Notification of a Proposal to issue a Certification Memorandum

FLARM system installations in CS-23, CS 27 and CS-29 aircraft

EASA Proposed CM No.: Proposed CM–AS-010 Issue 01 issued 07.02.2018

In accordance with the EASA Certification Memorandum procedural guideline, the European Aviation Safety Agency proposes to issue an EASA Certification Memorandum (CM) on the subject identified above. All interested persons may send their comments, referencing the EASA Proposed CM Number above, to the e-mail address specified in the "Remarks" section, prior to the indicated closing date for consultation.

EASA Certification Memoranda clarify the European Aviation Safety Agency's general course of action on specific certification items. They are intended to provide guidance on a particular subject and, as non-binding material, may provide complementary information and guidance for compliance demonstration with current standards. Certification Memoranda are provided for information purposes only and must not be misconstrued as formally adopted Acceptable Means of Compliance (AMC) or as Guidance Material (GM). Certification Memoranda are not intended to introduce new certification requirements or to modify existing certification requirements and do not constitute any legal obligation.

EASA Certification Memoranda are living documents into which either additional criteria or additional issues can be incorporated as soon as a need is identified by EASA.

Log of issues

Issue	Issue date	Change description
Issue 01	07.02.2018	First issue

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1. Introduction

1.1. Purpose and scope

The purpose of this Certification Memorandum is to provide guidance for classification, installation and compliance of equipment such as FLARM®[1] to typical applicable certification requirements for CS-23, CS-27 and CS-29 aircraft types.

1.2. References

The following reference materials may be used in conjunction with this Certification Memorandum:

Reference	Title	Code	Issue	Date
CS 2x.1301 CS 23.2500	Function and installation	CS-23 CS-27 CS-29	---	---
CS 2x.1309 CS 23.2510	Equipment, systems and installations	CS-23 CS-27 CS-29	---	---
CS 2x.1322	Flight Crew Alerting	CS-23 CS-27 CS-29	---	---
CS-SC051b	Installation of FLARM equipment	CS-STAN	Issue 2	30 March 2017
ED-14/DO-160	Environmental Conditions and Test Procedures for Airborne Equipment	EUROCAE ED-14 RTCA/DO-160	---	---
Part 21	Implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations	Commission regulation (EU) No 748/2012	---	---

[1] Several FLARM® type of equipment exist in the market. Some, are designed and manufactured by the original equipment manufacturer and some under license. The total amount of equipment (sensors, CPUs, displays, aural warning generators etc.) providing information about future flight paths and collision risks are referred as « FLARM® system ».

Reference	Title	Code	Issue	Date
21.A.804	Identification of parts and appliances	Part 21	---	---

1.3. Abbreviations

FLARM	FLight AlaRM, a traffic and obstacle awareness module predominantly used in gliders, general aviation and part 27/29 low flying aircraft.
PiP	Picture in Picture
FLARM® system	A number of equipment comprising from the basic FLARM CPU module alongside, sensors, display, aural warning generators, integrated or not, presenting traffic information and collision risks to the crew.
PiC	Pilot in Command
ACAS	Airborne Collision Avoidance System (referred to as TCAS as well)
ADSB	Automatic Dependent Surveillance Broadcast
ATC	Air Traffic Control
VFR	Visual Flight Rules
VMC	Visual Metrological Conditions
GPS	Global Positioning System
ELA	European Light Aircraft. In particular 'ELA 2 aircraft' means the following manned European Light Aircraft: (i) an aeroplane with a Maximum Take-off Mass (MTOM) of 2 000 kg or less that is not classified as complex motor-powered aircraft; (ii) a sailplane or powered sailplane of 2 000 kg MTOM or less; (iii) a balloon;

	(iv) a hot air airship; (v) a gas airship complying with all of the following characteristics: - 3 % maximum static heaviness, - Non-vectored thrust (except reverse thrust), - Conventional and simple design of: structure, control system and ballonet system, - Non-power assisted controls; (vi) a Very Light Rotorcraft.
DQR	Data Quality Requirements

2. Background & Risk Assessment

2.1. Background

"See and avoid" in the lower airspace has been for a long time entirely at the shoulders of pilots without the possibility of real time help in terms of confirming suspecting surrounding traffic. At the suspicion (or Air Traffic Control (ATC) information) of traffic in a close by area, pilots can spend a considerable amount of time trying to locate adjacent traffic. Areas of gliding activity or other traffic are very generally known without real time capability of verifying traffic information.

To improve the lack of information in the cockpit within an area of interest, legacy systems were developed by European industry (and encouraged by local National Authorities) as a situational awareness assistance. These systems made visual acquisition of surrounding traffic not only easy to confirm, but also affordable to obtain.

One of such systems is FLARM®. FLARM® primarily uses GPS position determination, and 3-dimensional flight path prediction, the latter being broadcasted via a low power transceiver to all adjacent traffic, in order to provide awareness to all recipients about adjacent traffic, which are also equipped with the same system. In addition, FLARM® systems may contain static obstacle data as well as predictive functions, which generate traffic/obstacle alerts to the crew, when conflicting traffic or obstacles are being found. The installation of such awareness equipment for ELA 2 aircraft is accommodated under CS-STAN according to CS-SC051b. For other installations this Memorandum provides some installation considerations.

Based on a variety of reasons the system has traditionally been used in VMC flight predominantly on gliders and light aircraft. This CM extends the installation of FLARM to CS-27 and CS-29 aircraft types and harmonises these considerations with the already used practices in CS 23 types of aircraft. In addition, it justifies a Minor modification under assumptions, but does not provide any guidance for credit against ADS-B or ACAS I/II standards. Indeed, there are versions of the system (called Power FLARM®) which do broadcast at 1090 Extended Squitter ADS-B Out signals, however, the Power FLARM® has not demonstrated compliance with transponder modes A/C/S, ADS-B or ACAS specifications.

2.2. Basic operating assumptions and classification of hazards

The main assumption is the use of the FLARM® system during VFR/VMC flight conditions. The Pilot in Command (PiC) is assumed to be exercising his responsibility for adherence to the rules of the air for traffic visual acquisition and clearance from the ground or obstacles. In addition, the visual scanning for traffic is assumed to be at least within the "normal" (primary and secondary) field of view of the aircraft (covering well both heading and track directions in reasonable cross wind conditions).

The next assumption relates to how the PiC perceives the information provided by the FLARM system. Here, it is important to mentally separate what is approved traffic information and what is a "nice-to-have" aid for situational awareness[2]. Mixing a variety of incoming traffic information on a single display may create confusion to the crew as to which targets are to be given priority, increase the head-down time as well as reduce valuable time to appropriately scan the airspace for conflicting traffic.

Under the above assumptions of correctly addressing the above identified hazards the worst case failure condition at the aircraft level can be classified as Minor. This classification also includes the integration of the aural alerting in CS 27 and 29 aircraft that some of the FLARM systems may generate. Note, the RPM alert is essentially the lifeline to the pilot in helicopters – especially in the single engine manually flown case. Furthermore, many single engine rotorcraft are being used for flight instruction. Therefore, as per basic airmanship practices a FLARM alert must not produce disturbances (let alone higher priority alerts) to the crew.

3. Guidance for compliance demonstration

In the previous section a Minor classification of failure conditions was assumed/proposed. In this section the underlying airworthiness assumptions for this classification are presented. However, like every guidance, these assumptions will not cover all possible installations resulting in different failure condition classifications. If any of these assumptions is not met the failure condition classification and the resulting minor change classification should be reassessed which may lead to a higher classification.

a) As mentioned in the previous section, If a display is used to depict FLARM "targets" it must depict the information in a "mentally separable" manner, so the pilot has readily the FLARM information at hand-without having to consider which information is from FLARM and which from other systems. This is obvious for hardware-separated displays, but for integrated system (e.g. a multi-function display) a Picture in Picture (PiP) FLARM presentation on a larger multifunction display is preferred. Display of FLARM information on the primary flight display cannot be accepted within the minor failure condition classification.

b) The FLARM equipment should meet the applicable chapters of the appropriate environmental qualification requirements (EUROCAE ED-14/RTCA DO-160, Environmental Conditions and Test Procedures. For Airborne Equipment, at the appropriate revision) or to

[2] Situational awareness here is defined as the mental thinking process that the pilot makes in order to confirm his own aircraft position within the surrounding environment. It is also the mental analysis of the already visually acquired targets to determine whether it is necessary to take further action (e.g. determine if the acquired aircraft is on collision course, if there is a necessity to divert the flight path of his "own-ship", etc.)

comply with an EASA-accepted equivalent. As a minimum, sections 4.5.4 Operating High Temperature Test, 15 Magnetic Effect, 16 Power Input, 21 Emission of Radio Frequency Energy. Section 26 Fire, Flammability of the ED-14G/DO 160G or compliance to CS-25 appendix F should be considered for flammability testing. All those test are tailored to demonstrate that no other aircraft functions are adversely affected.

c) The installation on the aircraft:

1. must be supported by an appropriate connection to an electrical bus that does not supply power to necessary aircraft systems for continued safe operation.
2. can be rapidly disconnected in case of emergency. A single switch for a complete system disconnection (including its displays and sensors) is one of various design solutions.
3. allows for adequate protection of all interfaced equipment.

d) The thresholds of cautions and warnings provided have to be justified, especially in changed or newly coded alerting envelopes. The proposed time thresholds must be justified either by tests, or by analysis, or by a combination of both. There needs to be adequate time margin for the crew to identify the incoming flight vehicle and to take timely reactions considering the performance characteristics of the own and target flight vehicle.

e) Antenna installation should not produce unacceptable levels of failures of detecting incoming traffic due to masking, GPS accuracy or any other area coverage limitations. If any shortcoming is identified, this must be clearly documented in the corresponding section of the flight manual supplement. If antenna diversity is used then both antennas must be investigated for adequately detecting incoming traffic.

f) A FLARM aural alert, if used in the aircraft, must be justified as to its prioritization and appropriateness for the type of aircraft installed. Low priority of FLARM alerting in relation to aircraft alerts and radios is expected. This implies the ability for the low priority aural to be automatically interrupted by a higher priority one. If no sequential prioritisation provided the FLARM® must not be set at a volume level that may disturb the crew.

g) The colour philosophy of 2X.1322 should be demonstrated and justified.

h) The design data shall allow the identification of parts and appliances belonging to the installation as required by Part 21 subpart Q (21.A.804).

i) When databases are included in the design, which are not becoming part of the certified aircraft configuration e.g. the obstacle data base, the data quality requirements (DQR) should be defined and a reference should be provided to the user.

j) The applicant should produce a flight manual supplement adequately addressing the equipment and installation limitations – including normal, abnormal and emergency situations. For equipment a placard must be placed restricting the use of this equipment to Situational Awareness purposes. In addition, it must be clearly stated in the flight manual that the approval of this equipment is restricted to the areas where telecommunication

regulations allow the use of the transmissions on the used frequency[3]. Adequate instructions to the crew must be provided in the appropriate place (Flight or Operating Manual) in order to allow correct use of the equipment.

4. Remarks

1. This EASA Proposed Certification Memorandum will be closed for public consultation on the 21th of March 2018. Comments received after the indicated closing date for consultation might not be taken into account.
2. Comments or suggestions regarding this EASA Proposed Certification Memorandum should be referred to the Certification Policy and Safety Information Department, Certification Directorate, EASA. E-mail CM@easa.europa.eu.
3. For any question concerning the technical content of this EASA Proposed Certification Memorandum, please contact:

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[3] The frequencies at which the equipment is working may need a licence from the responsible “telecommunication authority”.