



Federal Aviation Administration

Memorandum

Date: March 25, 2015

To: Manager, Certificate Management and Safety Oversight Branch, ACE-120A

From: Manager, Small Airplane Directorate, ACE-100

Prepared by: Donald J Young, Certificate Management and Safety Oversight Branch,
ACE-120A

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Honda
Aircraft, Model HA-420 (HondaJet), Battery System, Project TC9438AT-A

ELOS Memo#: ACE-15-10

Regulatory Ref: 14 CFR 23.1353(h)

This memorandum informs the certificate management aircraft certification office of an evaluation made by the Accountable Directorate on the establishment of an equivalent level of safety finding for the Honda Aircraft Model HA-420.

Background:

The Honda Aircraft Company HA-420 airplane is a normal category, twin engine, Class III airplane. It is powered by two General Electric Honda Aero Engines (GHAE) Model HF120 medium bypass turbofan engines mounted in a unique over-the-wing (OTW) configuration. The electrical system on the HA-420 is a 28 Voltage Direct Current (VDC) system powered from five sources: two 300-325 amp starter generators, two main batteries connected to the battery bus, and a ground power receptacle with reverse polarity protection.

The aircraft loads are distributed from two Left Hand (LH) and Right Hand (RH) independent Direct Current (DC) busing systems, each deriving power from one generator and one battery with the capability to cross from the other generator via bus tie contactors in the event of an on-side generator failure. Both the LH and RH main DC buses feed an associated battery bus which in turn is also fed cross side for redundancy.

The battery supplying the battery bus is isolated during engine starts and only the second battery along with an assist from the operating generator is utilized.

AC 23-17C, Systems and Equipment Guide for Certification of Part 23 Airplanes and Airships, provides guidance on the design, installation, integration, and approval of the electrical power supply. The guidance states the battery used to meet the emergency power duration requirements (60 minutes in the case of the Model HA-420 per § 23.1353(h)(1)(ii)), "should be an independent

power source from the airplane's starter battery." However, the guidance goes on to say that the airplane's starter battery may be used to meet the emergency duration requirement so long as adequate monitoring and procedures are incorporated so the flightcrew knows the airplane's starter battery meets the 60 minute criteria. Additionally, tests and analyses should be considered for determining the rated operating capacity of the battery, the normal service life, and the continued airworthiness requirement of § 23.1529.

Applicable regulations:

14 CFR 23.1353(h)

Regulations requiring an ELOS finding:

14 CFR 23.1353(h) - REQUIREMENT: "In the event of a complete loss of the primary electrical power generating system, the battery must be capable of providing electrical power to those loads that are essential to continued safe flight and landing for...at least 60 minutes for airplanes that are certificated with a maximum altitude over 25,000 feet."

Description of compensating design features or alternative Methods of Compliance (MoC) which allow the granting of the ELOS (including changes, limitations, or equipment needed for equivalency):

The design of the HA-420 Electrical System utilizes two independent batteries to provide electrical power during conditions where no generators are available. Although the batteries are identical, only one of these batteries is also used for engine starting.

The "adequate monitoring and procedures" are the compensating factor that allows compliance demonstration to meet the intent of § 23.1353(h). The following highlights summarize the anticipated monitoring and procedures:

- A Crew Alerting System (CAS) message is generated if a battery used to meet the emergency duration criteria is not in a condition or charge state for safe dispatch.
- The Airplane Flight Manual (AFM) procedures address any pilot actions that are required to assure proper battery status prior to or during flight, and the action required to resolve the CAS message.
- The Maintenance Manual procedures address any periodic maintenance actions that are required to assure proper battery status prior to flight.

Explanation of how design features or alternative Methods of Compliance (MoC) provide an equivalent level of safety intended by the regulation:

The battery system incorporates hardware and software designed for monitoring the availability of the battery, including after engine starting, and sending battery availability data to the Avionics System, which in turn provides CAS messages to the flightcrew. The CAS messages advise the flightcrew if the battery is in an unavailable or undispachable condition. The electrical load analysis for emergency duration allows for the battery being at the minimum dispatchable state of charge prior to takeoff, as opposed to assuming it is fully charged.

The monitoring feature of the battery system is accomplished through the charge rate, where the current approaches normal load when the battery reaches full charge. The battery system outputs an indication of the battery availability via the aircraft data bus. Other information from the

battery system may also be transmitted via the aircraft data bus and used to determine if battery maintenance is required.

The electrical load analysis for emergency duration assumed two in-flight restart attempts on the battery used for engine starting, and accounted for this depletion, as well as other factors such as battery aging and state of charge. If the monitoring system determines the battery does not meet the condition needed to meet the emergency duration requirement, a CAS message is displayed to the flightcrew and AFM procedures define the appropriate pilot action.

These compensating factors allow the battery used for engine starting to be safely used to power loads included in the emergency duration criteria because it ensures that the battery state of charge, as required for emergency duration, is not compromised by the engine starting function. If battery system monitoring indicates the battery does not meet the conditions established for dispatch, a CAS message is displayed to the pilot and AFM procedures define the appropriate pilot action. These monitoring features and procedures constitute an ELOS per the guidance provided in AC 23-17C.

FAA approval and documentation of the ELOS finding:

The FAA has approved the aforementioned equivalent level of safety finding in project issue paper S-4. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The Accountable Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number must be listed in the Type Certificate Data Sheet under the Certification Basis section (TCs & ATCs) or in the Limitations and Conditions section of the STC.

Equivalent Level of Safety Findings has been made for the following regulation(s):

14 CFR 23.1353(h) Storage battery design and installation
(documented in ELOS Memo ACE-15-10)

//SIGNED//

Pat Mullen, Acting Manager, Small Airplane Directorate,
Aircraft Certification Service

March 25, 2015

Date

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