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**GCAA  
ADVISORY CIRCULAR**

**AIRWORTHINESS  
AC NO: GCAA AC/AIR-012-R1**

**SUBJECT:**

**ELECTRICAL LOAD  
ANALYSIS**

DATE REVISED: 27-11-2018  
REVISED BY: Director Aviation  
Safety Regulation

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**1. PURPOSE**

This Advisory Circular (AC) provides information and guidance concerning an acceptable means of compliance with Guyana Aviation Requirements (GARS) Part 7, Subsection 7.1.6.7 "Power Supply, Distribution and Indication System".

**2. AUDIENCE**

Owners/Operators of Guyana registered aircraft.

**3. CANCELLATION**

As of its effective date, this Advisory Circular No: GCAA AC/AIR-012-R1 cancels Airworthiness Advisory Circular No: 12 dated 05-07-05.

**4. EFFECTIVE DATE**

This Advisory Circular is effective from January 1, 2019 until revised or cancelled by the Director General Civil Aviation Authority.

**5. CHANGES**

This change updates the circular to meet current requirements and also to include new reference documents regarding the subject at caption.

**6. RELEVANT REFERENCES**

- a. Guyana Aviation Requirements (GARS) - Part 7, Subsection 7.1.6.7.
- b. CAP 562 Book II Chapter 24 – Electrical Power.



## **7. Contact Information**

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## **8. FORM(S) TO BE USED**

Not applicable.

## **9. ELECTRICAL LOAD ANALYSIS**

### **9.1 Purpose**

- a. The Operator of an aircraft for which a Certificate of Airworthiness (C of A) is valid shall retain, as part of the required aircraft documentation, a current Electrical Load Analysis (ELA) in respect of that aircraft. In respect of an aircraft for which application for a C of A is being made, the currency of the existing ELA must be verified, and shall be made available to the Director General Civil Aviation upon request.
- b. The purpose of the ELA is to determine, for each major electrical source, the capacity required to provide adequate electrical power under the most extreme conditions. This is accomplished by evaluating and summarising the average and maximum demands under various flight conditions. The summary is used for the following:
  - (i) Relate the ELA to the system capacity.
  - (ii) Relate the ELA/system capacity to the probable duration of various normal and emergency conditions.
  - (iii) Provide essential data relating to the establishment of load shedding and emergency procedures.
  - (iv) Provide a permanent record of the electrical characteristics of all power generation and users installed in the aircraft.
  - (v) Provide a ready reference when considering additional system power requirements in respect of a proposed installation of additional electrical/avionics system(s).

### **9.2 Requirements**

- a. A complete ELA is normally provided as a permanent part of the aircraft documentation for each new aircraft prior to delivery to the customer, and it will normally have been compiled in consideration of the requirements of Paragraph 9.1 b. above. An ELA is required for all single and multi-engine aircraft issued, by the Authority, with a C of A in the Transport Passenger, Private or Special Category.
- b. The battery capacity shall be such that in the event of a complete loss of generated electrical power, adequate power will be available for a period of not less than 30 minutes following the failure, to support those services.



- c. For normal operating conditions, the ELA shall establish that the continuous capacity and the overload capacity of the electrical supply system shall be adequate to ensure the satisfactory functioning of all normal and essential equipment in all probable combinations, and that in respect of:
- (i) **Aircraft with more than One Power Unit** - In the event of the loss of one electrical source, the continuous and overload capacities of the supply system shall still be adequate to ensure the satisfactory functioning of all probable combinations of essential equipment, taking into account automatic load shedding and assuming that no further load shedding will be initiated by the crew for 5 minutes.
  - (ii) **Aircraft with One Power Unit** - The electrical supply system shall be such that following the loss of one electrical source; it will be possible for all combinations of essential systems, likely to be used in these circumstances, to function for at least 30 minutes.
- d. Under emergency operating conditions, the ELA shall establish that for each condition which may arise during and after any possible combination of failure of power sources, and in regard to the possible duration of and the combinations of systems likely to be used during such conditions, each essential system is provided with the electrical power necessary to enable it to function for the necessary duration.

## 10. MODIFICATIONS

- a. In accordance with Paragraph 9.1 a. above, no modification to, or installation of any equipment which may affect the electrical load of the currently approved installation shall be made until it has been determined by reference to the ELA that under the new loading conditions, the current carrying capacity of all parts of the system, and the generating and storage capacity specified in the ELA are adequate.
- b. Any modification to or installation or removal of any equipment which renders the previously approved ELA obsolete requires that a revision to the ELA be effected which will accurately reflect the revised electrical loading status for that aircraft.
- c. The revised ELA is required to be made available to the Director General Civil Aviation in support of any request for an avionics modification approval.

## 11. BATTERY DURATION

- a. Battery endurance can be estimated from either a practical test which involves applying typical aircraft loads for a period of time or by calculation. In either case, only 75% of the name plate capacity should be considered available because of loss of battery efficiency during service. The recommended statement is only intended to give the pilot an estimate of the battery endurance and conditions under which it can be achieved. Furthermore, because it is a relatively broad band estimate it should only be necessary to amend it if a refit with extra electrical loads is carried out.
- b. An example of how to calculate the duration is given below:
  - (i) Check the nameplate capacity of the battery and assume 75% is available, e.g. 12 amp/hour = 720 amps/mins. Thus 75% = 540 amps/mins.
  - (ii) Estimate the normal or pre-load shed cruise consumption. If this figure is more than twice the battery rating in amps (1-hour rate) a factor of 20% must be added to the power consumed to compensate for loss of battery efficiency under these heavy discharge loads. Assuming 5 minutes for pilot to shed essential loads following the low voltage warning, e.g. 15 amps (15 amps x 5 mins = 75 amps/mins).



- (iii) Estimate the minimum cruise load needed to maintain flight after the generator/alternator has failed. Consideration must be given to any loads that cannot be switched off, e.g. 10 amps.
- (iv) Estimate the consumption required during the landing approach, e.g. 20 amps for 5 minutes (100 amps/mins).
- (v) The cruise duration is therefore:

$$\frac{\text{Battery Capacity (a)} - \{\text{Pre-Load Shed Load (b)} + \text{Landing Load (d)}\}}{\text{Cruise Load (c)}}$$

$$\text{e.g. } \frac{540 - (75 + 100)}{10} = \frac{365}{10} = 36.5 \text{ mins.}$$

- (vi) Total Duration = Pre-Load Shed Cruise Time + Cruise Duration + Landing Time.  
e.g. Total duration = 5 + 36.5 + 5 = 46.5 minutes.

## 12. ADDITIONAL INFORMATION

- a. When ascertaining that the installed aircraft battery capacity is adequate for compliance with Item 11 above, the following loads shall be taken into account:

- (i) Attitude information;
- (ii) Essential radio communication;

**NOTE: For the purpose of calculations it is normally accepted that intermittent use of single VHF communication equipment satisfies this requirement. Utilisation on the basis of a total 15 minutes' reception plus 3 minutes' transmission in the 30 minutes' period would be an acceptable interpretation.**

- (iii) Essential cockpit lighting;
- (iv) Pitot head heater (applicable only to those aircraft certificated for flight in icing condition);
- (v) Any other services essential for the continued safe flight and landing of the particular aircraft; and
- (vi) Those services which cannot readily be shed.

- b. In order to ensure that the essential services will function adequately for the prescribed period, the calculation of the duration of the battery supply should normally be based on the following assumption:

- (i) Only 75% of the 'name plate' rating of the battery is available (this is to take into consideration loss of capacity with age and a realistic state of charge).
- (ii) The voltage/time discharge characteristic of the battery, appropriate to the load of the listed services, is not extended beyond a battery terminal voltage of 21.5 volts on a 24-volt system, pro rata for 12 volt systems, (this is to ensure that the voltage available throughout the prescribed period is adequate for satisfactory operation of the services).

Approved by:



Lt. Col. (Ret'd.) Egbert Field  
Director General Civil Aviation  
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