DIAL Introduction

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What we do?

**MISSION**
- M1 smarter, distributed ways of automating systems
- M2 Getting better value from industrial information and quantifying it
- M3 Managing systems subject to disruption and change

**SEGMENTS**
- Manufacturing
- Logistics
- Supply Chain
- End of Life
- Service
- Maintenance & Asset Management
- Construction

(Time critical) Decisions

(Sensing) Loop

(Physical) Operations

Requirements

Actuation
DIAL Timeline

1995  DIAL begins
1996  SPC, Diagnosis
97-99  MASCADA (agents), IPROMS (response)
98-00  BHP, Kawasaki, Unilever, Unipart contracts – holonic/agents/response/reconfigurability
2000  Auto ID Center, AOS relationship
2001  VOI (RFID) begins, Lab Upgrade
2002  CDAC Launched, Intelligent Products
2004  PROMISE (PLM), Auto ID Labs
2005  Aero ID
2006  DIAL Launch, BRIDGE (EPC), Service
2007  SAIM (Asset Info) SMART (retail RFID)
2008  Boeing - SAHNE, Airport Operations
2009  s4t
2010  Intelligent Logistics
2011  CSIC, Hitachi, Heathrow
2012  Boeing: Aladdin, Distal, CSIC AM Projects
2013  Automation: Foxconn, LOR, Travelex
2014  Boeing: Airports, Supply Chain, Horizon
2020, Intelligent Logistics [YHG]

Al in Manufacturing
Control/
Disruption & Change
RFID & Smart Products
Value of Information
Services/Assets & Information
Construction & Infrastructure
… Repair
Trends and Changes

• Production -> Supply chain -> Life Cycle
• Manufacturing -> Service -> Infrastructure -> …
• Business level decisions & information (in conjunction with operations level)
• Technical/Engineering PhDs -> [analytic] Operations Management PhDs
• 1970s style Lab -> +/- SOA Lab
• UK/EU Funding -> Industrial Funding ++
Application Areas

Resilient, reconfigurable manufacturing systems

Asset & Infrastructure information management

Customised, resilient Logistics

Automated Repair of Domestic Appliances

Supply Chain Information Tracking & Tracing

Airport information & performance
Project Snapshots

- Liz Salter: Automation Auditing
- Tariq Masood: Infrastructure Asset management
- Philip Woodall: Achieving Leveraged Advantage from Distributed Information [Aladdin]
- Mark Harrison: Automated Identification [Auto ID]
CSIC Asset Management projects

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Institute for Manufacturing
13th May 2014
MISSION
Transforming the future of infrastructure through smarter information

VISION
• Enable step changes in construction practice
• Establish a world-leading sensing and monitoring industry
• Extend asset life & reduce management costs

Construction Sector:
- Halcrow
- Laing O’Rourke
- ARUP
- Skanska
- Atkins
- WSP
- Costain
- Capita Symonds
- Mott MacDonald
- BRE

Infrastructure Owners/Operators:
- IRL
- National Grid
- Highways Agency
- Transport for London
- Tube Lines
- Network Rail
- Infrastructure UK
- Transport Scotland
- Crossrail
- Humber Bridge Board

Systems / Solution Providers:
- Toshiba
- IMETRUM
- Omnisense
- Thales
- GEA
- GE Aviation
- GE Healthcare
- IBM
- Sencive
- AeroFLEX
- RotaTube
- Horizon
- GE
- GE Aviation
CSIC – Asset Management Programme

Tools & Approaches to Improve Current Infrastructural Asset Management Practices

Tools & Approaches to Support Infrastructural Asset Management in the Future

Project 1: Whole Life Asset Cost/Value Assessment

Project 2: Whole Life Information Requirement Specification

Project 3: Asset Information Futureproofing

Project 4: Futureproofing of Infrastructural Assets
Process for **whole life value** based decision-making

**A. Establish the Context**

- A1 Set the scope, objectives and context
- A2 Define the problem/decision
- A3 Determine the time period for evaluation
- A4 Identify and define the asset system
- A5 Identify the level of service and performance requirements

**B. Value Mapping**

- B1 Identify all stakeholders
- B2 Identify each stakeholders requirements and objectives
- B3 Identify the value elements that constitute stakeholders requirements
- B4 Identify measurable value metrics for each element
- B5 Determine the influencing factors that impact the value metrics
- B6 Determine the asset related factors that influence value
- B7 Determine the external factors that influence asset and value metrics
- B8 Determine the various intervention and control options

**C. Value Optimisation**

- C1 Model the dynamic nature of value influencing factors
- C2 Model the impact of intervention options on the value influencing factors
- C3 Model the relationship b/w value influencing factors and the value metrics
- C4 Quantify the importance of each value metric
- C5 Calculate the total value of each intervention option
- C6 Perform sensitivity analysis and choose the best option

Asset Management is *the coordinated activity of an organization to realise value from assets* (ISO 55000)
Asset Information Requirements tools

Information requirements process

- Identify life cycle stages
- Identify decisions made and their criticality
- Identify information required for those decisions and its availability
- Calculate information risk to highlight areas of concern

Information Risk Analysis

- Probability that information is used
- Probability that unavailability leads to a direct consequence

Asset Information Model

<table>
<thead>
<tr>
<th></th>
<th>Asset Operation</th>
<th>Asset Design</th>
<th>Asset Specification</th>
<th>Asset Need</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plan/Design/Build Asset</strong></td>
<td>Technical/statutory/mandatory information to plan and develop the delivery of the infrastructure</td>
<td>Technical/statutory/mandatory information about design offering (asset and service)</td>
<td>Information to formalise asset design</td>
<td>Conceptual information about customer asset/service requirement</td>
</tr>
<tr>
<td><strong>Operate/Maintain</strong></td>
<td>Technical info to run infrastructure service</td>
<td>Asset level functional information to fully utilise the infrastructure</td>
<td>Information with respect to asset/infrastructure use</td>
<td>Information from provider enabling user to exploit infrastructure</td>
</tr>
<tr>
<td><strong>Evaluation</strong></td>
<td>Operational information on performance of infrastructure and operations</td>
<td>Info relating to the effectiveness of infrastructure/asset management and its SLA metrics</td>
<td>Information to illustrate the perception/expectation vs SLA</td>
<td>Information to determine fulfilment of asset need</td>
</tr>
</tbody>
</table>

- Probability that a consequence leads to other consequences
- Impact on business objectives

- Frequency of decision-making
- Accuracy of inspection reports
- Asset failures
- Direct consequences
- Service disruptions
- Customer satisfaction
- Impacts on business objectives

- Maintenance
- Task
- Develop maintenance plan
- Asset inspection reports
- Information Quality Process
- Information
- Other Consequences
- Direct Consequences
- Customer satisfaction
- Impact on Business Objectives
Process for developing information futureproofing strategy

A3. Information futureproofing

A31. Identify temporal retention requirements for each information

A32. Identify technical and organisational challenges that prevent meeting the retention requirements

A33. Evaluate and prioritise risks involved in the challenges

A34. Identify technological and non-technical options to address the prioritised challenges

A35. Evaluate the costs and potential benefits of each option

A36. Select the option that provides the best value
Infrastructure Futureproofing

- Establish best practice for infrastructure futureproofing
- Examine futureproofing approaches in other industries / sectors
- Identify common taxonomy, barriers, economic basis
- Propose approaches for integrating futureproofing into infrastructure asset management practices
Aladdin - Challenges

• The massive manual effort required to manage the vast amount of data available within Boeing

Aim:
• To automate data management tasks:
  value determination, data quality improvement, data sharing
  (while minimizing human workload)
Variations in data for identical parts

Some real examples (obtained from www.stockmarket.aero/ website)

**HYDRAULIC ACTUATOR**
- ACTUATOR-HYDRAULIC, CARGO DOOR
- HYDRAULIC ACTUATOR
- ACTUATOR HYD
- HYDR. ACTUATOR - CARGO DOOR
- ACTUATOR-DOOR-HYDRAULIC
- ACTUATOR, HYDRAULIC
- ACTUATOR (HYDRAULIC)

**FUSE ASSEMBLY**
- LE FLAP SLAT HYD FUSE
- Fuse Ay.
- FUSE ASSY
- FUSE ASSY. AUTO QTY. MEAS.
- FUSE ASSY, QTY MEASURING
- FUSE ASSY
- FUSE ASSEMBLY
Using the data value determination approach

1. Predict what data is unnecessary
2. Lower the prioritisation of this data through ETL (data transfer) processes
3. Potentially reduce ETL time of the critical data

Provide critical data to the decision maker as soon as possible
Aladdin – Technology transition

- Directly supporting revenue producing business units
  - In both production and support
- Boeing UK and US

Research output ≠ Something the business can actually use

- Working applications, not research prototypes
  - Able to feedback performance results to Cambridge without sharing real datasets
Thank you

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Distributed Information and Automation Lab
Institute for Manufacturing

May 2014
Auto-ID Labs worldwide
Linked Open Data for Products (GS1 Digital)

Open Data

Better visibility of your products / services to interested consumers

Publish as linked open data

Your company

Greater insights
Better decisions

Private Enterprise Data

Public-facing data (offerings & services)
Linked Open Data for Products (GS1 Digital)

Go to
http://tinyurl.com/rdfa-test

View Page Source and paste into
http://rdfa.info/play
Event-Based Traceability
Automation Lab re-development
Intelligent Products in Logistics
RFID and Value of Information in Construction
Thank you

www.autoidlabs.org.uk

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