



AEROSPACE INFORMATION REPORT

AIR8479™

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Considerations and Guidelines to Extract Knowledge from Long-Term Archival Data

RATIONALE

In the aircraft ecosystem, many documents and information in various forms are available across the aircraft life cycle, from birth to disposal, from text to documents to tables to images to drawings/models to other formats, spanning across many decades for a commercial aircraft. It is essential to retrieve the knowledge from these documents and use it to learn from the past, to make informed decisions in the future. This retrieved information needs to be mined, analyzed, and utilized to build and upkeep components, subsystems, and systems in the aircraft ecosystem.

Currently, a few standards are available for long-term archiving and retrieval of technical product documents (EN 9300) and digital certificate of conformity (DIN SPEC 9012). However, there is a need to elicit considerations and guidelines to extract knowledge from the long-term archival data. Digital technologies like blockchain, big data, cloud, and AI are being matured and widely used to improve efficiencies and reduce the cost of operations across the value chain. This aerospace information report (AIR) contains the considerations and guidelines to extract knowledge from long-term archival data.

TABLE OF CONTENTS

1.	SCOPE.....	3
1.1	Purpose.....	3
1.2	Approach.....	3
1.3	Intended Users.....	3
2.	REFERENCES.....	3
2.1	Applicable Documents	3
2.1.1	SAE Publications.....	3
2.1.2	A4A Publications	4
2.1.3	ASME Publications.....	5
2.1.4	FAA and EASA Publications	5
2.1.5	ICAO Publications	5
2.1.6	ISO Publications.....	6
2.1.7	LOTAR Publications.....	6
2.1.8	RTCA Publications	6
2.1.9	Other Publications.....	7
2.2	Abbreviations	7
3.	INTRODUCTION.....	8
4.	DATA LIFE CYCLE ACROSS THE AEROSPACE ECOSYSTEM	10
4.1	Scope of LOTAR Data	12

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5.	TRANSFORMATION OF DATA TO KNOWLEDGE	12
5.1	Data to Information.....	13
5.2	Information to Knowledge	15
6.	KNOWLEDGE	15
6.1	Knowledge Representation	15
6.2	Knowledge Extraction, Storage, and Retrieval for Consumption.....	16
7.	CONSIDERATIONS	17
7.1	Define Objectives and Scope.....	17
7.2	Understand Current (As-Is) and Envision Future (To-Be) Process	17
7.3	Adopt Industry Standards for Knowledge Extraction, Storage, and Retrieval	18
7.4	Utilize Semantic Data Dictionary and Aerospace Standards.....	18
7.5	Other Considerations	18
8.	GUIDELINES	19
8.1	Aligning Knowledge Extraction Use Cases with LOTAR Requirements.....	19
8.2	Differentiating and Linking Knowledge, Information, and Data Layers.....	20
8.3	Representing Knowledge in a Machine Processable Format	20
8.4	Human Aspects of Knowledge	20
8.5	Organizing Knowledge Layer	20
8.6	Contextual Awareness	20
8.7	Data Integrity and Quality.....	21
8.8	Extract Data and Align It to Knowledge Layers	21
8.9	Ensure Compliance and Security.....	21
8.10	Knowledge Visualization and Presentation.....	22
8.11	Maintain Long-Term Usability	22
9.	SUMMARY	22
10.	NOTES	22
10.1	Revision Indicator.....	22
Figure 1	Aerospace asset stakeholder interaction	11
Figure 2	Data, information, and knowledge representation	13
Figure 3	Knowledge extraction and retrieval process	16
Figure 4	LOTAR requirements and use cases.....	19
Table 1	Aerospace asset key stakeholder description and responsibilities.....	10
Table 2	Aircraft life cycle, stage-wise inputs and outputs	11
Table 3	Characteristics of data, information, and knowledge	14

1. SCOPE

The scope of this document is to provide considerations, guidelines, and best practices for extracting knowledge from long-term archival data. The document is intended to cover the data generated across all life cycle stages of an aircraft starting from concept to disposal. This document does not standardize the process, nor does it allow regulatory authorities to recognize the document as an acceptable means of compliance. It is only a guideline document to discover, capture, store, retrieve, process, and consume knowledge.

1.1 Purpose

The purpose of this document is to provide an overview, the process, and implementation guidance for effectively managing knowledge across the aircraft life cycle within an enterprise and the ecosystem.

1.2 Approach

This document presents an overview of knowledge life cycle stages, from identification, extraction, classification, representation, storage, retrieval to consumption of knowledge along with the considerations and guidelines to extract knowledge from long-term archival data.

1.3 Intended Users

The intended users of this document are engineers; practitioners; academicians; researchers; original equipment manufacturers (OEMs); partners; suppliers; operators; regulators; maintenance, repair, and overhaul (MRO) service providers; software product and service providers; and other stakeholders and users of digital data in the aircraft industry.

2. REFERENCES

2.1 Applicable Documents

The following publications are referenced in this document. The latest issue of publications shall apply unless otherwise specified. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

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

AIR7501	Aircraft Asset Lifecycle and Digital Data Standards Overview
ARP4754	Guidelines for Development of Civil Aircraft and Systems
ARP6823	Electronic Transactions for Aerospace Systems: An Overview
AS5553	Counterfeit Electrical, Electronic, and Electromechanical (EEE) Parts; Avoidance, Detection, Mitigation, and Disposition
AS6174	Counterfeit Material; Assuring Acquisition of Authentic and Conforming Material
AS9100	Quality Management Systems - Requirements for Aviation, Space, and Defense Organizations
AS9145	Aerospace Series – Requirements for Advanced Product Quality Planning and Production Part Approval Process

AS13004	Process Failure Mode and Effects Analysis (PFMEA) and Control Plans
SAE J1739	Potential Failure Mode and Effects Analysis (FMEA) Including Design FMEA, Supplemental FMEA-MSR, and Process FMEA
GEIA-859	Data Management Standard

2.1.2 A4A Publications

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

ATA e-Business Program Standards, <http://www.ataebiz.org/Pages/standards.aspx>

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

ATA 100, Specification for Manufacturer's Technical Data

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

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

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

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

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

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

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

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

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

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

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

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

Spec 2000, Gen 2 Procurement, Product Code 18G2P

iSpec 2200, Information Standards for Aviation Maintenance

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

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

Spec 2500, Aircraft Transfer Records, Product Code 174ATR

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

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

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

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

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

WASG, World Airlines and Suppliers Guide, Product Code 07326

CSDD, Common Support Data Dictionary, Product Code 17401

2.1.3 ASME Publications

Available from ASME, Two Park Avenue, New York, NY 10016-5990, Tel: 800-843-2763 (U.S./Canada), 001-800-843-2763 (Mexico), 646-616-3100 (outside North America), www.asme.org.

ASME Y14.100 Engineering Drawing Practices

2.1.4 FAA and EASA Publications

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

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

Title 14, Code of Federal Regulations (CFR), Part 21, Certification Procedures for Products and Articles

FAA Part 21, Federal Aviation Administration Certification Procedures for Products and Parts

FAR Part 21, Certification Procedures for Products and Parts

FAA Part 145, Federal Aviation Administration Repair Station Requirements

Regulation (EU) No 748/2012, Annex I (Part 21), Design Organization Approval/Production Organization Approval

EASA Part 145, European Union Aviation Safety Agency Requirements - Maintenance Organizations

2.1.5 ICAO Publications

Available from International Civil Aviation Organization, 999 Robert-Bourassa Boulevard, Montréal, Québec H3C 5H7, Canada, Tel: +1 514-954-8219, www.icao.int.

Business Rules, International Standard for Aircraft Make, Model and Series Groupings, Commercial Aviation Safety Group, Common Taxonomy Team, International Civil Aviation Organization (ICAO), May 2019 (1.6)

Definitions and Usage Notes, Air Traffic Causal and Contributory Factors, CAST/ICAO Common Taxonomy Team (CICTT), August 2014 (1.0.1)

Business Rules, International Standard for Engine Make, Model and Submodel Groupings, CAST/ICAO Common Taxonomy Team (CICTT), April 2014 (1.3)

Definitions and Usage Notes, Hazard, CAST/ICAO Common Taxonomy Team (CICTT), March 2014 (1.0)

Definitions and Usage Notes, Human Factor, CAST/ICAO Common Taxonomy Team (CICTT), October 2012 (1.7)

Definitions and Usage Notes, Aviation Occurrence Categories, CAST/ICAO Common Taxonomy Team (CICTT), May 2021 (4.8)

Definitions and Usage Notes, Phase of Flight, CAST/ICAO Common Taxonomy Team (CICTT), April 2013 (1.3)

Definitions and Usage notes, Positive Taxonomy, CAST/ICAO Common Taxonomy Team (CICTT), April 2013 (1.2)

Definitions and Usage Notes, System/Component Failure or Malfunction (POWERPLANT) (SCF-PP) SUBCATEGORY, CAST/ICAO Common Taxonomy Team (CICTT), April 2013 (1.2.1)

Definitions and Usage Notes, System Component Failure — Non-Powerplant (SCF-NP), CAST/ICAO Common Taxonomy Team (CICTT), August 2012 (1.0)

2.1.6 ISO Publications

Copies of these documents are available online at www.iso.org/store.

ISO 10303	Industrial automation systems and integration – Product data representation and exchange
ISO 30401:2018	Knowledge management systems – Requirements
ISO/ASQC 9001	Quality Systems – Model for Quality Assurance in Design, Development, Production, Installation and Servicing
ISO/EN/JIS 9001	Quality Management System Requirements
ISO/IEC 24707	Information technology – Common Logic (CL) – A framework for a family of logic-based languages
ISO/IEC 21838	Information technology – Top-Level ontologies (TLO)
ISO/IEC 20944	Information technology – Metadata Registries Interoperability and Bindings
ISO/IEC 19763	Information technology – Metamodel framework for interoperability (MFI)
ISO/IEC/IEEE 31320	Information technology – Modeling Languages

2.1.7 LOTAR Publications

Copies of these documents are available online at <https://lotar-international.org>.

J. Boy, J.-Y. Delaunay, November 2018, Technical Specification “Product Structure Validation”

J. Boy, J.-Y. Delaunay, September 2016, Technical Specification “Part 210 - As Designed”

J. Boy, J.-Y. Delaunay, January 2018, Technical Specification “Part 230 - As Built”

P. Duchier, T. Hedberg, August 2014, 3D Visualization Requirements Document

2.1.8 RTCA Publications

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

DO-160	Environmental Conditions and Test Procedures for Airborne Equipment
DO-178	Software Considerations in Airborne Systems and Equipment Certification
DO-254	Design Assurance Guidance for Airborne Electronic Hardware

2.1.9 Other Publications

EN9300/NAS 9300, Long Term Archiving and Retrieval of digital technical product documentation, Rev 1, 2017

S1000D International Specification for Technical Publications, Product Code 020713, Revision 4.1, S1000D-B6865-01000-00, Issue No. 5.0, 2019

AIAG APQP, Advanced Product Quality Planning

NHB 5300.4(1C), Inspection System Provisions for Aeronautical and Space System Materials, Parts, Components and Services

NHB 5300.4(1B), Quality Program Provisions for Aeronautical and Space System Contractors

NIST 800-171, Protecting Controlled Unclassified Information in Nonfederal Systems and Organizations

W3C OWL Web Ontology Language Overview

W3C OWL Web Ontology Language Semantics and Abstract Syntax

W3C Shapes Constraint Language (SHACL)

W3C RDF 1.1 Concepts and Abstract Syntax

W3C RDF Semantics

W3C RDF Schema 1.1

W3C SPARQL Protocol for RDF

W3C SPARQL Query Language for RDF

2.2 Abbreviations

AI	Artificial Intelligence
AIR	Aerospace Information Report
API	Application Programming Interface
ATA	Air Transport Association of America, currently known as Airlines for America (A4A)
CAD	Computer Aided Design
CAE	Computer Aided Engineering
CNC	Computer Numerical Control
CODEX	Common Open Data Exchange
EASA	European Union Aviation Safety Agency
eBOM	engineering Bill Of Materials
FAA	Federal Aviation Administration
FAR	Federal Acquisition Regulation
FOQA	Flight Operations Quality Assurance