EASA
European Union Aviation Safety Agency

[redacted]
Acting Resources and Support Director
Resources and Support Directorate

Cologne, *as per the e-signature*

Professor Catherine E. Mason LL.B (Hons)
His Majesty's Senior Coroner
Leicester City & South Leicestershire

Town Hall
Town Square
Leicester
LE1 9BG

[redacted]

Sent by e-mail only

Subject: **Inquest into the Deaths arising from the Helicopter Crash at King Power Stadium on 27 October 2018 – Regulation 28 Report to prevent future deaths**

Attachment: **Annex recalling the EASA replies to AAIB safety recommendations 2023-018, 2023-019, 2023-021, 2023-023, 2023-024 and 2023-025**

Dear Prof. Mason,

We would like to express our sincere appreciation for the investigation into the helicopter crash at King Power Stadium on 27 October 2018. We acknowledge the significant effort and dedication that has gone into this inquest, and we are grateful for providing the European Union Aviation Safety Agency (EASA) with the opportunity to respond to the concerns formulated in the Prevention of Future Death Report arising from this tragic event.

As you are aware, EASA assisted the Air Accidents Investigation Branch (AAIB) of the UK in the safety investigation into this accident in accordance with the provisions of Regulation (EU) No 996/2010. As mentioned in our previous submissions, there has been some topics on which we could not reach a common understanding, and that included the root cause of the accident (cf. 'Appendix K of the AAIB Final Report). Nevertheless, we understand the importance of these safety recommendations and have approached them with the utmost seriousness and consideration. Our decision regarding these recommendations were not taken lightly. They have been carefully produced according to a formal internal procedure that involved various subject matter experts from within the Agency, as well as management review.

In the context of aircraft certification, it is crucial to ensure harmonization of certification requirements applied by aviation authorities around the world, with the primary objective of ensuring aviation safety. EASA is committed to working closely with other regulatory bodies, including the UK Civil Aviation Authority (CAA), to achieve this goal. In fact, we have been in contact with the UK CAA and are aware that they are exploring certain concepts related to some of the safety recommendations proposed by the AAIB. We are open to engaging in consultation with UK CAA to assess the merits of these proposals and to discuss potential ways forward.

However, at this point, EASA maintains its position as already communicated in response to the AAIB's safety recommendations. For the sake of convenience, the latest responses to those recommendation that are reconfirmed in point 5 of the PFD as 'Coroner's Concerns' are recalled in the annex to this letter. We believe that our positions, as outlined in the annex, address the safety recommendations

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raised by the investigation. At the same time, EASA is working on other improvements to the rotorcraft certification process to address lessons learned beyond AAIB's safety recommendations. The Agency is committed to ensuring that any regulatory changes are proportionate, effective, and aligned with international best practices.

Once again, we would like to express our gratitude for the opportunity to respond to the Coroner's PFD report. We remain committed to working with all stakeholders to identify areas for improvement and to implement measures that enhance aviation safety.

We trust that this letter clarifies EASA's position in this matter and we thank you for your attention.

Yours sincerely,

[redacted]
(electronically signed)

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Annex recalling the EASA replies to AAIB safety recommendations 2023-018, 2023-019, 2023-021, 2023-023, 2023-024 and 2023-025

AAIB reference 2023-018: "It is recommended that the European Union Aviation Safety Agency amend Certification Specification 29.602 to require type design manufacturers to provide the results of all relevant system and flight testing to any supplier who retains the sole expertise to assess the performance and reliability of components identified as critical parts within a specific system application, to verify that such components can safely meet the in-service operational demands, prior to the certification of the overall system." [EASA reference: UNKG-2023-001]

Final EASA reply sent on 06/02/2024:

"Pursuant to point 21.A.20 of Annex I (Part 21) to Regulation (EU) No 748/2012, the applicant for aircraft type certification is responsible for the demonstration of compliance with the type certification basis (that includes certification specifications), and to record justifications of compliance within the compliance documents as referred to in the certification programme. This implies ensuring that parts and systems reach minimum performance and reliability targets.

Therefore, the applicant is responsible for providing any information such as, but not limited to, test results to its suppliers to ensure a final airworthy design.

This principle is not specific to certain products and should not be repeated in each Certification Specification where a supplier could be affected.

The European Union Aviation Safety Agency (EASA) considers that the above-mentioned regulatory framework, including Certification Specifications, is adequate and does not envisage creating new prescriptive requirements."

AAIB reference 2023-019: "It is recommended that the European Union Aviation Safety Agency introduce additional requirements to Certification Specification 29 to specifically address premature rolling contact fatigue failure across the full operating spectrum and service life of bearings used in safety critical applications." [EASA reference: UNKG-2023-002]

Interim reply sent on 06/02/2024:

"Point CS 29.571 (Fatigue Tolerance Evaluation of Metallic Structure) paragraph (d) of Certification Specification for Large Rotorcraft (CS-29) specifies the following with regard to Principle Structure Elements (PSE):

"Each PSE must be identified. Structure to be considered must include the rotors, rotor drive systems between the engines and rotor hubs, controls, fuselage, fixed and movable control surfaces, engine and transmission mountings, landing gear, and their related primary attachments."

The European Union Aviation Safety Agency (EASA) considers that this includes critical components within the rotor control mechanism, such as the tail rotor duplex bearing of the AW169.

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Acceptable Means of Compliance AMC1 29.571 (introduced with Amendment 11 of CS-29) addresses Rolling Contact Fatigue (RCF) which should be included, when applicable, in the fatigue tolerance evaluation of Principle Structure Elements (PSE). This AMC describes possible steps to be taken to minimise the risk of crack initiation due to RCF on PSEs (and in particular for integrated bearing races). A fail-safe approach is recommended wherever possible, such that cracking of the affected structural element(s) is detected prior to its residual strength capability falling below the required levels prescribed in CS 29.571(f). In addition to following a fail-safe approach, inspection and retirement times may be needed in order to ensure that the assumptions supporting the fail-safety and detection of failure remain valid throughout the operational life of the component.

EASA is however reviewing the opportunity to clarify the scope of application of AMC1 29.571, and similarly of AMC1 27.571, to ensure that critical bearings are always considered. A proposed amendment of CS-27 and CS-29 is planned to be included in the next Notice of Proposed Amendment under rulemaking task RMT.0128 'Regular update of the Certification Specifications for Very Light Rotorcraft (CS-VLR), Small Rotorcraft (CS-27), and Large Rotorcraft (CS-29)'."

AAIB reference 2023-021: "It is recommended that the European Union Aviation Safety Agency define the airworthiness status of life limits and how they should be controlled for existing non-structural critical parts approved to Certification Specification 29.602 requirements, already in service." [EASA reference: UNKG-2023-004]

Final reply sent on 22/03/2024:

"In accordance with point 21.A.7 of Annex I (Part 21) to Regulation (EU) No 748/2012, the Type Certificate Holder (TCH) must provide Instructions for Continued Airworthiness (ICA) for critical parts, either structural or non-structural, and, in case of large rotorcraft, the preparation of ICA must be performed in compliance with the Certification Specification (CS) 29.1529.

The ICA applicable to critical parts may be included within the Airworthiness Limitation Section (ALS) of the ICA and/or in other appropriate Sections.

Retirement Times or Operational Time Limits provided in the ICA are necessary for the safe operation of the aircraft and they have to be implemented in the Aircraft Maintenance Programme (AMP) to obtain approval by the Competent Authority [ref. point M.A.302(d)(2) of Annex I (Part M) to Regulation (EU) No 1321/2014]. This requirement is applicable to both ALS and other Sections of the ICA.

In addition, point 21.A.3A of Annex I (Part 21) to Regulation (EU) No 748/2012 contains the necessary provisions for ensuring the collection, investigation and analysis of occurrence reports to identify the necessary mitigations in terms of changes to the design and/or to the ICA to prevent or minimize the possibility of such occurrences in the future, as necessary. This includes, as per point 21.A.3A(a)(1), the identification of adverse trends or deficiencies that cause or might cause adverse effects on the continuing airworthiness of the product. The 'analysis' is not limited to those occurrences that require the involvement of the European Union Aviation Safety Agency (EASA) under point 21.A.3A(e).

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Taking into account the information above, the EASA considers that the necessary regulatory framework is already in place and, therefore, EASA does not intend to re-define or re-evaluate the airworthiness status of ICA for critical parts, either structural or non-structural, already in service."

AAIB reference 2023-023: "It is recommended that the European Union Aviation Safety Agency require manufacturers to retrospectively implement a comprehensive post removal from service assessment programme for critical parts, approved to Certification Specification 29.602 requirements, already in service. The findings from this should be used to ensure that the reliability and life assumptions in the certification risk analysis for the critical part or the system in which it operates remain valid." [EASA reference: UNKG-2023-006]

Final reply sent on 22/03/2024:

"Point 21.A.3A of Annex I (Part 21) to Regulation (EU) No 748/2012 defines the obligations applicable to the Type Certificate Holders (TCHs) to establish and maintain a system for collecting, investigating and analysing occurrence reports. This includes, as per point 21.A.3A(a)(1), identification of adverse trends or deficiencies that might cause adverse effects on the continuing airworthiness of the product.

In addition, acceptable means of compliance AMC1 21.A.3A(a) clarifies that, for parts whose failure could lead to an unsafe condition (and critical parts are candidates as they could have catastrophic effect upon the rotorcraft), the 'analysis' function of the system should ensure that reports and information sent, or available, to the Design Approval Holder (DAH) are fully investigated so that the exact nature of any event and its effect on continuing airworthiness is understood. This may then result in changes to the design and/or to the Instructions for Continued Airworthiness (ICA), and/or in establishing a mitigation plan to prevent or minimize the possibility of such occurrences in the future, as necessary. The 'analysis' is not limited to those occurrences that require the involvement of the European Union Aviation Safety Agency (EASA) under point 21.A.3A(e).

EASA considers that obligations outlined in 21.A.3A already indicate that the TCH shall collect, investigate and analyse reports and information [including the early rejection of parts from service as mentioned in guidance material GM1 21.A.3A(a) and 21.A.3A(b) Reporting system] that might question the certification assumptions for critical parts and when necessary, define design changes and implement mitigation plans.

Therefore, EASA considers that the necessary regulatory framework is already in place to address the intent of this Safety Recommendation (SR) and, therefore, there is no need to retrospectively implement a comprehensive post removal from service assessment programme for critical parts already in service."

AAIB reference 2023-024: "It is recommended that the European Union Aviation Safety Agency amend Certification Specification 29.602 to provide guidance and set minimum standards for the calculation of design load spectrums for non-structural critical parts. They must encompass, with an appropriate and defined safety margin, the highest individual operating load and combination of dynamic operating loads, and the longest duration of exposure to such loads that can be experienced in operation." [EASA reference: UNKG-2023-007]

Final reply sent on 24/03/2025:

"The accident investigation report mentions a non-conservative loads calculation at the time of certification as a root cause of the bearing failure.

The European Union Aviation Safety Agency (EASA) does not share this single factor conclusion, considering that other possible detrimental factors may also have contributed to the bearing failure.

The methodology for loads calculation as used by Leonardo is not novel or unusual and does not require complete reconsideration by means of new, prescriptive certification specifications.

However, as lessons learned from this accident, EASA considers that future approvals of hybrid bearing with ceramic balls will deserve more attention as regards to the failure mechanics and the sensitivity of the bearing to its working conditions (including abnormal conditions originated by e.g. manufacturing defects, degraded lubrication, improper maintenance, etc..) in order to better cope with a wider range of scenarios.

Consequently, EASA issued Certification Memorandum (CM)-RTS-003 titled 'Hybrid Bearings' on 13 Dec 2024 to provide specific guidance related to the demonstration of compliance with applicable CS- 27 and CS-29 certification specifications for hybrid bearings (combination of steel races with ceramic ball bearings). This is available on EASA's website at: https://www.easa.europa.eu/en/document-library/product-certification-consultations/hybrid-bearings

EASA considers that this action adequately addresses findings from this accident by highlighting relevant aspects to be addressed during the certification process of rotorcraft featuring hybrid bearings."

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AAIB reference 2023-025: "It is recommended that the European Union Aviation Safety Agency amend the relevant requirements of Certification Specification 29 and their Acceptable Means of Compliance (AMC) to emphasise that where potentially catastrophic failure modes are identified, rather than rely solely on statistical analysis to address the risk, the wider system should also be reviewed for practical mitigation options, such as early warning systems and failure tolerant design, in order to mitigate the severity of the outcome as well as the likelihood of occurrence." [EASA reference: UNKG-2023-008]

Final reply sent on 19/07/2024:

"The European Union Aviation Safety Agency (EASA) considers that practical mitigation options such as early warning systems and failure tolerant designs are relevant means to achieve adequate safety levels in rotorcraft designs.

According to CS-29 Amdt 11 (Certification Specifications, Acceptable Means of Compliance (AMC) and Guidance Material for Large Rotorcraft), CS 29.571 (Fatigue tolerance evaluation of metallic structure) and AMC1 29.571 (dealing with rolling contact fatigue (RCF)) address the need to take into account the impact of RCF and minimise the risk of crack initiation resulting from RCF on Principal Structural Elements (PSEs). In addition, AMC1 29.571 states that 'as it is difficult to totally preclude cracking initiated by RCF, a fail-safe approach is recommended wherever possible, such that cracking of the affected structural element(s) is detected prior to its residual strength capability falling below the required levels prescribed in CS 29.571(f)'. Hence AMC1 29.571 clearly introduces the notion of fail- safe designs and of means of detection to fulfil the objective of preventing failure as a result of RCF. This regulatory material was relatively new at the date of publication of the accident investigation report and it appeared, in EASA's view, not to have been considered.

Nevertheless, additional CS-29 provisions help to meet the intent of this safety recommendation:

(1) The design assessments specified by CS 29.547(b) (Strength requirements - Main and tail rotor structure) and CS 29.917(b) (Powerplant – Rotor Drive System - Design) require the identification of all failures in rotors and rotor drive systems that will prevent continued safe flight or safe landing, as well as the means to minimise the likelihood of their occurrence. As per Federal Aviation Administration (FAA) Advisory Circular (AC) 29-2C Change 7 (recognised as AMC to CS-29) sections 29.547 and 29.917, 'a design assessment […] should be carried out in order to substantiate that the system is of a safe design and that compensating provisions are made available to prevent failures classified as hazardous and catastrophic[…]'. The listed compensating provisions include design features (such as redundancies and safety factors) and the use of safety devices or vibration health monitoring systems, which cover the means proposed by the AAIB in this safety recommendation. Other compensating provisions such as inspections or checks, as well as preventive maintenance are also listed.

(2) Since some years EASA has recognised the need to clearly identify those continuing airworthiness tasks which are listed as compensating provisions in the aforementioned design assessments and are also considered key to ensuring that the hazardous and catastrophic failures of the design are either adequately mitigated or their probability of occurrence has been adequately minimised. EASA considers that these continuing airworthiness tasks should be:

(i) considered as candidates for Certification Maintenance Requirements (CMRs) in accordance with AMC 25-19 of CS-25 (Certification Specifications and Acceptable Means of Compliance for Large Aeroplanes). EASA currently addresses the application of the CS-25 CMR concept to support the demonstration of compliance with large rotorcraft certification specifications requiring safety assessment and design assessment, including CS 29.547(b) and CS 29.917(b), through a Means of Compliance Certification Review Item. Therein applicants are requested to detail the criteria and methods to demonstrate the adequacy of these CMRs.

(ii) evaluated for the need of dedicated certification testing to demonstrate adequate performance and suitable intervals. EASA is currently considering the possibility of introducing new AMC to CS 29.927(a) (Additional tests) to address this aspect. This would clarify the need to support inspection intervals and retirement times with appropriate directly applicable data.

In conclusion, while the relevance of a full assessment of the design and a detailed evaluation of the failure scenarios is agreed and already present in CS-29, EASA considers that mandating design measures to systematically mitigate the outcome of catastrophic failures could be counterproductive. This could lead to impractical and overly complex solutions, that negatively impact the reliability of rotors and rotor drive systems.

Based on the above, EASA considers that the necessary elements are in place to ensure that hazardous and catastrophic failures are adequately addressed during certification, by adequately mitigating such failures and/or minimising their probability of occurrence, thus, ensuring adequate safety levels."

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