

## R3 Pitch Competition

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| Team                | Aero-Knowledge Proofs  |
| Vision              | Privacy Preserving Proof-of-Compliance for Aircraft Maintenance  |
| Sector              | Aerospace Industry   |
| Team                | Huang Yupeng (黄宇鹏), Class 2 of Aviation Logistics 2018 Cohort (18航空物流2班), Guangzhou Civil Aviation College (广州民航职业技术学院), Student ID: 183103040213, Email: <a href="mailto:1173368574@qq.com">1173368574@qq.com</a> (no school email). I have been interested in aviation since I was a young child, and spent my spare time learning about civilian and military aviation, such as history, technology, operations, etc.   |
| General Description | In compliance with international and national aviation regulations to ensure safety, aircraft must be maintained on a regular, disciplined basis by the operator, who keeps a record of flights and maintenance operations. Such records are attested by engineers at various locations worldwide, who presumably do not collude with the operator. Regulators want to know if the aircraft is compliant with some rule sets to certify if it is safe to fly. Ideally, regulators can audit records in real-time to further reduce chances of oversight and possibility of collusion between the operators and the engineers. But some data pertaining to confidential commercial or military operations may need to be kept private. Therefore, we propose a zero-knowledge distributed ledger for aircraft maintenance compliance.   |
| Blockchain          | <p>Aircraft compliance requires provenance of records with a subsequent trusted chain of truth, and shared ledger technology offers the only viable solution for ensuring the trustworthiness of a common set of facts among three major parties</p> <ol style="list-style-type: none"> <li>1. Operators or regulated entities that perform aircraft operations requiring compliance to a regulation, such as airline or logistics company.</li> <li>2. Regulating or auditing or risk-bearing entities verify that all regulated entities conform to the rules and updates the rules when risks evolve, such as the Civil Aviation Administration of China (CAAC) who regulates airworthiness of aircrafts, owners of aircraft who leases their aircraft to others, or entities that financed an aircraft such that the aircraft is the collateral.</li> <li>3. Issuing or attestation entities that provide data to satisfy regulation, such as engineers or technicians attesting to the state of examined components, flight controllers attesting to the departure and arrival of aircraft at various locations, and equipment providing signed readings of sensors.</li> </ol> <p>The operator proves to the regulator that the latest maintenance data indicates the aircraft is airworthy, and the operator proves to the financier that the aircraft maintenance status means it is worth a given value, according to a formula provided by that financier.</p> <p>Although the shared ledger is required to establish trust and provenance, data cannot be stored on the ledger, due to business and regulatory considerations with respect to privacy and confidentiality, and because all encryption has a best-before date. An operator does not want to reveal the details of his operations and assets maintenance status to (business) competitors or (military) adversaries, and the aircraft identity must be kept anonymous from all parties except the regulators and the technicians, whose identities must be kept anonymous from the regulator but if needed the operator can be asked to validate the reports for the regulator. Therefore, instead of data stored on the ledger, proofs (commitments) are stored instead.</p> <p>The identity of the operator, the aircraft record, the report of the technicians, and the identity of the technician who signed the report are private data. The commitment to the aircraft record is public data. There is a record for the airplane that is committed to a public ledger, which includes miles flown. There are records that attest to</p> |

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|                                    | <p>repairs and inspections by mechanics that are also committed to the ledger. The decommitment is communicated to the operator. These records reference the identifier of the plane. Whenever the plane flies, the old plane record needs to be invalidated, and a new one committed with extra mileage. When a proof of “airworthiness” is required, the operator proves that for each part, the mileage is below what requires replacement, or that an engineer replaced the part (pointing to a record committed by a technician).</p> <p>Corda is ideal because of the peer-to-peer ledger concept and flexibility in adding stakeholders, and because nodes depend on how many relevant stakeholders are involved in each aircraft. Thus, there is more levels of confidentiality and privacy than using other types of blockchains.</p> |
| Market Size                        | According to CAPA Fleet Database, the world's fleet of commercial aircraft grew its numbers by 4% in 2017, to end the year at more than 31,000 for the first time. With the global aircraft fleet projected to reach almost 38,000 by 2028, the global aircraft MRO is estimated to reach a 10-year consolidated market size value of around 115 billion USD. In China alone, the civil aviation industry is 2.7 trillion USD, demanding 7690 new aircraft in the next two decades, worth 1.2 trillion USD.  |
| Partners                           | MRO and equivalent companies are the most important participants. The ICAO and other national regulators are the most important partners. Financiers such as banks are also ideal partners. Aircraft manufacturers and other suppliers of aviation components, including machine shops, should also be part of this network.   |
| Competition                        | Aircraft maintenance blockchain is in theoretical stages. China is in a good position to implement this, because of potential of co-ordinated action: all Chinese airlines are responsible for their own maintenance, and purchase parts through one state-owned supplier. There is more risk of cheating during maintenance, and there is no diverse MRO industry like in other countries around the world.   |
| Revenue Model                      | This network benefits verifiers of aircraft records, such as entities that must certify aircraft for certain jurisdictions, resell aircraft, or acquire insurance for aircraft. The revenue model is transactions-based tier-based membership or subscription model.   |
| Distribution Channels              | We may need to experiment with where to start this network. One possible starting point is the business aviation market, which are fairly small, and also used by regulators, auditors, financiers, and other important stakeholders. We may also choose a small jurisdiction to start, such as Macau SAR.   |
| Merits                             | Safety is the most important concern for aviation, which this aircraft compliance system will definitely improve upon. And therefore, risk will be reduced for aircraft and underlying business operations, and also lower costs. Air travel and air transport would be more affordable and acceptable, and will benefit the global economy.   |
| Risks                              | The biggest risk is adoption rate, due to the number of non-commercial entities involved, especially entities related to national governments and international agencies. Another significant risk is regulatory risk because of the political nature of the aviation industry, but an international organisation such as the ICAO both mitigates and increases this risk, depending on their stance.  |
| Next Steps                         | In China, this model may be adopted by a smaller trial group, as stated above. Another possibility is for the air force or naval air force to try in a trial group, and eventually try in a civilian aviation use case.  |
| Favourite Blockchain Twitter Troll | We do not use Twitter in China. Sorry.   |