

SUBJECT : Use of “Iron birds” for the rotor drive system and control mechanism tests

REQUIREMENTS incl. Amdt. : CS 29.923(a)(2)

ASSOCIATED IM/MoC : Yes / No

ADVISORY MATERIAL : FAA AC 29-2C Change 8 (AC 29.923A)

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INTRODUCTORY NOTE:

The following Equivalent Safety Finding (ESF) has been classified as important and as such is subject to public consultation in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

ABBREVIATIONS:

GAMA	General Aviation Manufacturers Association
OEI	One engine inoperative
TC	Type certificate

IDENTIFICATION OF ISSUE:

EASA has received requests for an Equivalent Safety Finding to CS 29.923(a)(2) and CS 29.923(a)(3)(ii) for the type certification of large rotorcraft. In addition, EASA has received from GAMA the Industry White Paper on Drive System Endurance testing (GAMA 22-49), requesting the approach described in this ESF to be considered as acceptable to meet CS 29.923.

The endurance tests prescribed in CS 29.923 require testing each rotor drive system and rotor control mechanism with the aim of demonstrating that they are capable of normal operation within the limitations proposed, without hazard of failure from excessive wear or deterioration due to mechanical loads.

In particular, the following requirements in CS 29.923 'Rotor drive system and control mechanism tests' are applicable:

- CS 29.923(a)(2) states: "The tests must be conducted on the rotorcraft."

In this context, the parts constituting each rotor drive system and rotor control mechanism should be considered as parts under test.

FAA AC 29.923A, which is accepted by EASA as means of compliance with CS 29.923 when complemented by EASA AMC1 29.923 for applications including a 30-min power rating, states:

"This section [29.923(a)] also requires the test to be conducted 'on the rotorcraft'. This means a rotorcraft that is in conformity to the type design for which approval is requested. However, many nonconforming features, such as doors, some cowling and instrumentation, fuel tanks (alternate external fuel supply may be utilized),

interior features, fire detectors, extinguishers, inlet ducts, exhaust baffles, etc., may be acceptable provided each item is technically considered and found to have no impact on the test results.”

In the context of AC 29.923A, the applicant may propose *nonconforming features* in the test, limited to elements of the rotorcraft type design that would not impact the test conditions for the parts under test. In these cases, a direct compliance demonstration to CS 29.923 is expected without an ESF.

However, at the time of initial type certification, performing the endurance test on the rotorcraft requires having all its elements in their final definition available and assembled. Often, this cannot be done in the timeframe allowed by Part 21.A.15(e) and 21.A.93(c) which establish the maximum period of validity of an application for a TC, respectively a design change. In this case, the applicant proposes to perform the endurance tests on so called “iron birds” using alternative and/or modified elements relative to the rotorcraft type design. These elements may include, for example, sections of the airframe, while parts under test and those needed to closely simulate the conditions that would exist during such tests on the conformed rotorcraft type would be excluded.

EASA considers that using “iron birds” as endurance test means cannot be considered simply as a non-conforming feature of the prescribed rotorcraft and must be considered as alternative test means. This alternative test means should be adequately demonstrated not to impact the test results to substantiate an Equivalent Level of Safety to CS 29.923(a)(2).

Considering all the above, the following Equivalent Safety Finding is proposed:

M-TS-0000357**Equivalent Safety Finding****CS 29.923(a)(2) - Use of "Iron birds" for the rotor drive system and control mechanism tests****1. APPLICABILITY**

This ESF is applicable to large rotorcraft for new TCs and design changes which consist in a substantial modification to the rotor drive and/or rotor control mechanism.

1.1 AFFECTED CS

CS 29.923(a)(2) from CS-29 Initial issue onwards (or identical requirements from FAR-29 and JAR-29)

2. STATEMENT OF EQUIVALENT SAFETY FINDING

According to CS 29.923(a)(2), the endurance tests must be performed on the rotorcraft. The parts constituting each rotor drive system and rotor control mechanism should be considered as parts under test.

In lieu of direct compliance with the CS identified in chapter 1.1, and provided that the below compensating factors are complied with, the test means may consist in modifications and/or replacements of elements (excluding the parts under test) from the conformed rotorcraft type, constituting a so called "iron bird". It should be ensured that the "iron bird" allows to closely simulate the conditions that would exist during such tests on the rotorcraft on the parts under tests.

3. COMPENSATING FACTORS

The applicant must demonstrate that the test means used for the endurance tests allows to closely simulate the rotorcraft configuration. For this purpose, the following compensating factors must be considered. To substantiate these compensating factors, different approaches including analysis and/or test results comparison may be proposed.

In the endurance test means, the use of alternative and/or modified elements (excluding the parts under test) relative to the rotorcraft type design must be demonstrated to closely simulate the stiffnesses, load reactions and vibration behaviour of the rotorcraft, using simulations and/or tests.

In addition, the applicant should not alter:

- a) the structures directly supporting the rotor drive systems and rotor control mechanism (as a minimum this typically includes the upper deck and tail boom structures),
- b) the rotor drive systems or rotor control mechanisms, and/or
- c) the engines, engine installations or rotor elements (see reminder below).

Note: Due to the damage inflicted on the engines and the ensuing costs caused by operating the engines at the 30-second/2-minute OEI ratings, the 30-second/2-minute portions of the endurance test can be accomplished on a test rig found to be representative of the rotorcraft as allowed in CS 29.923(b)(3)(iii).