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**QUALITY ASSURANCE STANDARD FOR DIGITAL PRODUCT
DEFINITION AT BOEING SUPPLIERS**

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Abstract

Document D6-51991, Quality Assurance Standard for Digital Product Definition (DPD) at Boeing Suppliers, provides uniform specifications for supplier control of Boeing Digital Product Definition data.

Maintenance

Maintenance of Document D6-51991, Quality Assurance Standard for Digital Product Definition at Boeing Suppliers, will be through the Supplier Management and Supplier Quality organizations.

Purpose

This standard establishes requirements for Boeing suppliers' DPD quality assurance/quality control system. The requirements contained in this document are intended to facilitate supplier deployment of DPD processes and to achieve technical coordination between customer, supplier and sub-tier supplier.

Scope

This document is a supplement to the Boeing Quality Management System (QMS), D6-82479 and describes the requirements for supplier digital data system controls. To use Boeing furnished datasets as authority for design, manufacture and inspection, a supplier must comply with this document. Boeing shall document supplier compliance as approved in the Boeing SQ Supplier Data System.

These requirements provide the basis for suppliers to create and implement plans, user level procedures and process documentation for the use of DPD. Individual programs may provide additional requirements. The supplier will have defined and reliable configuration management and Quality Assurance (QA) processes in place reflecting its methods of operation. Supplier is required to maintain integrity of DPD through all operations when new DPD methods are deployed. It is expected that suppliers will utilize DPD processes to continuously improve the quality of delivered product.

The application of this document is required for all phases of ISO9000 as supplemented by AS9100 or the suppliers QMS when Boeing digital product definition data is used in Supplier's computing systems and procedures to produce product(s) or digital data for product acceptance (including accountability of tooling and tooling used for inspection).

If a supplier is sending digital product definition data to Boeing, the requirements are obtained from the procurement agent and the purchase order, and the supplier must meet applicable data exchange requirements.

Authority and Responsibility of Authorized Boeing Quality Assurance Representatives

The Boeing quality assurance representative shall have access to supplier's documented DPD process and related documentation.

The Boeing representative shall verify conformance and document the supplier's capabilities related to DPD, Model Based Definition (MBD) and Coordinate Measurement Systems (CMS).

The Boeing representative shall maintain open lines of communication between Boeing, supplier and sub-tier supplier as required for technical coordination and to facilitate changing DPD processes to improve product quality.

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1. Digital Product Definition Quality Assurance Procedures and Documented Processes

1.1 **Documented Processes** - The Supplier shall develop and maintain comprehensive documented DPD processes and/or procedures that assure integrity of product engineering and/or tooling, and configuration is maintained throughout the supplier's QMS from receipt of Boeing data through creation of derivatives to product acceptance and process improvement.

1.1.1. This documented process shall specifically address the processes and techniques unique to all DPD processes beginning with the delivery of DPD data from Boeing to the supplier.

1.1.2. It is recommended that supplier documented DPD processes describe a single, consistent configuration management and QA process to meet all customer (Boeing, other companies, regulatory agencies, etc.) DPD requirements. This documented process shall remain in effect throughout the life of the contract.

1.1.3. Boeing reserves the right to survey and/or review the supplier's QMS to verify effectiveness of the supplier's documented DPD processes and procedures.

1.1.4. Elements of the documented DPD processes shall address, but not be limited to, the elements in sections 2.0 through 11.0. These sections in D6-51991 may be addressed in other supplier documents. If so, reference to these shall be made in the documented process.

Additionally, program specific requirements not provided in this document shall be implemented.

1.2 **Flow Diagram** - The supplier shall include a flow diagram in the documented process that graphically depicts the flow of data through the DPD system from receipt of Boeing DPD data.

1.2.1. The flow diagram shall specify all segregated, secure storage locations of authority and derivative media.

1.2.2. The diagram shall specify all supplier departmental organizations responsible for performance of CAD/CAM/CAI operations including organizations responsible for the delivery of Boeing data or supplier derived data to sub-tier suppliers.

1.2.3. The flow diagram shall identify the documented DPD processes, and or work instructions associated with control of the datasets and derivatives.

1.3 **Responsibilities** - The quality organization shall be responsible for the documented DPD processes with procedures for change control and notification to affected organizations. The authority and responsibility for each element of the documented DPD processes shall be defined and documented to assure consistent implementation.

1.3.1. The supplier shall update Boeing Supplier Quality (SQ) supplier data system profile and notify their Boeing Rep within 30 days of any changes to:

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- a) The Documented DPD Processes
 - b) CATIA synchronization per D6-56199
 - c) CAD, CAM, CAI software
 - d) Addition of new measurement equipment

Additionally, the supplier must submit an update to the SQ supplier data system profile using the Boeing supplier web portal annually.

Suppliers without access to the web portal can submit a DPD Capability Questionnaire by contacting their Supplier Management and Supplier Quality (SQ) DPD Technical Representative.

2. Configuration Management and Media Security

2.1 Media Security - The Supplier shall develop and maintain documented processes used to ensure the integrity and security of Boeing provided datasets, Specification Control Drawing (SCD) data using envelope datasets, supplier created CAD/CAM/CAI datasets, type design and tool designs shall include requirements for:

- 2.1.1. Storage of Boeing provided DPD, supplier created DPD derivatives, and digital product acceptance datasets.
- 2.1.2. Archiving procedures with read/write protection which ensure access control per the time specified per program or contract requirements.
- 2.1.3. Encryption protection for sending/receiving of electronically transmitted data.
- 2.1.4. Establishing and maintaining a data backup system including remote storage and disaster recovery.
- 2.1.5. Access control with permission and/or password protection shall be established in order to ensure that Boeing provided datasets will not be inadvertently modified. This process shall include derivatives datasets released for manufacturing and inspection.

2.2 Configuration Management and Traceability - The supplier shall develop and maintain documented processes to ensure configuration control of all Boeing provided datasets, supplier created CAD/CAM/CAI datasets, type design, tool designs, and datasets sent to sub tier suppliers, used in the fabrication of Boeing products. These procedures shall include the following;

- 2.2.1. A formal release process of DPD which ensures that only current authorized DPD datasets are available for use in production and inspection. The supplier shall ensure all Derivative (see definition) DPD data that is released, is traceable to the authority dataset(s) it was created from.
- 2.2.2. Supplier planning/traveler shall include traceability to the current authority dataset.
- 2.2.3. A documented process for change control for all datasets and dataset derivatives (including engineering, manufacturing engineering, Bill of Material, SSP's, SPECO's, APO's, and CAE datasets, Ect.).

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- 2.2.4. A documented process that includes control of non current (obsolete) authority datasets and dataset derivatives.
 - 2.3 **Engineering Type Design** - A supplier who performs Type Design or Tool Design for Boeing using Boeing provided MDD, MDI, MDS, TDI or other digital definition, will need to develop a documented process per section 1.0 of this document.
 - 2.3.1. The supplier shall describe documented processes for design and development to ensure customer acceptance, identification, security, access and change control of engineering and tool design. Designs will have traceability to provided engineering.
 - 2.3.2. Design and development outputs shall meet the program requirements for design and will identify any critical items, including any key characteristics, and specific actions to be taken for these items.
 - 2.3.3. The design will provide the data required to allow the product to be identified, manufactured, inspected, used and maintained; including the drawings, part lists and specifications necessary to define the configuration and the design features of the product. (e.g. material, process, features, annotation, specification, notes, and manufacturing and assembly data needed to ensure conformity of the product).
 - 2.3.4. The supplier will have a process to perform predetermined periodic design reviews to Boeing requirements to ensure that all requirements have been meet.
 - 2.3.5. A supplier who performs Type Design or Tool Design for Boeing, but does not manufacture any product is considered a non-manufacturing supplier and will need to develop a documented process per section 1.0 of this document. Elements of the documented DPD processes shall address, but not be limited to, the elements in sections 2.0, 4.0, 5.0, 6.0, 9.0, and 11.0 of this document.

3. Product Acceptance Software

- 3.1 **Commercial Off The Shelf Software** - The supplier shall document and maintain documented processes for control of Product Acceptance Software (PAS). PAS includes software used to manufacture or inspect products and are designed for use in the acceptance of those products.
 - 3.1.1. Supplier must document and maintain PAS procedures and reference applicable documents in their documented DPD processes. Procedures or documented processes shall provide for identification of software for a QA application, control of the QA approved version for product acceptance, and control of obsolete software.
 - 3.1.2. Procedures or documented processes will be maintained to prevent unauthorized changes, to limit personnel access to software files, and to archives masters and duplicates. Supplier PAS storage methods will take measures to minimize deterioration or regeneration of errors and to assure that reproduction of code occurs error free.
 - 3.1.3. Supplier PAS must be verified prior to product acceptance use. The supplier will establish and maintain a procedure independent of the software developer to determine that the software, and subsequent revisions, accomplishes its intended function. A

means of identifying approved PAS is required with configuration control and QA management procedures for relating the PAS to the product being accepted.

3.2 **Computer Aided Manufacturing Software** - When used for inspection, the supplier shall develop and maintain documented processes for configuration identification and control of CAM software.

3.2.1. Supplier must verify numerically controlled software prior to product acceptance, and maintain records.

3.3 **Supplier Developed Software** - Software developed by suppliers requires plans and instructions for building, configuration management, loading and testing of code.

4. Internal Quality Audits

4.1 **Internal Audits** - Internal Audit procedures shall include provisions for auditing all operations affecting DPD data and related documentation to assure compliance with contractual requirements, software and production part quality standards, and the observance of security restrictions.

4.1.1. The audit plan shall include provisions for audit of sub-tier suppliers using DPD data on Boeing products and tooling.

4.1.2. The audit plan shall meet the latest revision of D6-51991 requirements.

4.1.3. Results of all audits will be documented and maintained for review by an authorized Boeing representative per contract requirements.

5. Problem Reporting and Corrective Action

5.1 **Problem Reporting and Corrective Action** - The Supplier shall assure their nonconforming system includes digital product definition.

5.1.1. The supplier shall assure that software found discrepant will be suspended from use and manufacture is contacted for disposition.

5.1.2. The supplier's documented procedure for corrective action shall include reporting, tracking and resolving, hardware, software and dataset integrity.

6. Procurement Control

6.1 **Sub-tier Supplier Activity** - The supplier will flow down the requirements of this document (D6-51991 or equivalent document) to sub-tier suppliers and document sub-tier supplier compliance when Boeing authority datasets or dataset derivatives are used for manufacturing or product acceptance. This would include design collaboration when design responsibility is shared with sub-tier suppliers.

6.1.1. The supplier will be responsible to Boeing for the maintenance, change incorporation, use of DPD and observance of security restrictions by sub-tiers for design, manufacturing and inspection.

6.1.2. The supplier is fully responsible for and will establish procedural controls to assure Boeing DPD transferred (authority or derivative) between their company divisions and all levels of sub-tier suppliers will be in compliance with this document

6.2 **Export Control** – Flow down to sub-tier suppliers shall include ITAR, MLA, MA, TAA, and EAR requirements.

6.3 **Boeing Right of Entry** - Boeing reserves the right to survey and/or review the DPD quality assurance and configuration management systems of these sub-tiers.

7. Control of Measurement Equipment

7.1 **Calibration** - The supplier will develop and maintain a system for periodic maintenance of digital measurement equipment. Calibration shall be traceable to NIST or equivalent international standards, and shall meet original equipment manufacturer requirements.

7.1.1. These controls will provide records of date of acceptance/rejection and next maintenance due date. Measurement equipment will be physically identified in accordance with certification records. This includes all CMS equipment, N/C (CAM) equipment with calibrated inspection probe capability, Optical Lay-up Template (OLT's), ply cutters, and plotters used to produce Mylars or other inspection or tooling media.

7.2 **CMS Procedures** - Suppliers using CMS and OLT's for fabrication and/or inspection of Boeing products (parts and tools) must document and control their processes. Suppliers must comply with the product acceptance software, measurement equipment, inspection media and training requirements for CMS. When CMS equipment is used in a non-controlled environment the supplier must have a process to address environmental deviation and apply coefficient of thermal expansion.

Note: Additional CMS requirements are stated below and require capability approval by Boeing:

7.2.1. The supplier and its sub-tier suppliers utilizing CMS and OLT must have processes, documented procedures that provide adequate training, and procedural methods to perform acceptance on measurements. Supplier shall determine the applicability and document the criteria to perform the following:

- a) Purpose / Scope – Overview or statement of specific equipment and its intended use.
- b) Calibration – Supplier shall define calibration intervals and maintain a system for periodic maintenance of measurement equipment. The supplier must document inventory of all specific components used for CMS and OLT measurement that could affect the integrity of data collection. This inventory should include and not be limited to target accessories (e.g. bushings, adapters, sphere mounts, bar/rod, probing, drift nest, supports, etc.), all reflector types, and weather station equipment.
- c) Product Acceptance Software – Supplier shall perform Product Acceptance Software testing per section 3.0.
- d) Field Checks / Set up – Establish criteria for field checks / set up to ensure data and system accuracy prior to collecting measurement data.
- e) Drift Points / Stability – When environmental conditions, vibration, or stability of the product being measured could affect measurement data, drift point analysis is

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- required. A record of drift points measured and acceptance tolerance used, before and after measurements is required as objective evidence.
- f) Temperature Compensation / Scale Factors – When products are measured in an uncontrolled environment a documented process to compensate for thermal effects on the objects being measured is required. Verify compensation using a scale bar of like (product) material before and after measurements. A record of scale bars measured and acceptance tolerance used is required as objective evidence. The product dimensional characteristics being verified must meet the engineering definition requirements as defined in ANSI/ASME Y14.5, ANSI B89.6.2.1993.
 - g) Establish Coordinate System – Establish criteria for changing the coordinate system from a local coordinate system to a part or tool coordinate system. (e.g. tolerances, datum targets, datum features, tooling holes, tool enhanced reference system or best fit). Establishment of coordinate systems shall be in accordance with customer engineering definition and ANSI/ASME Y14.5 as applicable.
 - h) Multiple Station Set-up Criteria – When moving CMS equipment from one location to another, or combining CMS equipment during a survey, supplier shall document their process and acceptance tolerance. A minimum of seven adequately distributed common points used as reference for repositioning/adding the CMS equipment during a survey shall be verified and recorded as objective evidence.
 - i) Data Collection Parameters – Establish measurement guidelines and specific collection parameters for the CMS equipment prior to collecting measurement data. (e.g. point density, point maps, point labels, time/distance separation parameters, apex angles, distance limitations).
 - j) Data Analysis – Establish guidelines for the evaluation of 3D point data to tool engineering, engineering datasets, or drawings.
 - k) Reports – Establish standard process for CMS reports (e.g. job information, coordinate system establishment, object temperature, scale bars, drift points, data analysis and measured results). Reports shall be in English and in inches unless directed otherwise by customer contract.
 - l) Record Retention – Establish standard process for all inspection and test records to be archived and retained per customer contract requirements and provided to the customer upon request.
 - m) Training – Suppliers shall define training requirements to assure competence and maintain employee training records, including on-the-job-training, for all CMS users per section 11.0.

8. Inspection Media

8.1 **Inspection Planning for Validation** - When engineering definition 2D drawings include digitally defined surfaces/features (3D models); the supplier must ensure inspection of these surfaces/features. Supplier's QA organizations are responsible, at a minimum, for inspection media, measurement instructions and analysis of data for product acceptance. Inspection planning shall include the following activities, as appropriate, in meeting the specified design requirements:

- 8.1.1. Description of the method and instructions for validation of each digitally defined product feature for first article inspection.
- 8.1.2. To validate digitally defined product features with methods other than digital inspection the supplier must document the media and/or process used.

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- 8.2 **Inspection Media** - The Supplier shall develop and maintain documented processes to create inspection media from DPD datasets. These shall assure:
- a) Inspection media is independently derived from, and traceable to, the authority dataset
 - b) Media must be under configuration control
 - c) Media contains graphics and text sufficient to illustrate inspection operations
 - d) Media is created by qualified personnel
 - e) A media review process exists (checker, checklist, or peer/team review)
 - f) Digital inspection operations are performed by qualified personnel
- 8.2.1. Documentation of the coordinate system, datum targets, and datum features.
- 8.2.2. Digitized inspection data generated from Boeing provided full scale engineering Mylar plots must have evidence of QA acceptance.
- 8.2.3. Data or datasets identified as "Pre-Release" or "REFERENCE ONLY" may not be used for product acceptance purposes. Any use of this data for manufacturing or design is at risk of the supplier.
- 8.2.4. Supplier may use definition of MDD, MDI, MDS, TDI, loft surfaces or other digital definition, including IGES or STEP format, as authority for product acceptance when supplied by Boeing according to a Master Dimensions Request (MDR) process.
- 8.3 **Reduced Content Drawings** - Suppliers who receive reduced content drawings with an associated 3D model, must be able to extract information from the 3D model sufficient for manufacturing and inspection in addition to the 2D drawing.
- 8.3.1. Suppliers must identify and document for manufacturing and inspection, the following requirements at a minimum.
- a) All features identified on the 2D drawing
 - b) Features of the 3D model not defined by the 2D drawing
 - c) Fabrication & manufacturing process specifications
 - d) Flag notes, parts list & other specified requirements
 - e) SSP's, SPECO's, and APO's
- 8.4 **Model based Definition** - Suppliers who receive Engineering and/or Tooling MBD datasets must extract information from the dataset sufficient for manufacturing and inspection activity for the product. Additionally, utilizing MBD requires a capability assessment by Boeing.
- 8.4.1. Supplier's QA must verify that all design requirements; e.g., all features defined by feature control frames, annotation, specifications, notes and other specified requirements in the authority MBD dataset and associated parts list including dimensional and other properties are identified and planned for inspection/validation.
- Note: 2D drawings, 2D sketches/views, or a Low End Viewer (LEV) may be used to convey manufacturing and inspection information as required to fit the supplier's methods of operation
- 8.5 **First Article Inspection** - All explicit and implicit design characteristics within the engineering shall be positively identified within the FAI plan per AS9102. This shall include:

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- a) All features annotated within the 3D model (explicit)
 - b) Features of the 3D model not annotated (implicit)
 - c) All characteristics applicable on the 2D drawings/reduced content drawings
 - d) All applicable notes and material lists
 - e) All feature tolerances per the standard / general notes.

Note: 100% of all feature characteristics shall be identified and documented on the AS9102 form 3.

8.6 **Use of Plots** - Accuracy of plots used for inspection media will be verified prior to use. Refer to Boeing document D1-8110-9 for ordering, storage, and verification of Boeing provided PCM's, Reference Engineering Photo Template (REPT)'s, or Product Definition Templates (PDT)'s

8.6.1. Suppliers creating plots for product acceptance must have documented processes. These procedures shall include the following at a minimum, and require capability approval by Boeing;

- a) Plotter calibration.
- b) Verification of engineering definition.
- c) Verification and acceptance criteria of plot accuracy.
- d) Quality acceptance stamping

8.6.2. Plotting equipment shall be located in a temperature and humidity controlled environment.

9. Data Exchange Methods

9.1 **CAD Compatibility Requirements** - The supplier shall maintain the current level of hardware configuration, software, software revisions and other digital system information (e.g. PTF(s), project files) required to maintain compatibility with Boeing supplied datasets and/or data exchange formats per applicable Boeing system(s) requirement documents.

9.1.1. This includes CAD, LEV, data exchange, and other computing equipment that receives authority data and/or is installed/tested by Boeing. Supplier shall comply with and reference applicable synchronization documents in their documented DPD processes.

9.1.2. Supplier must have a documented process that ensures they can receive, validate, and store (per Section 2) all authority datasets without change to the data integrity.

9.1.3. The use of 3D-PDF is for viewing annotation, and may require authority 3D surface geometry for manufacturing and inspection use.

9.2 **Translations** - Suppliers are responsible for all dataset translations used for manufacturing and inspection, and must have a clear documented process for each. The documented process must include a method to verify the accuracy of translations. (See definitions for description of "translation".)

9.2.1. Acceptance criteria for accuracy of translated surface profile/geometry, (tolerance) must be determined by the supplier, and must ensure the end product will be within engineering tolerance/specification. Objective evidence of translation validation must be retained. (Typical allowable deviation tolerance is .0001 to .001 inch)

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- 9.2.2. Suppliers must be able to demonstrate the CAD translation process, including verification/interrogation methods used, and the ability to identify known discrepancies.
 - 9.2.3. The verification process for translation of datasets containing 3D annotation, i.e. feature control frames, dimensions, text, and/or surface geometry must ensure that all intended entities are accounted for in the translated dataset.

10. Special Tooling

- 10.1 **Tool Design** - The supplier shall describe documented processes to ensure release, acceptance, identification, security, access and change control of tool design and tool inspection datasets. This includes ERS datasets which will be accepted according to a documented installation procedure. Tooling datasets will have traceability to current authority engineering and derivative tooling dataset sources. The engineering authority dataset(s) will be identified on the tool design when applicable.
 - 10.1.1. Tool Designs shall be produced using authority data and when required by contract be approved by Boeing authorized personnel.
 - 10.1.2. The supplier will ensure that when Tool Design responsibility is flowed down to sub tier suppliers, the sub-tier supplier will be approved by the supplier.
- 10.2 **Traceability** - All digitally defined special tooling and physical inspection media (check fixtures, templates, etc.) will be identified and traceable to the authority tool design dataset and any tool inspection datasets.
- 10.3 **Inspection** - These tools and tooling media will be accepted and periodically validated to the authority design at a frequency determined to ensure accuracy and repeatability of the tool before use. Periodic inspection of digitally defined tools will meet the requirements of section 8.0 of this document as applicable.

11. Training and Process Performer

- 11.1 **DPD Training** - Suppliers shall define training requirements to assure competence and shall maintain employee training records, including on-the-job-training, for all DPD system users; e.g. quality, IT, planning, purchasing, contract review and Mfg.
 - 11.1.1. The supplier shall ensure that all personnel having DPD system access have completed training adequate to perform digital product acceptance activities including digital inspection media generation and 3D data collection.
 - 11.1.2. Training shall be updated due to changes driven by new equipment, software or Boeing program requirements.
 - 11.1.3. If Quality activities are performed by individuals other than the supplier's quality assurance personnel, the supplier shall define the specific tasks and responsibilities that are authorized and the training necessary to perform those tasks.

Definitions

ANNOTATION

Dimensions, tolerances, notes, text and symbology visible without any interrogation of the model.

AUTHORITY

Undisputed source of Boeing approved dataset used for product manufacture and quality assurance acceptance.

CAD

Computer Aided Design - (1) Any computer system or program that supports the design process. (2) The use of computers to assist engineering design in developing, producing and evaluating design, data and drawings. (For brevity, CAD is also referred to as the organization engaged in computer-aided design.)

CAE

Computer Aided Engineering - The use of computers to develop engineering data to supplement engineering designs for use in product production and inspection.

Note: Specific for BCAG DCAC processes, CAE data is extracted from PDM in the form of hardcopy reports or electronic PDM STEP Dataset transactions. The dataset contains bill of material (BOM) information (Parts Lists, Picture Sheet Data Lists, Tool Parts List, etc.) used by Boeing and suppliers to define and accept products.

CAI

Computer Aided Inspection - Also known as Coordinate Measurement Systems (CMS) and Computer Aided Measurement Systems (CAMS). Measurement equipment such as Coordinate Measuring Machines (CMM), Laser Tracker, and numerical controlled machinery with inspection probe capability used to support inspection activity.

CAM

Computer Aided Manufacturing – Also known as numerical control (NC). The use of computers and computer data in the development and production of all part types (products) including fabrication, assembly and installation.

CATIA

Computer-graphics Aided Three-dimensional Interactive Application. A CAD system with interactive graphics design software modules used to create 3D and 2D geometric designs of products.

CMS

Coordinate Measurement Systems - Also known as Computer Aided Inspection (CAI) and Computer Aided Measurement Systems (CAMS). Measurement equipment such as Coordinate Measuring Machines (CMM), Laser Tracker, and numerical controlled machinery with inspection probe capability which are used to support inspection activity.

COMMON POINT

A measured point with X, Y & Z coordinate values used to assist in the orientation of additional measurement instruments into the instrument network such as theodolites, laser tracker, PCMM, laser radar, scanners and photogrammetry camera stations.

CUSTOMER

The party (individual, project, or organization internal to or external to the company) responsible for accepting the product or for authorizing payment. Customers may or may not be users.

DATASET

Information prepared and maintained by electronic means (CAD/CAM), and provided by electronic data access, interchange, transfer, or on electronic media.

DERIVATIVE

A reproduction of all or part of an authority dataset. Derivatives include paper and mylar plots, tool designs, inspection datasets created to analyze as-built designs, check templates, numerical control (N/C) datasets/media, datasets with nominal values for CMS use, QA inspection plans and other extractions (dimensions, views, etc.) for inspection/measurement use.

DRIFT POINT(S)

A point or set of points, measured at least twice (at a minimum, at the start and finish of a measurement survey) used to determine the relative stability between the device performing the measurements and the object being measured. When the distance between a pair of drift points is analyzed a very small distance indicates stability, where as a larger distance indicates instability.

DPD

Digital Product Definition – The electronic data elements that specify the 3D Computer Aided Design (CAD) geometry and all design requirements for a product (including notation and parts lists), and the use of this data throughout an integrated CAD/Computer Aided Manufacturing (CAM) and Coordinate Measurement Systems (CMS).

EAR

Export Administration Regulations. This is the Dep't of Commerce agency, (Commercial or Dual Use)

ERS

Enhanced Reference System – A permanent reference system, established for the life of a tool, which is documented from a design reference system or created specifically for CMS. The ERS is used to provide a large number of known points coordinate for use in tool transformations; this allows rapid and accurate measurement in all areas of the tool.

FEATURE

Feature - Any hardware design attribute or characteristic. This includes physical portions of hardware such as a surface, face, edge, radius, hole, tab, slot, pin, etc., and requirements such as non destructive inspection (NDI) and interchangeability and replaceability (I&R). All features require validation to conform the product to the design authority. All features have associated notes and/or Geometric Dimensioning and Tolerancing Feature Control Frames (FCF) and one note or FCF may refer to several features.

IGES

Initial Graphics Exchange Specification - The American National Standards Institute (ANSI) data standard for the exchange of computer graphics generated product definition (no solids) between different manufacturers' CAD/CAM systems.

INSPECTION PLAN (Criteria)

A description of 2D and/or 3D computer generated inspection media/methods derived from authority DPD datasets and used to communicate inspection requirements and media usage to manufacturing and inspection areas. Typical inspection plans include engineering and plan configuration/traceability, overlay/setup instructions and a list and/or graphic representation of the features to be inspected.

ITAR

International Traffic in Arms Regulations - Dep't of State (Military)

LEV

Low End Viewer – An entry level visualization CAD system used to view, analyze, extract and print dimensional and other required data from the DPD dataset.

MA

Manufacturing Agreement- an agreement whereby a US person grants a foreign person an authorization to manufacture defense articles abroad and which involves or contemplates:

1. The export of technical data or defense articles or the performance of a defense service; or
2. The use by the foreign person of technical data or defense articles previously exported by the US person

MBD

Model Based Definition – A Boeing dataset containing the exact solid, its associated 3D geometry and 3D annotation of the product's dimensions and tolerances (and may include parts/notes list) to specify a complete product definition. This dataset does not contain a conventional 2D drawing. MBD is one possible format of DPD.

(Note: Model Based Definition is the undisputed source of definition)

MDD

Master Dimension Definition - A mathematically controlled surface definition which is computer generated. This definition consists of control curves defining the surface in two planes and the information in a logical form necessary to develop the third plane and/or any cross section. Each surface is uniquely identified by number.

MDI

Master Dimensions Identifier - A number identifying an array of coordinate data used by Design, Manufacturing and Inspection to describe an element of a surface or product configuration. The data may be an extraction from an MDD or any CATIA/APT designed surface.

MDR

Master Dimension Request - . A process used by suppliers, without demonstrated digital product definition capability(s) per requirements of this document, to request and receives 3D surface definitions and/or inspection media extractions from Boeing. Data format may be printouts, disks, plots, etc. with evidence of Boeing QA acceptance and traceability. Supplier shall contact Boeing procurement agent for process instructions.

MDS

Master Dimension Surface - A mathematically defined 3D surface generated using computer aided design. Each surface is uniquely identified by number.

MLA

Manufacturing License Agreements - Authorizes a US manufacturer to supply manufacturing knowledge (related to defense) to a foreign party. All foreign recipients must be named as parties to (or as “authorized sub licensees” under) the agreement.

PAS

PAS is considered software that performs product or tooling acceptance without subsequent inspection. Common PAS applications include: CMS software (CMM, Laser Trackers, Laser Radar, PCMM’s), CAD translators, and CAD Analysis Software.

(NOTE: Not embedded or loadable Airborne S/W)

PDM STEP

Product Data Manager (PDM) dataset(s) in STEP format with bill of material (BOM) information (Parts Lists, Picture Sheet Data Lists, Tool Parts List, etc.) used by BCAG to define CAE requirements. This dataset can be communicated to Boeing suppliers in a digital format.

PTF

Program Temporary Fixes – Software changes or additions released by the software manufacturer to correct user application problems before the next major software version is available.

REDUCED CONTENT DRAWINGS

Any DPD design dataset without full dimensioning of product features on a 2D sheet. This includes Reduced Dimension Drawings (RDD), Minimally Dimension Drawings (MDD), and Simplified Dimension Drawings (SDD) which contain reference to 3D surface definition or CAD geometry.

REFERENCE ONLY (REF)

(1) Notation indicating which layers or features of a design are not reliable or authorized for manufacturing and inspection use (2) Marked “Reference Only” datasets whose definition is not reliable and not authorized for design, manufacture or inspection.

SCALE BAR

A device used to verify that the proper scale factor has been applied to a three-dimensional measurement survey. The device generally consists of a bar with at least two or more fixed points. The distance between point pairs is determined, certified and is traceable to an international standard. In some metrology applications the Scale Bar may also be used to set scale (e.g. theodolite, photogrammetry).

SCD

Specification Control Drawing - A type of picture sheet geometry or book which depicts functional and physical interfaces, performance requirements, and quality assurance requirements to enable development and procurement of an Item (assembly or system) by an outside supplier

SPECIAL TOOLING

Tools of such a specialized nature that, without modification or alteration, their use is limited to the development and/or manufacture of production parts and assemblies. Examples of these tools include jigs, fixtures, molds, patterns and gages as identified by site specific documentation. See D33200-1 and D950-1159-1

STEP

Standard for the Exchange of Product model data. – Standard developed by the International Standards Organization for exchange of digital product data.

SUPPLIER

(1) An entity delivering products or performing services being acquired. (2) An individual, partnership, company, corporation, association, or other service having an agreement (contract) with an acquirer for the design, development, manufacture, maintenance, modification, or supply of items under the terms of an agreement (contract).

SUB-TIER SUPPLIER

An entity working under supplier contract(s) and providing products or services on Boeing programs.

TAA

Technical Assistance Agreement - An agreement for the performance of a defense service(s) or the disclosure of technical data, as opposed to an agreement granting a right to manufacture defense articles. Assembly of defense articles is included under this section, provided production rights or manufacturing know-how are not conveyed. Should such rights be transferred, a Manufacturing License Agreement (MLA) is required.

TDI

Tooling Data Identifier - A TDI is used by Boeing for the development of tools used by outside suppliers.

TRANSLATION

Translations occur when a digital dataset is changed from its original CAD system format to another CAD, CAM, and CAI application format and require verification.

References

The current issue of the following references is considered a part of this standard to the extent herein indicated.

D6-82479 Boeing Quality Management System Requirements for Suppliers

The following documents define specific Digital Product Definition (DPD) processes. Supplier shall contact their Boeing Procurement Agent to request applicable documents.

D1-8110-9 Reference engineering photo template (REPT) and product definition template (PDT) requirements, validation and verification processes, and handling instructions for plot centers and supplier use

D33200 Boeing Suppliers' Tooling Document

D6-56199 Hardware and Software Compatibility Requirements for Suppliers Use of BCAG CATIA Native Datasets as Authority for Design, Manufacturing and Inspection

D6-56643-700 IGES_CHK Program Users Guide

D6-56643-701 DEL_LAY Program Users Guide

D6-81491 Authority and Usage of CATIA Native, CATIA IGES and PDM STEP Datasets

D6-84368 V4/V5 transition interface agreements between Boeing and suppliers

D950-11059-1 IDS Seller Special Tooling Requirements

DAC-SIM-099 Digital Data Packaging and Downloading

PRO-5159 Assessment of Boeing Suppliers Digital Product Definition Capability

TA-PD-287 Electronic Exchange of Product Definition Data to Suppliers

Revision Record

Revision Letter
Changes in This Revision
Signatures

A

Revised pages iii, 2, 3 & 4

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Revision Letter
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Revision Letter
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E

Extensive revision of document to include upgrades to business process

Renumbered pages of entire document

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AUTHOR:	M Swan (signature on file)	_____	8/16/96
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Revision Letter
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F


Revision to add PDM STEP and update electronic business processes.

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Revision Letter**Changes in This Revision****I**
Removed Proprietary Stamp
Minor corrections for spelling and format**Signatures**

AUTHOR:	<u>Mark E. Clark</u>	<u>6-5946</u>	<u>11/9/05</u>
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Revision Letter**Changes in This Revision****J**
Minor corrections for format throughout document
Minor wording clarification throughout document
Revision to Section 1.3.1 for customer notification process
Revision to Section 2 Configuration Management and Media Security for clarification
Addition of Section 2.3 for outsourced design
Revision Section 7.2.1 for CMS clarification
Revision Section 8 for inspection media clarification
Addition of Section 8.6 for plot requirements
Defined new terms**Signatures**

AUTHOR:	<u>Mark E. Clark</u> 	<u>6-5902</u>	<u>9/2/10</u>
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