



AEROSPACE INFORMATION REPORT

AIR7123™

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Overview of Blockchain-Based Digital Authorized Release Certificate

RATIONALE

Digital transactions are not new but are now being recorded differently. For instance, blockchain is one of those means of recording digital transactions and is not well understood outside of a few communities. Every part in the supply chain, from a small switch to a whole aircraft, needs to have a certificate, but in many cases, it is still a paper certificate. A digital authorized release certificate (DARC) will help enormously to achieve higher efficiency in the aviation industry. The ATA e-Business program has created an XML standard for electronic transactions of these certificates (refer to ATA Spec 2000 [Ch. 16]), and a separate group has created DIN SPEC 9012. In addition, many paper documents are digitized by scanning to a PDF standard in which the information is electronic, but specific data fields are not necessarily machine-readable. This document will provide an overview, process, and implementation guidance on the use of blockchain technology to better secure the immutability and traceability of a DARC.

This SAE Aerospace Information Report (AIR) presents an overview of blockchain-enabled DARC and its viability to make it interoperable, transferable, verifiable, traceable, secure, and immutable. The scope of this document is to provide information on DARC and does not standardize the process to capture information. It is not meant for regulatory authorities to recognize this standard as an acceptable means of recording data collected via the required authorized release certificate (ARC) tags (refer to FAA Form 8130-3 and EASA Form 1) but rather could inform those regulatory bodies about considerations for using such data in a blockchain or similar environment.

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1. SCOPE

The scope of this document is to provide an overview, process, and implementation guidance on use of blockchain technology for a secure, immutable, and traceable digital authorized release certificate. This document does not standardize the process nor is it meant for authorities to recognize the standard as an acceptable means of recording data collected through the required authorized release certificate (ARC) tags.

1.1 Purpose

The purpose of this document is to provide overview, process, and implementation guidance on use of blockchain technology to secure the immutability and traceability of a digital authorized release certificate (DARC).

1.2 Approach

This document starts with an overview of the DARC, the current process and challenges, and how this process can be improved through blockchain technology to make it more secure, immutable, and traceable.

1.3 Intended Users

The intended users of this document include engineers, practitioners, academicians, original equipment manufacturers (OEMs), suppliers, operators, and maintenance, repair, and overhaul (MRO) service providers and regulators who are various stakeholders and users of digital authorized release certificates in the aircraft industry.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 A4A Publications

Available from Airlines for America, 1301 Pennsylvania Avenue, NW, Suite 1100, Washington, DC 20004, Tel: 202-626-4000, www.airlines.org.

ATA Spec 2000: Authorized Release Certificate (Ch. 16)

2.1.2 EASA Publications

Available from European Union Aviation Safety Agency, Konrad-Adenauer-Ufer 3, D-50668 Cologne, Germany, Tel: +49 221 8999 000, www.easa.europa.eu.

EASA Form 1, Authorized Release Certificate

2.1.3 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

FAA Form 8130-3, Authorized Release Certificate, Airworthiness Approval Tag

2.1.4 Other Publications

DIN SPEC 9012, Digital Certificate of Conformity, <https://e-coc.org/>

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR7356 Opportunities, Challenges, and Requirements for Use of Blockchain in Unmanned Aircraft Systems Operating Below 400 Feet Above Ground Level for Commercial Use

ARP6823 Electronic Transactions for Aerospace Systems: An Overview

ARP6984 Determination of Cost Benefits from Implementing a Blockchain Solution

2.2.2 Other Publications

Ugandharji, H.M. (2022). *Blockchain for Product Traceability* [White paper]. Infosys. <https://www.infosys.com/services/blockchain/documents/blockchain-product-traceability.pdf>.

2.3 Acronyms

AIR	Aerospace Information Report
ARC	Authorized Release Certificate
ATA	The ATA e-Business Program operated by Airlines for America (A4A)
DARC	Digital Authorized Release Certificate
DID	Decentralized Identifier
EASA	European Union Aviation Safety Agency
FAA	U.S. Federal Aviation Administration
ISO	International Organization for Standardization
OEMs	Original Equipment Manufacturers
MRO	Maintenance, Repair, and Overhaul
VCs	Verifiable Credentials
VPs	Verifiable Presentations
W3C	World Wide Web Consortium

3. INTRODUCTION

In the aviation industry, each aircraft part or component should have an approved ARC before the part or component is installed. Presently, ARCs are primarily in paper form represented by FAA Form 8130-3, EASA Form 1, or equivalents from other regulatory authorities. The ARC documents the airworthiness status of approved parts or components and helps provide traceability throughout the aviation ecosystem. Inconsistent and/or inaccurate ARC documents result in many challenges; for example, a missing signature in an ARC document or an incorrect part number or serial number can result in parts being held in quarantine until the issue is resolved. This can create unwarranted delays and additional cost to various stakeholders.

The non-digital ARC documents require manual processing, which can increase the risk of errors, delays, and fraud. They also have the burden of physical storage, which could be costly and inefficient. Moreover, paper forms/certificates may not have the same level of traceability and auditability as digital certificates, leading to challenges with authenticity and verification throughout the life cycle. Non-digital ARCs also have limited accessibility, making it hard for stakeholders (including regulators) to access and verify the certificate and its related information quickly and easily. Overall, the non-digital ARC processes can be time-consuming to create, share, and manage, resulting in delayed product releases and suboptimal business operations.

Digital documents and certificates are not new; however, the existing methods of digitization introduce additional challenges, like validating the identity of the person signing the document, data integrity, privacy, and non-repudiation status of the document. These challenges may have created slow implementation in digitization of ARCs. The developments and wider adoption of blockchain technology can potentially address several of these challenges by digitizing and modeling ARC as a World Wide Web Consortium (W3C) verifiable credential (VC). A blockchain-based DARC will be a more secure and tamper-proof digital document. It will help in improving process efficiency, compliance, and cost of compliance. For example, verifying the signer's identity on digital documents is challenging with traditional methods. Digital signatures require robust encryption and authentication methods to help ensure they are not forged. Blockchain can solve this by linking each signature to a unique, verifiable identity token on a decentralized ledger, helping to ensure authenticity and security.

3.1 Current Paper Process of Authorized Release Certificate and Associated Challenges

ARCs are physical documents that are issued to authorize the release of a product or article from a manufacturing or maintenance facility. ARCs are typically issued by a company's quality control department and must be signed by an authorized person.

ARCs include the following information:

- The name and address of the person or organization issuing the ARC.
- The name and address of the manufacturer of the product.
- The date of manufacture or maintenance.
- A statement that the product meets all applicable airworthiness requirements.
- A signature by an authorized person on behalf of the organization issuing the ARC.
- Detailed part identification information, such as the part number, serial number, batch or lot number, and a description of the part.
- In the case of a repair or overhaul, the ARC describes the nature of the work performed.