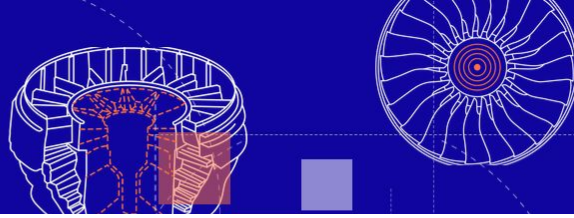


# BLOCKCHAIN INNOVATION CHALLENGE



## SCENARIO

An engine is scheduled to have a softlife proactive replacement of a major component, Line-Replaceable Unit (LRU). In hopes of improving a developing engine health monitoring issue the LRU was replaced. Subsequent flights revealed that the troubleshooting issue is still deteriorating. Eventually the technical team plans an engine removal to schedule it for a shop visit for rectification. As this engine is on a lease, removal of the engine for shop visit warrants a lease return check before it is released it back to the lessor.

### **1. Maintenance Planning Data Downloads**

Rolls-Royce TCAv Planners downloads the Maintenance Planning data for the Airline aircraft fleet's engines as generated from the Airline's ERP system. This exercise is currently done repetitively on a daily basis.

### **2. Line Maintenance Tracking Chart Updates**

The data is transferred to Rolls-Royce's Line Maintenance Tracking Chart (LMTTC) on Excel. RR TCAv Planner decides which engine tasks are due to be carried out within the next 30 days.

### **3. Work Request Input**

Rolls-Royce Service Representatives may need to raise ad-hoc engine tasks to be carried out for various technical reasons to help address reliability concerns arising from the weekly Engine Health Review.

Rolls-Royce TCAv Planners gets the ad-hoc work scope from the Work Request Input (WRI) before planning out the Work Instruction (WI) issuance to SIAEC in the Rolls-Royce Maintenance Instruction (RRMI).

#### **4. Issuance of Work Instructions and Purchase Orders**

Work Instructions based on the LMTC and WRI are created on the RRMI Excel sheet before exporting each WI into a PDF format. WI is then instructed via email to SIAEC PDD. Airline MPC is kept in the email loop

The WI issuance should be accompanied by a Purchase Order (PO) to SIAEC to allow the task to be invoiced against it. The PO is based on a contractual price catalogue. If the service is not found on the catalogue, SIAEC Purchasing will respond with a quote for approval by RR Purchasing.

#### **5. Issuance of Task Cards and Work Plan Update**

Work Instructions received by SIAEC PDD. Dependant on the type of work, the appropriate task cards (e.g: Special Inspection, Supplementary Job Card) is created and issued to SIAEC LAE for work completion.

All new tasks are updated by SIAEC to Aircraft OEM onto a Work Plan (Excel) used in the daily Production Input Meeting (PIM) briefing.

#### **6. Production Input Meeting**

For the aircraft that is going to be on-ground on the next day, the Work Plan (Excel) is referenced during the PIM to confirm which tasks will be carried out by SIAEC. The Aircraft OEM chairs the daily PIM while SIAEC provides the feedback on the available manpower resource in order to accept or defer the tasks to be carried out.

#### **7. Task Attempt - Completed / Deferred**

The task gets completed by SIAEC during the assigned ground time. Job Card is stamped off with the approval number by the verifying personnel and sent to the Tech Records department for safe-keeping. SIAEC MPU updates SIAEC internal database and close the ERP notification that the task is completed. A list of completed tasks for the day is compiled and emailed out to the Aircraft OEM, Airline and RR. The Work Plan (Excel) is updated that task is completed and taken off the list.

For various reasons including lack of manpower resources, task may be deferred for completion by SIAEC. Work Plan is updated that task is still outstanding.

### 8. LRU Change and Engine Change

The replacement LRU needs to come with aviation standard official paperwork (ARC, NIS etc.) to provide necessary authentication for the SIAEC LAE before installing on an operating aircraft. These documentations are typically hardcopies and possibly kept with the logistic supply chain or generated by the last operator / MRO Service Provider. Keeping track and physical paperwork is challenging and any lapse would delay the usability of the spare LRU, rendering it useless until all documentation is made available.

Keeping true with the scenario, eventually despite the LRU replacement did not helped mitigate the deteriorating engine health monitoring trend, resulting in a planned decision to remove the engine for shop visit rectification.

In the event of an Engine Change, Process Steps 2b-7 is repeated to get the work instructed, planned and attempted.

### 9. Engine Stand

The engine is transported from the aircraft to the PowerPlant Shop (PPS) by SIAEC QAT. The engine can only be transported using a specific type of Engine Stand. Rolls-Royce has equipped these Engine Stands with global IoT Trackers that allows for real-time asset management.

The data from the IoT-enabled Engine Stands combine with other data sources would allow the tracking of engine and stand at any point.

### 10. Powerplant Shop Works and Engine Checks

Repair works is outsourced to MRO Service Provider, located outside the SIAEC compound. At the PPS, the following activities needs to take place before the engine can be handed over to MRO Service Provider:

- Buyer Furnished Equipment (BFE) removal
- Engine Receive-In/ Dispatch Check
- Lease Engine Return Check

These activities would include inventory and visual checks of external parts and photo taking of engine with the stand

This documents are completed by SIAEC Tech and LAE. Once completed, the documents are verified by Airline MPC.

### 11. Defect Rectification (Spare Required)

During Lease Engine Return Check, visual inspection by found that an oil tube has been damaged and need replacement. SIAEC LAE proceed to raise a Supplementary Job Card (SJC) in order to request the required spares. Based on the SJC, the SIAEC Planner will raise a Material Request on SIAEC ERP System. A Pickslip is generated from the Material Request based on the SJC.

### 12. Material Fulfillment and Repair Completion

SIAEC Warehouse will prepare the required spares based on the Material Request. The available quantity of the spare is updated on SIAEC ERP System

Collection team collects and delivers the spare to the requesting planner. Printed pickslips presented by the Collection team during handover for reference and acknowledgement.

SIAEC Planner will update spare status on the SIAEC ERP system and inform the SIAEC LAE to collect their spares

The spares is used in the repair works. The SJC is updated.

### 13. Documentation - Engine Off-Log

On top of the checks, for any engine exiting the SIAEC compound, Engine Off-Log information needs to properly documented by SIAEC and passed on to the MRO Service Provider.

This Information is crucial for the shop induction and workscooping requirements of the engine during the visit. If this information is lacking, it may result in a deferral of the shop visit or missing an induction slot.

#### **Engine Off-Log includes:**

a) Engine removal notification (Word file from SIAEC Tech Records) - Documents the engine's "mileage" or Flight cycles/hours accumulated at the time of removal. The information comes from SIAEC LAE.

b) Components Life (Excel, ERP) - Documents the list of specific LRUs (Fuel Pump, etc) "mileage" or Flight cycles/hours accumulated at the time of removal.

c) Non-Modification/Modification Service Bulletins accomplishments - Documents the engine's "mileage" or Flight cycles/hours accumulated at the time of removal.

#### 14. Engine Returning to PowerPlant Shop

After the repair work has been completed, the MRO Service Provider will return the Engine together with the Engine Shop Visit reports detailing the various repairs/replacement that was carried out. Engine Shop Visit report is issued to RR Lessor.

During the shop visit, it is important to keep track of the repairs done and the action taken towards various part components within the engine which include removal and replacement. These activities need to be well documented together with part serial no and equipment no. Documents also need to be verified and stamped by the responsible personnels.

#### 15. Engine Returning to Service

For engine returning to service on an aircraft, the following activities need to take place:

- Engine Receive-In/ Dispatch Check
- Lease Engine Re-delivery Check

These activities would include inventory and visual checks of external parts and photo taking of engine with the stand.

These documents are completed by SIAEC Tech and LAE. Once completed, the documents are verified by Airline MPC.

#### 16. Engine Preservation - Humidity Tracking

When the engine is off the aircraft, it needs to be properly preserved by ensuring that it is not exposed to high levels of humidity. Methods of preservation include using a Humidity Sealed Engine Cover or storage in a Hot Room.

During the preservation, crucial information such as humidity levels need to be recorded in order to establish the integrity of the engine. Engine conditions can be tracked using IoT enabled Engine Stands and also sensors in the Hotroom and Humidity Sealed Engine Cover.

#### 17. Job Completion and Billing

Job completion is updated on the ERP with the proof of updated Tech Records and scanned Job Cards. The invoice is billed to RR Purchasing. Any differences in the quoted work will need to be approved before payment is processed.

The following is a summary of the purchasing process:

Work Instruction → Quote (as necessary) → Purchase Order → Approvals → Completion of tasks with Jobcards → Submission of billing review → Approvals → Invoicing → Approvals → Payment.