10 October 2025

MAA/RN/2025/04 – Use of Artificial Intelligence within Systems and Equipment subject to MRP design assurance processes

Issue

1. The continuing maturation and widening adoption of Artificial Intelligence[1] (AI) technologies in digital control systems and decision support tools has led to the requirement to clarify the position with respect to use of such technologies in the Defence Air Environment (DAE).

Scope

2. This Regulatory Notice (RN) is intended as an informative correspondence for the whole Regulated Community (RC), providing guidance on the use of AI within Safety-related Systems and digital architectures that have an influence on the flight path, Propulsion Systems or Safety features of Air Systems and equipment subject to MAA Regulatory Publications (MRP) design Assurance processes. It does not specifically aim to encompass AI used in wider DAE applications such as Logistics Information Systems or administration support activity; however the principles and guidance may be of use, and the RC is encouraged to contact the MAA should there be any related questions. It highlights, among other guidance, that the use of AI technology is conceptually the same as any other systems development approach in that the resultant output is to be assured to the required level and is therefore dependent on sufficient evidence (both its quantity and type).The MAA will continue to review the applicability of this RN in light of the rapid evolution of the subject matter. To ensure coherence, current guidance from the UK Civil Aviation Authority (CAA), foreign Aviation Regulators, and appropriate MOD Policies were reviewed during the production of this RN.

Implementation

3. This guidance is effective immediately and represents the MAA's current position with respect to AI technologies. AI technologies are evolving rapidly, and their safe and ambitious adoption will require the development of timely regulatory pathways. The MAA will continue to engage the RC and provide additional guidance as needed.

Background

4. While the Assurance of AI shares many common features with its traditional software counterpart, there are significant differences especially around low-level requirements and their verification. These differences may present Risks to Safety that are difficult to quantify in the overarching System Safety Case. It is not currently possible to be prescriptive on resolving these issues without architectural mitigation. Despite these challenges, AI may be beneficial to system

[1] Within the context of this RN the intended meaning of the Term 'AI' is as characterised within JSP936 – Dependable Artificial Intelligence in Defence and covers additional terms such as Machine Learning (ML), which is a subset of AI.

performance and / or Air Safety and if used, all associated Risks should be included in the System Safety Case and incorporate uncertainty around attempts at Risk quantification.

5. A System or Equipment utilising AI in applications likely to affect overall platform Airworthiness such as propulsion, flight management and flight control systems should demonstrate appropriate consideration of the MOD's five key AI ethical principles[2]. In the context of Air Safety, the principle of reliability is particularly pertinent and as such performance targets for AI components must be clearly defined for the operating context and demonstrated to a level of confidence that is commensurate with the Risk associated with failure. Where AI is complementary to, or replacing, an existing approach, whether that is provided through software, human decision-making or a combination thereof, existing performance targets must be considered for continuing acceptability. Where existing performance targets are deemed acceptable then the principle of demonstrating Globally At Least Equivalent (GALE) performance targets may be appropriate.

Certified Air Systems

6. For Certified Air Systems, the Applicant should raise a Military Certification Review Item (MCRI)[3] for MAA agreement. Some industry guidance is available for consideration to aid in MCRI development and in the wider Assurance of this technology, including:

a. The European Union Aviation Safety Agency (EASA) Artificial Intelligence Roadmap, which establishes the Agency's vision on the Safety and ethical dimensions of AI in the aviation domain, including usable guidance for AI[4].

b. The Assurance of ML for use in Autonomous Systems (AMLAS) methodology, developed by the University of York through the Assuring Autonomy International Programme (AAIP), comprises a set of Safety case patterns and processes for systematically integrating Safety Assurance into ML-developed software and generating supporting evidence.

c. European Organisation for Civil Aviation Equipment (EUROCAE) WG114 and SAE G34 are jointly developing a 'Process Standard for Development and Certification / Approval of Aeronautical Safety-Related Products Implementing AI'.

d. The Safety-Critical Systems Club (SCSC) Safety of Autonomous Systems Working Group's generic Safety Assurance Objectives for Autonomous Systems, containing objectives for ML-developed Programmable Elements (PE) implementations.

7. It is recommended that early applications of ML techniques for Air System PE use the most appropriate training methods (eg supervised learning using large, high-quality datasets) to generate models that then remain fixed for system integration and use within a defined operational design domain. System design choices can also reduce the criticality of AI PE, such as the system

[2] The MOD AI Ethical Principles outlined in JSP 936 Part 1 Section 3 encompass those set out in the CAA's CAP2970 – Building Trust in AI -5 Principles for AI and Automation.
[3] Refer to the Manual of Military Air System Certification (MMAC) for further guidance.
[4] EASA Concept Paper: Guidance for Level 1 & 2 machine learning applications, Issue 2.

architecture including Safety monitors developed using traditional techniques to bound the overall system behaviour. It is noted that use of adaptive systems (eg those with the ability to dynamically adjust system behaviour using real-time feedback) implementing Safety-related functions would bring significant certification challenges until the Assurance of such technologies is better understood.

8. It is recommended that particular care is taken to properly articulate how the intent of High-Level User Requirement behaviours can be demonstrated to be met through a combination of Hazard Analysis, Performance requirements, Data Requirements, Learning Approaches and Verification and Validation Approaches[5].

Non-Certified Uncrewed Air Systems (UAS)

9. The level of required technical scrutiny, Assurance and Integrity for UK military registered UAS is modulated to be commensurate with its assessed 2nd and 3rd Party Risk to Life (RtL), technical characteristics and intended Concept of Operations / Concept of Use (CONOPS / CONUSE) at Categorization[6]. The Joint Authorities for Rulemaking of Unmanned Systems (JARUS)[7] guidelines on Specific Operations Risk Assessment (SORA) are also considered a valid methodology for assessing the RtL and provide a framework to argue the associated levels of Assurance required for operations in the Specific Category[8, 9].

10. The guidance described at para 6. is relevant for consideration to aid in the Assurance of AI technology incorporated in non-certified UAS; early engagement with the MAA is recommended to agree upon an appropriate approach.

11. As is the case with certified Air Systems, it should be noted that use of adaptive systems implementing Safety-related functions would present significant challenges until the Assurance of these technologies is better understood. Such implementations would, therefore, likely present an Assurance deficit which may require technical (eg 'safety net' architectures, manual overrides and 'kill' switches) and / or operational mitigations. The MAA's existing principles and Assurance frameworks[10] that minimize RtL and deliver As Low As Reasonably Practicable (ALARP) and Tolerable outcomes remain applicable.

Military Air Traffic Management (ATM) Equipment

12. It is anticipated that advances in AI technologies will bring significant benefits and efficiencies to the ATM domain, such as the use of virtual 'co-controllers' assisting in conflict detection and resolution. For new, and Modifications to any in-service, Military ATM Equipment which incorporates AI technology, the Applicant should raise an Air Traffic Management Assurance

[5] JSP936 Page 23 – Requirements.
[6] Refer to RA 1600 – Remotely Piloted Air Systems.
[7] http://jarus-rpas.org/.
[8] Refer to the Remotely Piloted Air System Manual – Regulatory Process, Categorization, and Compliance for further guidance.
[9] Refer to RA 1605 – Remotely Piloted Air Systems Specific S2 sub-category.
[10] Such as, but not limited to: MMAC, Defence Standard (DefStan) 00-970, DefStan 00-055, DefStan 00-056, Radio Technical Commission for Aeronautics (RTCA) DO-178C / EUROCAE ED-12C, RTCA DO-326B / ED-202B, RTCA DO-356A / ED-203A.

Review Item (ATM-ARI)[11] for MAA agreement. The guidance described at para 6. is relevant for consideration to aid in ATM-ARI development and in the wider Assurance of this technology.

Non-Compliances

13. Where compliance cannot be demonstrated due to lack of suitable AI standards, or the difficulty posed by the unpredictability of the AI involved, the exposition of the fundamental regulatory principles articulated in the Air System Safety Case and supporting evidence remains valid such that evidence is gathered through verification (including trials, testing and analysis) and mechanisms for continuing performance monitoring for counter-evidence of system Safety. As with conventional complex PE, deterministic testing of AI implementations to verify correct functional performance in all foreseeable operating conditions is infeasible and is no substitute for appropriate development assurance. Consequently, the potential for anomalous behaviour in the AI implementation should be acknowledged and suitably mitigated.

Summary

14. The use of AI for Safety-related systems should be carefully considered. If the technology is to be used in this way, then as far as practicable, system design choices should reduce the criticality of AI PE. For Certified Air Systems and ATM Equipment the Applicant should raise an MCRI / ATM-ARI for MAA agreement of the AI assurance approach. For Non-Certified UAS early engagement with the MAA is recommended. The core principles used in the MAA's existing Assurance and Certification processes should continue to be applied to Air Systems and Equipment utilizing AI. As an evolving issue, the RC are encouraged to engage with the MAA as early as possible in the design process.

Queries

15. Any observations or requests for clarification on the content of this RN should be submitted by email to DSA-MAA-MRPEnquiries@mod.gov.uk.

Head Regulation and Certification
MAA

[11] Refer to the Manual of Military Air Traffic Management Equipment Assurance (MMATMEA) for further guidance.

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