Toward a Standard Methodology for Asset Monitoring: boost Performance

Olivier BANCEL
SYSTRA

6,100 employees around the world

50% of the world’s high speed rail lines

80 countries

1 in 2 of the world’s metro projects

60% turnover achieved internationally

60% of the world’s automated metros

€612m revenue in 2016
For 60 years, we have been turning clients’ visions into programmes, comprising perfectly controlled stages, delivered on time and within budget.

Design / Build / Maintain / Operate
Digital Asset Management on 2 layers

- Safety and Quality
- Non intrusive Maintenance
- Costs through remote Monitoring
- Preventative Maintenance
- Incident Management Efficiency

Operations & Maintenance

- Models and Simulation
- Maintenance Optimization
- Investment Plans
- Performance Plans
- Steering and Decision

Asset Management
Benefits of New Monitoring

**PREDICTIVE MAINTENANCE**
can perform 10 to 20% gains in OPEX

**NEW INFORMATION**
can enhance drastically safety and regularity by 20 to 50%

**NETWORK AVAILABILITY**
through non intrusive maintenance +10% trains

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**View**

**Control**

**Prevent**

**Decide**
What are these Datas?

Is there an existing structured Asset Register?

ASSET REGISTER
MMS
OCC
ERP
SCADA
MAINTENANCE
MEASUREMENT
Questions

➢ Do we know all data available and their quality and availability?

➢ Do we need some more data sources?

➢ How to design and implement new monitoring policies?

➢ Real time and back office purposes
Technology Opportunities
A Global Functional and Engineering Process

Functional Analysis

- Asset Assessment
- Performance Audit
- Maintenance Audit
- RAMS
- Data Assessment

MAP OF SOLUTIONS
- Data collection
- New technologies solutions
- Partner portfolio
- From BIM to O&M

SYSTEM DESIGN
- Sensors and measurements
- Data Management
- System Integration

SYSTEM IMPLEMENT
- Project Management

RUN PLAN
- Change Management
- Change Standards

USER REQUIREMENT
- Costs
- Investments
- Performance
- Safety

DIAGNOSTIC
- Asset Assessment
- Performance Audit
- Maintenance Audit
- RAMS
- Data Assessment

Transformation Process
User Requirement Structured Process

Main inputs
- Workshops with users & Stakeholders
- Reading of existing procedures and technical documentation
- Access to and exploration of the legacy system

Tasks and outputs
- User Requirement Analysis
  - Exploration and high level concept mapping
    - Concepts and functionality mind map
    - High level object model and object life cycle
  - User profiles and user requirements
    - User profiles
    - Use cases
    - Functional requirements
  - UX driven functional architecture orientations
    - High level business domain cartography
    - Applicative domains functions and interactions
  - User interface specifications
    - User experience requirement
    - Wire frame

Data Assessment
- Description of legacy system
- User profiles and requirements

Data Integration & Workflow
- Data assessment
Data Assessment

1. Identified Data
2. Existing but not used Data
3. New Monitoring Policies

Inventory
Data Quality
Potential of use

Data Standards
Data Governance
Data Processes
User Requirements
## Data Assessment

### Case Study Failure Database extract

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<th>Date of incident</th>
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<th>Car No</th>
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<th>Location of incident</th>
<th>Run cancelled</th>
<th>Initial delay</th>
<th>Peak incident</th>
<th>MMS No</th>
<th>MMS Fault description</th>
<th>Help line</th>
<th>Help line comment</th>
<th>Drivers report</th>
<th>Repair start date</th>
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Step 2: Engineering Process

**USER REQUIREMENT**
- Costs
- Investments
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- Safety

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**MAP OF SOLUTIONS**
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- From BIM to O&M

**SYSTEM DESIGN**
- Sensors and measurements
- Data Management

**SYSTEM IMPLEMENT**

**RUN PLAN**
- Change Management
- Change Standards

**Engineering Process**
Infrastructure Asset Monitoring
## Engineering and Data Skills

<table>
<thead>
<tr>
<th>Objective</th>
<th>Predictive</th>
<th>Conditional</th>
<th>Preventative</th>
<th>LCC</th>
<th>Performance</th>
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<tr>
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<td>Reduce impacts</td>
<td>Decide and Plan</td>
<td>Reduce impacts</td>
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<td>Why</td>
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<td>Middle term</td>
<td>Short term</td>
<td>Long term</td>
<td>Short/Middle term</td>
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<td>Pattern RAMS Monitoring</td>
<td>Pattern Models RAMS</td>
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<tr>
<td>Application and Analytics</td>
<td>Root Cause Analysis</td>
<td>Utilization Trending</td>
<td>Anomaly Detection</td>
<td>Depreciation Analysis, Simulation</td>
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<td>Rolling Stock Permanent Way</td>
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<td>Big Assets</td>
<td>Electronic components</td>
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</table>
## Portfolio of New Measurement Solutions

<table>
<thead>
<tr>
<th>Video recordings and Geometry</th>
<th>Catenary measurement</th>
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<td>Isolation</td>
<td>Optical Fiber</td>
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<td>Switch Power Monitor</td>
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<td>Vibrations</td>
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<td>Cable tension</td>
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<td>Heating</td>
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<td>Height and Stagger</td>
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<td>Weather forecast</td>
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</table>

### Use and performance of the assets

Tonnage, frequencies, numbers, incidents, minutes, weather conditions, maintenance intensity
Example Switch Maintenance Objective

- Remote Maintenance
  - Monitoring and Measurement Policy
  - Maintenance Standards and Practices

- Preventative
  - Critical components Analysis and Monitoring
  - Use and Performance of Assets

- Predictive and Conditional
  - Existing Data Analysis
  - Models and Simulation
Example Switch Monitoring

Non Intrusive and Conditional Maintenance

Conditional and Predictive Maintenance

Failure Information
- MMS
- Log Files
- Maintenance MMS

Preventative Monitoring

Scada information
- OCC Information
Step 3: change Standards and Practices

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**RUN PLAN**
Change Standards Engineering

Reliability Centred Maintenance

Reactive
- Small items
  - Non critical
  - Inconsequential
  - Unlikely to fail
  - Redundant

Preventive Maintenance (PM)
- Subject to wear-out
  - Consumable replacement
  - Failure pattern known

Condition Based Maintenance
- Random failure patterns
  - Not subject to wear
  - PM induced failures

Proactive
- Root Cause Analysis
- Age Exploration
- Failure Modes and Effects Analysis
- Acceptance Testing
Conclusion

➢ Think integrated and complete process
➢ Requires rail engineering skills

Journey and Value toward a fully Monitored Network
Questions

Thanks!
Questions

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