Blockchain – a game changer in aircraft leasing?

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The aircraft leasing industry is one of the fastest-growing industries globally. A number of factors have resulted in this growth, including but not limited to, a year-on-year increase in passenger traffic, the rise of low-cost carriers (LCC) and the growth of the APAC market[1].

Given the nature of this capital-intensive industry, it is interesting to note some of the antiquated systems and practices, which are still commonplace. For example, the maintenance of an aircraft is a process that uses cumbersome databases at best and, at worst, a paper-based system prone to losses and errors throughout.

With the rapid rise of digital technologies in other industries, it seems only a matter of time until the aircraft leasing game is affected. To that end, this article will explore the potential benefits of adopting Blockchain technology in the aircraft leasing industry and assess a number of potential use cases, which have a truly disruptive potential for all stakeholders involved.

What is Blockchain?

Blockchain is perhaps the biggest buzzword in the technology landscape today. Put at its simplest: a blockchain is a distributed ledger that provides a way for information to be shared and recorded by a community (DUP[2]).

A major characteristic of blockchain is that every member of the network maintains a full copy of the information and there must be a consensus of all members to validate any new update to the ledger. The information stored can relate to any digital form of information as, for example, but not limited to, transactions, digital assets, digital identities and even contracts. Each new block of information is then added to the chain.

The revolutionary aspect of blockchain, resulting from its distributed nature, is that each transaction can be accessed by the whole network. Therefore, there is the possibility of every party being able to view every transaction in the history of the network. With cryptographic algorithms validating how transactions are bundled into blocks and how blocks are added (consensus), the integrity and immutability of the network is ensured. If any one party tries to defraud or change the ledger, the network will see their copy is not valid and reject it.

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This particular point is important to note, because this allows the blockchain to replace trusted middlemen with a mathematic algorithm, which can perform the same job for a fraction of the cost and in a much quicker time. The trust in this system comes from its cryptography, which underpins its very core.

It is also prudent to note at this point that there are two main types of Blockchain systems: permissionless and permissioned[3].

1. **Permissionless** – a permissionless system is one where anyone can join the network and participate fully in the network – eg, read and write any transaction. It is also known as a public network. The best example of a permissionless blockchain is the Bitcoin blockchain, which underlies the world's most famous cryptocurrency, Bitcoin.
2. **Permissioned** – a permissioned network is one in which permission needs to be given to perform certain tasks. For example, permission may be needed to read certain transactions, it may limit who you can deal with and it may also state who can add and validate blocks to the chain. An example of a permissioned blockchain network is Ripple, where Ripple determines the scope and role of the users on the system.

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[1] Carroll P (16 Jan 2017). Irish aircraft leasing sector gears up for surge based on Asia growth. Available at: http://www.independent.ie/business/irish/irish-aircraft-leasing-sector-gears-up-for-surge-based-on-asia-growth-35369814.html

[2] Piscini P, Guasetella J, Rozman A and Nassim T (24 Feb 2016). Blockchain: Democratised trust. Available at: https://dupress.deloitte.com/dup-us-en/focus/tech-trends/2016/blockchain-applications-and-trust-in-a-global-economy.html

[3] Bauerie N (2016). What is the Difference between Public and Permissioned Blockchains? Available at: https://www.coindesk.com/information/what-is-the-difference-between-open-and-permissioned-blockchains/

We see a number of key blockchain characteristics that could be of real benefit to the aircraft leasing industry if utilised in the correct manner. They are:

- **data integrity** – the immutable nature of a blockchain allows for a greater certainty of data quality than normal database technologies. The underlying cryptography, coupled with the decentralised nature of the technology, makes it practically impossible to modify the data on the chain, or even hack the system. This could prove crucial in the tracking of aircraft parts or even in the fulfilling of obligations of a lease, (cybersecurity article)[4];
- **trust** – a blockchain is an immutable source of truth, providing a single source of the information recorded and validated in the network. Given the disparate and often antiquated database systems used in the aircraft leasing industry, a blockchain could provide the single source of truth for an aircraft or fleet that could be a game changer for a number of tasks which we will discuss later;
- **smart contracts** – a core feature of blockchain is that of smart contracts. Put simply, a smart contract is a computer programme which can be used to facilitate, verify or enforce rules between two parties. For example, after x number hours of use, an aircraft engine needs to undergo maintenance. When this figure is about to be reached, a smart contract could notify the maintenance provider and schedule such an appointment; and
- **additional capabilities** – while the above three points are a flavour of what the blockchain can do, there are a number of other technologies in the ecosystem which can complement the blockchain. For example, the Inter Planetary File System (IPFS) is a layer that sits on top of the Blockchain, allowing for increased storage capabilities – eg, lease or financing contracts could be stored here. IoT and blockchain can also work well together to create an immutable record of all the data with regards to a particular asset.

Lory Kehoe, director at Deloitte and EMEA Blockchain Lab lead, is bullish on the technology and believes these characteristics are a clear reason the technology is here to stay.

"People are still sceptical about whether blockchain will take off. We at Deloitte are firmly of the opinion that the inflection point is just around the corner and that our clients will need to be prepared to take full advantage of this truly exponential technology."

Potential use cases – assessing the potential of blockchain

While there are a number of different use cases, which could prove applicable in the aircraft leasing space, for the purposes of this article we will focus on three. They are: 1)

a blockchain system for tracking aircraft maintenance; 2) the creation of aircraft coins/tokens to eliminate inherent risks for airlines and lessors; and 3) AirChain, a one-stop shop for all stakeholders in the leasing ecosystem.

1. Blockchain for aircraft maintenance

The lifetime of a commercial aircraft can be up to 30 years, which means it may pass through five or six owners before it is decommissioned. Given this level of activity and transfer of ownership, the tracking and tracing of information relating to this aircraft can prove to be an arduous process. This is particularly clear when it comes to the maintenance documents associated with the aircraft.

John Maggiore of Boeing contends 90% of all of these maintenance records are paper-based, with "literally millions of boxes of paper-based documents"[5].

It is easy to understand that this system can have a number of drawbacks. First, having paper-based documents leads to the risk of loss or potentially fraud. The American Airlines case in 2015 was proof that fraud in maintenance can still be an issue[6].

Furthermore, Rudy Byrce of GE Aviation notes that there are frequently paperwork issues when the time comes to evaluate the assets[7]. For example, engines can generate thousands of pages of documents. This is a concern as older aircraft have no chance of having a digital copy.

Second, when it comes to due diligence, all of these records, whether paper-based or scanned copies, will need to be fully evaluated because of the lack of smart characteristics. Even in the current digital systems used for newer aircraft, this can prove a time-consuming task.

When looking at the role blockchain has played in helping to digitise the trade finance process, we can see projects underway; with the likes of the Hong Kong Monetary Authority and state bodies in Dubai to name two, we can see the potential benefit blockchain could play here.

An immutable record of the maintenance history of an aircraft is clearly of benefit to the stakeholders in the leasing community. Any issues arising can be clearly traced to a timestamped record of who performed an inspection and when, meaning a full audit trail in the event of an investigation. Furthermore, there is the potential, by having this single system, to speed up the due diligence process in releasing an aircraft. It could be as simple as scanning a QR code on an engine to see the full history of the asset.

Why stop here? We see companies such as Boeing testing blockchain technology to track not only the maintenance of an asset, but also its whole lifecycle[8].

Similarly, Airbus has discussed how blockchain could be used in supply chain tracking. By using blockchain to underpin the Internet of Things, we can see the potential of two disruptive technologies working in unison to digitise and future proof a difficult process for original equipment manufacturers (OEMs), lessors and airlines.

[4] Piscini E, Dalton D and Kehoe L (2017). Blockchain & Cyber Security. Let's Discuss. Available at: file:///C:/Users/jhallahan/Downloads/IE_C_BlockchainandCyberPOV_0417%20(2).pdf
[5] Seidenman P and Spanovich D (2016). Why Airlines, Aftermarket Struggle With Digital Record Keeping. Available at: http://aviationweek.com/connected-aerospace/why-airlines-aftermarket-struggle-digital-record-keeping
[6] Goglia J (2015). FAA Investigation Substantiates Mechanics Safety Complaint Against American Airlines. Available at: https://www.forbes.com/sites/johngoglia/2015/05/01/faa-investigation-substantiates-mechanics-safety-complaint-against-american-airlines/#3eb7bffa2a95
[7] Goglia J (2015). FAA Investigation Substantiates Mechanics Safety Complaint Against American Airlines. Available at: https://www.forbes.com/sites/johngoglia/2015/05/01/faa-investigation-substantiates-mechanics-safety-complaint-against-american-airlines/#3eb7bffa2a95
[8] Gutierrez C (2017). Boeing Improves Operations with Blockchain and the Internet of Things. Available at: https://www.altoros.com/blog/boeing-improves-operations-with-blockchain-and-the-internet-of-things/

2. Aircraft coins/tokens

The aircraft leasing industry is one of the most-capital intensive industries in the world. Foreign exchange (FX) risk has long been a problem in the aircraft-leasing industry. Granted, this is mainly an issue for airlines, many of which pay for leases and costs in US dollars but make profits in their native currency.

While less of an issue for lessors, any potential interest rate hikes for the US dollar would cause similar impacts to the industry. Furthermore, Basel IV reforms are threatening to increase the amount of cash, which banks must provide against the risk of an airline defaulting on repayments to lessors[9]. While the impact is still to be properly assessed, this could feasibly add to the premiums already paid for leases.

A potential solution to these issues is using cryptocurrencies or tokens to settle transactions between the parties in the aircraft leasing ecosystem. We see a similar initiative underway in financial services with the Utility Settlement Coin[10]. This coin is exploring the potential to create a digital cash system, which can facilitate interbank payments without the need for third parties such as clearing houses which add time and costs to the process.

We can see the potential of OEMs creating a number of coins based in different currencies. Boeing could enable payment with custom cryptocurrencies to enable on-chain foreign exchange (FX) payments with the banking system being used purely as an off-chain periodic settlement layer. Boeing could set the price for an aircraft and the lessor would still be in charge of the paperwork and leasing to the airlines. The lessor would benefit in this scenario by being able to operate in multiple digital currencies with different airlines. Airlines would benefit by being able to operate in digital currencies, which forgoes most of their FX risk.

In the future, if the digital currencies take off and are widely accepted and traded, there is the potential to settle transactions between the ecosystem players without the need for banks being involved in the process. This would be possible by the aviation financer being able to fund the acquisition cost in the digital currency rather than fiat currency. While this idea may seem farfetched to ecosystem players in leasing currently, the rise of Bitcoin has shown that, in the long term, digital currencies have the potential to disrupt the way parties transact with each other.

3. AirChain – a new ecosystem for aircraft leasing

While the first two use cases focus on specific applications and tasks within the aircraft-leasing industry, our third use case looks at the art of the possible with regards to the use of blockchain technology in aircraft leasing.

Many of the tasks and operations, which take place currently – including, maintenance, transfer of title, lease repayments, exchange of value – all happen in siloes. In many cases, it is difficult for any single party in the ecosystem to have a holistic view of their operations. While blockchain is lauded for its ability to streamline and

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digitise, it can also have a positive impact on industries by potentially creating new revenue streams and operating models.

Here we introduce the idea of AirChain – a future system for all ecosystem players in the aviation leasing industry. This private chain would be accessible by all of the stakeholders in the industry, with varying levels of access for each. On the chain, a number of activities could take place. As an immutable data store for aircraft information, the tracking of an asset mentioned in use case 1 could take place.

Furthermore, as lessors and airlines are on the system, smart contracts could be used to automate lease and title exchange. This exchange can be facilitated by what we call "tokenising" the asset, creating a digital token, which represents a physical asset – ie, an aircraft, engine or a part. This token can then be transferred in exchange for a digital currency, like the one we have mentioned in use case 2.

There is also the ability to implement what we call "side chains". A side chain is another blockchain which could interoperate with AirChain, which, in this case, would be called the main chain. This side chain would be the single data store for all of the interactions with a single aircraft. By storing the information in the side chain, the main chain would simply contain a reference (or hash) of the information in the side chain. This is crucial because it means the main chain in the system is not overloaded with information on every aircraft. Having a separate chain for each aircraft would also allow for an analytics layer to sit on top and aggregate fleet information for a particular airline or OEM, which could be shared back in a dashboard format.

A further benefit of having a chain for each aircraft would be to allow certain parties to have read or write access. For example, a maintenance, repair and overhaul company could be given read and write access to document its findings to the chain, whereas a regulator could be given only read access to view the information relating to an aircraft.

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[9] O'Halloran (2016). New banking rules could spell problems for aircraft leasing. Available at: http://www.irishtimes.com/business/financial-services/new-banking-rules-could-spell-problems-for-aircraft-leasing-1.2848746
[10] De Meijer CRW (2017). UBS and the Utility Settlement Coin. Available at: https://www.finextra.com/blogposting/14459/ubs-and-the-utility-settlement-coin

Potential barriers to adoption

While the above use cases work well in theory, based on our experience there may be a number of barriers to blockchain being adopted which we outline below:

- **network effect** – as discussed previously, blockchain is a network-based technology. To operate industry-wide platforms, there is a need for a majority of market participants to join to realise the value and potential that such a system could provide. A concern for a system such as AirChain would be that a critical mass is not reached and that the system fails. However, on the flip side of this, by starting with a small number of companies and realising the value between only a small number of parties, it could be assumed others would join to reap the benefits of the platform;
- **legal uncertainty** – as blockchain is in the early stages of its development, it is still unclear how the technology will be treated by regulators. In the aviation space, there would need to be a concerted by-in from the likes of the European Aviation Safety Agency and the Federal Aviation Administration in the US early on in the process. Furthermore, the validity and legal enforceability of smart contracts is still unclear, and any move to use them in a global system would need to be carefully considered;
- **reluctance of ecosystem players to adopt blockchain** – it is important to assess the benefits for all parties involved in any future state use cases or platforms. For example, would aircraft leasing companies want to share all of their information? Concessions could be made in the system to allow only lessors permission to access the information they want potential customers to see. This is where the governance and operating model of any potential platform becomes a crucial task; and
- **technology concerns** – the core concept of blockchain is still in its early stages. Although it is already possible to leverage the capabilities of this distributed network, advancements in functionality and usability are still to come. Furthermore, there are also concerns regarding the immutability of data in such a system. New regulations, such as the General Data Protection Regulation, will impact how blockchain-like systems are implemented and treated. As such, it is important to take this into consideration when thinking about building blockchain platforms. Last, but not least, governance models related to IT practices will change. The current lifecycle of software needs to be tweaked when considering blockchain: who owns the data, who is in charge of modifying the underlying code, which teams control package deployment and bug fixing in such a system? These are all important questions to take into consideration.

Next steps

So what is next on the blockchain journey? What is clear is that the aircraft-leasing industry appears to be behind the likes of banking, where pilot and production projects are beginning to emerge, such as the aforementioned Utility Settlement Coin and trade finance projects. However, Boeing and Airbus have been active in this space and are beginning to move from what we call the education phase into the testing phase. We also see airlines beginning to test the technology – for example, the start-up Loyyal is beginning to test blockchain technology for loyalty programmes[11].

For lessors, this is the time to begin exploring the technology. As David Dalton, Deloitte EMEA Blockchain Lab Sponsoring Partner notes: "Blockchain is not just a technology that can help digitise many aspects of the airline industry but also create new revenue streams and business models. Early innovators with Blockchain will capture value ahead of their competitors." We would recommend the following steps to ensuring you are not left behind by this ground-breaking technology:

- upskill some technical staff on the technology;
- assess what your competitors are doing in this space;
- talk to your customers about what they are doing in the blockchain space;
- identify the use cases which align with your long-term goals; and
- test the technology with an internal proof of concept.

The future powered by blockchain is closer than many think and now is the time to begin testing the technology and identifying the use cases which could have a long-term positive impact on your business. Given the exponential nature of this technology, the inflection curve may come sooner rather than later, and those who are best placed to capitalise will reap the benefits for many years to come. Now is the time, be ready. ∧

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[11] Rizzo P (2017). 2020 Vision: Why Start-ups Believe Blockchain Will Go Live in Dubai. Available at: https://www.finextra.com/blogposting/14459/ubs-and-the-utility-settlement-coin