



AEROSPACE RECOMMENDED PRACTICE

ARP6448™**REV. B**Issued 2012-06
Revised 2024-07

Superseding ARP6448A

Gaining Approval for Seats with Integrated Electronics
in Accordance with AC 21-49 Section 7.b

RATIONALE

This SAE Aerospace Recommended Practice needs to be revised to address a method of compliance to TSO MPS requirement AS8049, Section 3.4.5.

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1. SCOPE

This SAE Aerospace Recommended Practice (ARP) provides a framework for establishing methods and stakeholder responsibilities to ensure that seats with integrated electronic components (e.g., actuation system, reading light, inflatable restraint, in-flight entertainment equipment, etc.) meet the seat technical standard order (TSO) minimum performance standards (MPS). These agreements will allow seat suppliers to build and ship TSO-approved seats with integrated electronic components. The document presents the roles and accountabilities of the electronics manufacturer (EM), the seat supplier, and the TC/ATC/STC applicant/holder in the context of AC 21-49, Section 7.b ("Type Certification Using TSO-Approved Seat with Electronic Components Defined in TSO Design"). This document applies to all FAA seat TSOs C39(), C127(), etc.

The document defines the roles and responsibilities of each party involved in the procurement of electronics, their integration on a TSO-approved seat, and the seat's installation on an aircraft. Requirements for design and quality control and the methods for communicating design and change data between EMs and seat suppliers are defined such that standardization is possible across the industry to ensure continued airworthiness of TSO-approved seats with integrated electronic components. This document primarily focuses on correspondence between the seat supplier and the EM.

[Appendix A](#): Presents key characteristics of electronic components and guidance on how changes are classified per the requirements of Table 1 of AC 21-49.

[Appendix B](#): Provides an outline of a typical data approval process and the change management process between EMs and seat suppliers.

[Appendix C](#): While the responsibility rests solely with the seat supplier to ensure all TSO attributes identified in Table 1 of AC 21-49 are acceptable, [Appendix C](#) has been included to outline the process for delegating EMs authorization to assess the impact of changes on their equipment with respect to seat TSO attributes. This authorization will allow the classification of the change and the appropriate administration of the change by the EM via seat supplier delegation.

[Appendix D](#): Given the mix of business arrangements that can exist in the seat, in-flight, and aircraft procurement life cycle (buyer-furnished equipment, supplier-furnished equipment, customer-furnished equipment), there is discussion on the potential need for separate agreements between the EMs and seat suppliers to ensure binding flow down of design and quality control requirements. As such, a working together agreement (WTA) template is provided as [Appendix D](#).

1.1 Regulatory and Business Model

It is important to recognize that industry and the FAA have different needs when it comes to getting a seat with electronic components approved for use in an aircraft. The FAA looks at certification strictly from a regulatory point of view and to whom they issue the various approvals. The FAA makes the approval holder responsible for ensuring all aspects under that approval are met, regardless of how industry establishes the business arrangements.

For seats covered under technical standard order authorization (TSOA), there are two approvals: the seat TSOA and the installation approval (TC/STC/ATC). The TSOA holder will continue to review and approve changes as long as the seats with integrated electronic components are in the field. The installation approval holder may close their installation project after the last aircraft delivers and cannot review any proposed changes under that closed project. In these cases, a third-party TC/STC/ATC holder/applicant may be contracted to review and approve changes to electronic components for the aspects of the change that affect AC 21-49, Section 9 requirements.

For industry, regulatory obligations under each approval have to be met while having some flexibility for establishing business agreements and delegations such that said obligations can be achieved efficiently. This document defines the responsibilities from both a regulatory perspective and a business perspective.

1.1.1 Overview on Responsibilities (Post-AC 21-49 Business Practice)

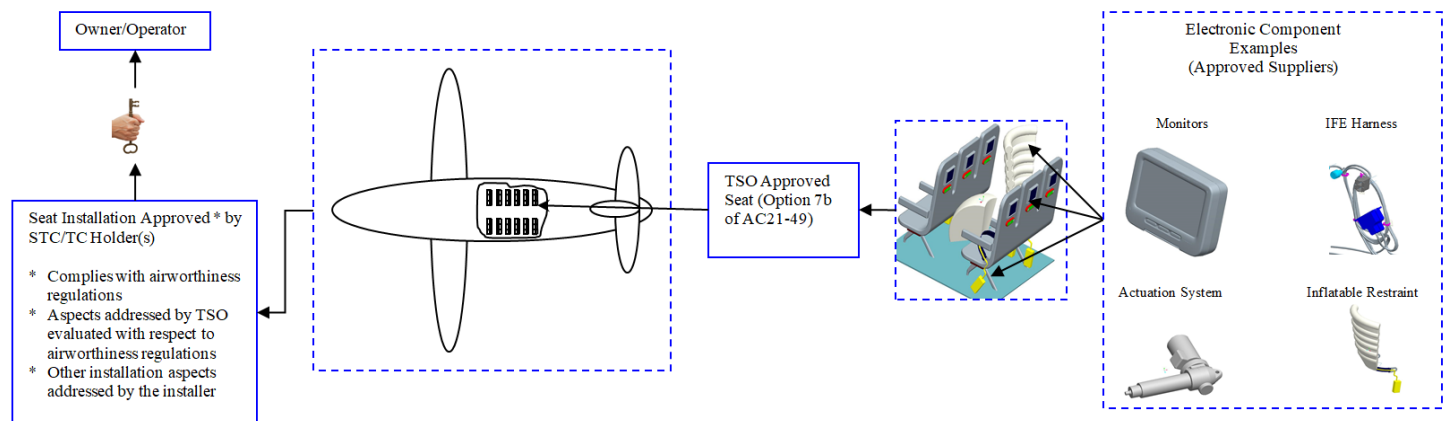


Figure 1

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

ARP5526	Aircraft Seat Design Guidance and Clarifications
AS8049	Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft
AS9100	Quality Management Systems - Requirements for Aviation, Space, and Defense Organizations
AS9116	Aerospace Series - Notice of Change (NOC)

2.1.2 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

AC 21-46	Technical Standard Order Program
AC 21-49	Gaining Approval of Seats with Integrated Electronic Components
AC 21-50	Installation of TSOA Articles and LODA Appliances
AC 25.562-1B_CHG1	FAA Advisory Circular - Dynamic Evaluation of Seat Restraint Systems and Occupant Protection on Transport Airplanes
AC 25.853-1	FAA Advisory Circular - Flammability Requirements for Aircraft Seat Cushions

AC 25.785-1B	FAA Advisory Circular - Flight Attendant Seat and Torso Restraint System Installations
PS-AIR-21-130-03-01	Clarification for Non-TSO Functions in Seats
PS-ANM-25.853-01-R2	Flammability Testing of Interior Materials
TSO-C39()	9g Transport Airplane Seats Certified by Static Testing
TSO-C127()	Rotorcraft, Transport Airplane, and Small Airplane Seating Syst (Includes Dynamic Test Requirements)

2.1.3 Code of Federal Regulations (CFR) Publications

Available from United States Government Printing Office, 732 North Capitol Street, NW, Washington, DC 20401, Tel: 202-512-1800, www.gpo.gov.

14 CFR Part 21	Certification Procedures for Products and Parts
14 CFR Part 23	Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes.
14 CFR Part 25	Airworthiness Standards: Transport Category Airplanes
14 CFR Part 27	Airworthiness Standards: Normal Category Rotorcraft
14 CFR Part 29	Airworthiness Standards: Transport Category Rotorcraft

2.2 Definitions

ARP6448 QUALIFIED ELECTRONICS MANUFACTURER: An EM with this delegation has demonstrated an understanding of AC 21-49 and this ARP. The EM is an approved supplier to the seat supplier and there is a WTA or equivalent in place between the EM and the seat supplier. See [Appendices C](#) and [D](#) for details.

ARP6448 DELEGATED ELECTRONICS MANUFACTURER: An EM with this delegation has met the requirements of an ARP6448 qualified EM, as discussed above. In addition, they must have written delegation from a specific seat supplier of the authorization to make Class 1 versus Class 2 change classifications on behalf of the seat supplier. See [Appendix C](#) for details. A delegated EM may have delegation from one seat supplier but not another. This delegation does not relieve the TSO holder of the responsibility for managing changes according to regulatory requirements and their local authority.

CLASS 1 CHANGE: A design change to electronic components, or their attachment to the seat, with potential impact to the attributes in Table 1 of AC 21-49 (utilizing the guidance in [Table A1](#)). While this class level has been used to associate the impact level of change to the TSO MPS, Class 1 changes may also be significant to the TC/ATC/STC applicant/holder. Class 1 changes require prior approval by the seat supplier.

CLASS 2 CHANGE: A design change to electronic components, or their attachment to the seat, with no potential impact to the attributes in Table 1 of AC 21-49. While this class level has been used to associate the impact level of change to the TSO seat, Class 2 changes may also be significant to the TC/ATC/STC applicant/holder. Class 2 changes do not require approval by the seat supplier prior to implementation when the EM has written delegation from the seat supplier to make the change class determination. EMs that do not have written delegation from the affected seat suppliers must submit Class 2 changes to the seat supplier for approval prior to implementation.

NOTE: Class 1 and Class 2 relate to AC 21-49, Table 1 attributes, which indicate a potential impact on the seat TSOA. All changes, regardless of TSO classification, require separate evaluation by the TC/STC/ATC applicant and/or holder as discussed in Section 9 of AC 21-49.

CONFIGURATION MANAGEMENT: Configuration management is the systematic process that establishes and maintains the consistency of a product (or article) and its functional and physical attributes with its requirements, design, and operational information throughout its life cycle. The goal of configuration management is to ensure that a certified baseline product (or article) definition is established and maintained throughout the product's (or article's) life cycle. This is accomplished through the establishment of clear configuration and quality management processes throughout the supply chain with appropriate agreements between parties that ensure changes are clearly communicated in advance of their incorporation and both quality and the certified baseline of the product (or article) definition are maintained. It is understood that changes deemed non-significant by one party may have a significant certification and configuration control impact on the part of another. Processes and agreements must be established between parties to ensure that configuration control requirements are met.

DESIGN DEFINITION: Design definition involves the establishment and implementation of documented procedures to define and control the design of a product (or article) in order to ensure that specified requirements are met.

ELECTRONICS MANUFACTURER (EM): A party that designs and manufactures electronic components to be used in the installation and collaborates with both the seat supplier and the TC/ATC/STC applicant/holder. The EM may be a production approval holder.

ELECTRONICS MANUFACTURER COMPONENT DATA (EMCD) FORM: Form used by the EM to communicate the initial data needed to satisfy Table 1 attributes of AC 21-49 and by the seat supplier to return disposition of the data to the EM.

ELECTRONICS MANUFACTURER NOTICE OF CHANGE (EMNOC) FORM: Form used by the EM to communicate design changes that affect Table 1 attributes of AC 21-49 and by the seat supplier to return disposition of the change to the EM.

CUSTOMER-FURNISHED EQUIPMENT (CFE): Typically, in-flight entertainment (IFE) components - e.g., PC power, video systems, and phones - are purchased by the airline and provided direct to the seat supplier at no cost and are referred to as CFE.

NON-CUSTOMER-FURNISHED EQUIPMENT (NON-CFE): Typical NON-CFE electronic components include reading lights, inflatable restraints, and seat actuation systems. These are specified and purchased by the seat supplier.

INTEGRATED SEAT: An airplane seat approved under a seat TSOA/LODA that includes electronic components. The electronic components may include IFE, in-seat power systems, reading lights, inflatable restraints, and electrically actuated seat features.

LETTER OF DESIGN APPROVAL (LODA): A LODA is a finding by the FAA that a foreign manufacturer's article design meets a specific TSO.

OPERATOR: Entity operating the aircraft (airline).

TC/ATC/STC APPLICANT/HOLDER: An entity that attains regulatory approval (TC/STC/ATC) for the installation of a TSO-approved seat onto a commercial passenger aircraft is referred to as the TC/ATC/STC applicant/holder. In certain instances, a separate TC/ATC/STC applicant/holder will be responsible for the electrical activation of the electronic components installed in the TSO seat. In this case, there will be two TC/ATC/STC applicants/holders: one that installs the seats and one that is responsible for the attributes of the electronic components described in Section 9 of AC 21-49.

SUPPLIER: Vendors supplying parts and/or services.

NOTE: Regulatory guidance on supplier and manufacturer responsibilities may be found in FAA AC 21-46, paragraph 2.2.1.

WORKING TOGETHER AGREEMENT (MULTI-PARTY): A binding agreement or a combination of agreements between a seat supplier and an EM that defines and assigns responsibilities to the parties to ensure that the TSO-approval holders have design and quality control over the electronic components integrated into the TSO-approved seat. These agreements are also known as working together agreements (WTAs) and often apply when design and quality control is not flowed down from the TSO holder to the EM by way of a commercially binding purchase order/contract, such as CFE scenarios. Similar agreements may be in place between the TC/ATC/STC applicant/holder and the EMs.

TYPE CERTIFICATE/SUPPLEMENTAL TYPE CERTIFICATE/AMENDED TYPE CERTIFICATE (TC/STC/ATC) APPLICANT: Person who fills out FAA form 8110-12, application for type certificate, production certificate, or supplemental or amended type certificate. In the context of this ARP, the TC/STC/ATC applicant will be referred to as “TC/ATC/STC applicant/holder.”

TSO APPLICANT/HOLDER OR SEAT SUPPLIER: A TSO applicant/holder is a person or organization who applies for and obtains a technical standard order authorization or letter of TSO design approval (LODA) under 14 CFR Part 21, Subpart O.

A seat supplier is a company that attains a TSO-approval for a seat that has integrated electronic components. These components can include IFE modules, actuation, lighting, in-seat power, inflatable restraints, passenger control units, and all the associated harnesses.

In the context of this ARP, a seat supplier is a TSO applicant/holder.

TSOA: A TSOA is a finding by the FAA that a manufacturer’s article meets a specific TSO and the manufacturer’s production system can manufacture articles conforming to the approved design. A TSOA is a design and production approval.

NOTE: Some OEMs have acronyms for electronic components that are installed on their aircraft, e.g., buyer-furnished equipment (BFE), customer-selected equipment (CSE), and seller-furnished equipment (SFE). These acronyms are not meaningful in context of this ARP.

2.3 Acronyms

AC	advisory circular
ADCN	advance document/drawing change notice
AECN	advance engineering change notice
ARP	aerospace recommended practice
AS	aerospace standard
ATC	amended type certificate
BFE	buyer-furnished equipment
CAA	Civil Aviation Authority
CB	certification branches
CFE	customer-furnished equipment
CG	center of gravity
CM	configuration management
CSE	customer-selected equipment
DCN	design change notice
EASA	European Union Aviation Safety Agency
ECN	engineering change notice
EM	electronics manufacturer
EMCD	electronics manufacturer component data

EMNOC	electronics manufacturer notice of change
ETSO	European Technical Standard Order
FAA	Federal Aviation Administration
FAI	first article inspection
HIC	head injury criterion
IFE	in-flight entertainment
ITCM	initial technical coordination meeting
LODA	letter of design approval
LRU	line replaceable unit
MPS	minimum performance standards
PAH	production approval holder
PC	production certificate
PMA	parts manufacturer approval
SFE	seller-furnished equipment
STC	supplemental type certificate
TC	type certificate
TSO	technical standard order
TSOA	technical standard order authorization
TTL	taxi, take-off, and landing
WTA	working together agreement

3. EM RESPONSIBILITIES

3.1 Overview

The EM will communicate with the operator, the TC/ATC/STC applicant/holder, and the seat supplier to address the following: technical issues, ensuring that the equipment meets owner/operator requirements, ensuring that the electronic components meet seat supplier and TC/ATC/STC applicant/holder requirements, and ensuring that appropriate configuration and quality management agreements are adhered to.

In addition, the EM will coordinate with the TC/ATC/STC applicant/holder and seat supplier for all installation, analysis, testing requirements, and data associated with the integration of electronic components into the TSO-approved seats and aircraft installation, respectively.

3.2 Design Definition

The EM will communicate to the seat supplier design data relating to the configuration of the electronic components with respect to the Table 1 attributes of AC 21-49; see [B.4.1](#) for the data required by the TSOA holder. The EM will communicate with the TC/ATC/STC applicant/holder for the data to meet the requirements of AC 21-49, Section 9.

Data requirements for TC/STC/ATC production approvals are discussed in Section 9 of AC 21-49 and in [3.3.2](#) but are not addressed in this ARP.

3.3 Configuration Management

3.3.1 EM Coordination with the Seat Supplier

The EM will implement a configuration control process for releasing initial design data and subsequent revisions to the seat supplier(s). The EMCD and EMNOC forms (see [Appendix B](#)) and instructions for their use as described herein will be used exclusively. Configuration management (CM) procedures will be in place with all involved entities that align bilateral processes with the CM requirements of this ARP.

EMs will manage their CM process, recognizing that change approval must be obtained from seat suppliers and TC/ATC/STC applicant/holders that hold design and production approvals for the electronic components that are being changed.

3.3.2 EM Coordination with the Seat TC/ATC/STC Applicant/Holder

In addition to approval from the TSOA holder, changes to electrical components that are installed on seats must also be approved for aircraft installation per Section 9.a of AC 21-49: "TSO-C39 and C127 performance criteria are not adequate to address installation of seat mounted electronic components into an aircraft. We [the FAA] can't approve items not listed in Table 1 for the electronic components under the TSO-approval. Those items must be approved for the aircraft using the type certification process (TC, ATC, or STC)."

This ARP focuses on the interaction between the EM and the seat supplier so the electronic components can be covered under the seat TSOA per option 7.b of AC 21-49. All changes must be reviewed by the TC/ATC/STC applicant/holder per Section 9 of AC 21-49.

3.3.3 Electronics Manufacturer Component Data (EMCD) Form

The EMCD form (see [Appendix B](#)) will be completed by the EM and supports submittal of top-level design data to the seat supplier. This data shall be sufficient for the seat supplier to assess the component's effect on the AC 21-49, Table 1 attributes of the seat's TSO MPS. This data also establishes the baseline configuration on which future receipt of the component into the seat supplier production system will be based. The EMCD form must be approved by the seat supplier and returned to the EM before related EMNOCs can be processed.

3.3.4 Electronics Manufacturer Notice of Change (EMNOC) Form

The EMNOC form (see [Appendix B](#)) will be completed by the EM to support submittal of change data to the seat supplier.

3.3.5 EMCD and EMNOC Administration

Record retention practices shall be in accordance with the seat supplier(s) requirements and verified in AS9100 audits.

3.4 Quality Control

The EM is responsible for providing electronic components for integration into the TSO-approved seat that conform to EM type design. The EM is required to coordinate changes related to their quality system with the seat supplier and the TC/ATC/STC applicant/holder.

The EM will provide adequate quality controls in the form of audits and training verification to ensure any change classification and change approvals that are delegated to them are performed per the criteria set forth in this ARP and any WTA that may be in effect.

3.5 Continued Airworthiness

The EM will ensure proper CM of the electronic components and software they manufacture and will coordinate changes with both the seat supplier and the TC/ATC/STC applicant/holder according to this ARP and any WTA that may be in effect to ensure that changes will not affect the seat TSO or the aircraft's certification.

4. SEAT SUPPLIER RESPONSIBILITY

4.1 Overview

The seat supplier obtains a TSO-approval and is responsible for showing compliance to the MPS of the applicable TSO for seats with integrated electronics. The seat supplier must also adhere to all configuration and quality management agreements with the TC/ATC/STC applicant/holder to ensure that type design is maintained. The seat supplier is responsible for preparing compliance documentation for TSO requirements as required by the FAA and other seat design requirements as specified by the TC/ATC/STC applicant/holder.

4.2 Design Definition

The seat supplier will review all electronic component integration requirements provided by the TC/ATC/STC applicant/holder and EM and develop a design that meets both the TSO and aircraft level certification requirements. The seat supplier must also provide the FAA the data necessary to demonstrate that the seat continues to meet the TSO MPS after integration of the electronic components and wiring.

When the electronic components are manufactured by the seat supplier (e.g., actuation components, harnesses, etc.), the seat supplier is responsible (as if it were an EM) for providing the design definition to the TC/ATC/STC applicant/holder and for administering a configuration control process; see [Figure B2](#).

4.3 Configuration Management

The seat supplier is responsible for coordinating with the TC/ATC/STC applicant/holder to ensure the TC/ATC/STC applicant/holder's TC/STC/ATC CM requirements with respect to design change are met while the program is active.

Once a program is complete, the seat supplier can make minor changes if the change can be evaluated with respect to that TSO's MPS per Table 1 of AC 21-49. Changes to electronic components must also be evaluated by the TC/ATC/STC applicant/holder per Section 9.a of AC 21-49 as discussed in [3.3.2](#) before the EM incorporates the change into production articles.

The seat supplier is responsible for the review and approval of changes communicated to them by the EM to ensure the TSO-approval is maintained. The seat supplier is also responsible for maintaining a quality control and CM system that includes electronic components whether or not component(s) are customer-furnished equipment (CFE) or non-customer-furnished equipment (non-CFE).

Seat suppliers shall develop a supplier control relationship, which may be a WTA, with EMs just as they do with suppliers of any other purchased commodity and be able to demonstrate that design and production quality controls are in place. Seat suppliers may implement configuration control delegation to the extent the EM has the core competency to act on the seat supplier's behalf. Delegation terms will be defined in the WTA (see [Appendix D](#) for an example WTA) and follow the guidelines of [Appendix C](#) for delegation.

An AS9100 audit does not evaluate an EM's understanding of AC 21-49 and this ARP. The seat supplier must assess the EM's capability to classify changes with respect to the performance standards of the TSO per this ARP and in compliance with AC 21-49 (see [Appendix A](#)).

4.4 Quality Control

The seat supplier is responsible for providing TSO-approved seats with integrated electronic components that conform to the seat design approved under the TSOA (or LODA) and meet the TC/ATC/STC applicant/holder's requirements. The seat supplier is also required to ensure the electronic components integrated in TSO-approved seats meet and will continue to meet Table 1 attributes of AC 21-49.

4.5 Continued Airworthiness

TSO-applicants follow the regulatory requirements for maintaining continuing airworthiness.

The TSOA holder will continue to evaluate change requests from the EM as long as the seat incorporating the electrical components remains in service.

5. TC/ATC/STC APPLICANT/HOLDER RESPONSIBILITY

5.1 Overview

The TC/ATC/STC applicant/holder will obtain the applicable certification (TC/STC/ATC) for the seat installation and electronic component activation in the aircraft and is responsible for showing compliance to the applicable airworthiness regulations for the aircraft, which includes the TSO-approved seat with integrated electronics. TC/ATC/STC applicants/holders will communicate with seat suppliers and EMs applicable technical issues regarding aircraft design, installation, configuration control, and quality requirements, along with regulatory requirements for certifying the seat installation in the aircraft.

5.2 Design Definition

Communicate all TC/ATC/STC applicant/holder and TC/STC/ATC regulatory requirements relating to the TSO-approved seat and all integrated seat-related electronic components to both the seat supplier and the EM. Review design data provided by the seat supplier and the EM to ensure aircraft installation requirements are met.

5.3 Configuration Management

The certified installation establishes a baseline for CM. The TC/ATC/STC applicant/holder is responsible for maintaining the installed configuration of the seat through the delivery phase of the program. Changes to seat electronic components must be approved by the TC/ATC/STC applicant/holder as there may be impact outside the TSO requirements. This approval process is in parallel to the EMNOC process defined herein.

When the TC/ATC/STC applicant/holder is purchasing electronics on behalf of the airline customer, they are responsible for ensuring the EM understands and complies with data transmittal requirements. This includes the first article inspection (FAI) documents and applicable certificates required by the seat supplier to confirm part configuration on receipt of parts which may route through a third-party logistics operation.

5.4 Quality Control

The TC/ATC/STC applicant/holder must ensure TSO-approved seats with integrated electronic components conform to the approved aircraft type design.

5.5 Continued Airworthiness

TC/ATC/STC applicants/holders follow the applicable regulatory requirement for maintaining continuing airworthiness. As discussed in [1.1](#), TC/ATC/STC applicants/holders may close their TC/STC/ATC project after the last aircraft delivers and will not continue to evaluate design changes to electronic components. In these cases, a third-party TC/STC/ATC holder/applicant may be contracted to review and approve changes to electronic components for the aspects of the change that affect AC 21-49, Section 9 requirements.

6. CONCLUSION

This document provides guidance on how to meet AC 21-49, Section 7.b ("Type Certification Using TSO-Approved Seat with Electronic Components Defined in TSO Design").

The responsibilities, areas of authority, and accountability of each party - as well as the communication protocols defined herein - are intended to ensure that compliant CM, design control, and quality control process are developed and implemented to ensure the requirements of AC 21-49 are met.

7. PARTS MANUFACTURER APPROVAL (PMA)

Seat suppliers shall not issue PMA assist letters for electronic components because the seat supplier's approval (TSOA) only covers electronic components for the attributes listed in Table 1 of AC 21-49.

8. NOTES

8.1 Revision Indicator

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

PREPARED BY SAE AIRCRAFT SEAT COMMITTEE

APPENDIX A - CHARACTERISTICS OF CLASS 1 AND CLASS 2 DESIGN CHANGES

A.1 PURPOSE

The purpose of [Table A1](#) and [Figures A1](#) and [A2](#) is to provide examples of typical changes to electronic components and to explain how the changes should be categorized as Class 1 or Class 2; see [2.2](#). Guidance regarding categorization of changes is presented in [Table A1](#), based on the approach from AS9116.

The guidance in [Table A1](#) may act as a tool to establish a uniform interpretation of AC 21-49, Table 1 among all local FAA-ACOs and other non-FAA civil aviation regulators.

A.2 CLASS 1 VERSUS CLASS 2 DESIGN CHANGE CLASSIFICATION

Each change must be evaluated to determine if it presents a potential effect on any of the six seat TSO attributes listed in [Table A1](#) of this ARP; if it does, it is a Class 1 change. Otherwise, it is a Class 2 change.

NOTE: Each change requires an additional approval to address installation of seat mounted electronic components into an aircraft as discussed in [3.3.2](#).

[Table A1](#) and [Figures A1](#) and [A2](#) are guidance to EMs for categorizing their design changes as Class 1 or Class 2. Any change that cannot be categorized as Class 2, based on the guidance below, should be presented to the seat manufacturer for evaluation as a Class 1 change.

[Table A2](#) links [Table A1](#) of this ARP to Table 1 of AC 21-49 and associates the TSO attributes with the appropriate seat TSO. Software was added to [Tables A1](#) and [A2](#) because software can be used to establish the seat back upright angle as well as other safety-related features and so can affect a TSO function.

NOTE: [Table A1](#) and [Figures A1](#) and [A2](#) provide guidance and do not address all electrical components that may affect the Table 1 attributes listed in AC 21-49. The EM must contact the seat supplier if there are any questions.

Table A1 - Characteristics of Class 1 and Class 2 changes

Attribute	Class 1 Characteristics	Class 2 Characteristics
Method of Attachment AC 21-49, Table 1: Strength of attachment of electronic components to seat.	Number and/or location and/or size. Type (threaded to shanked). Rivets (squeeze versus pop). Material changes. Fasteners incorporated into plastic or composite structures using proprietary processes or specifications. Attachment type changes: - Clamped versus threaded. - Clamped surface area. NOTE: Changes that affect an electrical component's ability to hold together or an electrical component's method of attachment (retention) to the seat are Class 1.	Hardware length changes provided equivalent thread or grip engagement are shown. Fastener variations in finish. Changes to harnesses or cables. Changes to electrical components that weigh less than 1/3 pound (0.15 kg).
Mass and Center of Gravity AC 21-49, Table 1: - Mass, location, and center of gravity (CG) of electronic components on seat under static loading. - Mass, location, and CG of electronic components on seat under dynamic loading.	Any change in mass or CG is a Class 1 design change.	No design changes that affect mass or CG can be Class 2. NOTE: CG changes are not applicable to cables and harnesses.