



AEROSPACE RECOMMENDED PRACTICE	ARP6109™	REV. A
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	Superseding ARP6109	
Electronic Engine Control Hardware Change Management		

RATIONALE

No foresseen need for evolution on this process oriented guide in a near future.

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FOREWORD

Changes to engine control systems have traditionally been classified as either minor or major, with the former being defined as having no change to the form, fit or function of the item to be changed. This method of classification has proved somewhat awkward with changes to electronic control or protection functions that address obsolescence.

The change might be to a component or function which is complex or which is obviously safety-related (such as the over speed protection function) while causing no change to form, fit or function. A level of risk may exist with this change which could warrant the use of a modification process, which may involve all parties to determine if an aircraft modification is required. This is often referred to as a 'Full Modification Process.'

For the full modification process, procedures and review stages not called for in the minor change process will need to be introduced. The resultant level of scrutiny that accompanies the change may be considered more fitting given its complexity or its potential functional impact if not implemented correctly. The use of a full modification process often requires identification of the revised configuration. This enables effective tracking in service should the change prove to have unexpected effects on unit performance. However, a shift from the minor change process to a full modification process could be considered excessive in some situations, as well as unmanageable for any unit that is regularly affected by obsolescence issues.

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1. SCOPE

1.1 General

This document is intended for use by manufacturers of aircraft, engines and Electronic Engine Controls [EECs] as a component change process and evaluation guideline. Its purpose is to provide an effective means of managing the modification of electronic hardware.

The process defined in this document is based upon:

- an understanding of the electronic component market evolution, e.g., obsolescence;
- lessons learned from the effects caused by the introduction of electrical component changes in a service fleet environment;
- industry best practice; and
- an understanding of the applicable regulations.

1.2 Purpose

The introduction of any design change to an Electronic Engine Control system will carry a potential risk to the aircraft safety and operability. The evaluation of the impact for any change can be difficult to manage as it may require involvement of the EEC manufacturer, the engine manufacturer and the aircraft manufacturer, who must each support the showing of conformance to all applicable certification standards.

Further complexity is brought about by the variety in the quantity and quality of the original design data.

The purpose of this document is to provide guidance on how to evaluate and classify a design change. It also provides a definition of the coverage and depth of analysis necessary to manage the risk of impact on aircraft safety and operability to a satisfactory level.

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 724-776-4970 (outside USA), www.sae.org.

ARP4754A Guidelines for Development of Civil Aircraft and Systems

2.1.2 FAA Publications

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

14 CFR Part 21 CERTIFICATION PROCEDURES FOR PRODUCTS AND PARTS

14 CFR Part 23 NORMAL, UTILITY, ACROBATIC, AND COMMUTER CATEGORY AIRPLANES

14 CFR Part 25 AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

14 CFR Part 27 NORMAL CATEGORY ROTORCRAFT

14 CFR Part 29 TRANSPORT CATEGORY ROTORCRAFT

14 CFR Part 33 AIRCRAFT ENGINES

TSO C-77B GAS TURBINE AUXILIARY POWER UNITS

AC 33.28-1 Compliance Criteria for 14 CFR §33.28, Aircraft Engines, Electrical and Electronic Engine Control Systems

2.1.3 EASA Publications

Available from European Aviation Safety Agency, Postfach 10 12 53, D-50452 Cologne, Germany, Tel: +49-221-8999-000, www.easa.eu.int.

Part 21 Certification of Aircraft and related product, parts and appliance, and production organisations.

CS - 23 Certification Specifications for Normal, Utility, Aerobatic and Commuter Aeroplanes

CS - 25 Certification Specifications for Large Aeroplanes

CS - 27 Certification Specifications for Normal/Small Category Rotorcraft

CS - 29 Certification Specifications for Transport/Large Category Rotorcraft

CS - E Certification Specifications for Engines

AMC 20-1 Certification of Aircraft Propulsion Systems Equipped with Electronic Control Systems

AMC 20-3 Certification of Engines Equipped with Electronic Engine Control Systems

2.1.4 Other Publications

IEC/PAS 62239-1 Process Management for Avionics - Preparation of an Electronic Components Management Plan

RCTA DO-254 / EUROCAE ED-80 Design Assurance Guidance for Airborne Electronic Hardware

MIL-STD-883H Department of Defense Test Method Standard, Microcircuits (Feb 26th, 2010)

MIL-HDBK-61A Configuration Management Guidance

2.2 Terms and Definitions

Terms not listed below are used in this document as defined in ISO 9000.

ARP: Aerospace Recommended Practice

CCB: Change Control Board

CFR: Code of Federal Regulations

COTS: Commercial Off-The-Shelf

CS: Certification Specification (EASA nomenclature)

DOA: Design Organization Approval

EASA: European Aviation Safety Agency

EEC: Electronic Engine Control

FAA: Federal Aviation Administration

FAR: Federal Aviation Regulation

FADEC: Full Authority Digital Engine Control

IEC: International Electrotechnical Commission

Major Change (as defined in CFR 21.93 (a)): Any change that does not meet the definition of Minor Change.

Minor Change (as defined in CFR 21.93 (a)): A change is considered Minor if it has no appreciable effect on weight, balance, structural strength, reliability, operational characteristics or other characteristics affecting the airworthiness of the product.

ODA: Organization Designation Authorization

Type Certificate: A type certificate is awarded by aviation regulating bodies after it has been established that the design of an aircraft, engine, or propeller has fulfilled all prevailing airworthiness requirements.

3. REGULATION AND GUIDANCE MATERIAL

3.1 Change Management Regulatory Requirements

Part of the designer's responsibility is to control the configuration of their products.

The manufacturing of the complete aircraft [including the engine and its components], along with its use and maintenance by operators (flight operations), requires configuration approval. This configuration approval is referred to as type design certification. Subsequent change to the certified type design must be approved for products to enter and to stay in service.

The EEC is made of analog and digital electronic hardware, operating system and application software. A growing percentage of EECs incorporate Commercial Off-The-Shelf (COTS) electronic components that were not developed specifically for use in EECs. The evolution of the electronic component market is such that many of these components become obsolete in a very short time when compared to the expected service life of the EEC. In order to introduce a change to the bill of materials, a change to the configuration must be approved. Component obsolescence or cost reduction are examples that may cause changes to the bill of materials.