Leonardo Helicopters

QRS-100 Digital Manufacturing (DMFG)

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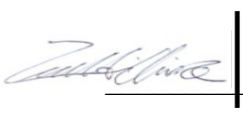
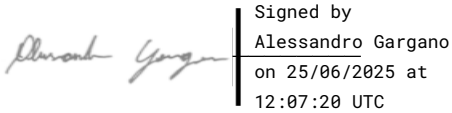
Digital Manufacturing (DMFG)

Owned by: C. Zucchetti \ A. Gargano





Approved by: Head of SQA Fabio Menciotti

Issue Date: June 2025 Issue: 07

CHANGES LOG

Issue	Approval Date	Main changes	Interested Paragraphs
01	November 2009	Initial Release	All
02	May 2010	Content and minor changes throughout	All
03	April 2015	New format	All
04	June 2018	Significantly reformatted. Data output media added. External Appendices incorporated in the body	All 5.2.3 6
05	June 2019	Identification of non-released design data	5.6
06	February 2025	Modified the responsibilities SQA-ME According to ENAC 0006-5063 and LHD QM/2024/1417	4.1- 5.2.4 - 5.3 - 5.4 Appendix 1
07	June 2025	General review – SDP removed	All

APPLICABLE DOCUMENTS

This document *shall* be applied together with the main document (QRS-01 Quality Requirements for Suppliers) and with the other applicable modules.

CONTENTS

1 Purpose

Purpose of this document is to set requirements to exchange digital data for the programs developed in 3D data.

2 Applicability

All subcontractors involved into digital products.

3 Effective date

Issue date

4 Acronyms, definitions and abbreviations

4.1 Acronyms and abbreviations

CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CDR	Critical Design Review
CMM	Coordinate Measuring Machine
DDS	Design Data Set
DIP	Dimensional Inspection Plan
DMFG	Digital Manufacturing
FAIR	First Article Inspection Report
ME	**LH** Manufacturing Engineering
LH	Leonardo Helicopter Division
FT&A	Functional Tolerancing and Annotation
ICT	**LH** Information Communication & Technology Department
LEV	Lower End Viewer
NDA	Non-Disclosure Agreement
PROC	**LH** Procurement
PDR	Preliminary Design Review
SQA	**LH** Supplier Quality Assurance Department
SWIP	Secure Web Information Portal
TBA	To Be Advised
VPM	Virtual Product Modeler
FTP	File Transfer Protocol

4.2 Definitions

Article: raw material, process, tool, gauge, equipment, detail part, sub-assembly, assembly, avionics equipment, software, CAD/CAM/CATIA media (including Digital Data Definition), documentation, aircraft, airborne/non-airborne equipment and service that *may* be provided.

Authoritative Data: Undisputed source of **LH** approved Design and associated data used for Product manufacture and Quality Assurance acceptance without any form of change, subject to access control and configuration management by the Supplier.

CATIA V5: Computer Aided Three-Dimensional Interactive Application, Product of Dassault Systems, V5: CATIA Version #5

Defined Tolerance: A Design tolerance defined by **LH**, see Explicit Dimension.

Design Data Set: Set of digital data which completely defines a part or assembly and is used to transfer this information to other users (Manufacturing, Quality, Suppliers, Maintainers, Customers). A DDS includes, but is not limited to, Part lists, Bill of Material, Design notes, exact 3D geometry and a minimum number of 2D drawings, documents, data files, etc. 3D models and 2D drawings are in CATIA V5 format.
REMARK: QRS-115_F05 form Design Data Set, is not applicable for this document.

Dimensional Inspection Plan: A plan describing inspection requirement extracted from the DDS.

Feature: A Design attribute or characteristic that includes physical hardware such as a surface, face, edge, radius, hole, tab, slot, pin, etc and requirements such as Non-Destructive Inspection and Interchangeability. All features require validation to certify the Product to the Design Authority. All features have associated notes and / or Geometric Dimensioning / Tolerancing**.**

LH Native CATIA: LH DDS transferred to a Supplier without being subject to amendment, corruption or interpretation.

Explicit Dimension: A dimension and tolerance embedded in the Design Data Set in the form of a 3D annotation or 2D dimension and explicitly displayed on the 3D model or 2D view.

Implicit Dimension: The dimensional value of a geometrical feature on the Design Data Set, DDS, that is not displayed on the 3D model or 2D view. The dimension is defined by extracting the digital CAD geometry using the CATIA toolset. The applicable tolerance is called-up in the associated Design notes.

Lower End Viewer: An entry level, visualization system (e.g. Enovia 3D com) used to view DDS with associated data as defined by **LH**.

Non-Disclosure Agreement: LH Agreement formally in place with a Supplier applicable to all types of **LH** proprietary information, e.g. designs, documentation, procedures, specifications, methodologies and data.

Pre-Release: Available for use under controlled conditions prior to being formally released (Pre-Released).

Non-Released Data: Available for use under controlled conditions prior to being Pre-Release status.

Sealed Data Transfer: A term used to describe the movement, transfer, validation and storage of data transferred to a **LH** Supplier for which the integrity of the data is sealed and therefore no change or conversion is permitted.

5 Requirements

5.1 Introduction

QRS-100 defines the minimum requirements for a Supplier to receive, manufacture and certify compliance to, a DDS as opposed to traditional 2D drawings.

The requirements and processes contained within this document are aligned to DMFG principles and methodologies focused upon operating high efficiency levels achieved from:

- Design for manufacture: Creating the opportunity for the Supplier to contribute to the Design content to introduce manufacturability prior to Design release.
- One-part-one-model: Single source control simplifying electronic distribution, tracking and configuration management of DDSs.
- Prioritising upon minimal 2D content within the DDS
- 3D models defined with Implicit Tolerances, Geometrical Dimensioning & Tolerancing principles and Design Notes.
- Operating from **LH** DMFG Methodologies (Appendix 2): **LH** have released DMFG methodologies applicable to both General and specific Technology /Commodity Type rules.
- Sealed Data Transfer: Technically retaining the content and Design intent of the **LH** Design.
- Dimensional Inspection Planning, DIP (see par.5.6 for detail).
- Version Control and Setup of CATIA V5: There is a need for the Supplier to operate the version of CATIA V5 specified by **LH** and configure the corresponding setup.

5.2 Supplier Selection and Capability Classification

5.2.1 Supplier Selection

Suppliers *may* be selected based on the applicable DMFG capability, related to:

- Data Input from **LH**
- Data Output to **LH**
- Tools Used

- Methodologies (Appendix 2)
- Integration of **LH** DMFG Environment

The three levels of capability progressively leading to High, as described below. The level of Supplier's capability is reported in the LH Statement of approval.
The Supplier cannot subcontract their DMFG activity.

DMFG CAPABILITY	SCOPE OF APPROVAL	DESCRIPTION
High	DMF-000	• Full integration with the DMFG environment exchanging **LH** DMFG native DDS. • Operating CATIA V5 configured in accordance with the specified DMFG hardware and software requirements. • Operating applicable DMFG methodologies in full 3D. • Producing FAI Plans and Dimensional Inspection Plans from the **LH** native DDS. As an example in this case, the Supplier operates as a client within both the **LH** system and **LH** DMFG environment.
Medium	DMF-001	• Exchanging **LH** DMFG native DDS. (Through SWIP Supplier portal or FTP Sites) • Operating CATIA V5 configured in accordance with the specified DMFG hardware and software requirements. • Operating applicable DMFG methodologies in 3D and 2D. • Producing FAI plans and Dimensional Inspection Plans from the **LH** native DDS. As an example in this case, the Supplier would have the minimum number of workstations to generate Process Plans, Work instructions and Tool Designs in 3D CATIA V5 and transfer models to **LH** e.g. of tooling designed by the Supplier in support of **LH** manufacture.
Low	DMF-002	• Only receiving **LH** native DDS. (Through SWIP Supplier portal or FTP Sites) • Unable to resend DMFG data to **LH** in 3D Format when applicable. • Operating applicable DMFG methodologies in 3D and 2D. • Producing FAI plans and Dimensional Inspection Plans from the **LH** native DDS.

		As an example in this case, the Supplier has a limited number of CATIA V5 workstations restricted to reading the **LH** DDS and preparing Dimensional Inspection Plans. For all remaining purposes and applications, the Supplier operates an alternative CAD/CAM system(s).

5.2.2 Data transfer

Refer to Appendix 1 for the schematic representing Sealed Data Transfer.

When a Supplier is invited by **LH** to contribute to an evolving Design, one or a combination of methods *may* be used by the Supplier to remotely view the current **LH** design to provide feedback, using for example:

- WebEx
- ReplyWeb
- Low End Viewer at the Supplier workstations
- Direct access to the **LH** concurrent environment
- Data exchange via SWIP Supplier portal or FTP sites shall be carried out as per **LH** Non-Disclosure Agreement, NDA.
  For suppliers authorized to the SWIP Supplier portal, its use is mandatory. The FTP site is allowed as interim solution for suppliers waiting for authorization to the SWIP Supplier portal.

In some cases, the Supplier *may* be invited to route 3D data to **LH**. For example, the routing of tool designs generated by the Supplier in support of **LH** manufacture, DIP to be validated, etc.

5.3 Supplier Methodologies

The Supplier *shall* create their own Application Matrix defining the methodologies listed in Appendix 2 and applicable to their business.
In accordance with QRS-01, it is responsibility of the Supplier to regularly check the **LH** Website to ensure they are using the latest issue of AWDMFG methodologies.
LH PROC has to be contacted for a copy of the updated documentation.

5.4 Configuration Management and Data Security

Throughout the manufacturing process the Supplier *shall* maintain the correct configuration of the Product Baseline and maintain traceability of each Product back to the **LH** Sealed Data Transfer and all associated DDS elements.

The Supplier *shall* generate processes and procedures according to DMFG principles and applicable AWDMFG methodologies.

In particular, the Supplier *shall*:

- Perform the Contract Review process to ensure the correct issue status of the transferred data. At all times the manufacturing release *shall* be traceable to **LH**'s original Sealed Data Transfer.
- Configure and trace the physical Product, Internal Process Models (DDS receipt, storage, and validation), Manufacturing Engineering and Inspection Planning in furtherance of the original **LH** DDS, associated specifications, data, procedures and DMFG methodologies as described in the paragraph 5.3.
- Ensure that any use of non-released DDSs are correctly authorised by **LH** and identified/controlled in accordance with paragraph 5.5.
- Record the version number of the **LH** CATIA DDS.
- Transfer no DDS from **LH** identified as "REFERENCE ONLY" for Production purposes.
- Certify and trace the Product compliance to the **LH** Sealed Data Transfer through the FAIR in accordance with QRS-101.
- Ensure a record of all data and DDS transmittals, to and from **LH**, is traceable to the Supplier's CAD software and authorised Users.
- Document in the Supplier's internal processes for any exchange, conversion of the original **LH** DDS, e.g. solely for manufacturing purposes, to ensure the original Design intent is retained with no risk of change or data corruption.
- Maintain secure storage of **LH** Sealed Data Transfer, **LH** methodologies and the Supplier's own CAD/CAM models. Access *shall* be controlled and restricted to authorised personnel taking into account the Non-Disclosure Agreement imposed by **LH**.
- Establish and maintain a secure data backup system and Disaster Recovery Process.
- Generate the relevant Dimensional Inspection Plan of products used in manufacture (see par.5.6 for detail).
- Conduct an Internal Audit of the internal processes and procedures at the commencement of manufacture, followed by periodic audits at least once a year to ensure continued compliance and effectiveness. Results of all Internal Audits *shall* be documented and maintained for review by **LH**. The Supplier *shall* increase the frequency of audits following the discovery of any adverse findings or at the request of **LH**.

5.4.1 Software configuration

The Supplier *shall* configure their CATIA V5 default settings using **"setup software"** provided by **LH PROC** as called-up by AWDMFG021.The Supplier *shall* operate and maintain the version of CATIA stipulated in AWDMFG021, aligned with last revision published by **LH**, to achieve technical compatibility with **LH** with minimum effort and maximum confidence.

The Supplier *shall* document their hardware and software, with each revision status as applicable, required to maintain synchronisation with **LH** Sealed Data Transfer in accordance with AWDMFG021.

This *shall* include:

- CAD packages and any additional computing equipment receiving Authoritative Data.
- The method of accessing and processing DDSs by each function of the Organisation.
- The revision numbers of AWDMFG021 and the associated **"setup software".**

5.5 LH Design Maturity

The Supplier is authorised to manufacture and dispatch Products traceable to fully released **LH** DDS provided by **LH**, e.g. at the "100%" maturity status of RELEASED 'R'.

The maturity status of DDS is available in the Part List document.

Controlled exceptions *may* take place only when **LH** explicitly authorise the manufacture from a Design prior to release for a specified purpose. **LH** controls *shall* take into account any restrictions imposed by the current Maturity status.

When applicable, prior to **LH** Design release the following *shall* apply to the receipt and control of a DDS at the Supplier:

- Products *shall* be securely and temporarily identified as 'non-conforming' and segregated accordingly.
- The Supplier's Configuration Management system *shall* provide traceability to the **LH** Purchase Order with any corresponding **LH** manufacturing instructions and restrictions.
- All manufacturing instructions and restrictions imposed by **LH** *shall* be invoked.
- Parts manufactured from 'pre-release' or 'non-released' DDS can only be dispatched to **LH** under the authorisation and controls imposed by LH through Purchase Order**.** The Certificate of Conformity shall clearly report the statement "Part manufactured under non-released design data".

5.6 Dimensional Inspection Plan

The Supplier *shall* produce a Dimensional Inspection Plan, DIP, to enable the Product definition in its entirety to be inspected and certified.

Any emerging anomalies *shall* be formally managed with **LH ME** with a record of close-out including traceability to the **LH** response.

The retention of 3D definitions via electronic work instructions is encouraged by **LH** for DIPs.

- Dimensional Inspection Planning, DIP: The creation of a DIP by securely extracting geometry for manufacturing and inspection purposes including Explicit dimensions, Implicit dimensions, and Design Notes.

- The Explicit and Implicit dimensions and Design Notes *shall* be extracted from the **LH** DDS for Manufacturing and Inspection purposes using the standard CATIA toolset. In all cases there *shall* be no form of interpretation or change of definition.

- The DIP *shall* be directly traceable to the original **LH** native CATIA DDS by competent personal trained in CATIA V5 using the standard CATIA toolset without interpretation or change.
- For **LH Critical parts** the DIP *shall* be submitted to **LH ME** for approval, prior to the FAI plan approval**.**
- For **LH Primary and Significant** parts, in the event that the FAI plan is issued by the Supplier, the FAI plan *shall* include the ballooned DIP and *shall* be submitted to **LH ME** for approval.
- Any resulting queries *shall* be formally recorded and resolved directly with **LH**.
- The DIP *shall* be subject to independent approval by the Supplier's Quality Organisation. This role *may* be delegated by Quality, in accordance with the Supplier's governing Procedures, to a competently trained position within the Organisation, e.g. within Manufacturing Engineering.
- FAIR and batch inspection results *shall* be traceable to the requirements of the DIP. For example, CMM programming, CMM reports, and Bench Inspection requirements *shall* originate from the DIP.
- FAIR requirements in QRS-101 *shall* apply. The DIP *shall* be quoted in the FAIR as the document required for subsequent steady state batch inspection clearance.
- It is essential to use **LH** native CATIA throughout, in particular for CMM inspection purposes.

5.7 Technical Problem Reporting and Corrective Action

The Supplier *shall* ensure any irregular or non-conforming Sealed Data Transfers are formally identified to **LH** as being discrepant, quarantined from use and reviewed for disposition.

The Supplier *shall* develop and maintain procedures for recording, reporting, tracking and resolving any data transfer, hardware, software and DDS issues.

5.8 Ongoing LH Approval of Suppliers

Following approval to QRS-100, **LH** reserves the right to periodically audit the Supplier's ongoing compliance.

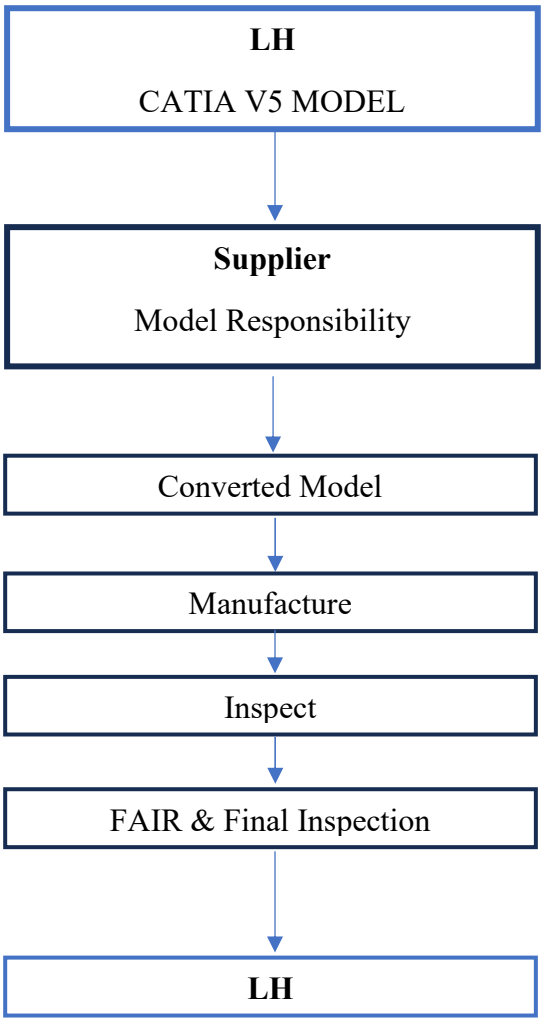
5.9 Training Requirements

Regular checks for training provisioning *shall* be conducted for all functions to achieve and maintain minimum competency levels against QRS-100 requirements. Associated training records *shall* be updated and maintained for this topic. Refer to Appendix 3 for training guidelines.

6 Annexes, Appendices and Forms

- Appendix 1 – Sealed Data Transfer
- Appendix 2 – Methodologies
- Appendix 3 – Guidelines for Minimum Training Requirements for CATIA & DMFG Methodologies

Appendix 1 – Sealed Data Transfer



Notes:

1. LH native CATIA *shall* be used for Inspection purposes, any conversion or change of LH native CATIA is not permitted
2. The Supplier *shall* operate the release of CATIA specified in AWDMFG021

Appendix 2 - Methodologies

		Mechanical, Sheet Metal, Composite, Structure	Mechanical, Sheet Metal, Structure	Composite, Structure	Mechanical, Sheet Metal, Composite	Mechanical, Sheet Metal	Mechanical	Composite	Structure
		Type 1	**Type 2**	**Type 3**	**Type 4**	**Type 5**	**Type 6**	**Type 7**	**Type 8**
"Dimensiong and tollerancing principal rules and guidelines"	**AWDMFG002**	x	x	x	x	x	x	x	x
"Standard notes"	**AWDMFG006**	x	x	x	x	x	x	x	x
"DMFG environment for external suppliers"	**AWDMFG021**	x	x	x	x	x	x	x	x
"General dimensional inspection criteria for machined parts"	**AWDMFG034**	x	x	no	x	x	x	no	no
"General dimensional inspection criteria for composite parts"	**AWDMFG037**	x	no	x	x	no	no	x	x
"General dimensional inspection criteria for sheet metal parts"	**AWDMFG038**	x	x	no	x	x	no	no	no
on request	**AWDMFG039**	x	x	no	x	x	x	no	no
Excerpt of document AWDMFG040 "Manufacturing engineering methodologies for composite parts "	**Report IE/10/0004**	x	no	x	x	no	no	x	no
Excerpt of document AWDMFG041 "Manufacturing engineering methodologies for sheet metal parts "	**Report IE/10/0005**	x	x	no	x	x	no	no	no
Excerpt of document AWDMFG045 "Assemblies management in VPM for structure components"	**Report IE/10/0006**	x	x	x	no	no	no	no	x

For AWDMFGXXX applicable revision check, please visit the LH Supplier portal under the technical documentation section, LH PROC has to be contacted for a copy of the updated documentation.

Appendix 3 - Guidelines for Minimum Training Requirements for CATIA & DMFG Methodologies

#	Supplier Function and Department	Topic and Training Requirement	Training Source
1	**Inspection Planning** Manufacturing Engineering & Quality Control	**CATIA V5 & Related Modules** Extracting the Design Definition from the LH DDS including Implicit Dimension for Manufacturing & Inspection Purposes. Includes Inspection Planning for CMM programming (where applicable).	Dassault Systems or a formal DS Service Provider
2	**Remaining Support Functions** e.g. QA, QC	**CATIA Low End Viewer, LEV** Viewing the LH DDS	The LEV Provider or a formal Service Provider.
3	**As Appropriate**	**Applicable DMFG Methodologies and Engineering Standards*** Responsibility for: - A direct operation - A support role *e.g. ASME Y14.5M	Supplier self-training
4	**CMM Operation**	**Operating with LH Native CATIA**	CMM Supplier or Formal Service Provider