Bottleneck-focused

Production Planning and Control

based on Goldratt`s „Theory of Constraints“

Dipl.-Ing. MBA Thomas Hoffmann
Technical Director
tom.hoffmann@lhaero.com
Company Overview
Key Facts for 2013

- Specialized in Turboprop and small Turbofan Engines
- 100% subsidiary of Lufthansa Technik AG
- 490 employees
- More than 220 Mio. € Revenue
- More than 100 Customers
- 480 Engines repaired and overhauled (per year)
- Service Center in Tulsa, Melbourne, Beijing and Buenos Aires
- Lease engine portfolio of more than 50 engines
- On-site services (300 events per year worldwide)
- 24/7 AOG hotline
Company Overview

Lufthansa Technik Product Division „Engine Services“

Lufthansa Technik AERO Alzey – Production System
Company Overview

Competence Center for regional aircraft engines

GE CF34 Turbofan Engine
PW100 & PW150 Turboprop Engine
PW 901A/C Auxiliary Power Unit
Company Overview

Typical workflow at LTAA
Production System

Major Production Challenges

- Engine removals from aircraft mostly driven by unforeseen issues
  - Shop load forecast difficult

- Workscope mostly based on findings
  - Repair can require 100MH or 1500MH

- Many material sources
  - Repair of original part, new material, used material

- Many Customer decisions during shop visit
  - Mainly cost driven

- OEM requirements to consider
  - Deviations from manuals all to be accepted by aviation authority, OEM and customer
Production System

Major Production Challenges

- Engine removals from aircraft mostly driven by unforeseen issues
  - Shop load forecast difficult due to strong capacity fluctuation
Production System
Former Production Monitoring & Control at LTAA

- **Daily production meetings**
  - Up to 90 engines to be discussed
  - 25 Participants, 2 hours
  - Data collection on the shop floor to fill individual spread sheets (1 hour preparation)
  - Afterwards information needs to be distributed (1 hour)
  - Not all issues were addressed
  - No documentation of decisions

- **KPIs were only available looking backwards**
  - Already too late for corrective actions
  - Justification discussions instead of pro-active solutions
Production System

New LTAA Production System is based on Goldratt's Theory

- LTAA's production system is based on Goldratt's Theory\(^1\)
- The throughput of any linear production is always limited by a single „bottleneck“
- In a series of funnels, the „bottleneck“ is the funnel with the smallest outflow surface
- The task is to IDENTIFY and RESOLVE bottlenecks continuously

\(^1\) [„The Goal“ by Eliyahu M. Goldratt and Jeff Cox]
Production System
New LTAA Production System is based on Goldratt’s Theory

- Goldratt suggests in his „Theory of Constraints“ five steps to eliminate constraints:

1) Identify the constraint(s).

2) Exploit the constraints by keeping it running.
   - Protect it with a buffer.
   - Aim for alternative routings.
   - Avoid defects by improving the quality.
   - Ensure it is properly maintained.

3) Subordinate all other resources to the constraint, as the constraint affects the bottleneck capacity and therefore determines the output of the entire production.

4) Elevate the constraint by increasing the capacity, e.g. by buying an additional machine or working overtime.

5) If the constraint has been resolved, revolve to step one.
Production System

Business Strategy governs Information System

**Business Strategy**

**WHERE**

- Customer Intimacy
- Open Slot Philosophy
  - Customized workscopes
  - Quick response time
- Operational Excellence
  - Highest quality standards
  - Cost efficient workscopes
  - Short lead times

**IS Strategy**

**WHAT**

- One database
- Full transparency of all production processes
- Easy access to information
- Forecast of workload, material, bottlenecks (Goldratt)
- Paperless production
- Greatly reduced communication efforts
- Constant Improvement of IT system

**IT Strategy**

**HOW**

- Real-time Scheduling System (FastPro) forecasting bottlenecks
- User specific visualization & workflow platforms
- Dedicated SQL server – independent from ERP system
  - easy, fast improvements of applications
- MS Visual Studio (interface, complexity)
Production System

Typical workflow at LTAA – Network plan
Production System

Goldratt’s theory assigned to LTAA’s Production System

- **Main Production bottlenecks at LTAA are:**
  - Capacity (man power)
  - Material availability
  - Tooling
  - Deviations from OEM technical documentation
  - Production line stops

**Identify Bottlenecks**

In order to identify a bottleneck, all workflows are visualized to everyone involved in the process – from mechanic to manager

**Resolve Bottlenecks**

In order to resolve a bottleneck, all critical workflows are addressed in dedicated workflow databases
Production System

IT architecture at LTAA

LTAA ERP System

Lufthansa Technik AERO Alzey – Production System

Scheduling/Timing Line Stop Management

SAP

FAST/pro

Oracle

FAST/pro

Shop Performance Viewer

FAST/pro

SAP

Concessions

SQL

Microsoft SQL Server

Workflow Apps

FAST/pro

Financial Performance Viewer

FAST/pro

SAP

Concessions

SQL

Engine Shop Visit Viewer

FAST/pro

FAST/pro

Material Planning

Tooling Delivery

Concession Database

Linestop Management

Bottlenecks

Bottlenecks

IDENTIFY

RESOLVE

Capacity Planning
Production System
Practical implementation
Lufthansa Technik AERO Alzey – Production System

Production Planning

Success so far…

- Fully transparent production system → all information is available for everybody
- Real-time monitoring and control of all production processes → less communication/meetings necessary
- Each LTAA bottleneck addressed in dedicated workflow databases
- Simulation of the future using FAST/pro Scheduling technology to identify and resolve FUTURE bottlenecks
- Increased work-center efficiency
- All production KPIs enhanced (TAT, CDP, Efficiency, TCRR)\(^1\)
- Significantly higher engine output per month @ same workforce size

\(^1\) [TAT=Turn Around Time, CDP=Customer Delivery Performance, TCRR=Test Cell Rejection Rate]
Vielen Dank für Ihre Aufmerksamkeit.

Thank you for your attention.

General Contact: lhaero@lhaero.com / www.lhaero.com
Marketing & Sales: sales@lhaero.com
AOG & On-Site Services: Worldwide (+49 (0)172 620 3503), Americas (+1 918 605 1883) & Australia (+61 409 368 648)
Engine Lease Services: elss@lhaero.com

Copyright © 2013 Lufthansa Technik AG. All rights reserved.

The information contained in this presentation is proprietary to Lufthansa Technik AG and is disclosed in confidence. The presentation and the information contained herein shall be kept strictly confidential and shall not be used, disclosed to others or reproduced without the express written consent of Lufthansa Technik AG. Nothing contained in this publication shall constitute any warranty, guarantee or liability for Lufthansa Technik AG, its subsidiaries and affiliates but is for information purposes only. Accordingly, Lufthansa Technik AG its subsidiaries and affiliates neither expressly nor conclusively accept responsibility or liability for the actuality, accuracy and completeness of the statements and information contained in this publication.