FAA
Aviation Safety

SPECIAL AIRWORTHINESS INFORMATION BULLETIN

SAIB: SW-14-06
SUBJ: Electrical System Assessments **Date:** December 4, 2013

This is information only. Recommendations aren't mandatory.

Introduction

This Special Airworthiness Information Bulletin (SAIB) alerts owners, operators, maintainers, and system modifiers of the requirements and safety implications for performing an accurate electrical system assessment after any modification of a Part 27 or Part 29 rotorcraft that affects the electrical system.

Paragraph 27.1351(a)(2) of Part 27 and 29.1351(a)(1) of Part 29 require an accurate accounting of the electrical system capacity to ensure that the electrical generating capacity safely provides for the required electrical load. A Part 27 rotorcraft assessment may be accomplished by an electrical load analysis (ELA) or by "electrical measurements that take into account the electrical loads applied to the electrical system, in probable combinations and for probable durations". An ELA is required for a Part 29 electrical system change assessment.

At this time, this airworthiness concern is not an unsafe condition that would warrant airworthiness directive (AD) action under Title 14 of the Code of Federal Regulations (14 CFR) part 39.

Background

Recent reports from the field raise concerns that an accurate assessment of the electrical system capacity is not always accomplished for modifications that have been approved and fielded. The regulations are clear and there are many sources found in the current military, industry, and FAA certification guidance that emphasize the importance of an accurate electrical system evaluation after any rotorcraft alteration that affects the electrical system. Advisory Circular (AC) 29-2C and AC 27-1B provide certification guidance. FAA Order 8110.4C, Type Certification, paragraph 4-19.f.(2) requires the following statement in the Limitations and Conditions section of any Supplemental Type Certificate (STC) "The installer must determine whether the design change is compatible with previously approved modifications". The FAA's Flight Standards Service Office, AFS-300 Major Repair and Alteration Job Aid, under AFS-1 Memorandum, dated October 12, 2012, states that "Anyone performing an alteration that may have an effect on the aircraft electrical power system must determine that the system has the capacity to accommodate that change". The Job Aid references industry guidance, ASTM F2490-05e1, military guidance, MIL-E-7016, and FAA AC 43.13-1B for guidance in performing an ELA. FAA Order 8100.17A, Field Approval Designation Handbook, paragraph 14.a.(1)(f), lists an electrical load analysis as possible required data and the accompanying Figure B-1. Field Approval Checklist, section 12, provides a block to document the electrical load analysis.

The availability of adequate electrical power has become increasingly challenging with the evolution in electronic equipment for applications that provide required electrical or electronic functions, avionics, navigation systems, and various mission specific systems that expand the capabilities of rotorcraft. The regulations are intended to ensure that the electrical system can safely provide power to all electrical equipment required for continued safe flight and landing and that the sum total of the applied electrical load will not exceed the rotorcraft's electrical generating capacity. The capabilities

of electronic systems for applications such as news gathering, law enforcement, homeland security, and emergency medical services rotorcraft are continuously evolving and adding new systems to these rotorcraft. The sum total of the electrical load for all installed electrical equipment for many of these rotorcraft applications can easily exceed the rotorcraft's electrical capacity. As a result, the pilot is now burdened with the need to monitor and manage the rotorcraft's total applied electrical load to ensure that an overload condition does not occur during all phases of flight. An overload condition could potentially result in loss of the rotorcraft's electrical generator.

Electrical system architectures vary from simple to complex. A more complex architecture allows separation of electrical components, and independent and redundant functions through the use of multiple power busses and switches. This eases pilot workload on electrical power management, by automatically prioritizing essential systems to available power. An electrical assessment must also consider the effect any change to the rotorcraft electrical system may have on each electrical buss in addition to the assessment of total system capacity.

Recommendations

We recommend that you perform an accurate ELA for the electrical system to ensure that each modification to the rotorcraft is compatible with the previously approved configuration and that the electrical system capacity can accommodate the change. AC 43.13-2B states that the electrical load analysis procedure consider phases of flight: taxi, takeoff, slow cruise, normal cruise, and landing. The analysis should consider the most adverse conditions.

The electrical system ELA should be performed to evaluate system capacity for all phases of flight. The ability of the electrical system to provide power to required systems for each phase of flight must be determined and deemed adequate. The addition of non-required equipment may be accomplished for any phase of flight, but the total load of required equipment plus non-required equipment must never exceed the rotorcraft's electrical system capacity.

We recommend that the electrical system capacity ELA be performed for the following 3 rotorcraft configurations:

1) With all normal electrical generating systems operational (i.e. both generators operating in a dual-generator installation of with one generator operational in a single generator installation).
2) After failure of 1 normal electrical generating system (i.e. failure of the first generator in a dual generator installation).
3) After failure of all normal electrical generating systems (i.e. aircraft electrical power is provided by the aircraft battery only). VFR operation and IFR operation require the ability for operation of all equipment required for safe flight and landing for specific time periods in the event all electrical generation is lost. The electrical system capacity and architecture must be shown to satisfy these requirements.

The electrical system capacity should be characterized by a not to exceed capacity over a specific time period specific to the generator(s) as installed. It is important to understand that the capacity of the installed generator is usually de-rated from the manufacturer's generator capacity specification. The generator manufacturer's capacity specification is based on bench testing while the installed generator capacity rating is based on installation cooling tests. Therefore, when performing an ELA, one must use the installed generator's de-rated capacity rating. The ELA should ensure that no possible combination of installed equipment (i.e. required and non-required) may exceed the rotorcraft's electrical system capacity for each phase of flight for the 3 rotorcraft configurations mentioned above. If an overload condition is identified in the ELA, the installer must provide a means to automatically shed non-required equipment to prevent a generator overload condition.

Another potential option is to install switching logic circuitry that precludes certain combinations of equipment from being powered on at the same time.

For Further Information Contact

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For Related Service Information Contact

The ACs and Orders referenced in this SAIB are located at the FAA's website at http://rgl.faa.gov.