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ASK THE EXPERT

Jeffrey Miller
Aerospace Industry Leader
at Rockwell Automation

Rockwell Automation's Digital Thread for Supply Chain Resiliency

Rockwell Automation's Jeffrey Miller discusses how digital thread technologies and industrial data integration can strengthen aviation, aerospace, and defense industrial supply chains, reducing costs and improving resilience through extended connectivity and predictive capabilities

Q AW: What scope is there for aviation companies to use data to remove cost and time from their supply chains?

A JM: Global aviation supply chains, especially those for MRO are already advanced in their uses of product lifecycle data for integrated planning and inventory visibility. And there's more capability to be had by harnessing, contextualizing, and integrating data from broader sources, by applying industrial data management principles to enhance the sharing and use of distributed data to improve supply network performance and resilience. Most supply chain uncertainties, most unknowns convert into costly inventories. Better information, more complete contexts improve decision making. That drives cost out of aviation supply chains. Brittle supply chains are characterised by poor connectivity, gaps in data, and delays in awareness. By remediating these deficiencies, less inventory is needed for mitigation of uncertainty.

Q AW: Could you give a real-world example of how a digital thread can ensure a resilient supply chain?

A JM: Commercial carriers closely measure actual versus planned aircraft availability. A lot of effort goes into minimizing the frequency of unplanned AOG (aircraft on ground) events. A client found that a particular component accounted for a significant percentage of its unplanned groundings. It also determined that certain operating data of that component provided reliable a predictor of its remaining useful life. Those data enabled the scheduling of its replacement before predicted failure. But preventatively replacing a functioning component on an asset that's moving from place to place presented a complex challenge. Imagine trying to find the correct spare part for that tail number, at any one of many locations the aircraft will transit, along with a suitably trained line maintenance technician available at that place and time of transit, during a layover period of sufficient duration to perform the replacement procedure! Here's where the power of the digital thread for the supply chain came into play.
We enhanced the supply chain data model to include timely, systemwide visibility of spares inventory, transfer orders, planned receipts and scheduled consumptions. Then, we associated work instructions with line technician locations, availabilities and aircraft dispatch schedules. Finally, we wrote a simple solution-seeking routine to find the intersection of those criteria and issue work orders. In effect, all we did was take information that already existed in independent systems and apply digital thread principles to connect and contextualize those data so a decision could be made, and an AOG event avoided – all without need of human intervention.

Q AW: How do you make sure that different systems from different suppliers can talk to each other?

A JM: Applying the framework and rules of Unified Namespace during construction or updating of supply chain data architectures help assure interoperability between dissimilar systems. It can be difficult to interlock data from inventory,

warehouse management, factory systems, and production schedules from siloed enterprise and factory solutions. Today, those siloes may be bridged through intermediary architectures and standards, if data can be made visible. Companies realise this and they're willing to put money into new forms and levels of data integration. We identify and organize data using digital thread principles, industrial data modelling, and unified namespace capabilities to bring them together and remove barriers to interoperability.

Q AW: How important is inclusion of materials management in the Digital Thread, and how does it integrate with fleet operations and maintenance planning?

A JM: We're accustomed to performing line maintenance, conducting hangar-based MRO, and managing configurations each as closed processes governed by regulatory compliance, routine PM programs, Service Bulletins, and operational needs. Yet, the efficiencies of these processes are often determined by material management activities which, in general, have not been interlocked. Today, a growing number of spare parts management solutions are adopting AI-powered digital thread principles to reduce spare part cycle times and shorten AOG events. For MRO, and A- and B-checks, digital thread integration of spare part configurations, part location planning and visibility to multi-party inventory balance, fleet scheduling, line, hangar, and logistics capabilities are together enhancing aircraft availability.

Q AW: To what extent can better data connections alleviate the supply chain problems aviation has experienced since the pandemic?

A JM: Core digital thread principles are not yet as widely integrated into today's global aviation supply networks as they are in other industries, but deployment is accelerating. More timely and complete connections to data and sources make new capabilities available to address top issues of anti-counterfeiting, visibility, supply continuity and more. Today, these supply chain capabilities are helping companies navigate complex tariff and sovereign trade issues, where short notice sourcing decisions and dynamic material movements are becoming more frequent.

Q AW: Do digital thread principles have other applications in aviation?

A JM: Absolutely, yes! Digital thread principles are as vital to digital twins as they are to supply networks. Principles of data sourcing and formatting, architectures, accessibility, and timeliness are key to creating useful digital twins. Indeed, the value of a digital representation of physical thing or system is determined by the quality of the digital thread. We use digital twins to validate product designs, commission processes and whole factories. Airframers today are using process digital twins to optimize factory scheduling and enhance flexible manufacturing by modelling various operating scenarios. There is plenty of room for growth in the utility of digital twins in aircraft assembly to enable greater throughput for each unit of CAPEX investment.