



1. Applicability

All aircraft fitted with an electrical system.

2. Purpose

To clarify the need and occasions where an Electrical Load Analysis is required and to identify the particular regulations mandating those requirements.

3. Background

The purpose of an electrical load analysis (ELA) is to ensure that the demand on the aircraft's electrical system does not result in the undesirable situation that, during operations in the most onerous circumstances, the electrical system would be inadequate in meeting those system demands or where the emergency reserves are insufficient to meet the requirements during an emergency. AC 21-38(0) provides guidance on a method of performing such an analysis.

Most aircraft that are registered in Australia have been built and certified to an accepted design standard. Whilst Attachment 1 has some examples owners/operators need to confirm the particular regulation applicable to their aircraft. When compliance to the nominated standard has been established, a Certificate of Airworthiness (C of A) is issued.

It is important to remember that Authorisation Holders under subpart 21.M or 21.J of CASR 1998 have a legal responsibility to maintain compliance to the design standard when approving any modification to an aircraft registered in Australia. To comply with this the 21.M or 21.J Authorisation Holder, during the development of any modification that may have an effect on an aircraft's electrical power system, must ensure that that system has the capacity to accommodate that change.

An ELA needs to be performed to establish the baseline electrical capacity of the aircraft. Whilst the form this analysis takes is determined by the 21.M or 21.J Authorisation Holder and will be dependent on the type, age and complexity of the aircraft, it still needs to be documented. From this baseline, it is the modification designer's responsibility to establish whether the modification is viable and remains compliant with the design standard for which the C of A was issued against.

There is no requirement to conduct an ELA prior to such time that a modification is to be incorporated. The aircraft manufacturer's original ELA (if it exists) is acceptable provided there have been no modifications to the original delivered configuration.



The original certification basis for the aircraft, engine or propeller may not adequately ensure safety if a modification consists of a new design or substantially complete redesign. For example, Electronic Flight Instrument Systems (EFIS) were not envisaged in the original certification basis of older amendment 14CFR23 or Part 3 of the US Civil Air Regulations (CAR) aircraft. Installation of EFIS equipment and related hardware in these aircraft, are to comply with the latest amendment of the applicable design standards. Subregulation 21.101(2) of CASR 1998, requires the latest design standard based on the date of application and this regulation also allows CASA to impose additional conditions. This will also include any changes to the ELA baseline or development of an ELA baseline.

4. Recommendation

Aircraft owners and registered operators, Subpart 21.M or 21.J Authorisation Holders and LAMEs need to be aware of their individual responsibilities with regard to ELAs as follows:

- Prior to issue of an Australian C of A for an aircraft, the issuing delegate, as part of the airworthiness assessment, needs to ensure that the aircraft's electrical system is compliant with the nominated design standard. New aircraft imported directly from the manufacturer or a used aircraft that has a valid export C of A from a recognised National Airworthiness Authority can reasonably be assumed to be compliant.
- The compilation of an ELA prior to the incorporation of a modification is mandatory for all aircraft fitted with an electrical system and have been issued a C of A under the design standards listed above unless there is a current ELA available. This is to ensure that the modification is fit for purpose and to demonstrate compliance with the applicable regulation, examples of have been included in Attachment 1 to this AWB.
- The aircraft owner or registered operator is responsible to ensure that the appropriate aircraft records are maintained. It is the operator's responsibility to ensure the continuing relevance of that ELA – when modifications are incorporated the operator must ensure that it is updated. This will make sure that during the next modification design phase the 21.M or 21.J Authorisation Holder will be assessing system capacity against the actual aircraft configuration.
- The LAME may perform the ELA as a task as part of the verification steps identified in an engineering order or as a maintenance task if requested by the operator.
- The 21.M or 21.J Authorisation Holders are responsible for accepting that ELA and approving that data as applicable to the aircraft being modified.



5. Note

Issue 4 of this AWB was issued to remove a note about authorities listed in Regulation 21.012 of CASR 1998. The change bars in this revision refer to the changes made between issue 2 and 3.

6. Enquiries

Enquiries with regard to the content of this Airworthiness Bulletin should be made via the direct link e-mail address:

AirworthinessBulletin@casa.gov.au

Or in writing, to:

Airworthiness and Engineering Standards Branch
Standards Division
Civil Aviation Safety Authority
GPO Box 2005, Canberra, ACT, 2601



Attachment 1 to AWB 24-007 Issue 3

Examples of Design Standards

Most aircraft that are registered in Australia have been built and certified to an accepted design standard. The ones that are not certificated to these recognised design standards are dealt with in other ways with specific restrictions e.g. LSA or aircraft in the Limited Category.

The following are examples, in part, of current and past standards applicable to the electrical systems of aircraft:

Civil Air Regulation (of the United States) 3.682 at Amendment 14

- (a) *Electrical power sources, their transmission cables, and their associated control and protective devices, shall have sufficient capacity to furnish the required power at the proper voltage to all load circuits essential to the safe operation of the airplane.*
- (b) *Compliance with paragraph (a) of this section shall be shown by means of an electrical load analysis, or by electrical measurements, which take into account all electrical loads applied to the electrical system, in probable combinations and for probable durations.*

FAA/JAA/CS § 23.1351 § 27.1351

- (a) *Electrical system capacity. Each electrical system must be adequate for the intended use. In addition -*
 - (1) *Electric power sources, their transmission cables, and their associated control and protective devices, must be able to furnish the required power at the proper voltage to each load circuit essential for safe operation; and*
 - (2) *Compliance with paragraph (a)(1) of this section must be shown as follows -*
 - (i) *For normal, utility, and acrobatic category airplanes, by an electrical load analysis or by electrical measurements that account for the electrical loads applied to the electrical system in probable combinations and for probable durations; and*



- (ii) *For commuter category airplanes, by an electrical load analysis that accounts for the electrical loads applied to the electrical system in probable combinations and for probable durations.*

FAA/JAA/CS § 25.1351 § 29.1351

- (a) *Electrical system capacity. The required generating capacity, and number and kinds of power sources must -*
- (1) *Be determined by an electrical load analysis; and*
 - (2) *Meet the requirements of §25.1309*