

AEROSPACE INFORMATION REPORT

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Aircraft Asset Lifecycle and Digital Data Standards Overview

RATIONALE

The aerospace ecosystem is complex with many stakeholders exchanging technical, operational, and maintenance data across lifecycle stages of aircraft from engineering, manufacturing, operations, and maintenance to disposal. Many standards have been developed to standardize and improve the effectiveness, efficiency, and security of the data transfer process. There are still challenges in data transfer due to the non-availability of standards in certain areas or lack of awareness and implementation of some standards. Hence, the purpose of the current document is to review the data being exchanged between various stakeholders in the aerospace asset lifecycle and the availability of standards for the data transfer. Further, the purpose is to identify gaps and non-availability of data standards. The current focus of this document is limited to aircraft operations, maintenance, transfer, and disposal processes post-build stage, and does not include the detailed interactions during the aircraft build phase. The scope is also limited to key stakeholder interactions throughout the stages of aircraft operations, maintenance, and disposal.

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1. SCOPE

This SAE Aerospace Information Report (AIR) reviews technical, operational, and maintenance data being exchanged between key stakeholders in aerospace asset lifecycle and data standards available for such exchanges. It identifies gaps and non-availability of data standards in certain areas. The scope of the current document is limited to aircraft operations, maintenance and disposal stages post-build phase, and does not include the detailed interactions during the aircraft build phase.

1.1 Purpose

The purpose of this document is to present a study of technical data being exchanged across various lifecycle stages of an aircraft and identify available standards for the exchange of such data. The document examines the non-availability of data standards and identifies gaps in the available data standards. The current document is anticipated to evolve as the new standards are identified.

1.2 Intended Users

The document is intended for producers, owners, and users of aircraft life cycle data like business users, functional analysts, data engineers, data architects, and IT professionals of the aerospace ecosystem. These users are from various organizations of the aerospace ecosystem, such as original equipment manufacturers, suppliers, operators, owners, regulatory authorities, MROs, lessors, disposers, IT product suppliers, IT service providers, and others. The document is also useful for organizations developing standards like SAE, A4A, AIA, ASD, IATA, ISO, ARINC, EUROCAE, RTCA, and others.

1.3 How to Use This Document

The document is an informational report and provides a review of documents defining the aircraft asset life cycle and associated data standards. This document aligns existing data standards to each of the aircraft lifecycle phases and provides an understanding of data standards available. Gaps in current data standards are identified to assist the aerospace industry in improving the completeness and quality of the data. Section 2 presents the available documents and data standards reviewed in this document. The abbreviations and definitions referred to in the text are given in Section 2 of this document. A brief introduction of the aircraft lifecycle is discussed in Section 3 and the details of the applicable standards are given in Section 4. Data interaction between various stakeholders and applicable standards are discussed in detail in Section 5. This document also presents the gaps and non-availability of documents in certain important areas and are given in Section 6. Finally, conclusions are provided in Section 7.

2. REFERENCES

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 Applicable Documents

2.1.1 Airlines for America (A4A) Publications

Available from Airlines for America (A4A), 1301 Pennsylvania Avenue, NW, Suite 1100, Washington, DC 20004, Tel: 202-626-4000, www.airlines.org.

ATA e-Business Program Standards.

ATA e-Business Program, High Level Information Flows and Specification.

CSDD Common Support Data Dictionary, Product Code 17401, Revision 2017.1

MSG-3: Operator/Manufacturer Scheduled Maintenance Development, Volume 1 - Fixed wing Aircraft, Product Code 18123, Revision 2018.1

MSG-3: Operator/Manufacturer Scheduled Maintenance Development, Volume 2 - Rotorcraft, Product Code 18123R, Revision 2018.1

Spec 42 Aviation Industry Standards for Digital Information Security, Product Code 18044, Revision 2018.1

Spec 1000BR_4.1 Civil Aviation Business Rules for S1000D Issue 4.1, Product Code 19120, Revision 2019.1

Spec 1000BR_4.2 Civil Aviation Business Rules for S1000D Issue 4.2, Product Code 19121, Revision 2019.1

Spec 2000 Aircraft Transfer Part List (Ch. 15), Product Code 1415AT, Revision 2014.1

Spec 2000 Airline Inventory Redistribution System - AIRS (Ch. 12), Product Code 1412AR, Revision 2014.1

Spec 2000 Authorized Release Certificate (Ch. 16), Product Code 1816ARC, Revision 2019.1

Spec 2000 Automated Identification and Data Capture (Ch. 9), Product Code 16029, Revision 2016.1

Spec 2000 Electronic Logbook (Ch. 17), Product Code 1817EL, Revision 2018.1

Spec 2000 Electronic Work Package (Ch. 18), Product Code 1818W, Revision 2018.1

Spec 2000 Industry Metrics (Ch. 13), Product Code 1413M, Revision 2014.1

Spec 2000 Materials Management (Ch 3-4, 6), Product Code 1434MM, Revision 2014.1

Spec 2000 Procurement Planning (Ch. 2), Product Code 1402PP, Revision 2014.1

Spec 2000 Provisioning (Ch. 1), Product Code 1401P, Revision 2014.1

Spec 2000 Reliability Data Collection/Exchange (Ch. 11), Product Code 19111, Revision 2019.1

Spec 2000 Repair Order Administration (Ch. 7), Product Code 1407R, Revision 2014.1

Spec 2000 Warranty Claims (Ch. 14), Product Code 1814WC, Revision 2018.1

Spec 2000 Gen 2 Procurement, Product Code 18G2P, Revision 2018.1

iSpec 2200 Information Standards for Aviation Maintenance, Revision 2018.1, A4A Publications, 2018

Spec 2300 Data Exchange Standard for Flight Operations, Product Code 060319, Revision 2019.1

Spec 2400 Allowable Configuration Data Exchange Standard, Product Code 18S240, Revision 2018.1

Spec 2500 Aircraft Transfer Records, Product Code 174ATR, Revision 2017.2

WASG World Airlines and Suppliers Guide, Product Code 07326, Revision 2015.1

2.1.2 AFRA Publications

The Best Management Practice for Management of Used Aircraft Parts and Assemblies and for Recycling of Aircraft Materials, Aircraft Fleet Recycling Association, Version 3.3, 2017

2.1.3 ARINC Publications

Available from ARINC, 2551 Riva Road, Annapolis, MD 21401-7435, Tel: 410-266-4000, www.arinc.com.

ARINC 424	Navigation Database
ARINC 429	Digital Information Transfer System (DITS) Part 1 Functional Description, Electrical Interfaces, Label Assignments and Word Formats, ARINC Industry Activities
ARINC 429	DITS Part 2 Discrete Word Data Standards
ARINC 604	Guidance for Design and Use of Built in Test Equipment
ARINC 624	Design Guidance for Onboard Maintenance System
ARINC 629	Multi-Transmitter Data Bus Part 1 Technical Description
ARINC 629	Multi-Transmitter Data Bus Part 2 Applications Guide
ARINC 664	Aircraft Data Network, Part 1 Systems Concepts and Overview
ARINC 664	Aircraft Data Network, Part 2 Ethernet Physical and Data Link Layer Specification
ARINC 665	Loadable Software Standards, ARINC Industry Activities
ARINC 811	Commercial Aircraft Information Security Concepts of Operation and Process Framework
ARINC 822	Aircraft/Ground IP Communication
ARINC 823	Datalink Security
ARINC 842	Guidance for Usage of Digital Certificates
ARINC 843	Aircraft Software Common Configuration Reporting

2.1.4 ASD Publications

S4000P	International specification for developing and continuously improving preventive maintenance, Issue 2.0, 2018
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2.1.5 ASD/AIA Publications

SX000i	International guide for the use of the S-Series Integrated Logistics Support specifications, Issue 1.2, 2018
S2000M	International specification for materiel management, Issue 6.1, 2017
S3000L	International procedure specification for logistic support analysis, Issue 1.1, 2014
S5000F	International specification for in-service data feedback, Issue 2.0, 2019
S6000T	International specification for training analysis and design, Issue 1.0, 2020

2.1.6 ASD/AIA/A4A Publications

S1000	International Specification for Technical Publications, Product Code 020713, Revision 4.1, S1000D-B6865-01000-00, Issue No. 5.0, 2019
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2.1.7 ASD-STAN/AIA Publications

EN9300/NAS9300 Long Term Archiving and Retrieval of digital technical product documentation, Rev 1, 2017

2.1.8 EUROCAE Publications

Available from EUROCAE Secretariat, 102 rue Etienne Dolet, 92240 Malakoff, France, Tel: +33 1 40 92 79 30, www.eurocae.net.

EUROCAE ED 76A	Standards for processing aeronautical data, 2015
EUROCAE ED 201	Aeronautical Information System Security (AISS) framework guidance, European Organization for Civil Aviation Equipment (EUROCAE), 2015
EUROCAE ED 202A	Airworthiness Security Process Specification, Revision A, European Organization for Civil Aviation Equipment, 2014
EUROCAE ED 203A	Airworthiness Security Methods and Considerations, Revision A, European Organization for Civil Aviation Equipment, 2018
EUROCAE ED 204	Information Security Guidance for Continuing Airworthiness, European Organization for Civil Aviation Equipment, 2014
EUROCAE ED 205	Process Standard for Air Traffic Management/Air Navigation Services (ATM/ANS) ground systems security aspects for certification/declaration, 2019

2.1.9 FAA, EASA Publications

AC120-78A Electronic Signatures, Electronic Record Keeping and Electronic Manuals.

FAA Form 8130-3 Authorized Release Certificate, Airworthiness Approval Tag, Feb 2014.

EASA Form 1 Authorized Release Certificate

2.1.10 ICAO Publications

Available from International Civil Aviation Organization, 999 University Street, Montreal, Quebec H3C 5H7, Canada, Tel: +1 514-954-8219, <http://www.icao.int/>.

ICAO 1004 2020-2022 Global Aviation Safety Plan, Publication date 2014-12

2.1.11 IATA Publications

Available from International Air Transport Association, Publications Assistant, 800 Place Victoria, P.O. Box 113, Montreal, Quebec H4Z 1M1, Canada, Tel: 1-514-874-0202, www.iata.org.

Airlines' Business Requirements for Original Equipment Identification and 2D Barcode Tagging for Aircraft Cabin Equipment, June 2018

Aviation Identification & Authorization System, Whitepaper, August 2015.

Guidance Material for the implementation of Paperless Aircraft Operations in Technical Operations (PAO:TO), November 2017

Best Industry Practices for Aircraft Decommissioning (BIPAD), 1st Edition, ISBN 978-92-9229-827-2, 2018

Guidance Material and Best Practices for Aircraft Leases, 4th Edition, ISBN 978-92-9229-594-3, 2017

2.1.12 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ISO 10303-209:2014	Industrial automation systems and integration – product data representation and exchange – Part 209: Application protocol: Multidisciplinary analysis and design, Publication date 2014-12
ISO 10303-210:2014	Industrial automation systems and integration – product data representation and exchange – Part 210: Application protocol: Electronic assembly, interconnect and packaging design, Publication date 2014-12
ISO 10303-235:2019	Industrial automation systems and integration – product data representation and exchange – Part 235: Application protocol: Engineering properties and materials information, Publication date 2019-06
ISO 10303-238:2007	Industrial automation systems and integration – product data representation and exchange – Part 238: Application protocol: Application interpreted model for computerized numerical controllers, Publication date 2007-05
ISO 10303-239:2012	Industrial automation systems and integration – product data representation and exchange – Part 239: Application protocol: Product Life Cycle Support, Publication date 2012-11
ISO 10303-242:2014	Industrial automation systems and integration – product data representation and exchange – Part 242: Application protocol: Managed model-based 3D engineering, Publication date 2014-12

2.1.13 RTCA Publications

Available from RTCA, Inc., 1150 18th Street, NW, Suite 910, Washington, DC 20036, Tel: 202-833-9339, www.rtca.org.

DO-200B	Standards for Processing Aeronautical Data, 2015
DO-326A	Airworthiness Security Process Specification, 2014
DO-355	Information Security Guidance for Continuing Airworthiness, 2014
DO-356	Airworthiness Security Methods and Considerations, 2018

2.1.14 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.

AIR6904	Rationale, Considerations, and Framework for Data Interoperability for Health Management within the Aerospace Ecosystem
ARP9034A	A Process Standard for the Storage, Retrieval and Use of Three-Dimensional Type Design Data
AS5395	Health and Usage Monitoring System Data Interchange Specification
SAE JA6268	Design & Run-Time Information Exchange for Health-Ready Components

2.1.15 Other Publications

Jean B., Model-Based Enterprise, Manufacturing & Standards, AFNet, 2018

Industrial Automation Language of the future, European Automation, Special Reports

Darek K., OPC: The Ins and Outs to What its about “The Every Man’s Guide to OPC,” 2009

OPC Unified Architecture (UA), OPC Foundation, 2008, <https://opcfoundation.org/about/opc-technologies/opc-ua/>

Modbus communication protocol suite, www.modbus.org

MQTT Version 5.0, Oasis Standard, 2019, <https://docs.oasis-open.org/mqtt/mqtt/v5.0/os/mqtt-v5.0-os.docx>

2.2 Abbreviations

A4A	Airlines for America
AC	Advisory Circular
ACARS	Aircraft Communications Addressing and Reporting System
AD	Airworthiness Directive
AFRA	Aircraft Fleet Recycle Association
AIA	Aerospace Industries Association
AIR	Aerospace Information Report
AISS	Aeronautical Information System Security
AMM	Aircraft Maintenance Manual
AMP	Aircraft Maintenance Program
ARC	Authorized Release Certificate/Airworthiness Approval Tag
ASD	Aerospace and Defence Industries Association of Europe
ASD-STAN	Aerospace and Defence Industries Association of Europe for Standardization
ATA	Air Transport Association of America now referred to as Airlines for America or A4A
COC	Customer Originated Changes
CM	Configuration Management
CMM	Component Maintenance Manual
DDG	Dispatch Deviations Guide
DTD	Document Type Definition
DITS	Digital Information Transfer System
EASA	European Union Aviation Safety Agency
EIPC	Engine Illustrated Parts Catalog
EUROCAE	European Organization for Civil Aviation Equipment
FAA	Federal Aviation Administration
FCOM	Flight Crew Operational Manual

IATA	International Air Transport Association
ICA	Instructions for Continued Airworthiness
ICAO	International Civil Aviation Organization
IPC	Illustrated Parts Catalogue
ISO	International Organization for Standardization
IT	Information Technology
IVHM	Integrated Vehicle Health Management
LSPs	Loadable Software Parts
MEL	Minimum Equipment List
MMEL	Master Minimum Equipment List
MQTT	Message Queuing Telemetry Transport
MRBR	Maintenance Review Board Report
MRO	Maintenance, Repair and Overhaul
MPD	Maintenance Planning Document
MSPs	Media Set Parts
MTI	Maintenance Training Information
OASIS	Organization for the Advancement of Structured Information Standards
OMS	Onboard Maintenance System
OEM	Original Equipment Manufacturer
RFID	Radio Frequency Identification
RFQ	Request for Quotation
RITA	Rotorcraft Industry Technology Association
SB	Service Bulletins
SRM	Structural Repair Manual
STC	Supplimentary/Supplemental Type Certificate