



BLOCKCHAIN IN AEROSPACE & DEFENSE

Establishing an industry approach to blockchain governance, standards, and participation

INTRODUCTION

For an aerospace and defense industry that relies on complex global supply chains and securing sensitive information, distributed ledger, also known as “blockchain,” technology offers solutions. Blockchain is already being used widely in financial and other sectors and could address key priorities for the A&D industry, including supply chain provenance, cyber security, and overall risk mitigation. As blockchain technology continues to evolve, A&D should develop a common approach to blockchain governance, standards, and our participation in the ecosystem.

At its core, blockchain is a system that maintains and records data so that multiple stakeholders can confidently share mutual access. It operates by recording and storing every transaction across the peer-to-peer network in a cryptographically-linked block structure that is replicated across network participants. Every time a new data block is created, it is attached to the end of the existing chain formed by all previous transactions, creating a chain of blocks – the “blockchain.” This allows a blockchain to contain a record of all transactions and data recorded in the chain from its inception.

In most modern business applications where data is shared or passed between different entities or business partners, a one-way data flow exists where each entity maintains its own database. Each participant is the administrator of its own database and decides whether and when to modify, append, or reject relevant data received from an external entity. This structure typically results in each party maintaining differing data points or differing states of data, even after attempts to reconcile data with the other participants.

Blockchains enable multiple stakeholders to operate from a single, shared, mutualized data ledger, eliminating the need for separate record keeping and reconciliation. In a blockchain construct, multiple parties can read and write to the distributed ledger while maintaining provenance, control, auditability, tamper evidence, and data integrity.

There is a long history of A&D companies seeking to address industry challenges through access to a mutualized set of data, but most attempts have fallen short. Blockchain offers a new opportunity to address several of our challenges, including:



LOCATION & AVAILABILITY OF PARTS



AUTHENTICITY OF PARTS



“AS-FLYING” CONFIGURATION OF AIRCRAFT



EXPECTED CONTRACT FULFILLMENT, VERIFICATION & PAYMENT



EXPEDITED TRANSFER OF AIRCRAFT OWNERSHIP



CERTIFICATION OF MAINTENANCE AND FLIGHT PERSONNEL

As A&D companies embark on their own digital transformation, technologies like blockchain will form an important piece of new digital data architectures that help them move to new, agile, networked business processes.

The foundation for successful blockchain initiatives is less about a technical implementation and more about building

a willing and cooperative ecosystem of participants. It is important to establish a governance process to achieve agreement across each participating organization, with the opportunity for this process being encoded into smart contracts on a blockchain network.

We believe the time to act is now. Blockchain is revolutionizing business at a pace that will not allow industries to wait and see what happens. To keep up, A&D organizations must educate themselves and assess blockchain’s impacts to determine its value. Consortia are forming and attempting to gain agreement on industry use cases. Without participation, companies risk falling behind or having the future state of business dictated to them. That is why the A&D industry should ensure it is leading when it comes to this new technology and the way the world uses it.

This paper highlights the benefits of blockchain for use cases, the need and value of establishing a ‘minimum viable ecosystem’ (MVE), how to scale the MVE, and actionable next steps to adoption.

USE CASES AND BENEFITS

One of the best ways to use blockchain is through proofs of concept and use cases. This usage can be found across the A&D industry, ranging from business-outcome focused programs to purely technology-driven experiments.

But companies are increasingly asking a simple question: How can we use blockchain to benefit our company?

Blockchain generates unique value through six core characteristics of the technology.

- > **Tamper-Evident:** blockchain creates a permanent tamper-evident record of transactions.
- > **Auditability:** blockchain offers a real time track and trace audit trail of transactions.
- > **Decentralization:** blockchain permits data and assets to remain in the hands of their owners, not a central authority.
- > **Automation:** blockchain supports business rule automation and self-validation of ledger entries.
- > **Security:** blockchain provides record-level data security and a high degree of network resilience.
- > **Cost effectiveness:** blockchain augments existing IT investments with access and accuracy of data.

In many cases, these problems may be addressed to some extent by existing technologies. But would characteristics of blockchain create additional value through supplementing or supplanting those existing technologies?

Based on initial experience within A&D, blockchain can support a range of well-defined business problems across our industry:

Aerospace and Defense Challenge	What Makes Blockchain an Option
Location and Availability of Parts	A <i>decentralized</i> and <i>cost-effective</i> registry of part-inventory locations based on information in existing, distributed systems and locations.
Authenticity of Parts and Supply	A tamper-evident, <i>auditable</i> , and <i>secure</i> record of a part or supplier through its history in the market, including an understanding of export controls (ITAR/EAR) and characteristics like dual use technology.
“As-Operated” Configuration of Assets	A mechanism for collecting configuration inputs from <i>decentralized</i> parties in a highly secure fashion.
Speed of Contract Execution and Payments	An <i>automated</i> set of digital contracts to trigger and execute transfer of value for performance or outcome-based contracts, particularly in the aftermarket.
Lease Return to Service	An <i>auditable</i> , real-time record of the asset coming off lease and its associated documentation. This would compress the time required to return an asset off lease.
Certification of Maintenance and Quality	A mechanism for collecting certification data from <i>decentralized</i> parties in a highly <i>auditable</i> and secure fashion.

A survey of publicly announced blockchain proofs of concept in A&D suggests that companies are actively seeking to address several challenges through the use of blockchain, from configuration management in the aftermarket, to supply chain security, to track and trace of parts.

CREATING A MINIMUM VIABLE ECOSYSTEM

While using blockchain through proofs of concept has generated additional interest and validated the technology's capabilities, this technology can do much more. To perceive its full potential, we must move beyond a simple "original equipment manufacturer (OEM) and tier one supplier" model of the A&D industry. We should acknowledge the multiple layers of relationships that exist from initial product concept, through operational service and support, to asset retirement.

Like other platform technologies, blockchain and distributed ledgers gain their success, power, and influence from scale. For blockchain to move beyond contained proofs of concept in A&D, it needs a minimum level of scale, which we call the minimum viable ecosystem (MVE).

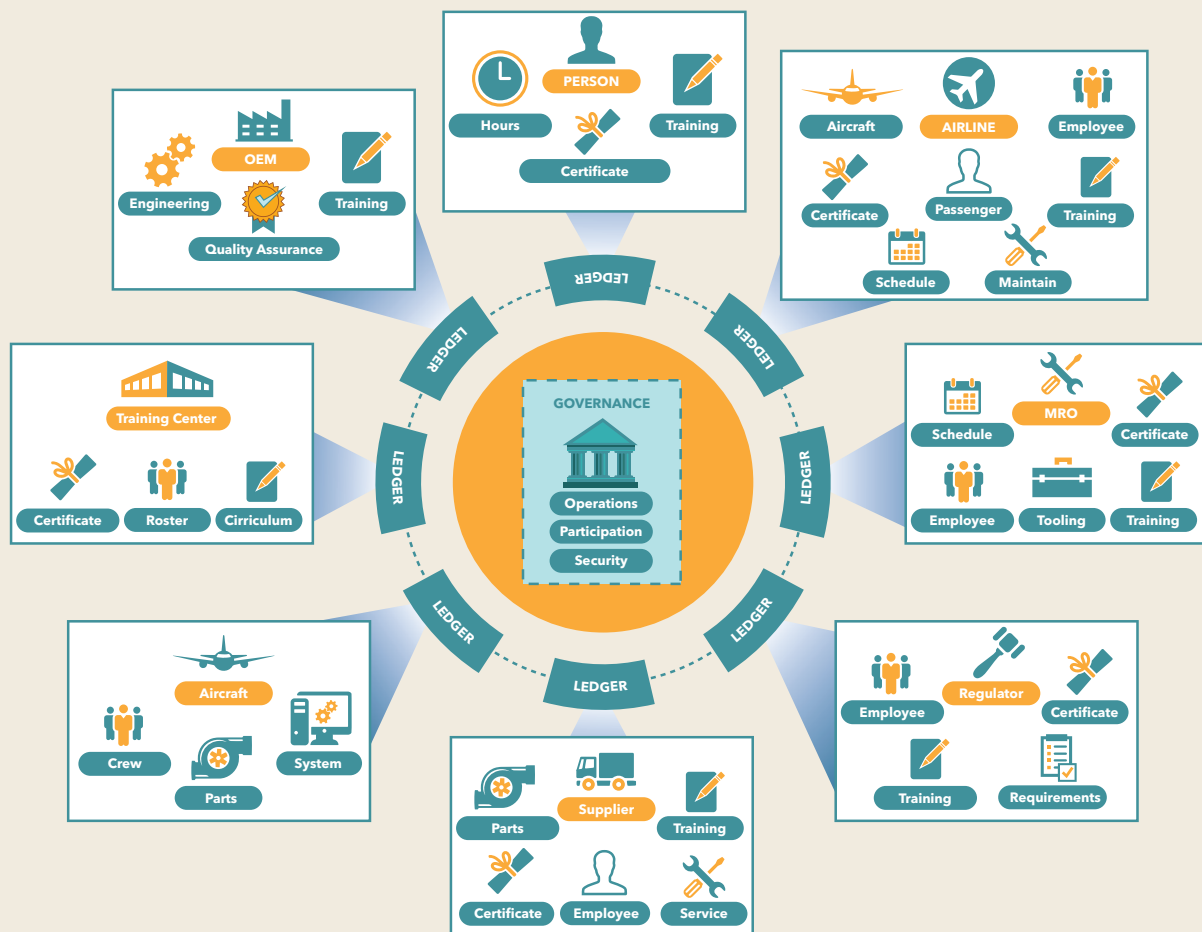
The MVE is the foundational next step for the progression of blockchain into the A&D ecosystem because it incorporates three crucial aspects of blockchain adoption: breadth, scale, and standards.

Breadth

The A&D ecosystem is distinguished by the breadth and variety of companies within it, as indicated in Figure 2. It includes large scale OEMs, governmental entities, defense organizations, small fixed base operators, global airlines, maintenance organizations, and many players in between. So A&D technology solutions must clear a high bar for affordability and interoperability to be effective across the industry.

While each segment of our industry will have slightly different participants in an MVE, the following figure – based on information from The Boeing Company – helps to illustrate a representative MVE for commercial aviation.

Figure 1 Aviation Industry Ecosystem Blockchain Perspective



Many current technologies only focus on specific segments, contributing to process and data gaps. Blockchain can help fill these gaps by reducing the effort behind sharing information and validating contractual performance. These realized efficiencies will improve the reliability and performance of the A&D ecosystem. If blockchain is paired with an MVE of users from a majority of the segments in A&D's ecosystem model, it can show its true potential of serving companies regardless of size, segment, or role in our industry.

Scale

The MVE also provides sufficient scale, which is essential, as the benefits of blockchain increase with growth in participants in a given blockchain environment. This scale could be demonstrated in numerous use cases, such as:

- > The volume of financial transactions across a leasing value chain;
- > The volume of part configuration and quality among operators, OEMs, and maintenance, repair and overhaul service providers; or
- > The track and trace of parts across multiple tiers of a supply chain.

In all instances, a blockchain MVE must engage multiple parties in different segments of the overall ecosystem to generate the scale of blockchain transactions required to drive network benefits.

Standards

Lastly, any adequate MVE must include standards, governance, and predictability. Industry partners in a blockchain must have agreed on mechanisms for publishing, capturing, and interpreting the data stored and accessed through distributed ledgers. The failure to reach common definitions of data types across blockchain networks will significantly increase the complexity of partners' participation in multiple blockchains, particularly as those ledgers reach into the farther tiers of the industry supply and service chains.

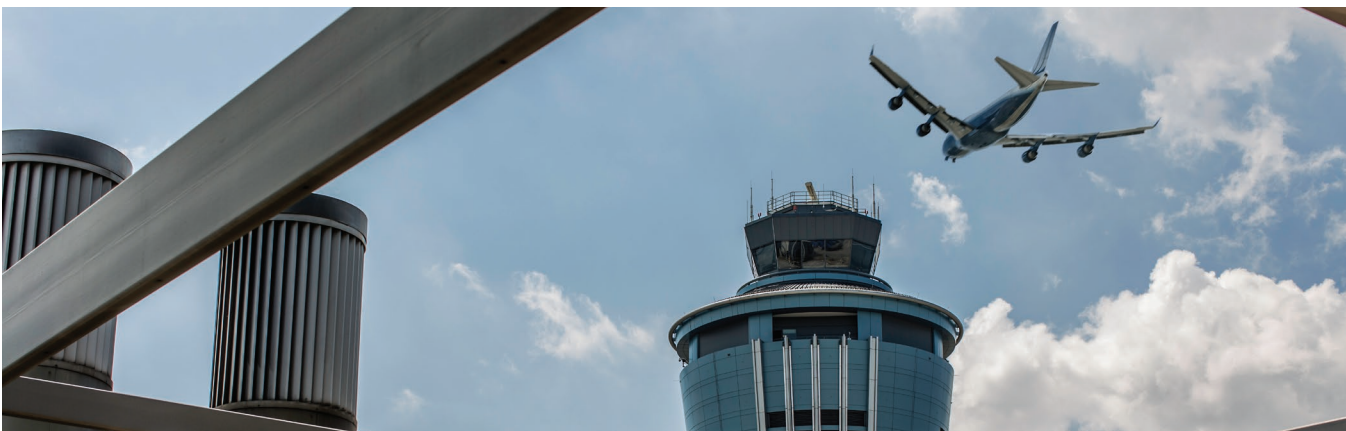
While multiple "OEM" and "tier one" companies may sponsor blockchains, other members of the ecosystem will be faced with the challenge of providing data to multiple ledgers. This "many to many" relationship of participants to private blockchains will quickly accelerate the cost and complexity of blockchain participation, unless general agreement can be reached on a consistent mechanism for registering data into these ledgers and eventually support interoperability among ledgers.

The MVE must also address pragmatic requirements beyond technology adoption. It must show that standards truly facilitate commercial and defense activity and do not create a new set of compliance-driven complexities. It must illustrate how a common governance model can drive not only alignment to standards, but also confidence in how blockchain can support and enhance compliance with regulatory, cyber, and information security obligations of the A&D industry. Demonstrating that blockchain will avoid additional administrative burdens, while supporting or enhancing security requirements and regulatory obligations, is just as important an outcome as building confidence in the technology.

Requirements of Developing an MVE

Getting to an MVE, however, will require a different approach and set of sponsors than the current slate of proofs of concept. Proofs of concept can occur within a company or across a group of players with existing relationships or partnerships. They are, however, exceedingly difficult to scale beyond that. An MVE, across many participants in multiple industry segments, therefore requires a different form of sponsorship.

The organizers of the MVE must be able to demonstrate both a broader interest than that of a single OEM and the relationships to recruit and coordinate different players across the ecosystem to participate. In many ways, the organizers are creating a common good along with the set of standards and norms that must be in place for any complex relationship.



ROLE OF AIA AND THE NEXT STEPS TO ADOPTION

We believe AIA can uniquely facilitate the formation and development of the blockchain MVE. We play a unique role in bridging the interests of industry, the supply chain and customer stakeholder groups, regulators, and national interest. We are a neutral non-profit that can serve as a convener and create a blockchain consortium in the A&D industry.

AIA can also ensure that any effort to establish a relevant use of blockchain technology for A&D is guided by its four strategic focus areas:

- 1. Encouraging investment in aerospace and defense;**
- 2. Strengthening industry-government engagement;**
- 3. Bolstering our global competitiveness; and**
- 4. Ensuring we continue to innovate and attract a 21st century workforce.**

For the A&D industry to “get in the game,” we believe that industry partners and AIA can drive a series of defined steps toward adoption:

- Convene workshops and symposiums to develop, communicate, and drive the A&D MVE vision outlined above.
- Engage industry members and government/customer partners in leadership positions to align on key standards recommendations.
- Recommend specific areas for A&D industry investment in blockchain, government engagement, and international collaboration.
- Promote A&D blockchain positions at key industry and government forums.
- Collaborate with other industry entities and key standards organizations to formulate a cohesive A&D direction and roadmap based on agreed standards.
- Recommend how to structure governance bodies to manage compliance of emerging standards while facilitating the current rapid pace of innovation in blockchain.
- Focus on aligning with standards organizations to advance critical A&D industry use cases while avoiding additional administrative or business process burdens.
- Engage blockchain experts and consortia to discuss best practices and ensure our voice is included.



Blockchain is a team sport, causing new business networks to form that connect players within industry sectors. The success of these initiatives is dependent on ecosystem agreement, collaboration, and enablement to drive the adoption of blockchain. For solutions to scale quickly, integration to existing ecosystems and defined governance will be required.