



# Blockchain Technology and Manufacturing

**THE SHOT PEENER** has always shared current information on the products, processes and services in our industry. You've probably noticed that we are now publishing more articles on what's ahead—the technologies that could influence our industry in the near and not-so-near future.

Blockchain is one of those technologies. It has captured our imagination because of the benefits it could bring to manufacturing. Let's first define blockchain and then explore how it fixes a fundamental weakness in manufacturing. I'll also share how aerospace and defense companies are using blockchain now.

## BLOCKCHAIN DEFINED

Many people connect blockchain with digital currencies like Bitcoin, but diverse industries including finance, healthcare, fashion, diamond mining and food safety are integrating blockchain into their business operations.

One of the best definitions for blockchain is from David Amoyal in his article titled "What is Blockchain Technology?"<sup>1</sup> Mr. Amoyal wrote, "A blockchain is a decentralized, distributed public ledger of transactional data secured by *cryptography*. Transactions are grouped together in blocks and are linked together in a chain to create an immutable ledger that is nearly impervious to fraud. People in the network agree by consensus to any updates in the records (or transactions) in the ledger. This consensus makes the records reliable. These records are also immutable, meaning they can never be erased."

*Cryptography is the method of disguising and revealing, otherwise known as encrypting and decrypting, information through complex mathematics.*

*In blockchain, cryptography is primarily used for two purposes:*

1. Securing the identity of the sender of transactions
2. Ensuring that past records are tamper proof

Lisk Academy ([www.lisk.io/academy](http://www.lisk.io/academy))

Think of a blockchain system has a shared network where every entry is timestamped, secure, and synchronized. Its immutable records can keep thousands of strangers honest and records consistent. And that brings us to the value of blockchain technology to manufacturing: Control of supply chains.



## BLOCKCHAIN IN SUPPLY CHAINS

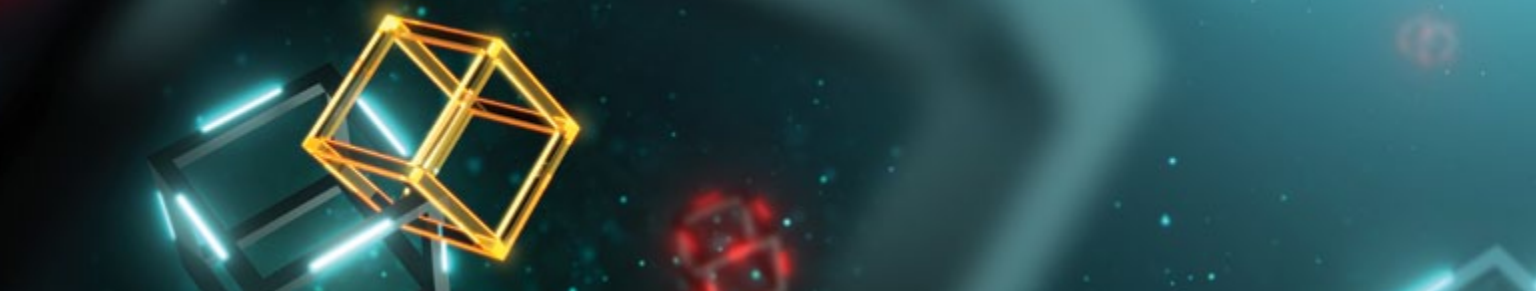
Whether you are an original equipment manufacturer (OEM) or a shot peening facility, your product or service is part of a supply chain. These supply chains are crucial to our livelihoods but they are complex and difficult to control. Problems associated with supply chains include the introduction of counterfeit parts, lack of transparency and accountability, corruption, delays, and unnecessary expenses. Making matters even more complicated, supply chains are often global. Blockchain technology can be the solution for these problems.

*"Consider a large Tier One OEM shipping components to GM or Ford. Without blockchain and other smart technology, the OEM often is unable to trace the raw material it uses. Blockchain shows its value in those second- and third-tier supplier networks by adding a method to control and monitor the process."*

Joel Neidig

Director of Research and Development at ITAMCO

The following is a recap of the three properties of blockchain that will enable the technology to disrupt supply



chain management in a positive way. Much of the information on these properties comes from an article titled “Blockchain and Supply Chain: A Dynamic Duo.”<sup>2</sup> These properties are:

- Decentralization
- Immutability
- Transparency

#### *Decentralization*

Decentralization is the foundation of blockchain technology. Now individual suppliers “own” their data, making it impossible to verify its authenticity in a supply chain. In contrast, every “node” (a computer connected to the blockchain’s network) shares data stored in the blockchain. Data is timestamped and verified in an encrypted process. Furthermore, the participating nodes on the blockchain network verify the authenticity of each block.

#### *Immutability*

What keeps participants from tampering with data in a blockchain network? Blockchains are built on *cryptographic hash functions* that make data in a block chain immutable (i.e, tamper proof). For example, it would be impossible for a participant to raise the price of a product to justify extra payments in an existing record. Everyone in the blockchain can add new data to the blockchain, but no one can change or delete an existing record. If you make a mistake, you need another entry to fix it. (A *cryptographic hash function* is a mathematical equation that enables many everyday forms of encryption. This includes everything from the HTTPS protocol to payments made on e-commerce websites.)

#### *Transparency*

Every transaction and its associated value are visible to anyone with access to the secure blockchain system. Each node, or user, on a blockchain has a unique 30-plus-character alphanumeric address that identifies it. Users can choose to remain anonymous or provide proof of their identity to others. While a person’s real identity is secure within a blockchain, every participant in the blockchain will see all transactions entered with his/her public address. This level of transparency is not possible within today’s supply chains.

## **BLOCKCHAIN IN AEROSPACE AND DEFENSE**

Aerospace and defense companies are early adopters of technology. In fact, according to research by Accenture, a global professional services company, 86 percent of aerospace or defense companies expect to adopt blockchain into their

systems by 2021. Here are three applications of blockchain technology in aerospace and defense.

#### *Airworthiness Certificate Tracking*

An airworthiness certificate shows that an aircraft and its components follow all the airworthiness requirements from regulatory authorities of the country where the aircraft is registered. Tracking certificates and related materials through the lifetime of a plane is complex, slow and vulnerable to fraud. Sanjeev Ramakrishnan, general manager and business unit leader at Wipro, believes the biggest challenges in the current airworthiness certificate system that blockchain addresses are storing and securing the digital assets at every level of the supply chain.<sup>4</sup> (Wipro is a global corporation based in India that provides information technology, consulting and business process services.)

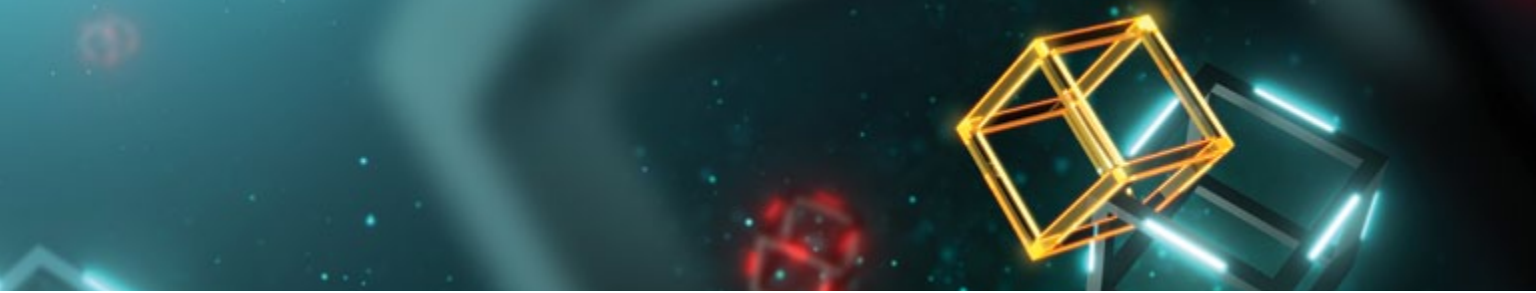
The level of traceability in blockchain provides an automatic audit trail. In addition, the provenance of each part would be registered in a blockchain. “It also prevents counterfeiting as it ensures that each part comes from a genuine partner. The shared ledger ensures a tamper-proof and reliable version of data is available for all participants,” said Mr. Ramakrishnan.<sup>4</sup> Wipro has provided their blockchain airworthiness solution to a global aircraft manufacturer. Their client uses the solution to manage and audit their aircraft part suppliers as part of their quality assurance processes.

#### *Aircraft Maintenance*

Air France KLM’s engineering and maintenance division is evaluating a new digital ledger for managing replacement parts on in-service airplanes. The solution incorporates Microsoft Azure—a set of cloud-based services—and blockchain. Ramesh Sivasubramanian, a Ramco Aviation engineer, recently demonstrated a repair process for an Air

*Here’s how a blockchain platform prevents corruption of its data. Each block holds information describing the block that comes before it in the chain. This information is in the form of a cryptographic hash. A cryptographic hash is a unique ID in the form of a text string generated with the following variables:*

- the timestamp of the current block,
- the list of transactions,
- an identifier of the previous block, and
- variable called a nonce (a number used once).<sup>3</sup>



France aircraft with an “aircraft on the ground” (AOG) status due to a hydraulic system failure. After troubleshooting the mock AOG situation, the engineering team concluded that an actuator needed repair. Sivasubramanian then showed how an Air France engineer could acquire a replacement actuator by creating a blockchain ledger that could be viewed by the engineer, the Air France KLM logistics and loan officers, and any other engineer or technician responsible for getting the replacement part to Air France.<sup>5</sup>

### Parts Tracking

Tracking flight-critical aircraft parts from their origin drives up the cost to operate military aircraft. The Naval Air Systems Command (NAVAIR) and the Fleet Readiness Center Southwest (FRCSW) are exploring a blockchain technology named SIMBA Chain to track aviation parts at maintenance facilities across the country. The Indiana Technology and Manufacturing Company (ITAMCO) developed SIMBA Chain.

NAVAIR’s agreement with ITAMCO gives the Navy access to cutting-edge blockchain code and innovative protocols that can quickly and securely recall data. The Navy plans to combine file access tracking and blockchain into a technology bundle for the management of aircraft parts. The technology will be useful for the U.S. Navy, the U.S. Department of Defense and external industry partners.

FRCSW is a Maintenance Repair and Overhaul facility that manages relationships with much of the Naval Aviation Enterprise, making it well positioned to assist the Navy in reducing costs and increasing efficiencies for maintenance programs across the country and around the world.

ITAMCO is working with the U.S. Air Force and Army to develop similar blockchain-based programs.

### BLOCKCHAIN UNLEASHED

It may take years for blockchain technology to be widely used but if your product or service is part of a large supply chain in aerospace and defense, you may be introduced to it sooner than other industries. We will continue to publish articles on subjects like IoT, artificial intelligence and blockchain to make us more comfortable facing the challenges—and opportunities—facing our industry. ●

<sup>1</sup> <https://www.chainbits.com/blockchain-101/what-is-blockchain-technology>

<sup>2</sup> “Blockchain And Supply Chain: A Dynamic Duo” at <https://blockgeeks.com/guides/blockchain-and-supply-chain>

<sup>3</sup> <https://cryptomaniaks.com/latest-cryptocurrency-news/blockchain/why-is-blockchain-important>

<sup>4</sup> “Is Blockchain Coming to Manufacturing?” by David Greenfield at [www.automationworld.com](http://www.automationworld.com).

<sup>5</sup> <https://www.aviationtoday.com/2017/10/03/air-france-klm-evaluating-mro-potential-blockchain>



*Blockchain technology transforms record keeping in Maintenance, Repair and Overhaul (MRO) facilities.*

*For example, many maintenance records are kept in databases or on paper. In comparison, blockchain makes a “virtual record,” providing a tamper-proof record of the origin of every part on the aircraft, every time the plane was inspected or repaired and by whom, from the time the plane was built. (Photo used with permission by Air France KLM.)*



*Vidal Nuno, work leader for the fuel cells installation shop at the Fleet Readiness Center Southwest (FRCSW), opens a storage cage where ready-for-issue fuel cell parts are stored for legacy F/A-18 Hornets. A joint project by NAVAIR and FRCSW using blockchain technology will improve the efficiency of the distribution system for all parts within the naval aviation community.*

*(Source: [www.frsw.navylive.dodlive.mil/2018/09](http://www.frsw.navylive.dodlive.mil/2018/09))*