Supply Chain & Predictive Maintenance

October 5, 2017
Speakers

Andy Schmidt
- SVP, Intelligent Solutions
  - Digital Services
  - Technical Consulting
  - AAR Ventures
- 32 years of aviation experience
  - Flight Test Engineering
  - Consulting & Banking
  - Aftermarket Services
  - Boeing, OW, Macquarie, ATK
- Topic: Panel Moderator

Sakher Haddadin
- Head of Logistics
  - Warehousing
  - Internal and external logistics
  - Inventory management
- Experience
  - Startup airlines
  - Supply chain optimization
  - Cost reduction
  - RJAF, RJ, Wataniya Airways
- Topic: Logistics outsourcing to help MROs focus on their core business

Matt Davies
- SVP, Technical Services
  - Value Engineering
  - Warranty Management
  - Contract Compliance
- 20 years in aviation
  - Power Plant Engineering
  - Reliability & Cost Control
  - Repair Cycle Management
  - GE, Honeywell
- Topic: Operator and Repair Station Alignment

Rodolphe Parisot
- SVP Digital & Innovation
  - Digitizing Services
  - Digitizing Operations
  - MRO Innovation Lab
- 16 years of experience
  - Aircraft engineering
  - Health Monitoring
  - Component & Engine Repair
  - Air France
- Topic: How big data helps to improve the MRO supply chain
Aircraft Health Management & Prognostics

- Early fault recognition
- Correct classification and assignment of faults

Condition Monitoring

- Identify the nature or cause of a fault

Detection

Diagnostics

- Corrective
- Predictive

Maintenance

Prognostics

- Assess deviations or degradations from normal operating conditions
- Predict remaining time before failure
Predictive Maintenance & Supply Chain Alignment

SUPPLY CHAIN

Matl Planning & Allocation

Maintenance

Repair

Part Issued & Replenishment

Improved Operational Performance & Better Business Results

Predictive Maintenance Trigger
How often are parts pulled unnecessarily or unexpectedly because of misalignment?

How much disruption occurs when this happens? How much does this cost?

Is there a “joined-up” approach to better detect and rectify unnecessary or unanticipated removals and supply chain misalignment?
Sakher Haddadin

**Topic:** Logistics outsourcing to help MROs focus on their core business
Matt Davies

**Topic:** Operator and Repair Station Alignment
Rodolphe Parisot

Topic: How big data helps to improve the MRO supply chain
MRO Supply Chain supported by Big Data

MRO Europe – October 2017

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Journey of MRO Supply chain supported by Big Data

- Combine Operator & MRO Experience
- Agnostic capabilities
- Operation driven (D&Cs)
- Predictive maintenance
- Quick Fixing
PROGNOS for Aircraft
Predictive feature

5QA1 (Feed pump in NOGO position) showed impending failure signal

Swap of positions: pump about to fail in a non-critical position, for study, and a healthy one in critical position

3 weeks after, pump failed in Shanghai (GO IF)

Predict supply chain demand
⇒ 2 days of A380 grounding avoided!
PROGNOS for Aircraft
Curative feature: quick fixing for sporadic failures

Failures appear on ECAM without any detailed information (e.g. transfer pump issue)
Mechanics follow the troubleshooting manual steps

With Prognos, sub-system is directly targeted (e.g. pressure switch)
Mechanics go directly to the effective AMM task

- Up to 3 weeks in case of sporadic failures
- Unnecessarily pulled components

PROGNOS: failures are fixed within TAT
Decrease irrelevant supply chain demand / decrease NFF rate
Journey of MRO Supply chain supported by Big Data

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- Quick Fixing
- Optimized Component Repairs
Optimized Component Repairs

Big data @ test bench

- **Test LRU on bench**
- **Already Experienced? Skip Trouble Shooting**
- **“Classical” Trouble Shooting** → Time & spare parts
- **Repair Spare parts**
- **Datalake**
- **Acquiring Experience**
- **Gaining from Experience**

- More comprehensive repair
- Better TAT and cost – less spare parts
- Better Reliability
Optimized Component Repairs

Refined assessment of testbench measures

Acquiring Experience

Gaining from Experience

Test LRU on bench vs. Cloud of points

Fine measures (qualitative vs. binary)
Identify single points
- Rogue unit
- Deviation (predictive maintenance)

- Better Rogue Unit identification & repair
- Less NFF
- Better Reliability (less « zero hours »)
Journey of MRO Supply chain supported by Big Data

- Combine Operator & MRO Experience
- Agnostic capabilities

- Operation driven (D&Cs)
- Predictive maintenance
- Quick Fixing

- Optimized Component Repairs
- Optimized Inventory Sizing
Inventory optimization in aeronautics is complex.

- **Option 1**: Pretend it is simple and apply simple tools like Poisson law, safety stocks or Min/Max.

- **Option 2**: Embrace this complexity through advanced methods, such as probabilistic forecasting and quantitative optimization.

### An innovative approach

- **OLD WORLD**
  - Traditional time-series forecast
    - Time-series analysis
    - Workstation
    - Excel sheets

- **NEW WORLD**
  - Probabilistic forecast
    - Big data and machine learning
    - Cloud computing
    - Collaborative web app
How does it work?

- **Agility**: software on top of the existing ERP, no IT change needed
- **Data crunching** and probabilistic simulations at scale through Cloud Computing
- **New type of modelization**: simulate all scenarios instead of just the most likely one
- **Rational and consistent decision making**: considering both financial & operational interests
AFI KLM E&M is working, since 2015, in a collaborative project with its partner LOKAD

12 months after implementation:

- **4.6% reduction** on rotatable component inventory with no impact on Service Level
- **Optimized distribution** of the pool within AFI KLM E&M worldwide inventory network
MRO supply chain and Big data

Next Steps

- **Open**: integrate customers, partners, suppliers, competitors

- **Fully integrated and transparent** Supply Chain. M2M capabilities

- **Agile**: think big, start small, scale fast

- Entire data spectrum. MRO/Airline profile brings more value to your data

- Co-design new Services with Customers
The MRO Lab

Adaptive Innovations
Initial Questions

- What is the biggest challenges you see preventing tighter alignment

- What do you need to accelerate and improve your efforts to better align your supply chain? Internally? From OEMs? From your customers (Matt & Rodolphe)? From your suppliers (Sakher)

- Open to audience