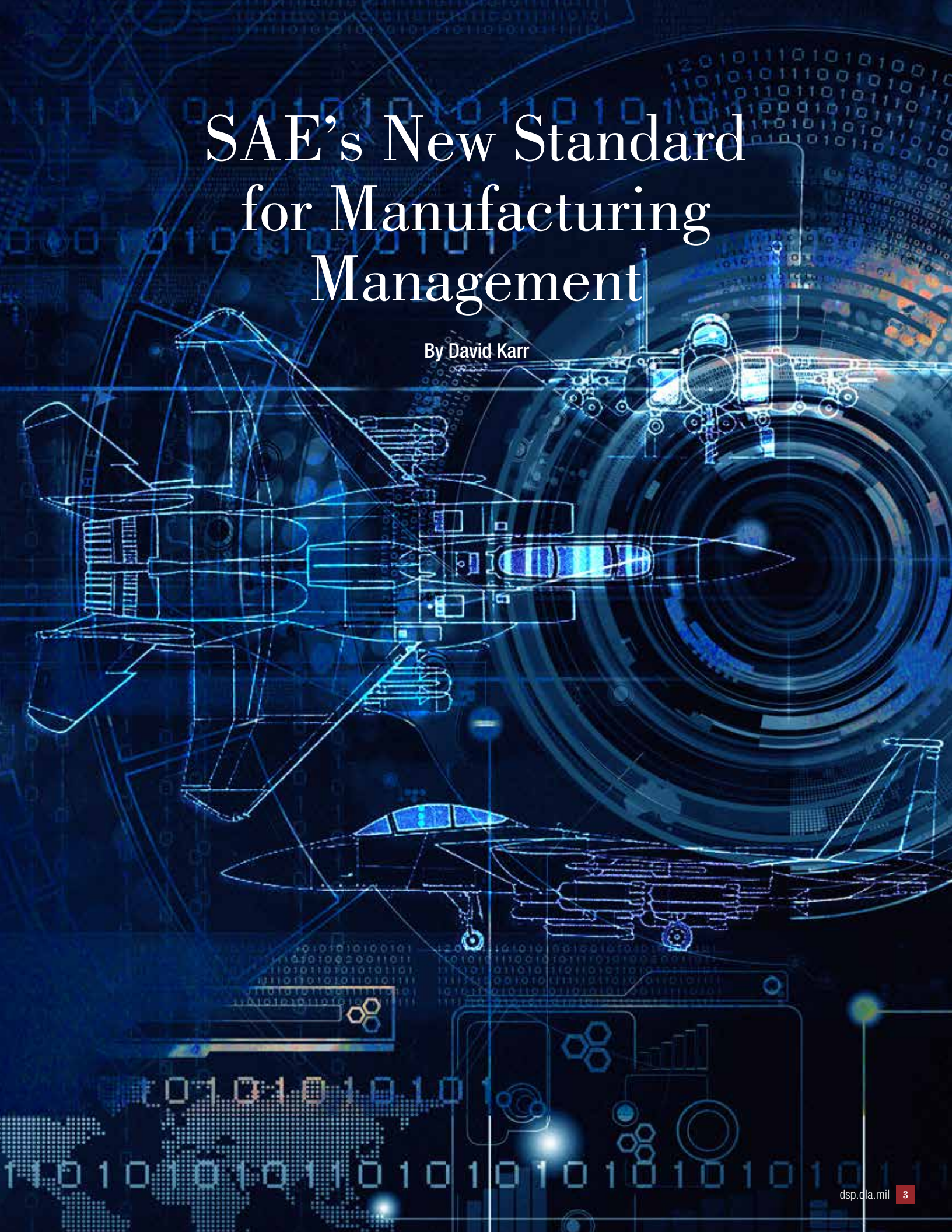
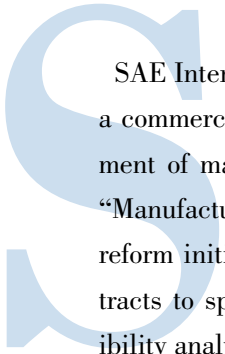


SAE's New Standard for Manufacturing Management

By David Karr





SAE International recently published AS6500, “Manufacturing Management Program,” a commercial standard governing the implementation of best practices for the management of manufacturing operations. In many ways, AS6500 replaces MIL-STD-1528A, “Manufacturing Management Program,” which was canceled as part of DoD’s acquisition reform initiative in the mid-1990s. Until then, DoD used the military standard in contracts to specify requirements, such as manufacturing feasibility assessments, producibility analyses, supplier management, and production readiness reviews.

In the absence of MIL-STD-1528A, DoD contracts were generally silent on manufacturing requirements. DoD lost its ability to require a standardized approach to ensuring manufacturing processes were ready for development and production. Companies implemented a wide range of systems with an equally wide range of effectiveness. Subsequently, the Government Accountability Office identified the lack of manufacturing maturity on many programs as a root cause that led to cost overruns, schedule delays, and quality problems. Compared with commercial industry, DoD has been willing to accept more risk when it comes to a lack of manufacturing maturity when DoD programs enter into the production phase. Commercial companies demonstrate that their manufacturing processes are stable and capable before they commit to a production decision. That has not always been the case with DoD programs, and it is a situation that DoD and industry are hoping to turn around with the publication of AS6500.

Senior defense industry leaders have told their DoD counterparts that when budgets are tight (and when aren’t they?), they sacrifice manufacturing activities that are perceived to add cost in the near term because there are no specific customer requirements to perform those tasks, even though they are beneficial. This is especially true in competitive environments when offerors are reluctant to propose additional activities that are not specifically required in the request for proposals (RFP). One industry leader said that he had to lay off all of his producibility engineers in the 1990s because of the perceived added cost. Manufacturing managers have the difficult job of justifying initiatives that will have long-term benefits, but will increase costs in the short term. By including AS6500 in RFPs, industry manufacturing managers will have a customer requirement against which they can budget value-added, long-term improvement activities.

Background

DoD recognized the need for improvement and standardization in the area of manufacturing management. However, unlike the quality management area, which has commercial standards such as ISO 9001 and AS9100, no government or commercial manufacturing management standards were available. As a result, the Defense Standardization Council

approved the development of a manufacturing management standard and directed that the first priority for the development be a non-government standard. DSPO established a working group to identify potential standards developing organizations (SDOs) and select the best SDO to develop the standard. In September 2013, the working group recommended, and DSPO announced the selection of, SAE International to develop the standard.

SAE was ideally suited for this effort, because it already publishes and maintains several standards in related fields, such as AS9100, “Quality Management Systems—Requirements for Aviation, Space and Defense Organizations”; AS9102, “Aerospace First Article Inspection Requirement”; and AS9103, “Aerospace Series—Quality Management Systems—Variation Management of Key Characteristics.” SAE provides flexibility to its committees to proceed in a way that best meets its needs in terms of the committee membership, operations, and the format and content of the final document. It also has a recognized, structured approach for document review and balloting that ensures all voices are heard and the resulting standard is technically sound.

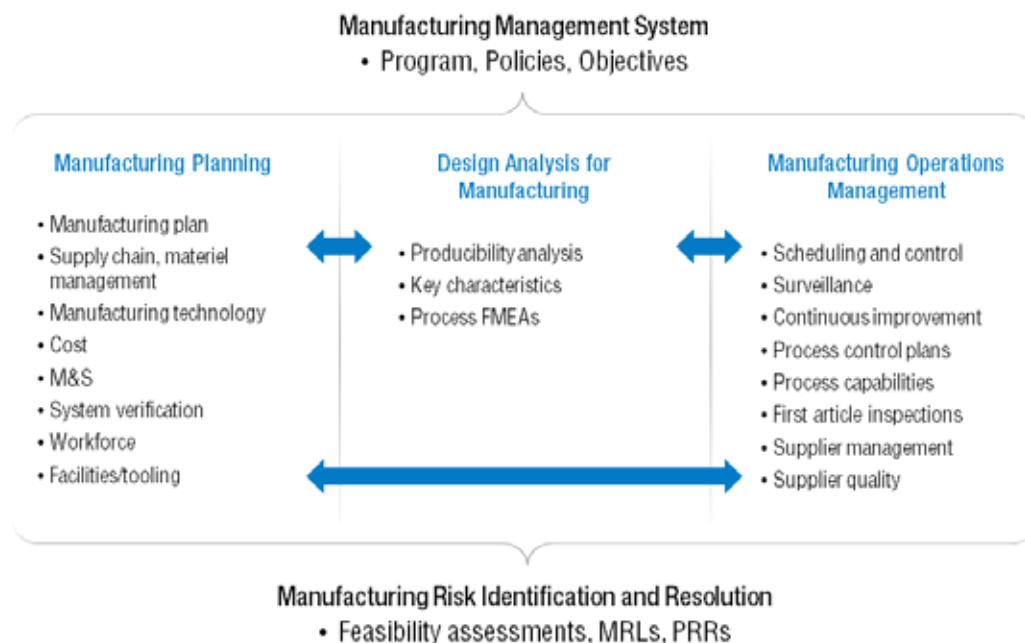
SAE established a new committee, the G-23 Manufacturing Management Committee, in November 2013 to develop the standard. The committee’s charter states it is “responsible for the development, coordination, publication, and maintenance of a standard that documents best manufacturing practices aimed at promoting the timely development, production, modification, fielding, and sustainment of affordable products.”

The G-23 Committee, which is balanced between DoD and defense industry subject matter experts, invited industry associations to review the document and provide feedback. Two rounds of detailed reviews of the document were conducted over a span of 8 months, and the committee addressed nearly 350 comments. In November 2014, the Aerospace Council approved the standard for publication.

Content of the Standard

AS6500 applies to all phases of the system acquisition life cycle and is intended for use on all programs with manufacturing content. It describes both the tools to measure manufacturing maturity and the activities that should be conducted to successfully mature the manufacturing processes. As shown in Figure 1, the standard covers manufacturing planning, design analysis, operations management (including supplier management), and manufacturing risk identification. It includes specific practices, such as producibility analyses, identification of key characteristics, and process failure modes and effects analyses.

Figure 1. Overview of AS6500 Content



Notes: FMEA = failure modes and effects analysis, M&S = modeling and simulation, MRL = manufacturing readiness level, and PRR = production readiness review.

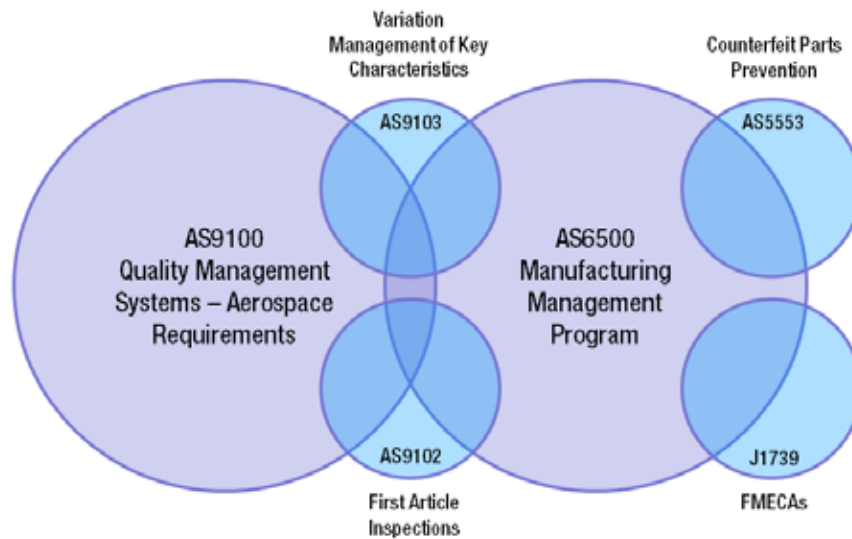
A key element of AS6500 is the use of manufacturing readiness levels (MRLs) to assess the maturity of manufacturing processes and components. MRLs have become the generally accepted approach among the services and many defense companies to determine manufacturing readiness and identify manufacturing risks. MRL determinations are made through the evaluation of nine topic areas or “threads,” arranged in a matrix of objective criteria that reflects the growing expectation for product maturity as a program progresses through its life cycle. The threads, criteria, and matrix were developed by an MRL Working Group consisting of members of the Office of the Secretary of Defense, military services, Defense Acquisition University, and industry. AS6500’s adoption of this approach will further in-grain MRLs into the defense industrial base.

Because suppliers perform a significant amount of development and production, many delivery and quality problems begin at lower-tier vendors before they become apparent to the prime contractor. AS6500 not only addresses in-house manufacturing management at prime contractors, but also their management of suppliers.

The standard requires organizations to establish and maintain supplier management systems to evaluate the capabilities of suppliers, track and report supplier performance, and identify and manage supplier risks. The standard also focuses on ensuring the quality of parts delivered by suppliers by flowing down quality requirements, verifying suppliers’ procedures for controlling quality, and using predictive indicators to provide early detection of potential quality problems at suppliers.

As illustrated in Figure 2, AS6500 goes hand-in-hand with AS9100, as well as with several other commercial standards: AS9102; AS9103; AS5553, “Fraudulent/Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition”; and J1739, “Potential Failure Mode and Effects Analysis in Design (Design FMEA), Potential Failure Mode and Effects Analysis in Manufacturing and Assembly Processes (Process FMEA).” AS6500 complements AS9100 by providing more detailed application requirements for manufacturing and supplier management. It also incorporates key elements of AS9102, AS9103, AS5553, and J1739 and refers the users to those standards for more detailed guidance.

Figure 2. AS6500 and Related Commercial Standards



Note: FMECA = failure mode, effects, and criticality analysis.

Implementation

AS6500 must be included in statements of work to be contractually binding. The standard may be tailored to meet the needs of each program’s unique situation. Requirements within the standard are designed to reduce program life-cycle costs. Those that are not specifically applicable may be eliminated or adapted to fit the program. For example, the requirements for design analysis may not be appropriate when applying the standard in a mature production program.

Although the standard is primarily aimed at the defense industrial base, the G-23 Committee made every effort to write the requirements as generically as possible so that other industries may use the standard. The G-23 Committee also designed the standard to be applicable to companies of nearly any size, allowing adaptation of the requirements appropriate to the level of effort, the complexity of the product, and the size of the supplier. The standard’s requirements are intended to be top level, providing each company the flexibility to implement its own processes to meet the requirements.

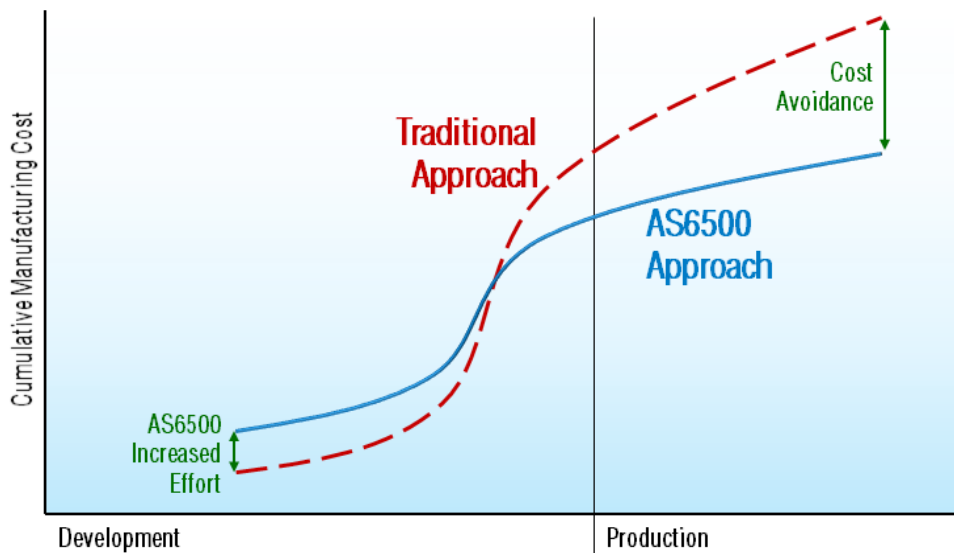
Benefits

AS6500 will directly contribute to the success of DoD's Better Buying Power (BBP) initiative. Key tenets of BBP include achieving affordable programs, controlling costs throughout the life cycle, incentivizing productivity, and eliminating unproductive processes. AS6500 supports the BBP tenets through the application of producibility techniques, early focus on production costs, and the implementation of continuous improvement and lean manufacturing processes. Since a significant portion of a program's life-cycle cost is driven by manufacturing activities, increased effectiveness in manufacturing management will lead to overall program affordability.

Application of AS6500 in the early phases of development and production may require additional resources. However, this investment will pay off in the long term by driving down the cost of development and production through improved quality, higher schedule confidence, and more producible products. As Figure 3 depicts, the savings during development and production will far outweigh the investments required in early phases, resulting in an overall reduced program life-cycle cost.

AS6500 sets the standard in manufacturing management and provides a contractual vehicle for ensuring more consistent implementation of these practices throughout the defense industrial base. The effectiveness of these practices has been demonstrated time and again, and implementing them early in the acquisition life cycle will allow both DoD and industry to benefit from reduced costs, more capable manufacturing processes, and more robust products.

Figure 3. AS6500 Costs vs. Savings



About the Author

David Karr is the technical advisor for manufacturing and quality in the Engineering Services Directorate at the Air Force's Life Cycle Management Center at Wright-Patterson Air Force Base. He is responsible for developing policies and processes in the areas of manufacturing and quality and for assisting programs.