAA upon request; and

4.1.8 Make available to the FAA information regarding all delegation of authority to suppliers.

4.1.9 Other countries follow requirements of bilateral agreements, if applicable.

4.2 How to Mark Each Article.

Mark each article pursuant to § 21.616(d) and § 45.15(b), and as specified in the TSO.

4.2.1 Before you ship any article, you must determine that it conforms to its approved design and mark it with all the information required by § 21.616(d), which includes the specific TSO for which the authorization was granted. You must also mark the article with all specific marking requirements as called out in the TSO for which authorization was issued and as described in paragraphs 4.2.4 and 4.2.5 of this AC. Be sure to review appendices in the TSO, as they may contain additions or exceptions to other marking requirements contained in a referenced industry document (such as Society of

Automotive Engineers (SAE) documents, aerospace standards (AS), or RTCA, Inc. (RTCA) documents).

4.2.2 The marking must be permanent and legible. The marking must be accessible (without the use of tools) in a location where it is easily readable and not easily erased or disfigured. If you receive information about your in-service articles that the TSO markings are missing or can no longer be read, you must investigate the cause and make any design changes necessary to resolve the issue.

4.2.3 When you believe an article is impractical to mark (for example, because of size or space limitations), you must request a deviation, unless the specific TSO provides explicit alternative marking instructions.

4.2.4 Electronic part marking that identifies the article by electronically embedding the identification within the hardware component itself (using software) may be used instead of marking the article on the equipment nameplate. If electronic marking is used, it must be readily accessible without the use of special tools or equipment. Electronic marking of an article is acceptable when the information provided by an electronic identification query system is stored in non-volatile memory. The electronic identification system must be verifiable on board the aircraft, when the aircraft is on the ground at any geographic location, and must provide the specific information required by § 45.15. Ensure that the installation instructions include instructions and technical data needed to facilitate electronic part marking display on the aircraft.

4.2.5 Refer to paragraph 5.4 of this AC for further marking information on multiple TSO articles.

4.2.6 Refer to paragraph 5.3 of this AC for further marking information on incomplete TSO articles.

4.3 **Report Service Difficulties Pursuant to § 21.3.**

4.3.1 As a TSOA holder, you are required by § 21.3(b) to report to us any defect in your article that you have determined could result in any of the occurrences listed in § 21.3(c). These occurrences include, but are not limited to:

4.3.1.1 Fires;

4.3.1.2 Engine exhaust system failures;

4.3.1.3 Toxic or noxious gases in the crew compartment or passenger cabin;

4.3.1.4 Malfunctions, failures, or defects in the propeller control system;

4.3.1.5 Flammable fluid leakage;

4.3.1.6 Structural or material brake system failures;

4.3.1.7 Malfunctions, failures, or defects in the flight control system including interference with normal control; and

4.3.1.8 Malfunctions or failures of attitude, airspeed, or altitude instruments.

Note: Review § 21.3(c) for the complete and accurate list of your responsibilities.

4.3.2 If we determine during an accident investigation or service difficulty that your article is unsafe, you must report to us at our request any results you find or actions you plan to take to correct the deficiencies. You will also have to submit to us any data we need to help the FAA issue an airworthiness directive (pursuant to § 21.3).

4.4 Design Changes.

4.4.1 As a TSOA holder, you are responsible for any design changes you make to your article and for updating the descriptive and substantiation data. Design changes to your article are classified as either minor or major. We require that you evaluate all design changes to determine if they are minor or major changes.

4.4.2 Pursuant to § 21.601, it is the responsibility of the TSOA holder or LODA holder to control the design relative to the applicable TSO requirements, including all parts, processes, or services procured from an outside source. Similarly, it is the responsibility of the TC/STC holder to ensure the TSO articles that have undergone design changes continue to meet the applicable airworthiness requirements of the aircraft.

4.4.3 Minor Design Changes Under a TSOA.

We permit TSOA holders to make minor design changes to their articles without further approval. However, all minor design changes must be substantiated to show compliance with the applicable TSO MPS requirements (pursuant to § 21.619(a)). We encourage you to propose to your ACO what constitutes a minor change, including the changes made by your suppliers, for the particular TSO article being manufactured and work with your ACO to establish a mutually agreed upon process for managing minor design changes. Sometimes minor changes may require significant substantiation (including testing) to ensure the article still meets the TSO requirements. However, unless the change results in a "substantially complete investigation" to the TSO, it can be classified as minor pursuant to § 21.619(a). Note that a major/minor design change classification under § 21.619(a) or (b) is made at the article level relative to the TSO standard and should not be confused with a major/minor design change classification under § 21.93. Design change classifications under § 21.93 are made at the product level.

4.4.3.1 We encourage you to use a partnership for safety plan to formalize the agreement discussed in 4.4.3.1 with your ACO. You can find more information on this process in the FAA and Industry Guide to Product

Certification. The manufacturer must maintain and submit to the FAA, on request, minor change substantiation data (pursuant to § 21.619(a)).

4.4.3.2 The article model and/or part number are used for configuration management at the aircraft level. You should change the part number of any article where a minor change to a previously manufactured article may affect the interchangeability at the product level, the use or installation of the article, or the minimum performance standards specified in the TSO. Update any associated documentation, such as the installation instructions, to identify the difference between the previous and new part number versions of the article.

4.4.3.3 Pursuant to § 21.619(a), you must substantiate and document all minor design changes. You must notify your ACO within the timeframe agreed upon with them. We recommend the data be submitted before shipping any articles. This will prevent you from distributing potentially noncomplying articles in the event the ACO finds that a minor change claim is improperly substantiated. You must state in your minor change notification letter that the changed article complies with the TSO. This statement reaffirms your compliance with part 21, subpart O. You can send this letter to the ACO by email.

4.4.3.4 If we determine a minor design change submittal is not sufficiently or properly substantiated, you must provide additional substantiation or other data as requested by your ACO. This could require you to retest the article to show compliance with the TSO standard. If, after review of the substantiation, the ACO determines that the article no longer meets the TSO MPS, you must immediately stop marking and shipping any changed articles and comply with the TSO requirements.

4.4.3.5 If we determine a minor design change is really a major design change, as defined in § 21.619(b), you must immediately stop marking and shipping any changed articles and comply with the criteria for major design changes.

4.4.4 Major Design Changes Under a TSOA. As stated in § 21.619(b), the FAA requires a new TSO application for all major design changes to TSO articles under a TSOA.

4.4.4.1 If the applicable TSO is revised while the application is being evaluated, you should provide an OPR summary with functional impacts to applicants for installation approval of the article;

4.4.4.2 A sufficient description should be provided for proper assessment;

4.4.4.3 Any OPRs with potential safety impact should be corrected;

4.4.4.4 OPR information should be provided in the installation manual or supplemental data;

4.4.4.5 There should be a means for updating OPR summary if necessary;

4.4.4.6 The TSOA holder should provide contact information in case installer needs more information; and

4.4.4.7 The TSOA holder should have a means to accept problems reported from the field.

4.4.4.8 Only need to demonstrate compliance with the TSO in effect at the time of the original application, not the revised TSO.

4.4.4.9 The ACO can give up to a 6 month relief period to applicants with pending applications provided the specific TSO being applied for contains provisions for doing so. If the applicant does not submit a complete application within this time, it must comply with the most recent TSO version.

Note: Some revised TSOs may contain a statement that the older version of the TSO will remain effective for a period of months after a revision becomes effective. During this time, the ACO may accept applications for either version of the TSO.

4.4.5 Design Changes Under a LODA.

Design changes to articles that have been issued a LODA are subject to the requirements defined in the applicable bilateral agreement. Generally, when the CAA considers a design change minor, it is approved without any FAA involvement. Design changes the CAA considers major require the LODA holder to apply for a new LODA.

4.4.6 Design Change by a Person Other Than the Manufacturer - TSOA and LODA.

Pursuant to § 21.619(c), we permit design changes to a TSO article by a person other than the original manufacturer who holds the TSO authorization, such as the product operator, the installer of the article, or the maintenance personnel. If the person seeking approval is another article manufacturer (refer to § 21.601(b)(5)), they must apply under a separate TSOA or LODA and obtain approval before modifying the article. The article may also be altered as part of an installation in an aircraft or engine, and approved under part 43 or the applicable airworthiness regulations in 14 CFR parts 23, 25, 27, 29, 31, 33, and 35. In all cases, the article must be permanently marked to indicate it has been modified.

4.4.7 The determination of whether a design change, repair, or alteration is major or minor varies, and depends on which FAA approval is being affected. These changes are classified differently within their specific regulatory basis, and this classification depends on whether the FAA approval is a TSOA, STC, repair, or alteration. Minor changes under a TSOA may be a major change for other types of FAA approval and vice versa. Regardless of the classification of the modification, all modifications must be substantiated relative to the applicable requirements (pursuant to § 21.619).

4.5 **Transferability.**

As stated in § 21.614, the holder of a TSO authorization or letter of TSO design approval may not transfer the TSO authorization or letter of TSO design approval. However, they may submit a request to the FAA for a transfer. The term "transfer" applies only to the TSO design approval. The production approval process that the MIDO accomplishes during a transfer is the same process for a new applicant or an applicant that is adding additional capability to an existing facility. TSOA transfer requests must be made by the current holder of the TSO authorization or letter of TSO design approval.

4.5.1 Examples of a Transfer.

When the sale or liquidation of a company that holds TSOA or LODA causes a change in the company's legal status, those TSOA or LODA must be transferred. TSOA or LODA design data may be sold from one company to another, and this is also considered a transfer.

4.5.1.1 For example, the acquisition of a company with a TSOA or LODA by a holding company would require a transfer of the TSOA or LODA if the acquired company is disbanded or absorbed into the purchasing company. In this case, the legal entity that received the TSOA or LODA will no longer exist, so the original holder would be required to request a transfer of the TSOA to the purchasing corporation before being disbanded or absorbed. A company can transfer a TSOA or LODA only when we grant them an exemption to § 21.614.

4.5.1.2 As another example, assume XYZ Company holds a TSOA, and ABC Corporation purchases XYZ Company. ABC Corporation plans to disband and absorb XYZ Company. In this case the legal status of XYZ has changed (for example, the company no longer exists as a legal entity) and the acquisition of the XYZ Company would necessitate a transfer of the TSOA or LODA.

4.5.2 Example of What Is Not a Transfer.

4.5.2.1 A company changing its name or relocating its facilities does not necessitate the TSOA or LODA to be transferred. The acquisition of a company with a TSOA or LODA by a holding company would not necessitate the transfer of the TSOA or LODA if the acquired company continues to exist as the same legal entity to which the original TSOA or LODA was issued under the following conditions:

4.5.2.1.1 The acquired company retains possession of the TSOA or LODA, substantiating data, and responsibilities under the original authorization or approval; and

4.5.2.1.2 The acquired company retains the same quality system (TSOA only).

4.5.2.2 Example: ABC Corporation purchases XYZ Company. XYZ Company holds a TSOA and will continue to operate under the same name, in the same location, with the same management, and under the same production system. In this case the legal status of XYZ has not changed and therefore the TSOA is not transferred.

4.5.3 Articles Approved With a TSOA.

Pursuant § 21.614, if you are changing your name, relocating your facilities, or being acquired by another company, you must inform your ACO before the action occurs, and you:

4.5.3.1 Should expect your ACO to forward this information immediately to your MIDO/MISO;

4.5.3.2 Must not ship any articles from a new facility until the MIDO has inspected and approved the new facility, and the ACO has reissued your TSOA; and

4.5.3.3 Should expect your ACO to reissue the TSOA at the same level as the original TSO after the MIDO determines your QS meets the requirements of § 21.137 pursuant to § 21.607 and you can produce each article to conform to your approved design.

4.5.4 Articles Approved With a LODA.

Pursuant to § 21.621, if you are a foreign manufacturer who holds a LODA and you are changing your name, relocating facilities, or being acquired by another company, you:

4.5.4.1 Must ensure your CAA provides the FAA written confirmation that your legal status remains unchanged after an acquisition;

4.5.4.2 Must not mark or ship any articles with the TSO marking until the FAA has reissued the LODA for name changes or facility relocations; and

4.5.4.3 Should expect the FAA to reissue the LODA at the same level as the original TSO after receiving written confirmation from the CAA that your article meets the TSO after a name change or facility relocation.

4.5.5 Converting a TSOA to a LODA.

Our regulations do not contain a provision for a manufacturer currently holding a TSOA to become a foreign manufacturer by relocating its design and production facilities outside the United States. In this case, your foreign facility should apply for a separate LODA as described in this AC. As the design approval holder (DAH) for the original TSOA, you will retain continued operational safety (COS) responsibilities.

4.5.6 Converting a LODA to a TSOA.

Our regulations do not contain a provision for a foreign manufacturer holding a LODA and wanting to become a U.S. manufacturer by relocating its design and production facilities into the United States. In this case, the manufacturer's facility in the United States should apply for a new TSOA as described in this AC, applying for the current version of the applicable TSO(s). As the DAH for the original LODA, you will continue to have COS responsibilities.

CHAPTER 5. ADDITIONAL TSO TOPICS

5.1 Receiving a Parts Manufacturer Approval (PMA) to Modify a TSOA Article.

We do not issue PMA to modify TSO articles; we issue PMA to modify products (aircraft, engines, and propellers). PMA approves replacement and modification articles for specific type-certificated products. These articles may reside in an assembly approved under a TSOA on these specific products, but the PMA limits installation of these articles to those specific products. PMA cannot approve replacement articles solely for original articles approved solely under a TSOA.

5.2 Shipping a Subcomponent of an Article Independent of the Complete Article.

You can ship a subcomponent of an article independent of the complete article, but you must complete an FAA Form 8130-3, Airworthiness Approval Tag, or other acceptable document. This tag will help make clear that the subcomponent is only a piece of an article and to clarify the article in which it is intended to be installed.

5.3 Incomplete TSO Article.

An incomplete TSO article is one that provides only part of the performance and/or functionality specified in the applicable TSO. For us to approve and issue a TSOA or LODA for an incomplete TSO article, all of the following conditions must be met:

5.3.1 The incomplete article provides a major and independent TSO function. There must be TSO requirement(s) that are specific to the function provided by the incomplete article (that is, in addition to general requirements related to software or environmental qualification).

5.3.1.1 Example of an incomplete article that provides a major and independent function: TSO-C4, *Bank and Pitch Instruments*, contains requirements that apply to an electronic flight instrument system (EFIS). The EFIS displays "bank and pitch" information, but does not include a vertical gyro. Because the EFIS provides a major independent TSO-C4 function that meets specific TSO requirements pertaining to a display, you may be granted an incomplete TSOA to TSO-C4.

5.3.1.2 Example of an incomplete article that does not provide a major and independent function: a cooling fan for a global positioning system (GPS) covered by TSO-C196b, *Airborne Supplemental Navigation Sensors for the Global Positioning System (GPS) Equipment using Aircraft-Based Augmentation*. Because the cooling fan does not provide a major contribution of the TSO-C196b function, it is not eligible to be qualified as an incomplete TSO article.

5.3.2 The TSO MPS provides appropriate and adequate standards for evaluation of the article as an incomplete article. You must identify and meet all the specific performance standards in the TSO that apply to the incomplete article (pursuant to § 21.603(a)(1)).

5.3.3 In the installation drawings and/or installation manual, you must adequately document detailed instructions and limitations, pursuant to § 21.50 and § 43.13, for the installation and use of the incomplete article. For example, company "ABC" manufactures under TSO-C119c, *Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS II* with Optional Hybrid Surveillance, a traffic alert and collision avoidance system (TCAS) antenna with an interface that is interoperable with a Company "XYZ" Model "123" TCAS computer. The installer must substantiate the interoperability between these two components when showing compliance with the applicable airworthiness requirements.

5.3.4 You must list in the installation manual the specific MPS that your article meets. This should be provided by referencing the specific paragraphs of the TSO (a single reference can frequently be used to include a parent paragraph and all of its subparagraphs). This information will assist the installer of the TSO article in knowing the limitations of the article's capabilities, to comply with § 21.50.

5.3.5 When not obvious from the component, you should permanently and legibly mark the article with at least "INCOMP" adjacent to the TSO number marking (for example, "Meets TSOC69c INCOMP") and include detailed instructions in the installation drawings or installation manual. Marking an article "INCOMP" or "Incomplete" will eliminate ambiguity about the article's level of compliance.

5.4 Multiple TSO Authorizations for the Same Article.

If you elect to apply for a TSO Authorization, you must apply for all applicable TSO pertinent to the functions your article provides. You also need to request a deviation from § 21.15(b) to establish one TSO as the primary TSO to mark the article having multiple TSO approval.

5.4.1 Marking.

After having TSOA and the deviation approval, you can:

5.4.1.1 Mark the primary TSO number on the nameplate (marking each individual TSO number on the article's nameplate may be impractical).

5.4.1.2 Mark the primary article permanently and legibly with a statement that the remaining TSO marking requirements are in the installation manual (IM), (e.g., "See Inst Mnl for Addtl TSO approvals and/or markings.").

5.4.1.3 List the other TSOs (and marking requirements for each TSO) in the front section of the IM for the article's primary TSO.

5.4.2 Multiple TSO Authorizations With Incomplete TSO.

You should apply for multiple TSO authorizations even when the article does not meet the entire TSO but meets the requirements for an incomplete TSO article, as explained in paragraph 5.3 of this AC. In cases where the article does not completely meet any TSO, a primary TSO must be established for marking. Typically this is the TSO that the article comes closest to meeting in full. The requirements listed in paragraph 5.3 of this AC must be followed when applying for an incomplete TSO. The article or the installation manual must list each TSO authorization and identify its associate deviation approval, as applicable.

5.5 **Non-TSO Functions (NTF).**

5.5.1 Definition of a Non-TSO Function

5.5.1.1 An NTF is a function provided by an article that is not covered by the TSO MPS, does not support or affect the hosting article's TSO function(s), and could technically be implemented outside of the TSO article.

5.5.1.2 When you design and manufacture an article, the article functions may be addressed by the MPS of the TSO, or the article may provide additional functions that are not covered by any TSO. With FAA acceptance of your TSOA application, you are authorized to certify that the design and manufacturing of the article meet the MPS of the applicable TSO. NTF are accepted on a "non-interference" basis relative to the compliance of the TSO requirements for a given article.

5.5.2 FAA Guidance on NTFs.

You may choose to integrate an NTF into a TSO article to support a foreign airspace requirement, minimize the amount of line replaceable units and interconnected wiring systems in an aircraft installation, address a specific customer/industry need, or for product differentiation. NTFs may be included and accepted on a non-interference basis, as part of your TSO submittal. A TSOA may be issued for the article, if you demonstrate that it meets all of the following conditions:

5.5.2.1 The hosting article is eligible for a TSOA and meets the applicable TSO performance requirements;

5.5.2.2 There is no applicable TSO for the NTF;

5.5.2.3 The added NTF does not affect or interfere with the hosting TSO article's ability to meet the TSO MPS or violate any limitations imposed by the hosting TSO; and

5.5.2.4 The hosting TSO article's environmental qualification, and hardware and software design assurance levels adequately support the NTF, as applicable.

Note: The criticality of the NTF should not exceed that of the hosting TSO article. Conversely, if the integrated NTF criticality is lower than the hosting TSO article, you may choose to adopt the higher design assurance levels throughout or to employ proper partitioning techniques.

5.5.2.4.1 The NTF descriptive and substantiation data are evaluated by the FAA for compliance with the MPS (for example, structural, environmental, or flammability requirements) of the TSO.

5.5.2.4.2 Substantiation data from the TSO testing showing compliance with TSO requirements is also applicable to the NTF components. For example, an in-flight entertainment system integrated into a seat design provides non-TSO functionality for the seat. The components that make up the in-flight entertainment system are required to meet the structural and flammability MPS of the seat TSO. The related substantiation data that is generated to meet the TSO MPS can be used by the TC or STC applicant without retesting the components that enable the NTF. Additional substantiation data that is not required by the seat TSO MPS may be required by the TC or STC applicant to show compliance with the applicable aircraft airworthiness requirements.

5.5.2.4.3 NTF descriptive or substantiation data that is not needed to show compliance with the TSO MPS is evaluated separately during the aircraft installation design approval (for example, TC/STC). Guidance for the approval of non-TSO functions relative to the aircraft airworthiness regulations is contained in paragraph 5.d of AC 21-50, *Installation of TSOA Articles and LODA Appliances*.

5.5.3 Non-TSO Function Evaluation Procedures.

The installer of the article in an aircraft is responsible for obtaining regulatory compliance approval of the TSO article and its NTFs before installation. This task is difficult because the installer generally may not have the equipment, or the expertise available to the TSO manufacturer to accomplish a thorough equipment performance evaluation, especially when the performance of an NTF must be determined by laboratory simulation or under stress conditions. This AC provides a procedure for you to help the ACO evaluate NTFs at the time of TSO application. If you follow this procedure, the FAA ACO can acknowledge the design assurance levels and environment testing accomplished on NTFs, if required by the TSO MPS, to preclude the need for repeated evaluation for each installation approval.

5.5.3.1 Project Planning Considerations.

Since the TSO minimum performance requirements do not cover the integrated NTF, the ACO will need adequate time to review the

manufacturer's declared performance requirements to verify that the non-TSO function can reasonably be accommodated within the hosting TSO article. Manufacturers intending to integrate non-TSO functions in a proposed TSO article should plan accordingly and coordinate with their ACO at the earliest opportunity and well in advance of their TSO application, to avoid potential delays to their project. Use of a Partnership for Safety Plan (PSP) should be encouraged to formalize and adapt integrated non-TSO function to each manufacturer's internal TSO procedures. Each project specific certification plan should address any specific ACO test and validation requirements.

5.5.3.2 Data Submittal.

Data submitted to the ACO to permit review of an NTF should include, as a minimum, the following:

5.5.3.2.1 A clear definition of the intended function and any anticipated operational credit that may be sought at the time of installation so your justification for the proposed hazard classification of failure condition(s) can be evaluated;

5.5.3.2.2 Your declared performance requirements. Where possible, you are encouraged to adopt existing industry-accepted standards, such as RTCA, European Organization for Civil Aviation Equipment (EUROCAE), SAE, or Aeronautical Radio, Incorporated (ARINC);

5.5.3.2.3 Your proposed test procedures to validate the performance requirements for the non-TSO function, including RTCA Document RTCA/DO-160 (revision level same as hosting TSO article) environmental test conditions;

5.5.3.2.4 Installation and operating instructions/limitations and maintenance instructions for the non-TSO function(s) as applicable;

5.5.3.2.5 If the TSO article includes software and/or complex custom airborne electronic hardware, your verification of the hosting TSO article's software and/or airborne electronic hardware design assurance levels;

5.5.3.2.6 The manufacturer's verification that the hosting TSO article's software and hardware design assurance levels, including RTCA/DO-254 complex electronic hardware requirements in accordance with AC 20-152, RTCA, Inc., Document RTCA/DO-254, *Design Assurance Guidance for Airborne Electronic Hardware*, remain appropriate for the non-TSO function. If the non-TSO function includes software components, all RTCA/DO-178 (revision level same as hosting TSO article) software artifacts normally furnished to the ACO or retained by the manufacturer must clearly describe the non-TSO function software components and demonstrate compliance with the requirements of paragraph 5.5.3.2.3.

5.5.3.3 ACO Evaluation Criteria.

If, following early coordination with the ACO, it is determined the NTF is of a simple nature, where descriptive and substantiation data compliance with the MPS of the TSO is easily understandable, your NTF will be evaluated on a non-interference basis during the normal application process. However, the ACO will require a concurrent TC or STC project evaluation if it is determined that the added NTF(s):

5.5.3.3.1 Are complex and difficult to review and to fully understand without a concurrent installation evaluation;

5.5.3.3.2 Have a high degree of system flight deck to pilot interface;

5.5.3.3.3 Are of a simple nature individually, but combined in such a way or in sufficient quantities to become complex and difficult to review and fully understand without a concurrent installation evaluation; or

5.5.3.3.4 Incorporate new or novel technology.

Note: If a TC/STC project is being accomplished at an ACO that is different than the ACO responsible for issuing the TSOA, both offices will coordinate in the review of your declared NTF performance requirements.

5.5.3.4 NTF Acceptance and Installation Data.

5.5.3.4.1 The TSOA that the FAA letter issues to you documents the TSOA(s) being granted, including the integrated NTF that was evaluated by the ACO in conjunction with the hosting TSO article.

5.5.3.4.2 It is essential to note that the TSO article and any integrated NTF are inseparable at the article level, and should be covered by a common manufacturer's hardware and/or software part number. The TSOA letter conveys design and production approval for the TSO function as well as design acceptance on a non-interference basis and production approval for the NTF. For example, if the TSO has MPS for functional performance, hardware and software design assurance, and environmental qualification, then the TSOA letter will also convey the ACO acceptance of your statement of conformance to these requirements for the NTF. Because the NTF is not covered under the TSO authority granted by § 21.603(a), AC 21-50 provides additional guidance for the acceptable use of TSO data for installation approval. The following additional information must be included in your article installation manual, component maintenance manual, and/or operating manual to support the aircraft installation approval requirements:

5.5.3.4.2.1 A description of the NTF, including key performance specifications, as well as qualification levels, such as software, hardware, and environmental;

5.5.3.4.2.2 Interface requirements for the NTF and applicable installation test procedures;

5.5.3.4.2.3 Installation and operating instructions/limitations and maintenance instructions for the NTF as applicable;

5.5.3.4.2.4 For NTFs that contribute to catastrophic or hazardous failure conditions on the aircraft, the manufacturer should also include a safety analysis of the NTF as implemented in the hosting TSO article. The safety analysis should identify the failure modes and effects of the NTF and the expected probability of the failure modes. The analysis should consider exposure times for latent failures, recommended maintenance checks, and the failure rates for the applicable components of the hosting TSO article.

Note: You should evaluate the integrated NTF contributing to major or lower failure conditions using the same procedures that are applied to any TSO article contributing to major or lower failure conditions.

5.5.3.5 Manufacturer Responsibilities.

With ACO acceptance of your data submitted in accordance with paragraph 3.1.2 of this AC, the NTF should be integrated and qualified using your existing configuration control and TSO qualification procedures. You should incorporate the NTF data within the required TSO application data provided to the ACO, including results of testing discussed in paragraph 5.5.3.2 of this AC. You should ensure the results of any TC/STC installation performance testing that may have been required by paragraph 3.8.4 are also available for review by the TSOA-issuing ACO.

5.5.3.6 Design Change/Modification to an Article that provides NTF(s).

Because the TSO article and any integrated NTFs are inseparable, all subsequent design changes to the components providing non-TSO functionality must be treated the same as design changes made to components providing TSO functionality (refer to § 21.619). You are responsible for 1) ensuring the changes to the NTF do not interfere with the article's compliance with the TSO; 2) controlling the design and quality of the article, including the NTF data listed in the letter of TSOA; 3) evaluating the design changes pursuant to § 21.619 to ensure the article continues to comply with the TSO; and 4) evaluating the design changes to confirm the non-interference of the accepted NTF. If the design change is extensive enough to require a substantially complete investigation of compliance of the accepted NTF, you must obtain FAA approval before incorporating the change into your approved design. If the design change does not require a substantially complete investigation of compliance of the accepted NTF, you must report it when you report other minor design changes. See paragraph 4.4 of this AC for further details on design changes.

APPENDIX A. LIST OF ACRONYMS

AC	Advisory Circular
ACO	Aircraft Certification Office
AEH	Airborne Electronic Hardware
AIR	Aircraft Certification Services
ARINC	Aeronautical Radio, Incorporated
AS	Aerospace Standards
CAA	Civil Aviation Authority
COS	Continued Operational Safety
CMM	Component Maintenance Manual
DAH	Design Approval Holder
EASA	European Aviation Safety Agency
EFIS	Electronic Flight Instrument System
ELOS	Equivalent Level of Safety
EUROCAE	European Organization for Civil Aviation Equipment
FAA	Federal Aviation Administration
GPS	Global Positioning System
ICAO	International Civil Aviation Organization
LODA	Letter Of Design Approval
MIDO	Manufacturing Inspection District Office
MISO	Manufacturing Inspection Satellite Office
MPS	Minimum Performance Standards
NTF	Non-TSO Function
OPR	Open Problem Report
PMA	Parts Manufacturer Approval
QS	Quality System
RTCA	Radio Technical Commission of Aeronautics
SAE	Society Automotive Engineers
SOD	State Of Design
SOM	State Of Manufacturing
STC	Supplement Type Certificate
TC	Type Certificate
TSO	Technical Standard Order
TSOA	Technical Standard Order Authorization
TCAS	Traffic Alert and Collision Avoidance System

APPENDIX B. SAMPLE COMPLIANCE MATRIX

The matrix in this appendix provides Technical Standard Order Authorization (TSOA) holders one example of what a compliance matrix may look like. It is only an example and does not provide a specific compliance method to any specific standard. Table B-1 below provides guidance regarding the sample compliance matrix.

Table B-1. Sample Compliance Matrix

What is the purpose of this sample compliance matrix?	This sample compliance matrix was developed to help you demonstrate compliance with applicable regulations and standards.
How were the sample compliance matrix and the lists of applicable regulations developed?	Various matrices used by Aircraft Certification Offices (ACO) on past and present certification projects and current guidance materials were used to develop the sample compliance matrix and the lists of applicable regulations for Technical Standard Order (TSO) projects. However, these examples are for illustrative purposes only and are not based on any project submitted to the Federal Aviation Administration (FAA).
How should the sample matrix be filled in to generate a matrix specific to a project?	The sample compliance matrix for TSO articles is split into three parts: • Part 1 covers compliance with Title 14 of the Code of Federal Regulations (14 CFR) part 21. Refer to "Part 1: 14 CFR Part 21" below for an example of a completed part 21 compliance matrix. • Part 2 covers compliance with a TSO. Refer to "Part 2: Technical Standard Order (TSO)-CXXX" below for an example of a completed TSO compliance matrix. • Part 3 covers compliance with a minimum performance standard (MPS). Refer to "Part 3: Minimum Performance Standard (MPS)-ASxxxxx" for an example of a completed MPS compliance matrix. **Note:** The MPS text was excluded from the example for copyright protection, but should be included in the actual matrix.

The following paragraphs describe the matrix entries, with the circled letters below matching the circled letters in the examples and templates.

Part 1	14 CFR Part 21 Sample Matrix	This sample matrix is designed to facilitate demonstrating compliance to part 21. This matrix does not include all subparagraphs of part 21; only the regulations that require demonstration of compliance are listed. You should update the sample matrix in accordance with the instructions below.
Part 2	TSO Sample Matrix	This sample matrix is designed to facilitate demonstrating compliance with a TSO. Complete this matrix in accordance with the instructions below. If the article complies with multiple TSOs, complete this matrix for each applicable TSO.
Part 3	Industry defined MPS Sample Matrix (SAE, RTCA, etc.)	This sample matrix is designed to facilitate demonstrating compliance with an MPS. Complete this matrix in accordance with the instructions below. If the article complies with multiple MPSs, complete this matrix for each applicable MPS.

Table B-1. Sample Compliance Matrix (Continued)

(a)	Paragraph Number	Reference paragraph number of applicable regulations, TSO, or MPS applicable to the matrix (TSO or MPS) being completed.
(b)	Paragraph Title/Text	Reference paragraph title and text of applicable regulations, TSO, or MPS applicable to the matrix (TSO or MPS) being completed.
(c)	Amendment Level	Reference amendment level of applicable regulations (CFR Matrix).
(d)	Methods of Compliance	Enter the method or combination of methods used to show compliance with the regulations, TSO, and MPS. Make an entry for each regulation, paragraph, or subparagraph in the matrix. Columns may be changed/added to accommodate actual methods of compliance used.
	Analysis (A)	This method of compliance includes a quantitative or qualitative assessment, as appropriate, of structures, systems, and components. An analysis may be a precursor to tests and a validation of the design. An analysis should be validated using published previous experience or appropriate testing to be accepted for showing compliance to the requirements.
	Design (D)	This method of compliance encompasses the inherent features of structures, systems, or components. Inspection of hardware, the drawings, the bill of materials, or other documentation such as material specifications shows compliance with the applicable requirements.
	Test (T)	This method of compliance is a test of the article. The specific test conditions need to be defined in the documentation supporting the test.
	Similarity (S)	This method of compliance is a comparison between a previously approved design controlled by the applicant and the proposed design. The intent is to show that these designs are the same in all ways relative to showing compliance with the applicable MPS, so the proposed design will perform the same or better than the previously approved design. The applicant should account for any differences in the requirements if the revision levels of the TSO are not the same for the two designs. Refer to the other guidance applicable to the different MPS to determine if similarity is proper.

	Other (O)	Specify any other method used to demonstrate compliance.
(e)		Enter the plan, drawing, and report numbers used to document the showing of compliance with the requirement. The items referenced here should contain sufficient detail to show compliance to the requirement.
(f)		List the documents that are being used to show compliance with 14 CFR part 21 (Part 1). Modify the TSO number (Part 2) and the MPS number (Part 3) to identify the applicable TSO and MPS.

Part 1: 14 CFR Part 21								
			Method of Compliance (see Instructions for details)					
14 CFR Part 21 Subpart O - Technical Standard Order Authorization		**Amdt**	**A**	**D**	**T**	**S**	**O**	**Documentation**
(a)	(b)	(c)			(d)			(e)
21.603	**Application.**	[21-92]						
21.603(a)	(a) An applicant for a TSO authorization must apply to the appropriate aircraft certification office in the form and manner prescribed by the FAA. The applicant must include the following documents in the application:	[21-92]						
21.603(a)(1)	(1) A statement of conformance certifying that the applicant has met the requirements of this subpart and that the article concerned meets the applicable TSO that is effective on the date of application for that article.	[21-92]						

Part 1: 14 CFR Part 21								
			Method of Compliance (see Instructions for details)					
14 CFR Part 21 Subpart O - Technical Standard Order Authorization		Amdt	A	D	T	S	O	Documentation
21.603(a)(2)	(2) One copy of the technical data required in the applicable TSO.	[21-92]						
21.603(a)(2)(b)	(b) If the applicant anticipates a series of minor changes in accordance with § 21.619, the applicant may set forth in its application the basic model number of the article and the part number of the components with open brackets after it to denote that suffix change letters or numbers (or combinations of them) will be added from time to time.	[21-92]						
21.603(a)(2)(c)	(c) If the application is deficient, the applicant must, when requested by the FAA, provide any additional information necessary to show compliance with this part. If the applicant fails to provide the additional information within 30 days after the FAA's request, the FAA denies the application and notifies the applicant.	[21-92]						
21.607	**Quality system.** Each applicant for or holder of a TSO authorization must establish a quality system that meets the requirements of § 21.137.	[21-92]						

Part 1: 14 CFR Part 21								
			Method of Compliance (see Instructions for details)					
14 CFR Part 21 Subpart O - Technical Standard Order Authorization		Amdt	A	D	T	S	O	Documentation
21.608	**Quality manual.** Each applicant for or holder of a TSO authorization must provide a manual describing its quality system to the FAA for approval. The manual must be in the English language and retrievable in a form acceptable to the FAA.	[21-92]						
21.609	**Location of or change to manufacturing facilities.**	[21-92]						
21.609	(a) An applicant may obtain a TSO authorization for manufacturing facilities located outside of the United States if the FAA finds no undue burden in administering the applicable requirements of Title 49 U.S.C. and this subchapter.	[21-92]						
21.609	(b) The TSO authorization holder must obtain FAA approval before making any changes to the location of any of its manufacturing facilities.	[21-92]						
21.609	(c) The TSO authorization holder must immediately notify the FAA, in writing, of any change to the manufacturing facilities that may affect the inspection, conformity, or airworthiness of its product or article.	[21-92]						

Part 1: 14 CFR Part 21								
			Method of Compliance (see Instructions for details)					
14 CFR Part 21 Subpart O - Technical Standard Order Authorization		Amdt	A	D	T	S	O	Documentation
21.610	**Inspections and tests.** Each applicant for or holder of a TSO authorization must allow the FAA to inspect its quality system, facilities, technical data, and any manufactured articles and witness any tests, including any inspections or tests at a supplier facility, necessary to determine compliance with this subchapter.	[21-92]						
21.616	**Responsibility of holder.** Each holder of a TSO authorization must—	[21-92]						
21.616	(a) Amend the document required by § 21.605 as necessary to reflect changes in the organization and provide these amendments to the FAA.	[21-92]						
21.616	(b) Maintain a quality system in compliance with the data and procedures approved for the TSO authorization;	[21-92]						
21.616	(c) Ensure that each manufactured article conforms to its approved design, is in a condition for safe operation, and meets the applicable TSO;	[21-92]						
21.616	(d) Mark the TSO article for which an approval has been issued. Marking must be in accordance with part 45 of this chapter, including any critical parts;	[21-92]						

Part 1: 14 CFR Part 21								
			Method of Compliance (see Instructions for details)					
14 CFR Part 21 Subpart O - Technical Standard Order Authorization		Amdt	A	D	T	S	O	Documentation
21.616	(e) Identify any portion of the TSO article (e.g., sub-assemblies, component parts, or replacement articles) that leave the manufacturer's facility as FAA approved with the manufacturer's part number and name, trademark, symbol, or other FAA approved manufacturer's identification;	[21-92]						
21.616	(f) Have access to design data necessary to determine conformity and airworthiness for each article produced under the TSO authorization. The manufacturer must retain this data until it no longer manufactures the article. At that time, copies of the data must be sent to the FAA;	[21-92]						
21.616	(g) Retain its TSO authorization and make it available to the FAA upon request; and	[21-92]						
21.616	(h) Make available to the FAA information regarding all delegation of authority to suppliers.	[21-92]						
21.618	**Approval for deviation.**	[21-92]						
21.618	(a) Each manufacturer who requests approval to deviate from any performance standard of a TSO must show that factors or design features providing an equivalent level of safety compensate for the standards from which a deviation is requested.	[21-92]						

Part 1: 14 CFR Part 21								
			Method of Compliance (see Instructions for details)					
14 CFR Part 21 Subpart O - Technical Standard Order Authorization		Amdt	A	D	T	S	O	Documentation
21.618	(b) The manufacturer must send requests for approval to deviate, together with all pertinent data, to the appropriate aircraft certification office. If the article is manufactured under the authority of a foreign country or jurisdiction, the manufacturer must send requests for approval to deviate, together with all pertinent data, through the civil aviation authority of that country or jurisdiction to the FAA.	[21-92]						
21.619	**Design changes.**	[21-92]						
21.619	(a) Minor changes by the manufacturer holding a TSO authorization. The manufacturer of an article under an authorization issued under this part may make minor design changes (any change other than a major change) without further approval by the FAA. In this case, the changed article keeps the original model number (part numbers may be used to identify minor changes) and the manufacturer must forward to the appropriate aircraft certification office any revised data that are necessary for compliance with § 21.603(b).	[21-92]						

Part 1: 14 CFR Part 21								
			Method of Compliance (see Instructions for details)					
14 CFR Part 21 Subpart O - Technical Standard Order Authorization		Amdt	A	D	T	S	O	Documentation
21.619	(b) Major changes by the manufacturer holding a TSO authorization. Any design change by the manufacturer extensive enough to require a substantially complete investigation to determine compliance with a TSO is a major change. Before making a major change, the manufacturer must assign a new type or model designation to the article and apply for an authorization under § 21.603.	[21-92]						
21.619	(c) Changes by persons other than the manufacturer. No design change by any person (other than the manufacturer who provided the statement of conformance for the article) is eligible for approval under this part unless the person seeking the approval is a manufacturer and applies under § 21.603(a) for a separate TSO authorization. Persons other than a manufacturer may obtain approval for design changes under part 43 or under the applicable airworthiness regulations of this chapter.	[21-92]						

Part 1: 14 CFR Part 21								
			Method of Compliance (see Instructions for details)					
14 CFR Part 21 Subpart O - Technical Standard Order Authorization		Amdt	A	D	T	S	O	Documentation
21.620	**Changes in quality system.** After the issuance of a TSO authorization—	[21-92]						
21.620	(a) Each change to the quality system is subject to review by the FAA; and	[21-92]						
21.620	(b) The holder of the TSO authorization must immediately notify the FAA, in writing, of any change that may affect the inspection, conformity, or airworthiness of its article.	[21-92]						

Part 2: Technical Standard Order (TSO)-CXXX							
		Method of Compliance (see Instructions for details)					
Para #	**Paragraph Text**	**A**	**D**	**T**	**S**	**O**	**Compliance Action & Documentation**
(a)	(b)			(c)			(d)
a.	**APPLICABILITY.**						
(1)	**Minimum Performance Standard.** This Technical Standard Order (TSO) prescribes the minimum performance standards that anti-collision light systems must meet in order to be identified with the applicable TSO marking. Anti-collision light systems that are to be so identified and that are manufactured on or after the date of this TSO must meet the minimum performance standard of the Society of Automotive Engineers Inc. (SAE), Aerospace Standard (AS) 8017A, "*Minimum Performance Standard for Anti-collision Light Systems*," dated January 30, 1986.						Provide document name, such as "Application Number XXXX" or "Project Notification Letter," submitted to the FAA as part of a TSOA application. This document must also include a statement of conformance stating compliance with 14 CFR part 21, subpart O and the MPS for this TSO. All documentation must be identified with the document name/identifier, date and revision number.
(2)	**Environmental Standard.** SAE AS 8037 incorporates as a reference RTCA Document No. DO-160B, "*Environmental Conditions and Test Procedures for Airborne Equipment*," dated July 1984.						
(3)	**Additions.** In addition to paragraph 3, General Standard, of AS 8017A, all materials used must be self-extinguishing when tested in accordance with applicable requirements of section 1359(d) and Part 25, Appendix F of the Federal Aviation Regulations (FAR) effective May 1, 1972.						

Part 2: Technical Standard Order (TSO)-CXXX							
		Method of Compliance (see Instructions for details)					
Para #	**Paragraph Text**	**A**	**D**	**T**	**S**	**O**	**Compliance Action & Documentation**
b.	**MARKINGS.**						
(1)	In addition to the marking specified in FAR Section 21.607(d), the following information shall be legibly and permanently marked on the major equipment component.						
(i)	Class I, II, or III (ref. SAE AS 8017A).						
(ii)	Nominal power input rating.						
(2)	Each separate component of equipment that is manufactured under this TSO (e.g., remote power supply) must be permanently and legibly marked with at least the name of the manufacturer, the TSO number, and part number.						
c.	**DATA REQUIREMENTS.**						
(1)	In addition to the requirements of FAR section 21.605, the manufacturer must furnish the Manager, Aircraft Certification Office (ACO), Federal Aviation Administration, having purview of the manufacturer's facilities, one copy each of the following technical data:						
(i)	Operating instructions.						
(ii)	Equipment limitations.						
(iii)	Installation procedures and limitations.						

Part 2: Technical Standard Order (TSO)-CXXX							
		Method of Compliance (see Instructions for details)					
Para #	**Paragraph Text**	**A**	**D**	**T**	**S**	**O**	**Compliance Action & Documentation**
(iv)	Schematic drawings as applicable to the installations procedures.						
(v)	Wiring diagrams as applicable to the installation procedures.						
(vi)	Specifications.						
(vii)	List of the major components (by part number) that make up the equipment system complying with the standards prescribed in this TSO.						
(viii)	An environmental qualification form as described in RTCA Document No. DO-160B.						
(ix)	Manufacturer's TSO qualification test report.						
(x)	Nameplate drawing.						
(2)	In addition, to those data requirements that are to be furnished directly to the FAA, each manufacturer must have available for review by the Manager of the ACO having purview of the manufacturer's facilities, the following technical data:						
(i)	A drawing list, enumerating all of the drawings and processes that are necessary to define the article's design.						
(ii)	The functional test specification to be used to test each production article to ensure compliance with this TSO.						
(iii)	Equipment calibration procedures.						

Part 2: Technical Standard Order (TSO)-CXXX							
		Method of Compliance (see Instructions for details)					
Para #	**Paragraph Text**	**A**	**D**	**T**	**S**	**O**	**Compliance Action & Documentation**
(iv)	Corrective maintenance procedures (within 12 months after TSO authorization).						
(v)	Schematic drawings.						
(vi)	Wiring diagrams.						
d.	**DATA TO BE FURNISHED WITH MANUFACTURED UNITS.** One copy of the data and information specified in paragraphs (c)(l)(i) through (viii) of this TSO, and instructions for periodic maintenance and calibration which are necessary for continued airworthiness must go to each person receiving for use one or more articles manufactured under this TSO.						
e.	**COLOR AND INTENSITY SPECIFICATIONS.** The chromaticity coordinates contained in AS 8037, paragraph 3.3.1 for aviation red, green, and white provide an equivalent level of safety to those specified in section .1397 of FAR Parts 23, 25, 27, and 29. For national and international standardization these coordinates have been made identical to the existing International Civil Aviation Organization requirements. This also applies to specifying intensity in terms of “candelas” in AS 8017A as opposed to “candles” in section .1407 of FAR Parts 23, 25, 27 and 29. In practical application, all existing anti-collision light installations meet both the TSO and FAR requirements.						

Part 2: Technical Standard Order (TSO)-CXXX							
		Method of Compliance (see Instructions for details)					
Para #	**Paragraph Text**	**A**	**D**	**T**	**S**	**O**	**Compliance Action & Documentation**
f.	**AVAILABLE REFERENCE DOCUMENTS.**						
(1)	Copies of SAE AS 8037 may be purchased from SAE International. Copies of documents may be ordered from www.sae.org						
(2)	Copies of RTCA Document No. DO-160B may be purchased from RTCA at 1150 18th Street, NW, Suite 910, Washington, DC 20036						
(3)	14 Code of Federal Regulations part 21 subpart O may be purchased at www.gpo.gov						

Part 3: Minimum Performance Standard (MPS)-ASxxxxx							
		Method of Compliance (see Instructions for details)					
Para #	**Paragraph Text**	**A**	**D**	**T**	**S**	**O**	**Compliance Action & Documentation**
(a)	(b)			(C)			
1	**SCOPE**						
1.1							
1.2	Systems consists of all necessary parts						
1.3	400 candelas (Type I => Rotorcraft; Type II => Fixed Wing; Type III => Fixed Wing & Rotorcraft)						
1.3.1							
2	**PURPOSE**						
3	**GENERAL STANDARDS**						
3.1	Class I - Rotorcraft - 150 Candelas						
3.1.1	Color						
3.1.2	Minimum Affectivity						
3.1.3	Flash Rate						
3.2	Class II - Fixed Wing Aircraft - 400 Candelas						

Part 3: Minimum Performance Standard (MPS)-ASxxxxx							
		Method of Compliance (see Instructions for details)					
Para #	**Paragraph Text**	**A**	**D**	**T**	**S**	**O**	**Compliance Action & Documentation**
3.2.1	Color						
3.2.2	Minimum Affectivity						
3.2.3	Flash Rate						
3.3	Class III - Rotorcraft - 100 Candelas						
3.3.1	Color						
3.3.2	Minimum Affectivity						
3.3.3	Flash Rate						
3.4	Color Specifications						
3.4.1	Aviation Red						
3.4.2	Aviation White						
3.4.3							
3.5	Effective Intensity						
3.5.1	Aviation Red						
3.5.1.1							
3.5.1.2							

Part 3: Minimum Performance Standard (MPS)-ASxxxxx							
		Method of Compliance (see Instructions for details)					
Para #	**Paragraph Text**	**A**	**D**	**T**	**S**	**O**	**Compliance Action & Documentation**
3.5.2							
3.5.3							
3.6	Flash Frequency						
3.6.1							
3.7	Explosion						
4	**PERFORMANCE STANDARDS UNDER ENVIRONMENTAL CONDITIONS**						
4.1							
4.1.1							
4.1.2							
4.1.3							
4.2	Environmental Tests						
4.2.1	Temperature and Altitude						
4.2.2	Humidity						
4.2.3	Vibration						

Part 3: Minimum Performance Standard (MPS)-ASxxxxx							
		Method of Compliance (see Instructions for details)					
Para #	**Paragraph Text**	**A**	**D**	**T**	**S**	**O**	**Compliance Action & Documentation**
4.2.4	Explosion						
4.2.5	Waterproofness						
4.2.6	Fluids Susceptibility						
4.2.7	Sand and Dust						
4.2.8	Fungus Resistance						
4.2.9	Salt Spray						
4.2.10	Power Input Test						
4.2.10.1							
4.2.11	Voltage Spike						
4.2.12	Audio Frequency Conducted Susceptibility						
4.2.13	Induced Signal Susceptibility						
4.2.14	Radio Frequency Susceptibility						
4.2.15	Emission of Radio Frequency Energy						
5	**SYSTEM INFORMATION**						
5.1	Manufacturer’s operating instructions and equipment limitations						

Part 3: Minimum Performance Standard (MPS)-ASxxxxx							
		Method of Compliance (see Instructions for details)					
Para #	**Paragraph Text**	**A**	**D**	**T**	**S**	**O**	**Compliance Action & Documentation**
5.2	Installation Procedures						
5.3	List of components						
5.4	Equipment data sheets						
5.5	Maximum and minimum voltage needed after installation to meet minimum performance standards						
5.6	Wire size/length limitations between components						

APPENDIX C. ADVISORY CIRCULAR FEEDBACK

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by (1) complete the form online at https://ksn2.faa.gov/avs/dfs/Pages/Home.aspx or (2) emailing this form to 9-AWA-AVS-AIR-DMO@faa.gov

Subject: AC 21-46A Date: _____

Please check all appropriate line items:

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

☐ Recommend paragraph _____ on page _____ be changed as follows:

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

☐ Other comments:

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

Submitted by: _____ Date: _____