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Maintenance Work Order Natural Language

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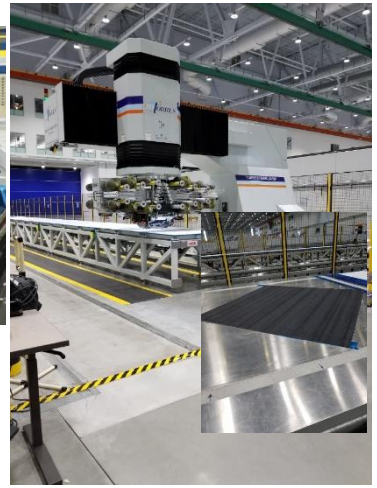
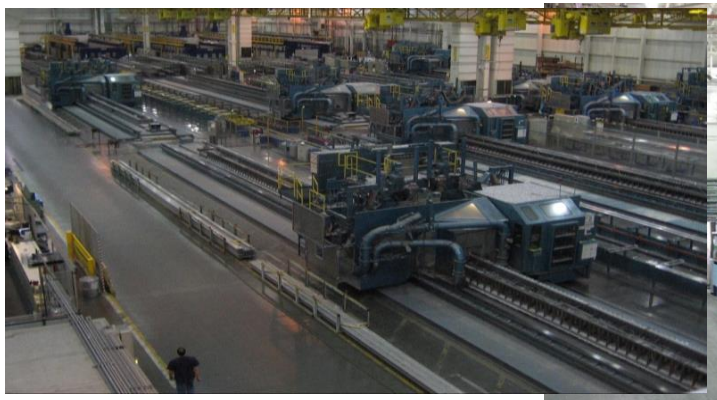
Aircraft Manufacturing Mission Critical Equipment

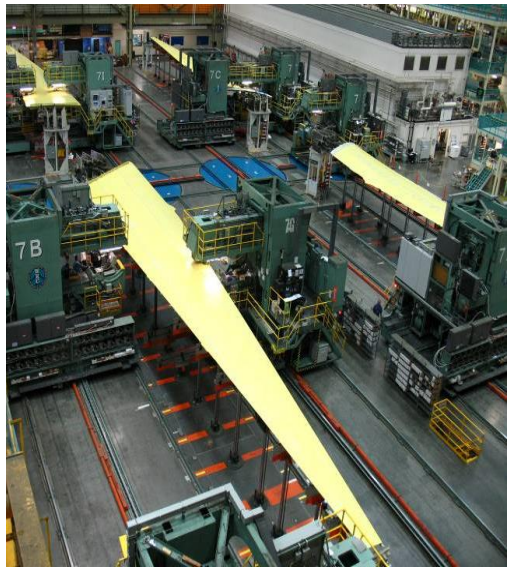




Composite Fabrication




Metal Fabrication

Drill & Fill Systems



Support Systems

Equipment Data Flow Architecture "Boeing Model"

Manufacturing Operations Management

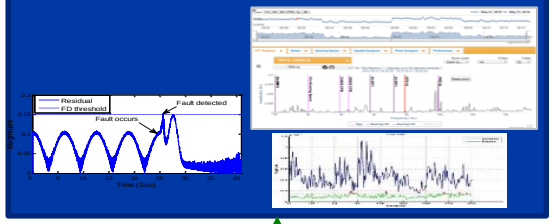
- Data collections for OEE
- Historian
- Dashboards
- Legacy and New Equipment Plans

Process Control

- Product Quality Data Assessment
- Machine Capability assessment vs. Engineering Requirements
- As built vs. as Designed Digital Twin
- Performance to Plan

Total Productive Maintenance

- FMEA Integration
- System Interfaces
- Health Monitoring and Fault Detection
- CBM
- Reliability plan



Manufacturing Operations Management (MOM)

Historian – Time Stamped Data

Availability
Performance
Quality

BEN

Factory Floor

PLC

Machine Tool Data Agent

Data Tags & translation

Industrial PC & Standard Interface

Sensors Data

Maintenance Tickets

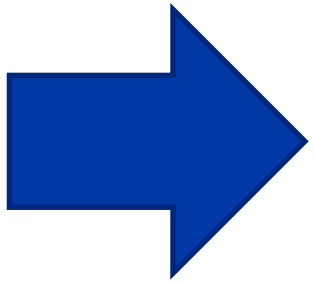
Maintenance Systems, Data Collections, & Performance Evaluation

Improvements that can reduce maintenance costs:

- **Standardized operator daily effort**
- **Control or eliminate reactive maintenance**
- **Planned maintenance to include all details and lessons learned**
  - Good mechanics training
  - Develop machine and process FMEA and Failure Tree
- **Accuracy and reliability of machine and part data**
  - Detailed operator tie-ins
  - Standardized report format

Performance data for visibility and actions

- Machine control data
- Sensor data
- OEE: Accurate Downtime Client data
- Health Monitoring: Deep learning & AI



Failures
Still Occur

Maintenance Work Order Tracking Tools & Standard Language Used to Document & Track Failures

Issues with Non-Standard Work Order Tracking

- Repetitive issues can occur under different naming conventions
- Root cause is not investigated due to lack of documentation
- Absence of sufficient data for analytic studies
- Lack of information to track problems for a family of machines
- Lack of information to make machine design improvements
- Increased maintenance costs
- Increased support costs

Challenges with Natural Language Planning in Large manufacturing

- Significant number of different machines and work centers
- Differences in priorities at each geographic location
- Difficulties to agree on standardizations
- Lack of support to enforce standard terms to identify machine problems
- Data may not be shared across the different sites
- Technology is still new and the benefits will need to be explored further
- Need a unified plan and software tool
- Expertise are limited
- A formal plan needs to be put in place, funded, and aligned to the legacy systems

✓ Natural language standards and decision support will benefit large manufacturing firms
✓ System can build the foundation for improving the maintenance functions