

Standard Issues

QUALITY MANAGEMENT SYSTEMS

Reaching New Heights



Move past minimum QMS requirements to achieve greater improvement

by L.L. “Buddy” Cressionnie and Alan Daniels

Now that you have successfully achieved certification to the revised International Organization for Standardization (ISO) and aviation, space and defense (ASD) standards, what are the next steps for your organization? A quality management system (QMS) isn’t intended to sit on a shelf between revisions. Rather, it requires maintenance and continual improvement to ensure it effectively meets business needs.

Often, leadership openly wonders why QMS certification doesn’t result in the improvements it envisioned. More often than not, however, leadership stopped implementation or improvement activity after receiving certification.

The key is not looking at a QMS as a project with a beginning and an end, but as a business system providing substantial benefits when time and effort are applied to it.

How do I improve my QMS?

This column discusses how to affect quality in your organization with certification to QMS standards, and by understanding requirements, assessing and improving process maturity, and leveraging published support materials. The authors are active in the international development of ISO and ASD industry standards. This qualifies us to provide insights into ISO concepts and ASD industry requirements beyond ISO that any organization can apply to improve its products and services.

The ASD industry is a trendsetter in the world of standards. It operates in an environment in which quality and product safety are critical to success. The industry is at the forefront of quality innovation that not only is desirable, but also necessary. ASD creatively manages risk and change to meet the ever-changing requirements and expectations throughout the supply chain.

Additional attention must be paid to ensure new requirements in the AS9100:2016-series of standards are understood. Data analytics show there are few nonconformities identified to the new requirements, so it is believed that additional understanding and auditing are necessary for these requirements.

Using ASD standards for improvement

The AS9100 series of standards¹ are based on ISO 9001:2015 requirements, which are included in their entirety in the AS9100-series of standards. The ASD industry added requirements to make the standard more robust to drive improvement, a consistent quality output delivered on time with product safety. These ASD requirements can help any organization improve, regardless of the industry it supports.

+ Customer and applicable statutory and regulatory requirements. The ASD industry is tightly controlled and regulated, making it necessary to understand requirements coming from customers, and statutory and regulatory agencies.

FIGURE 1

AS9100:2016 (Rev. D) vs. FAA Part 21 correlation matrix

Section 1—Correlation of FAA Part 21 paragraphs to AS9100:2016 (Rev. D) clauses

AS9100:2016 (Rev. D)		FAA Part 21:2017	
Clause No.	Clause title	Paragraph No.	Paragraph title
4.	Context of the organization		
4.1	Understanding the organization and its context	21.146	Responsibility of holder
		21.316	Responsibility of holder
		21.616	Responsibility of holder
4.2	Understanding the needs and expectations of interested parties	21.2	Falsification of applications, reports, or records
		21.3	Reporting of failures, malfunctions, and defects
		21.4	ETOPS reporting requirements
		21.5	Airplane or Rotorcraft Flight Manual
		21.6	Manufacture of new aircraft, aircraft engines, and propellers

Section 2—Correlation of AS9100:2016 (Rev. D) clauses to each FAA Part 21 paragraph

FAA Part 21:2017		AS9100:2016 (Rev. D)	
Paragraph No.	Paragraph title	Clause No.	Clause title
Subpart A—General			
21.1	Applicability	N/A	
21.2	Falsification of applications, reports, or records	4.2	Understanding the needs and expectations of interested parties
		7.5.3.1	Control of documented information
		7.5.3.2	Control of documented information
21.3	Reporting of failures, malfunctions, and defects	4.2	Understanding the needs and expectations of interested parties
		7.4	Communication
		8.1.1	Operation risk management
		8.1.3	Product safety
		8.2.1	Customer communication
		8.3.6	Design and development changes
		8.5.5	Post-delivery activities
		8.5.6	Control of changes
		8.7.1	Control of nonconforming outputs
		8.7.2	Control of nonconforming outputs
		9.1.1	General
		9.1.2	Customer satisfaction
		9.1.3	Analysis and evaluation
		10.1	General
10.2.1	Nonconformity and corrective action		
10.2.2	Nonconformity and corrective action		

ETOPS = extended-range twin-engine operational performance standards

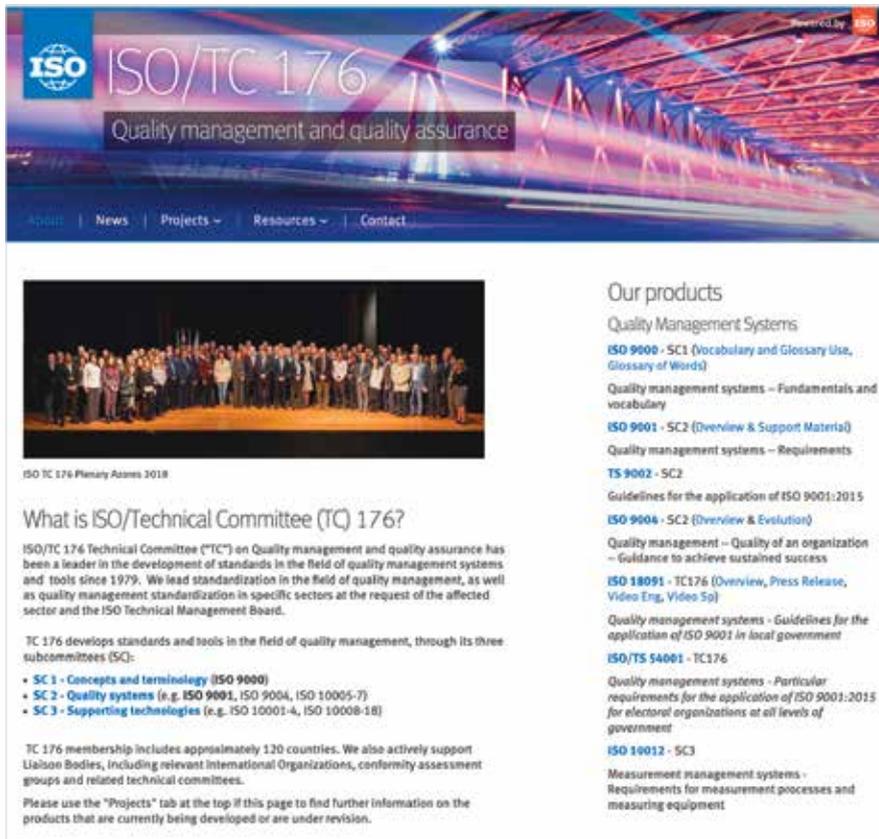
FAA = Federal Aviation Administration

Rev. = revision

Source: International Aerospace Quality Group (IAQG), "Requirements Correlation Matrix," <https://tinyurl.com/y6gsjmhp>.

FIGURE 2

ISO/TC 176 quality management and quality assurance



(Methods for improving these processes are provided later.)

- + **Leadership.** Leadership commitment and focus are critical to QMS success. Leadership's full engagement in management reviews establishes a successful QMS culture. The ASD industry requires an annual interview with top management to determine whether it is meeting leadership and engagement requirements.
- + **Measurement traceability.** The ASD industry sets additional requirements for measurement traceability to ensure

the tight tolerances required in the industry are consistently met.

- + **Documented information.** The ASD industry also sets additional requirements for documented information to ensure processes are repeatable and records are retained. Additional information from the latest revision to AS9100 also has been included for data integrity and information protection.
- + **Quality awareness.** New requirements in the AS9100-series of standards pertain to developing a culture in which employees understand

how they contribute to product or service conformity, and product safety. The importance of ethical behavior also was added because customers expect honest and truthful dealings throughout the QMS.

- + **Planning.** Many QMS failures occur because of poor planning and failure to address changes. The ASD standards focus on upfront planning to prevent problems, including controls to prevent nonconformance escapes to the customer. Additional controls include engaging functional organizations in the process and change management.
- + **Risk management.** Risk has been in AS9100 since the standard's initial release in 1999. ISO 9001:2015 added the concept of risk-based thinking that transcends the QMS. The ASD industry also focuses on operational risks in *AS9100, Clause 8—Processes*. Many users only look for the word "risk" in the standard. However, there are numerous other ASD processes that are introduced to reduce or eliminate risk—such as production process verification, which is when the organization ensures the production process can produce products that meet requirements.
- + **Configuration management.** The ASD industry has requirements to ensure the identification and control of physical and functional attributes delivered match what was contracted, designed, procured, built and maintained.
- + **Product safety.** Product safety always has been required in the ASD industry to protect the flying public, astronauts, warfighters and anyone engaged with the product. Providing a safe product to users is fundamental to any organization that delivers product.
- + **Preventing counterfeit and suspect counterfeit parts.** Controls are required to ensure counterfeit or suspect counterfeit parts are not included in products. At one time, counterfeit parts were easy to identify and were

FIGURE 3

International Aerospace Quality Group support materials

IAQG 9100 - Quality Management Systems - Requirements for Aviation, Space and Defense Organizations

This document standardizes quality management system requirements to the greatest extent possible and can be used at all levels of the supply chain by organizations around the world. Its use should result in improved quality, schedule and cost performance by the reduction or elimination of organization-unique requirements and wider application of good practice. While primarily developed for the aviation, space and defense industry, this standard can also be used in other industry sectors where a quality management system with additional requirements over an ISO 9001 system is needed.

- 9100:2016-Series - QMS: Aviation, Space and Defense Organizations Standards Clarifications
 - [9100:2016 Series Clarification Table](#)
- 9100:2016 - QMS: Aerospace Improvement Maturity Model (AIMM) (*In Development*)
- 9100:2016 - QMS: Aviation, Space and Defense Organizations Guidance Materials
 - Support Materials
 - [Frequently Asked Questions \(FAQs\)](#)
 - [Gap Assessment Worksheet](#)
 - [9100 Evaluation Guidance Material](#)
 - [Relationship between IAQG Standards and 9100:2016 Standard \(Table C1\)](#)
 - Correlation Materials
 - [Correlation matrices between 9100:2009 and 9100:2016](#)
 - [Matrix of 9100:2009 mapped against the 9100:2016](#)
 - [Correlation of 9100:2016 mapped against EASA Commission Regulation \(EU\) 748/2012 Part-21](#)
 - [Correlation of 9100:2016 mapped against FAA Part-21](#)
 - Presentations
 - [Executive Level Summary Presentation](#)
 - [Key Changes Presentation](#)
 - [Clause-by-Clause Presentation](#)
 - 9100:2016-Series Major Changes Recording (in Development)
 - Articles: Reprinted with permission from Quality Progress © 2019 ASQ, www.asq.org. All rights reserved. No further distribution allowed without permission.
 - [2019 February ASQ Quality Progress: We Have Liftoff](#)
 - [2019 May ASQ Quality Progress: The Complete Package](#)

a risk for high-dollar parts. Now, counterfeit parts are difficult to identify and even operate in performance characteristics at nominal values. Counterfeit parts are becoming a concern for public commodities that cost a single

dollar. They also can include falsified test reports that indicate the product meets certain requirements.

- + **Design and development.** The ASD industry has put in additional controls for robust design and

development processes focused on verifying and validating products and services, and designing for manufacturability to external providers and production activities.

- + **External provider controls.** Effective external provider control is essential to the ASD industry, where 70% to 80% of the airframe cost comes from suppliers. So, the industry provides additional requirements—including direct and sub-tier controls, supplier risk assessment, supplier performance evaluation and management, and flow-down requirements—to ensure suppliers understand expectations.
- + **Special process.** ASD products frequently require special processes, so additional requirements were added to the AS9100-series of standards for situations in which the resulting output can't be verified by subsequent monitoring or measurement. The industry also has introduced the National Aerospace and Defense Contractors Accreditation Program (called Nadcap) certification to ensure special process products follow the defined process.
- + **Nonconforming output control.** ASD products must conform to specifications and product safety requirements. Therefore, rigorous additional requirements were added for dispositioning nonconforming outputs, including controlling these outputs and scrap.

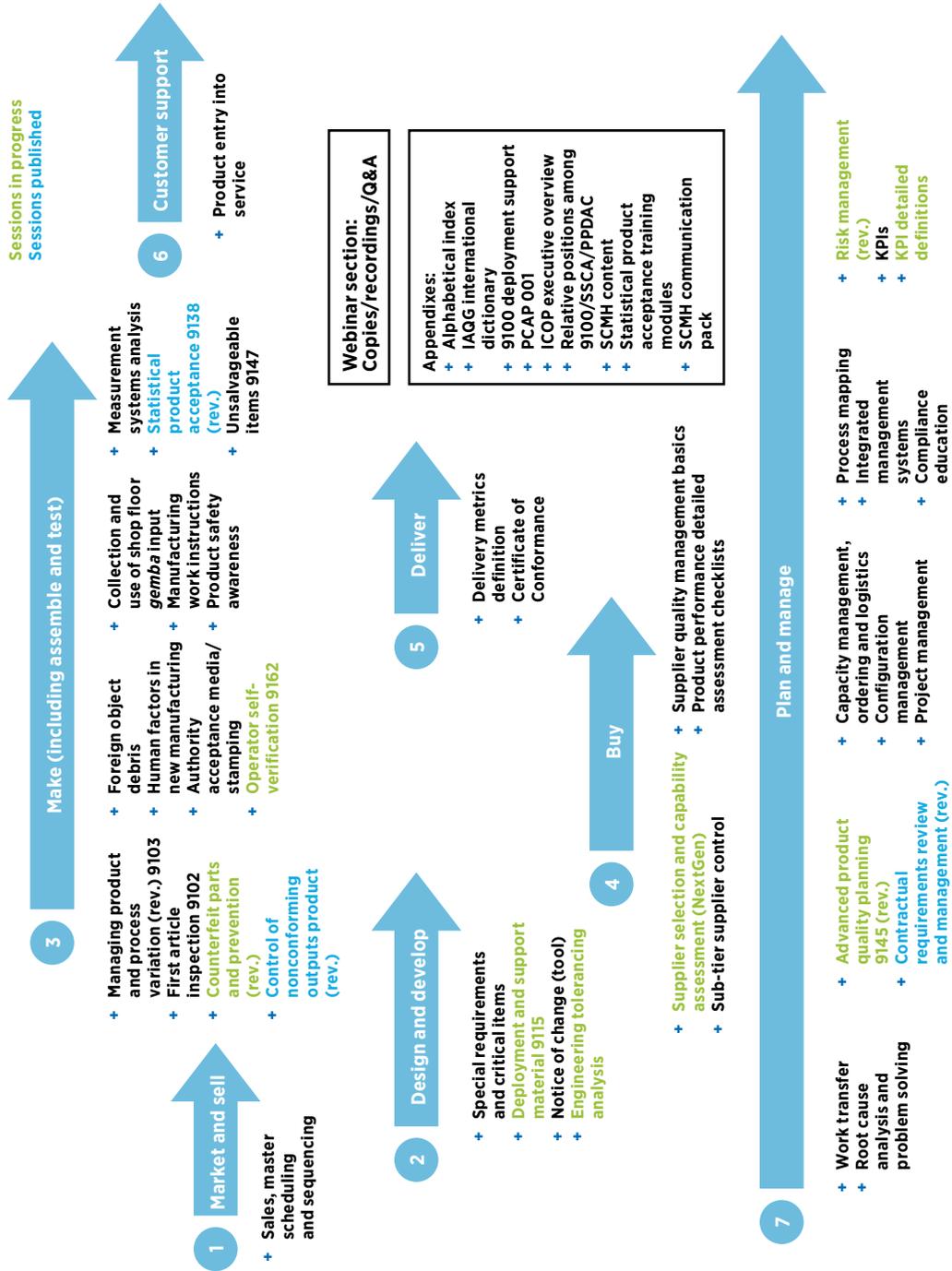
Understanding customer, statutory and regulatory requirements

Enhancing the organization's focus on the customer and improving customer satisfaction by understanding requirements—including customer, statutory and regulatory requirements—are fundamental to an effective QMS. Organizations must ensure these requirements are identified and ensure compliance with requirements.

The newly published aviation correlation matrix (Figure 1, p. 68), which maps

FIGURE 4

SCMH content



IAGG = International Aerospace Quality Group
ICOP = industry controlled other party
KPI = key performance indicator
PCAP = people capability
PPDAC = product performance detailed assessment checklist
Q&A = question and answer
Rev. = revision
SCMH = supply chain management handbook
SSCA = supplier selection and capability assessment

Source: International Aerospace Quality Group, "Supply Chain Management Handbook (SCMH)," <https://tinyurl.com/y56twzsf>.

FIGURE 5

Assessment and improvement maturity model (AIMM)

Level 5— Optimizing	Organization is focused on being best in class through continuous improvement, and process efficiency and innovation.
Level 4— Predictable	The processes to achieve expected outcomes are managed systematically, based on quantitative targets and measures.
Level 3— Deployed	The processes to achieve expected outcomes are defined and deployed across the organization.
Level 2— Managed	The processes result in expected outcomes that are consistently achieved and controlled, but mainly at the project or product level.
Level 1— Initial	Expected outcomes are achieved but in a reactive and unrepeatable fashion.

AS9100 Standard

Expected outcomes

AIMM overall concept

Maturity levels

Expected outcomes	Maturity Assessment Criteria				
	Level 1 Initial	Level 2 Managed	Level 3 Deployed	Level 4 Predictable	Level 5 Optimizing
The competencies for functions / roles / positions are determined	Competencies are determined for some key functions / roles / positions	Competencies are determined for all functions / roles / positions for projects teams / product lines	A standard process for determining needs is used	Job profiles and associated competencies are systematically defined for all functions / roles / positions and periodically reviewed	The needs of new competencies to serve the evolving context of the organization and its business needs are proactively determined
People are competent on the basis of appropriate education, training, or experience	Competence of individuals is evaluated for some key functions / roles / positions	Competence of individuals is evaluated for all functions / roles / positions	A standard process for evaluating competence of individuals is defined and fully deployed across the organization	The competencies of individuals needed for professional growth are periodically reviewed and evaluated (e.g. as part of job performance reviews or competencies matrix reviews)	Career planning is systematically implemented, with proactive determination of the related evolution of competencies
				Self-assessment of competencies by individuals are established and used and an input to the periodic reviews.	

Maturity assessment criteria matrix

the Federal Aviation Administration and European Union Aviation Safety Agency airworthiness requirements to AS9100, is a good resource for understanding regulatory requirements. It shows relationships between aviation airworthiness regulatory requirements and AS9100 clauses. The AS9100 standard does not meet all of these requirements because some apply only to commercial aviation, so it is still the organization's responsibility to understand how it meets these requirements.

It is highly recommended that organizations identify, understand and ensure compliance through internal audits that verify that customer, statutory and regulatory requirements are being met by their QMSs.

Support materials and supply chain management handbook (SCMH)

ISO and the International Aerospace Quality Group (IAQG) publish an extensive array of support materials to help users understand requirements and improve:

- + **ISO technical committee (TC) 176 (quality management and quality assurance), technical group 1 (communications and product support).** Guidance information on TC 176 standards can be found on the ISO TC 176/TG 1 website (see Figure 2, p. 69).²
- + **IAQG support materials.** The IAQG requirements team publishes support materials to aid organizations in implementing any of

the AS9100-series standards. The support material topics include published clarification, frequently asked questions, evaluation guidance materials on what to look for and what to ask, correlation matrixes (including to the previous revision of the standard and regulations), presentations describing the standard and new changes, and published articles (see Figure 3, p. 70).³

- + **SCMH.** The IAQG product and supply chain improvement team provides guidance materials to improve quality and on-time delivery throughout the entire ASD value stream. By sharing best practices of subject matter experts for a wide range of activities, the objective is to help the supply

chain improve its quality performance through a better understanding of ASD industry QMS requirements and expectations. The SCMh sections are structured around the seven elements of a supply chain business process model, covering the entire product life cycle (see Figure 4, p. 71).⁴

Using improvement standards

ISO and ASD requirement standards, such as ISO 9001 and the AS9100-series of standards, set the minimum expectations for effective organizational performance. These standards do not stand alone—they have a complete suite of improvement standards. The ISO and ASD improvement standards and tools can be applied to any organization, regardless of industry. These standards include ISO/Technical Specification (TS) 9002, ISO 9004, the ISO 10000-series and AS9100-series of improvement documents. Organizations embarking on new processes or improving existing ones should examine these standards to understand global industry expectations.

ISO/TS 9002 provides guidance, with a clause-by-clause correlation to clauses 4 through 10 of ISO 9001:2015 to aid users in understanding requirements. It also provides guidance and examples of what an organization can do—it is not intended for audit or evaluation purposes. ISO/TS 9002 is an excellent guidance document that does not add new requirements to ISO 9001.

Previous Standard Issues columns offer additional details on these topics:

- + ISO 9004.⁵
- + ISO 10000 series of standards.⁶
- + AS9100 series of standards.⁷

Using maturity criteria

Many ISO and AS9100-series certified organizations receive feedback from their internal and certification body audits about which aspects of their QMS conform or don't conform to the standard requirements. Nonconforming evaluation results certainly generate improvement opportunities, but how can organizations improve QMS effectiveness that is deemed conforming? By assessing their processes against maturity model criteria and taking actions to get to higher levels of maturity.

These maturity models are included in the ISO 9004 Annex A self-assessment tool and the new IAQG aerospace improvement maturity model (see Figure 5). These maturity models can be focused on a particular activity or applied to the entire QMS. Certified and noncertified organizations can apply these maturity models to measure and improve the performance and effectiveness of their QMS.

Get the most out of it

An effectively implemented QMS is directly tied to organizational performance and future sustainability. As discussed earlier, many tools are available to help organizations identify improvement opportunities in their QMSs through QMS certification and improvement standards, and by understanding requirements, assessing and improving process maturity, and leveraging published support materials. Organizations must leverage these resources to improve their QMSs to ensure they effectively meet business needs and achieve the full benefit of a QMS after certification. [QP](#)

NOTE AND REFERENCES

1. The AS9100 series of standards includes *AS9100—Quality Management Systems—Requirements for Aviation, Space and Defense Organizations*; *AS9110—Quality Management Systems—Requirements for Aviation Maintenance Organizations*; and *AS9120—Quality Management Systems—Requirements for Aviation, Space and Defense Distributors*.
2. International Organization for Standardization (ISO), "ISO/TC 176: Quality management and quality assurance," <https://committee.iso.org/home/tc176>.
3. International Aerospace Quality Group (IAQG), 9100:2016 Support Materials, www.iaqg.org.
4. IAQG, "Supply Chain Management Handbook," <https://tinyurl.com/y56twszf>.
5. Isaac Sheps and Pierre L'Espérance, "A Standard's Evolution," *Quality Progress*, August 2018, pp. 51–56.
6. L.L. "Buddy" Cressionnie and Paul Palmes, "A Well-Known Secret," *Quality Progress*, November 2018, pp. 50–52.
7. L.L. "Buddy" Cressionnie, "The Complete Package," *Quality Progress*, May 2019, pp. 52–55.



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