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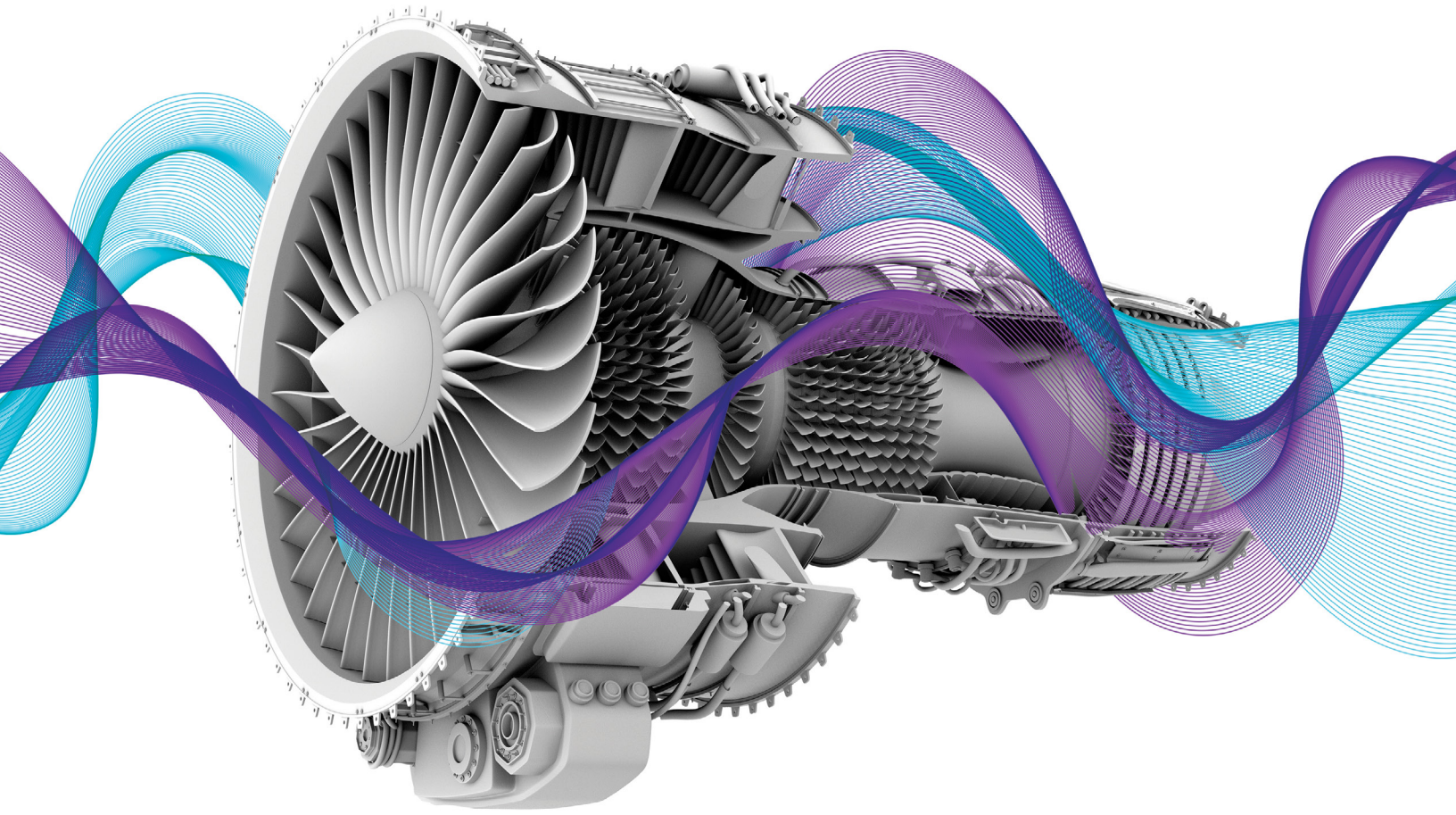
EXTENDING THE DIGITAL THREAD WITH BLOCKCHAIN

in Aerospace and Defense



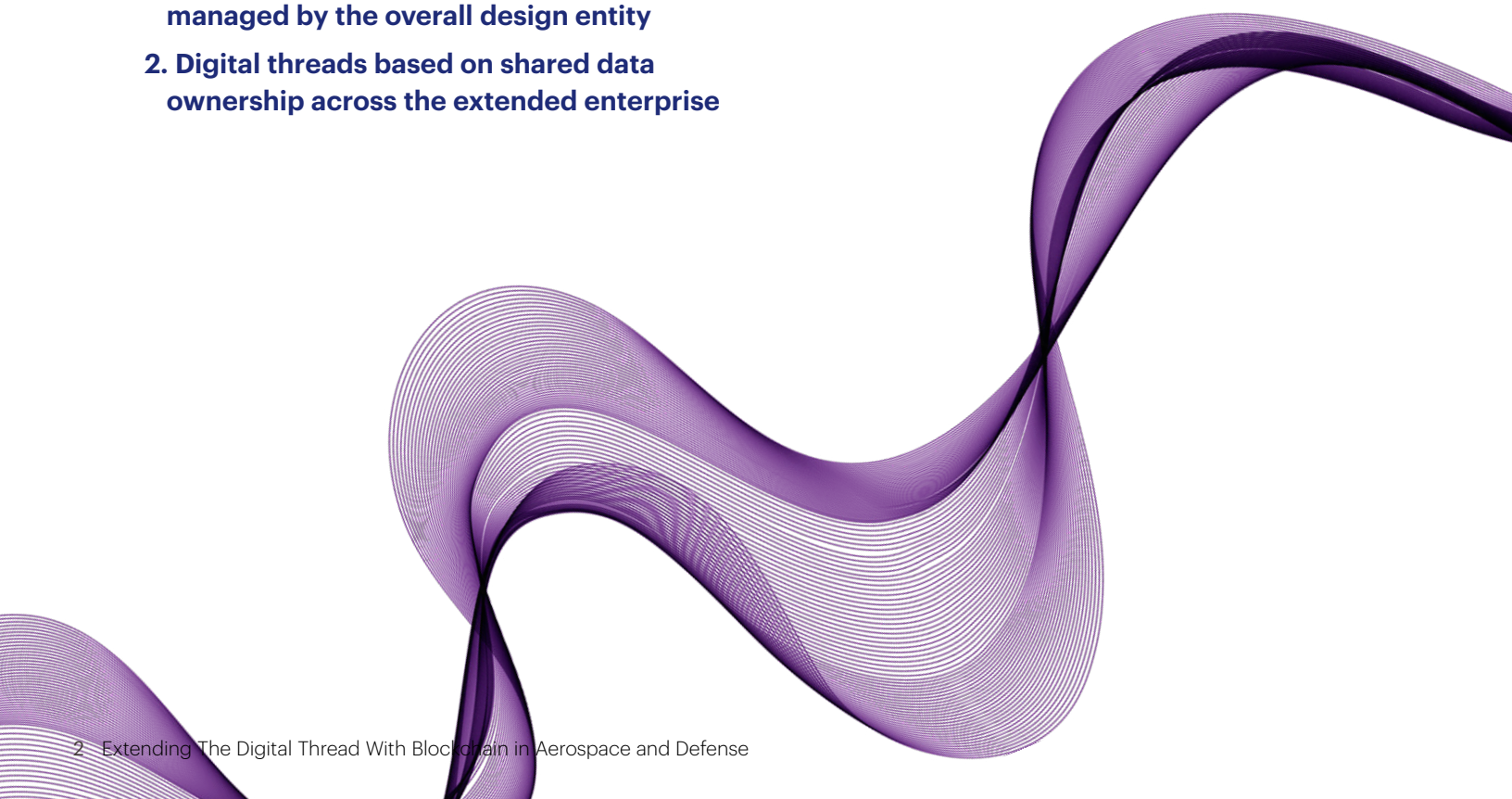
The aerospace and defense industry has been a trailblazer in the use of digital twins to drive innovation through product design. A recent Accenture survey of aerospace and defense organizations revealed that **97 percent were using or evaluating digital twin technologies as a core component** of their product innovation process.[1] To fuel additional growth, aerospace and defense organizations will need to build new business models based on differentiated and value-added services that leverage their products as platforms.

To this end, aerospace and defense organizations need to move beyond the digital twin to master the use of the digital thread. The digital thread enables the flow of information across the entire value chain from OEMs to suppliers, partners, and operators. The digital thread effectively enriches the digital twin and enables key insights that help aerospace and defense organizations develop new revenue sources across the product-services continuum.

However, realizing the digital thread is easier said than done. Sharing complex and unstructured data across the extended enterprise by bringing together multiple organizations to share information in a secure fashion—while maintaining design, build, and maintenance authority—is a complex proposition. To this point, Accenture's survey of multiple aerospace and defense OEMs and major suppliers found two evolving models of data ownership emerging in the next three years to support the digital thread[2]:

1. **Digital threads that are centralized and managed by the overall design entity**
2. **Digital threads based on shared data ownership across the extended enterprise**

The centralized model is founded on the principle of a common platform that is extended beyond the enterprise. While conceptually simple, this model is extremely complex to execute in practice. A look at the prevailing product development and manufacturing infrastructure reveals a rather interesting reality. Major aerospace and defense organizations have a proliferation of platforms with unwieldy point-to-point integrations. This model imposes a high cost of ownership and upkeep, and extending this model outside of the enterprise to multiple parties to enable the digital thread is extremely challenging. With that reality in mind, a shared model of data ownership becomes a viable and attractive alternative. Accenture believes one path to realizing the shared data model, while providing for control of design, build, and support authority is the use of blockchain technology.



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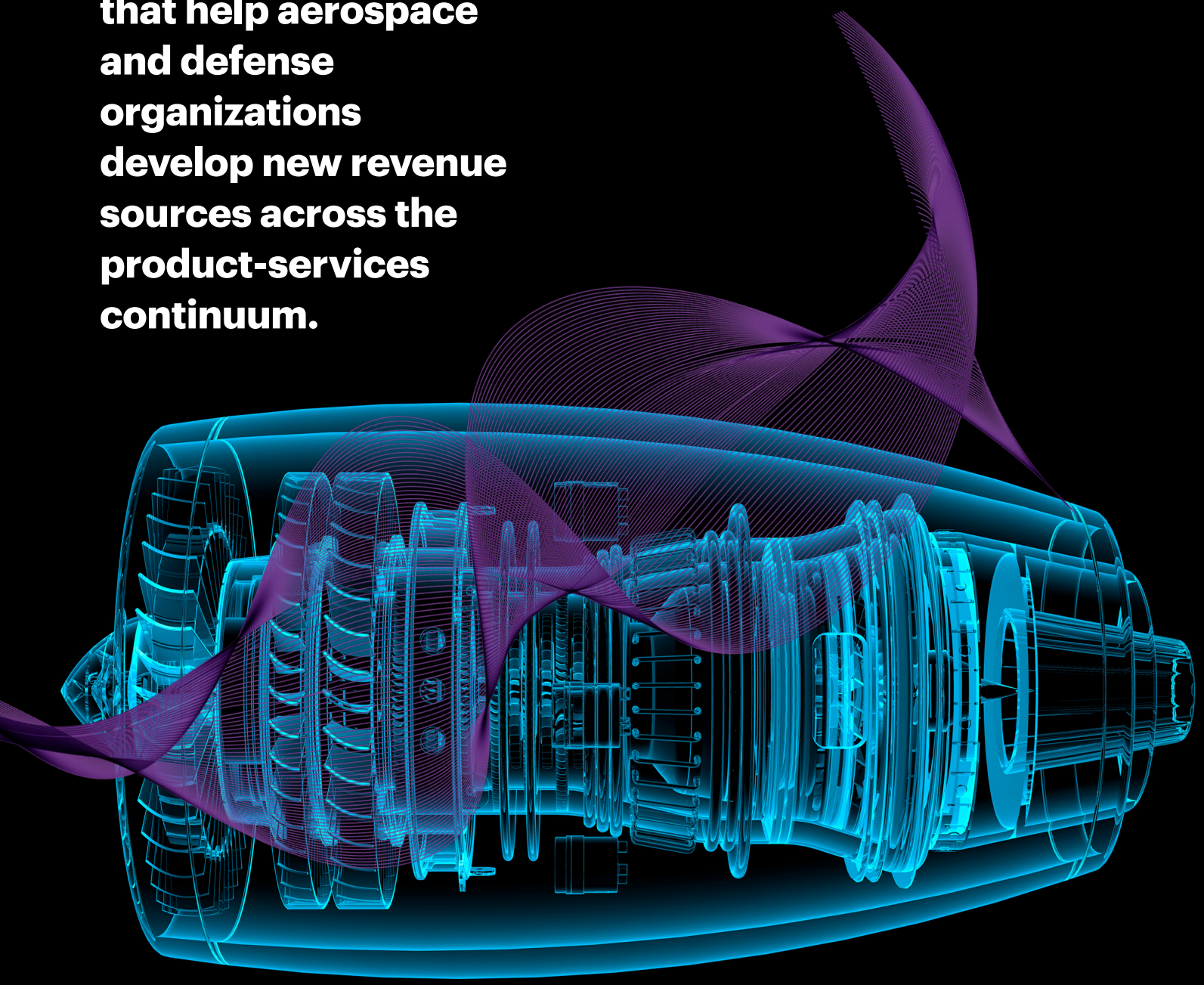

BLOCKCHAIN IN THE DIGITAL THREAD: WHY AND HOW

The shared model of the digital thread poses serious questions and challenges about how companies with design and manufacturing ownership can quickly, accurately, authoritatively, and securely share product and software data with their supply chain partners. As noted above, creating a digital thread by linking together the multiple, discrete ERP, PLM, and other systems scattered across the supply chain with interfaces or a single common database is possible, but very expensive and not suitably secure. Distributed ledger technologies, such as blockchain, provide an intriguing alternative. Indeed, 57% of aerospace and defense companies surveyed by Accenture indicate that they are using blockchain to better manage or use product and usage data.

At its core, blockchain is designed to facilitate accurate, auditable, and secure record keeping across a group of dispersed parties. While originally designed to support financial transactions and settlement, blockchain's characteristics readily lend themselves to the representation of the physical world within the digital thread. The basic characteristics of blockchain are its immutability, support of automation, cost effectiveness, auditability, decentralized nature, and security. These are all basic requirements for managing a complex configuration across multiple parties.

FIGURE 1

CHARACTERISTICS	What It Means	Implication For The Digital Thread
IMMUTABILITY	• Data cannot be altered without knowledge of all stakeholders • Single source of truth across all nodes	Enable sharing of highly trusted product data across suppliers and operators that need to know
AUTOMATION	• Network self-validates all ledger entries • Business rule automation • Near-real-time processing	Accelerate the time and accuracy of data exchange and transformation (e.g., part number reconciliation)
COST EFFECTIVENESS	• Elimination of intermediary costs • Reduction in operational costs related to exceptions and reconciliation	Eliminate the need to build new data hubs or point-to-point interfaces across multiple, discrete ERP, PLM, and MRO systems
AUDITABILITY	• Real time track and trace audit trail • Improve business, operational, and regulatory reporting	Improve ability to monitor engineering changes and respond to regulatory requirements
DECENTRALIZATION	• Assets are controlled by their owners rather than third party custodians • Information can be validated with a consensus mechanism instead of a third party	Employ an infrastructure designed for distributed multi-party use, while retaining rights and ownership of data per contractual provisions
SECURITY	• Public-key encryption provides record-level security of data • No single point of failure – network is resilient against attacks on individual nodes	Increase the trust of participants in sharing data and reduce the risk of compromised engineering or performance information

Because of these characteristics, blockchain has the potential to enable some of the most important use cases across the digital thread, those in which the exchange of design, manufacturing, and support and sustainment data generates business growth or cost efficiency. The digital thread provides opportunities for manufacturers and suppliers to effectively, accurately, and securely collaborate on design and engineering data. It opens new opportunities to more tightly coordinate the production of products and software. It provides a new conduit for in-service performance and configuration data. Across these three areas of the digital thread, blockchain enables four key sets of use cases: the management of identity, configuration, certification, and entitlement and access.

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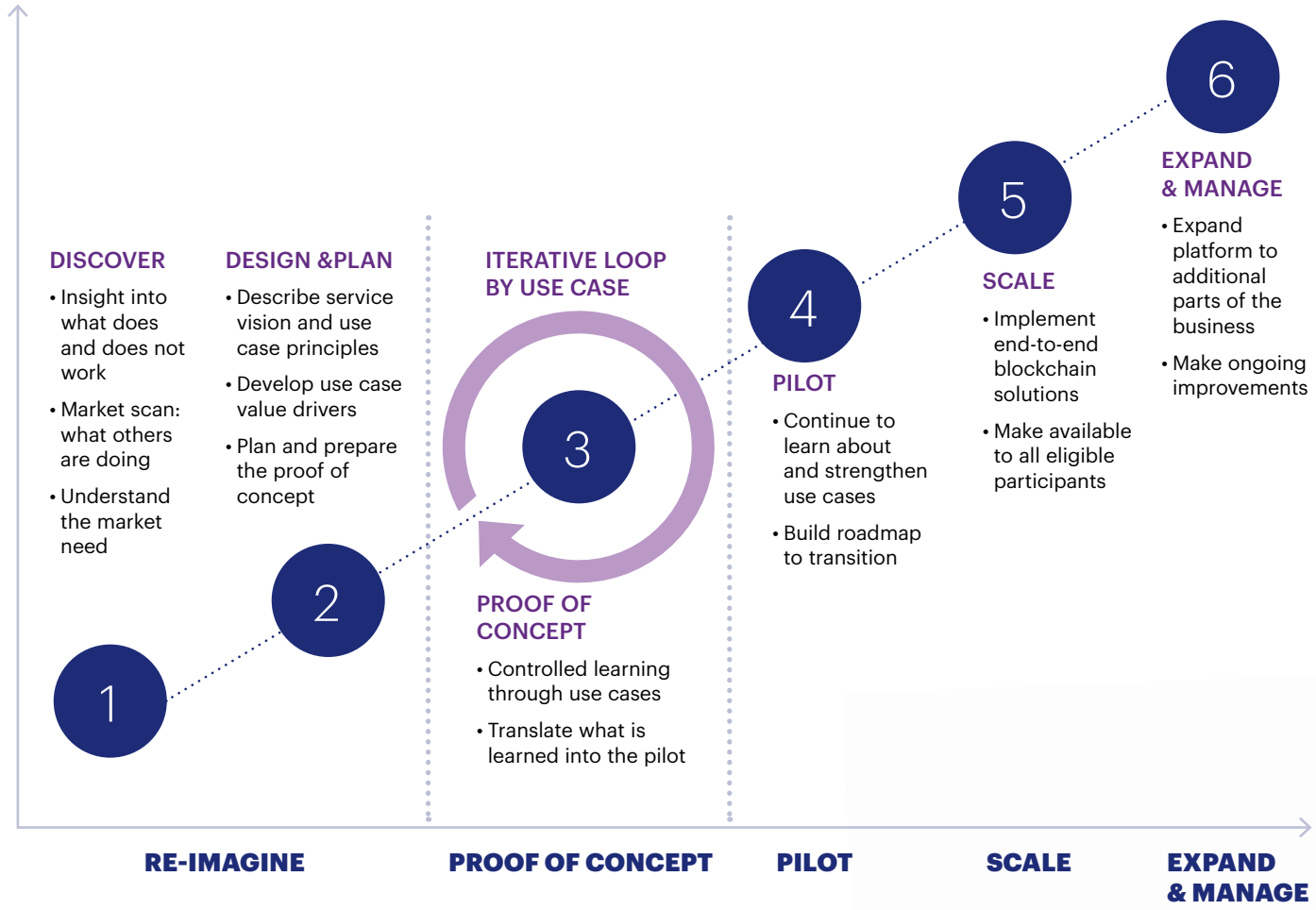
CASE STUDY

In one such proof of concept, Accenture worked with a defense contractor to address the certification and authenticity of critical parts in its supply chain. Working together, we sought to create a blockchain solution that would provide an immutable and auditable digital thread proving hardware, software and documentation authenticity and compliance as components moved through the value chain. Using CryptoSeal and FPGA fingerprinting technology, we gave material a unique identity that was recorded in a private blockchain. This combination of technologies permits the secure and transparent tracking of transactions between OEMs, suppliers, manufacturers and customers. Every time an item in the supply chain is exchanged, the transaction is permanently documented and easily recovered. This dramatically reduces delays, costs, and human error that affect the surety of transactions underpinning the current supply chain.

FIGURE 2 BLOCKCHAIN USE CASES IN THE DIGITAL THREAD

BLOCKCHAIN ENABLED	INTEGRATED DIGITAL THREAD		
	DESIGN	PRODUCE	SUPPORT
IDENTITY	Of Design Authority	Of Supplier	Of Assets and Companies
CONFIGURATION	Of Third Party Design	Of As-Built and Delivered Assets and Software	Of As-Maintained Assets and Software
CERTIFICATION	Of Indivduals	Of Operators, Quality, Material Authenticity	Of Partners, Quality, Material
ENTITLEMENT + ACCESS	To Controlled Data	To Work Instructions	To Technical Publications and Software

FIGURE 3 THE BLOCKCHAIN JOURNEY



GETTING STARTED WITH BLOCKCHAIN IN THE DIGITAL THREAD

For aerospace and defense companies, establishing a digital thread and the use of blockchain within it, is not just a technology exercise. Rather, it must be a structured program that aligns business value, a pragmatic approach to technology, and the engagement of partners willing to collaborate on the digital thread. As companies identify their overall digital thread strategies and scope, they should carefully consider the opportunities and use cases in which blockchain may provide additional value. Rapid proofs of concept and solution prototypes can quickly demonstrate the business value and practicality of blockchain within specific digital thread use cases.

For companies considering blockchain within their digital threads, perhaps the most important consideration will be how to engage suppliers, partners, and customers in a meaningful relationship that employs blockchain to benefit all parties. Blockchain, while a disruptive technology, is by nature a new mechanism for facilitating relationships and commerce. Its ability to create growth and maximize efficiency is directly tied to the willingness of participants from across the value chain to employ blockchain in the service of the digital thread.

Such ecosystem engagement and adoption will require answering questions regarding blockchain in the multi-echelon aerospace and defense supply chain:

1. How can OEMs make it easy for suppliers to participate in perhaps multiple blockchain ecosystems and digital threads?

2. What are, or should there be, common standards for representing part number and other data in the blockchain?

3. To what extent should legacy programs be integrated into the digital thread or instantiated in the blockchain?

A targeted approach, focused on use cases and business value, can help aerospace and defense companies address these questions and move toward securing the industry participation that is required to realize the promise of the digital thread.

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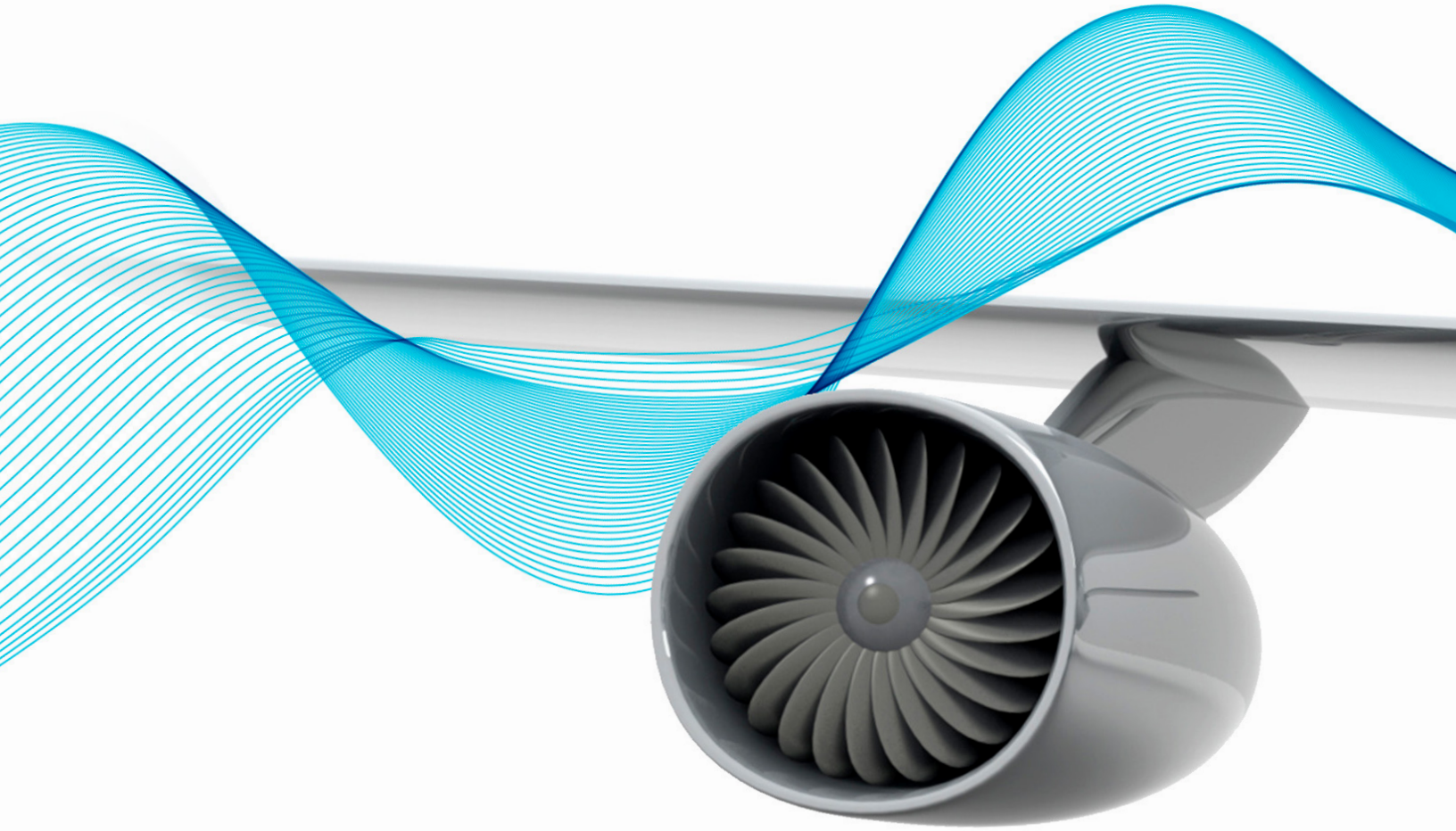

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SOURCES

[1] Digital Thread Accenture Research 2017: a global survey of Communications, Media and High Tech, and Aerospace and Defense company senior executives in North America, Europe and Asia Pacific. This aimed to understand and analyse how companies are evolving their use of lifecycle management technologies into new concepts including Digital Threads and Digital Twins.

[2] Ibid.