

International specification for technical publications
utilizing
a common source database



Quality assurance and quality review – methods and
processes for S1000D projects

Dipl.-Math. Ferry Berendi & Dipl.-Ing. Sascha Prohaska

Quality for S1000D publications

- The quality is a characteristic of a product
- The quality is a property of technical publications
- Deficiencies in quality of technical publications result in deficiencies of the product
- For technical publications this means:
 - Technically and functionally mature
 - Correct data for operation and maintenance
 - Authored in line with the specification

Technically and functionally mature – Examples

- Right and save operation
- Save handling of hazardous material
- Correct performance data
- Correct mass data
- Correct test and maintenance procedure (eg servicing, non-destructive testing, remove and install)
- Correct technical data (eg adjustment and tolerance values)
- Correct unit of measurement
- Correct failure codes
- Correct wiring data

Correct data for operation and maintenance

- The technical publication represent the defined maintenance concept (eg in line with LSA)
- Correct applicability
- Correct required conditions
- Correct support equipment
- Correct spares and supplies
- Correct skill level and qualification
- Complete data for scheduled maintenance including life limits

Correctness from a technical publication view (examples)

- Conform to S1000D and project business rules
- Correct data module code
- Correct use of the language (eg Simplified Technical English)
- Correct and consistent revision management and change marking
- Correct security classification
- Complete warning and cautions
- Correct quality assurance status
- Consistent nomenclature and abbreviations
- Correct and consistent referencing
- Conform to illustration rules
- Usability of the technical publications

Quality assurance requirements in S1000D (Issue 4.0, Chapter 3.7)

- Quality assurance is the collection of activities to ensure that the contents of the data modules/publications are adequate and technically accurate.
- Quality assurance for military air programs differs from the civil air QA.
- Civil customers and civil aviation airworthiness authorities' requirements are, that the manufacturer's organization leads to the required quality which must comply with acceptable rules such as those detailed in the ATA series of specifications.
- The QA requirements for both military and civil programs in land and sea applications are defined by the customer and by the project or organization.

In-process review - Military and first QA review - Civil

- An In-Process Review (IPR) is an optional review by the customer of data modules / technical publications that are being produced by the contractor for the Product.
- The IPR ensures that the data modules / technical publications are being prepared to the required scope, depth and timescale in accordance with the contract and the applicable specifications.
- Practical experiences show that IPR is difficult to perform and requires good preparation.
- IPR requires mature data – this means first verified data module, and should be performed only on selected information upon request.
- First QA review is the process by which the contractor's QA organization verifies that the produced output adequately.

First verification

- First verification is the process by which the contractor validates that the data modules / technical publications are:
 - the correct data modules / technical publications
 - fit for purpose
 - adequately describe the Product
 - technically accurate
 - safe to use by the customer
- First verification is certified by the contractor and for civil aerospace programs, the first verification must satisfy the civil aviation airworthiness authority of the contractor.
- The first verification is documented in the element <qualityAssurance> of the data module and in-house QA documents.

Methods of first verification

- The methods of first verification depend on the type of technical information they contain.
- Some drafts can be checked against items of design documentation such as drawings, test schedules etc. This is known as “table top” first verification.
- Other drafts, such as those containing procedural steps, can require a practical demonstration of the procedure. This is known as “on object” first verification.
- Other drafts may require that both types of first verification are carried out.
- The contractor must use his engineering judgment in deciding which first verification method is to be used.
- The first verification is tasked to authorized persons

Practical demonstration of first verification

- A practical demonstration of first verification of a procedure must be carried out in sequence and under conditions that provide reasonable assurance of the suitability of the procedure.
- The customer must be informed of any situations where a contractor in military programs is not able to carry out first verification because of the lack of facilities.
- For civil programs, data modules / technical publications containing procedural information for airborne equipments must be shop first verified.

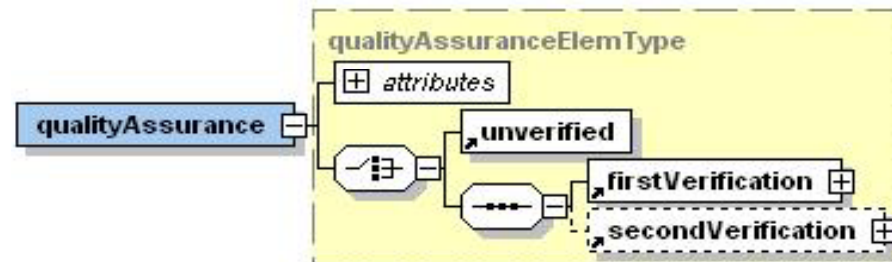
Second verification

- Second verification is the optional process by which the customer carries out a practical demonstration of the data modules / technical publications, supplied by the contractor, to make sure that the technical information is adequate to permit the efficient and safe use of the Product.
- The responsibility for the technical accuracy of the information remains with the contractor.
- For operational publications (eg flight crew checklist) it is common practice that a team consisting of customer and contractor are checking and approving the data modules.

Methods of second verification

- The methods of second verification that may be used are table top, on object or both, in the same way as first verification.
- The application of these methods must be determined by the project or organization.
- The focus of the second verification is the in-service usability.
- In military projects the second verification and can be carried out for example during troop trials.

Markup element <qualityAssurance> (Issue 4.0)



- The mandatory element: <qualityAssurance> contains the details of the status of the QA process as required by the project.
- The data module must be identified as either being unverified or verified
- Mandatory attribute verificationType of the elements <firstVerification> and <secondVerification>:
 - "onobject", used to indicate that the first verification was carried out at the Product
 - "tabtop", used to indicate that the first verification was carried out on a desktop
 - "ttandoo", used to indicate that the first verification was carried out "on object" and "table top"

Markup example for QA

- First verification “table top“ and second verification “table top“ and “on object“
- `<qualityAssurance>`
`<firstVerification verificationType="tabtop"/>`
`<secondVerification verificationType="ttandoo"/>`
`</qualityAssurance>`

QA markup

- Unverified data module must not be used for operation.
- In case that unverified data modules must be distributed, they must be marked as unverified examples.
- Avoid the first verification of a data module dependent of its applicability
- Data modules cannot be second verified only. They must also be first verified.
- Any change of a data module requires an assessment whether a re-verification is required. This process should be documented in the QA programme.
- For every change of a data module, this means for changes to the QA status too, the issue number must be increased. This is always a subject for discussion – specific for changes due to second verification, which is performed by the customer.

Quality assurance process

- To ensure that the data modules / technical publications are produced in accordance with the customer's requirements, the contractor must include in his production procedures the appropriate control of quality.
- The assurance of quality must be substantiated by evidence that the quality control is maintained and that in-house checks and first verification have been carried out.
- As part of this quality assurance, the customer may review the contractor's quality control, including the in-house checks and first verification, to ensure that the required quality is achieved by the contractor.

Quality assurance program

- The contractor must produce and maintain a documented QA program for the technical information that is contracted for.
- The QA program should take into account such areas as
 - procedures for the preparation, in-house checks and first verification of the data modules/technical
 - co-ordination with design, production, product support and other such departments
 - formal IPR (military) or first QA reviews (civil)
 - first verification of the data modules/technical publications
 - commenting, recording and reporting, on issues raised
- The review process should be kept as simple as possible.

Tools for quality control in the definition phase

- Specifications and requirement paper
- Quality assurance plan
- Quality control plan and quality control specification for
 - syntactical (formal) inspection for the validation of the data module instance and the S1000D and business rules conformity
 - Semantical (content) inspection
 - Visual inspection of the IETP and paper output
- Quality control checklists
- Business rules – project guidelines and style guides
- Business rules give a standard way for data authoring and enable the use of automated processes for checking the publications

Methods for quality control in the production and maintenance phase

- The data module requirement list to guarantee completeness and correct applicability
- The CSDB for version control, data integrity and consistency
- The BREX (business rules exchange) data module to describe and exchange the project business rules
- Use of a shared source data environment with engineering and other support disciplines (eg generation of illustration from 3D design data)
- Configuration control of the data module by documenting the change authority
- Maintainability demonstrations and practical tests during production
- Feedback from training

Tools for quality control for production of publications

- SMGL and XML editor
- Illustration tools
- Generator for tables and formulae
- Converter, input forms and filter for data input
- Resource information repositories
- Simplified Technical English checker
- Parser and syntactical rule checker
- IETP-X to verify the deliverable

The clever combination of tools is the key to good quality

Business process integration

- Use of XML und XPDL (XML Process Definition Language) for process and rules modeling according to WfMC (Workflow Management Coalition) as for example the HiCo tool X-Process™
- To document, standardize and control the process sequences and the publication rules
- To be used during data module generation process or in batch mode as quality control
- Increases productivity in authoring and quality control
- Re-usability for other projects and issues of S1000D

Semantical quality control - Examples (1)

- The complex process requires control concept and tools - at least DML, CSDB, IETP-X
- Check of the data module list (DML)
- Completeness of the list of applicable publications (LOAP) and publication structure
- Data module check table top – identification and status section (examples: issue, applicability, QA, ...)
- Data module check table top – content section, common constructs (examples: references, preliminary requirements, change marking, ...)

Semantical quality control - Examples (2)

- Data module check table top and on object – procedural information (examples: warnings, references, structure of procedures, Simplified Technical English, ...)
- Data module check table top and on object – maintenance planning information (example: time limits, checks complete, ...)
- Data module check table top and on object – fault information (example: all fault codes documented and fault isolation available)
- Data module check table top and on object – parts information (example: ambiguous data module title, correct applicability, ...)
- Data module check table top – equipment information (example: consistency of information for item installed on the product (ILC=A) and item removed or on the bench (ILC=B or C))

Typical problem areas in operational and technical publications

- Deficiencies in training and experience of the authors
- Deficiencies in the quality management and in the knowledge about the QA processes
- Deficiencies in the technical publication production process (insufficient defined, documented and communicated)
- Deficiencies in the interdisciplinary collaboration, including changes to design data after design freeze during production
- Incomplete requirements lead to missing information
- Incomplete and inconsistent data (eg warnings)
- Lacks of experience in using Simplified Technical English
- Empty or nearly empty data modules
- Invalid references (to data modules, spares, support equipment, supplies)
- **Insufficient “on object“ verifications**

Quality control of S1000D publications within MoD Austria

- The quality control was performed by the department BMLV-MSL/BO “Bundesministerium für Landesverteidigung – Materialstab Luft, Abteilung Betriebsorganisation” in the period from mid 2007 until now for the project “Luftraumüberwachungsflugzeug”.
- The amount of data modules to be checked is about 25000.
- The data modules are written to S1000D Issue 1.8 + and contain aircrew publications, maintenance publications for aircraft and engine, wiring data and publications, equipment publications, support equipment publications and illustrated parts catalogues.
- The publications are delivered as IETP-X or checklist on paper and are in use since beginning of 2008.
- Quality control is performed in two steps
 - Syntactical quality control
 - Semantical quality control

Quality control of S1000D publications within MoD Austria

- Syntactical quality control
 - Completeness of deliverable (check IETP-X with data module list)
 - Tagging in accordance with S1000D and the relevant industry specifications
 - Check Information code with Information Name
 - Applicability valid
 - Quality assurance status set to first verified
 - Warning, cautions & note valid

Quality control of S1000D publications within MoD Austria

- Data analysis
 - Data module analysis for usage or support in continuative logistic programs (Logistic Information System - LOGIS)
 - Compare content of IPD Data Modules from IETP-X with S2000M data
 - Integrity check of procedural data modules with illustrated parts data (referenced spares)
 - Consumables correct
 - Support equipment and special tools defined and correct
 - Verify task code with LSA

Quality control of S1000D publications within MoD Austria

- Semantical quality control (table top and on object)
 - Check correct applicability
 - Analyze practicability with specialists
 - Verify completeness in accordance with practicability
 - Examine clarity of information
 - Verify the content of checklists with data module
 - Inspect technical information for plausibility

Summary

- S1000D contains all requirements for a comprehensive quality management
- Integrated quality assurance and control is not always a focus in the projects and suffers due to cost reductions
- Available tools for quality improvement are not used or are insufficient
- Cost optimisation requires a integrated and well defined quality and process management
- Authoring process must contain on object checks
- Interactive electronic technical publications are the challenge to achieve the required quality