Promise & Challenges of Blockchain Implementation for Engine MRO

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Etihad Airway Engineering

Blockchain project was sponsored by Mubadala Aerospace R&D program

OUTLINE

- Overview of Etihad Airways Engineering
  - Facility
  - EYE Customers
  - Capabilities
  - Certification
- Sanad Aerotech / **EYE Blockchain Pilot Project**
- Overview of Pilot Project

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OUR MAINTENCANCE AND ENGINEERING FACILITIES

- Etihad Aviation Group owns one of the biggest commercial aircraft services provider (MRO)
- Built on a reputation for service reliability and on time delivery
- Extensive maintenance capability for both Airbus and Boeing aircraft including advanced composite repair, cabin refurbishment, component services, and design, engineering and innovation

SOME OF OUR CUSTOMERS

ETIHAD

Etihad Airways Engineering
EASA P21 Approvals

EASA

Terms of Approval 21J.163 ETIHAD AIRWAYS ENGINEERING L.L.C.
Issue 5, 13/11/2015

Terms of Approval
Design Organisation Approval Certificate
EASA.21J.163

1 Scope of approval

This Design Organisation Approval has been granted for:

- designing major changes to large aeroplanes in accordance with the applicable type-certification basis and environmental protection requirements, in the following areas:
  - Cabin interiors
  - Galleys or other interior equipment
  - and related structure, environmental systems and electrical systems;
- designing minor changes and minor repairs to large aeroplanes in accordance with the applicable type-certification basis and environmental protection requirements, in the following areas:
  - Cabin interiors
  - Galleys or other interior equipment
  - Structure
  - Avionics
  - Installation of avionics equipment
  - Electrical systems
  - Environmental systems
  - Hydro-mechanical systems
  - Powerplant/fuel system;
- designing minor changes and minor repairs to turbine engines and APU's in accordance with the applicable type-certification basis and environmental protection requirements;
- demonstrating and verifying the compliance with the applicable type-certification basis and environmental protection requirements; and
- demonstrating to the Agency this compliance.

2 Categories of products

Large aeroplanes
Turbine engines
Auxiliary Power Units (APU)

4 List of products

[Not applicable]

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P21-J Design Organization

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EASA

PRODUCTION ORGANISATION APPROVAL CERTIFICATE

Reference: EASA.21G.0057

Pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council and to Commission Regulation (EC) No 748/2012 for the time being in force and subject to the condition specified below, the EUROPEAN AVIATION SAFETY AGENCY hereby certifies:

Etihad Airways Engineering L.L.C.
Next to Abu Dhabi International Airport, PO Box 46450, Abu Dhabi, United Arab Emirates

as a production organisation in compliance with the Annex (Part-21), Section A, Subpart G of Regulation (EC) No 748/2012, approved to produce products, parts and appliances listed in the attached approval schedule and issue related certificates using the above references.

CONDITIONS:

1. This approval is limited to that specified in the enclosed terms of approval, and
2. This approval requires compliance with the procedures specified in the approved production organisation exposition, and
3. This approval is valid whilst the approved production organisation remains in compliance with the Annex (Part-21) of Regulation (EC) No 748/2012.
4. Subject to compliance with the foregoing conditions, this approval shall remain valid for an unlimited duration unless the approval has previously been surrendered, superseded, suspended or revoked.

Date of original issue:	20th March 2017
Date of this revision:	20th March 2017
Revision No.:	0
Signed:	Jiří NOVÝ

For the competent authority: EASA

EASA Form 55a Issue 2

P21-G Production Organization

- Only EASA Major Mod Approval in MENA.
- Only EASA Production Approval in MENA.
- Only Flammability Testing Lab in MENA.
- Only 3D Printing Approval for Aviation in MENA

Using its Major Part 21J Design Approval and extensive material testing, Etihad was first Airline MRO under EASA to have approval to design, certify and fly 3D-Printed Cabin Parts
Strata Manufacturing (a Mubadala Company) has been approved to produce 3DP interior parts under EYE's P21 approvals

BlockChain– Partners

1. Sanad Aerotech

2. Etihad Airways Engineering

3. Block. Aero

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Blockchain

Definition of Blockchain

- Blockchain, in its simplest form, is a **decentralized digital database**.
- It is a technology that stores and transfers incorruptible blocks of information across a **peer-to-peer (P2P) network.**
- It is a **"trust-less"** system as special mathematical functions protect every aspect.
- It allows data to be recorded and transferred in a **transparent**, **secure,** and **efficient** way.

Sanad Aerotech in collaboration with Block Aero and EYE launched a Blockchain pilot project to allow Sanad Aerotech and Etihad Aviation Group (as a customer of Sanad Aerotech) to better understand the technology and explore its benefits for aviation MRO. The project was sponsored by Mubadala Aerospace R&D program.

Key Goals

Traceability	Establishes trusted and immutable traceability for ARCs and other key trace documentation.
Speed	Increased asset liquidity is achieved by automating asset digitization creating interactive "Asset Profiles" which are committed to the blockchain
Compliance	Improvement of global safety management systems and compliance with contractual requirements of aircraft and engine lease agreements

A structured approach designed to demonstrate business value through rapid proofs of concept

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Technology Promise:

Creating a single shared overview of the movement of components/ parts/ materials through their lifecycle across the supply chain between various owners/stakeholders:

- Components movement data
- Component usage data
- Component maintenance data
- Asset status-data for residual value monetization
- Financial/contractual transactions
- Auditing & compliance assurance

All stakeholders can easily see what has been done to the component, when, by which technician, and under what certification credentials.

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Benefits (low-hanging fruits):

- Eliminate lengthy engine data-exchange processes without compromising data security/integrity
- Improved insights for repair time and inventory
- Better contract negotiation, tracking, closure cycle
- Fast traceability for troubleshooting, warranty status, insurance claims, certification compliance, etc.

An airline engineer can assess failure of a component to be replaced/ maintained during or after a given flight and create a ***block-chain*** *that allows the process to start and have everything ready for maintenance at an MRO shop somewhere in a different content*

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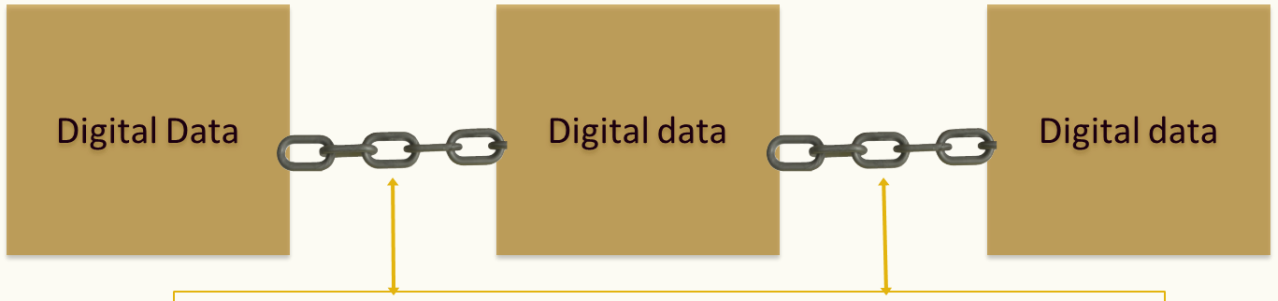
Project Description

- Blockchain is a shared, incorruptible, distributed digital ledger for recording transactions and tracking assets
- An asset can be tangible or intangible (engine, components, certificate, IP, …)
- Many aviation applications are under investigation by OEMs, Airlines & MROs
- Sanad Aerotech in collaboration with EYE and BlockAero launched a pilot to use Blockchain for engine maintenance
- Objective is to gain better understanding of Blockchain and how it can benefit MRO/Parts tracking

The ledger/ account book has the following properties:

- It is digital
- It makes the recording of transactions and tracking of assets easier
- It is shared amongst all
- It is secured and incorruptible
- chronological

'BLOCK' 'CHAIN'



The blocks are linked chronologically by chains that secures the blocks using cryptographic methods that makes it irreversible and immutable.

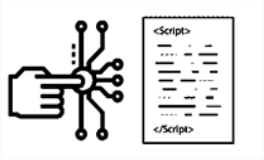
Digital Process/Architecture

Source Data

ERP Systems
Tabular Data
Scanned Records
Human Input

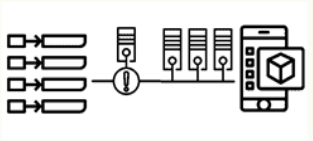
Processing

OCR
NLP
API
Human Input

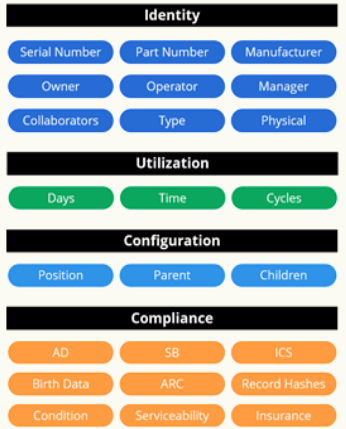


Push-to-Chain

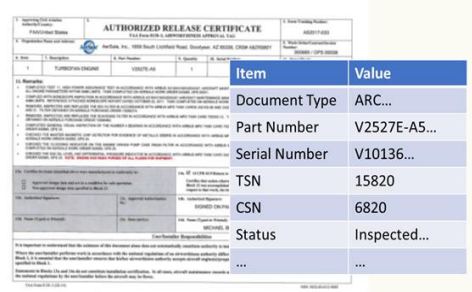
Automatic
Semi-Automatic
Human Validation



Blockchain Asset



Artificial Intelligence (AI)



AUTHORIZED RELEASE CERTIFICATE

Item	Value
Document Type	ARC...
Part Number	V2527E-A5...
Serial Number	V10136...
TSN	15820
CSN	6820
Status	Inspected...
...	...

Blockchain Technology

Common Ledger Advantage

Solving Dispute Resolution

Security & Traceability

Digital Asset

Optimized MRO Process

Reduce TAT

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Engine MRO Process

Asset

LEASING

Current Manual Process

Receive Customer Data
- Work scope
- AD/SB Status
- Defects
- Manuals

Work Instructions
- Accessory Check list with prefilled incoming data

Inspection
- Task cards

Workshop inspections
- Shop reports
- Accessories check list

Config Data Entry
- Config team Manual Entry to cMRO

TRC meeting
- Engine Data
- LLPs
- ADs/SBs
- Etc…

Planning
- Digital production strip/pre-inspection/assy Cards
- Hard Copies non-digital

Maintenance Shops
- MCF reports
- Engine Component
- Accessory Check List
- Missing Parts Incoming/Outgoing

Final Shop Reports
- Final Work Scope
- Configuration List
- AD /SB List

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Benefits/Next Steps

Electronic Signatures
- Enable e-signature
- Enable e-ARC

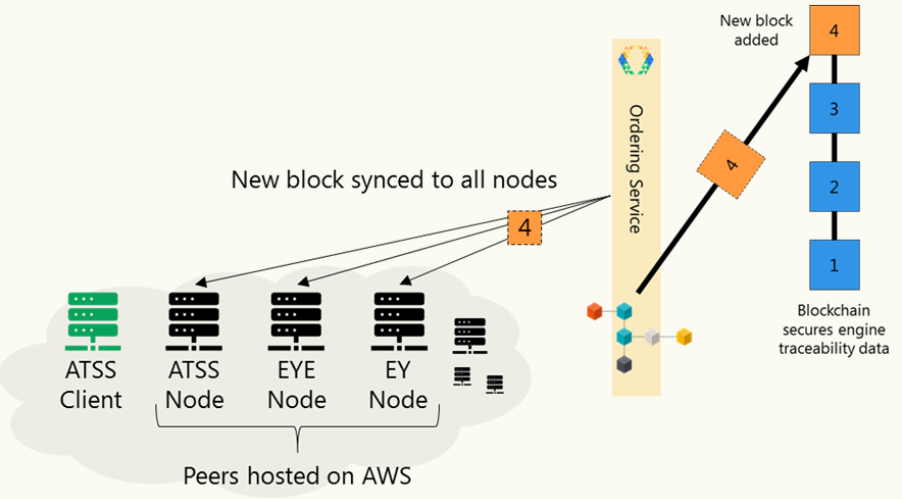
Digital paperwork
- Paperless MRO – Reduce TAT/
- Optimized MRO Transactions

Data Exchange
- Security of data
- Automated checking of data accuracy
- Auditing time reduced

Connected MRO
- Connected with Vendors & Customers
- TAT Reduction due to quick exchanges

Technology
- Own Platform
- Collaborate with customers
- Collaborate with vendors

Understand the technology and its potential benefits to MRO



Implementation Challenges

- Each entity has its own customized IT system for itself. A level of harmonization is required to implement Blockchain efficiently
- Entry to implementation. Where do you start Blockchain tracking? Do you need to run two parallel systems initially
- Which transactional information uploaded to the ledger and which remains at the local IP level?
- A lot of data need to be digitized with very high level of confidence everywhere within network
- Regulatory acceptance and approval for Blockchain transactions
- Agreement on one neutral and affordable platform with each user within network
- Who is willing to offer their precious data for platform development and how do you secure it?
- It's a very complex supply chain. Which "manageable domain" do you chose for successful implementation?

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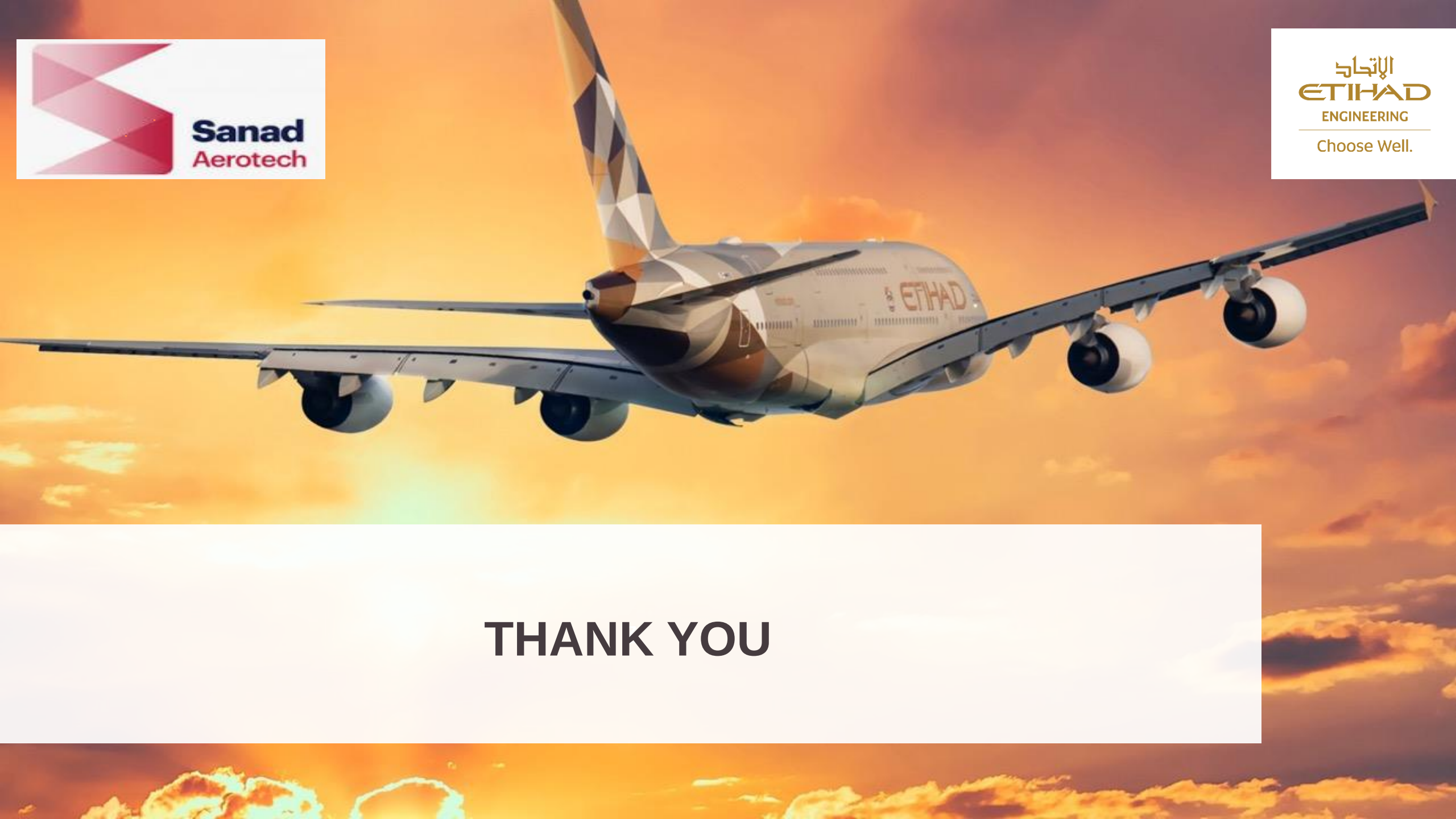
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THANK YOU