Embedding SE within Network Rail

Brian Halliday
Enhancement Engineering
Embedding SE within Network Rail

Need
Process
People
Tools
Railway Business Needs

- Reduced Journey Times
- Increased Capacity
- Improved Punctuality
- Increased Availability
- Enhanced Safety
- Lower Ownership Costs
West Coast Route Modernisation
A Catalyst for Change

- Built in 1800’s
- UK’s busiest mixed traffic railway
- 2,500 train moves per day
- 75 million passenger journeys per year
- 43% of UK freight traffic
West Coast SE Team Composition

- Recruited Experienced SE Practitioners
- External Specialist Services
- SE Consultants
- Programme Management Team Staff
- Rail Discipline Engineers
- System Integrator contract
Top-down commitment to SE was vital

Control of system requirements & project workscope fundamental

Systems modelling key to selecting railway layouts & system designs

SE approach had to embrace new technology, major enhancements & condition-based renewals

Use of external expertise was key in establishing SE practice but,
- Effectiveness constrained by limited domain knowledge
- Capability retention an issue
CP4 Output Requirements (2009-14)

- Increase punctuality to 92.6%
- Reduce delay minutes by 23%
- Increase railway availability by 37%
- Reduce costs by 21%
- Deliver capacity projects
A few interesting CP4 Projects!

Thameslink

Crossrail

IEP

Signalling Centres

Kings Cross

Birmingham New Street
Guide to Railway Investment Projects (GRIP)

- Applied to all Network Rail projects
- Eight stage development lifecycle reflecting the significant business and technical milestones
- Emphasis on front-end options identification & selection
- Each stage delivers an agreed set of products to defined quality criteria
- Stage gate reviews test a project’s progress
Modular S&C – Adopting a Systems Approach
High Output Ballast Cleaning System

Integrated System Validation Trail
- Austria
Information Management
Service Development Lifecycle: V-Model

SDL Stage Key
- Business Engagement
- Solution Definition
- Design
- Development
- Deployment

High Level Bus. Req.
- Business Req (incl NFR)
- Functional Specification
- Outline Solution Design
- Detailed Solution Design
- Solution Package

Integration Test
- Unit/ System/ Factory Test
- Pre-Production Test
- Acceptance Test
- Implementation

满意的
Relates To
Capacity Projects - Enhancement Engineering

Client & Stakeholder Functional Requirements

Programme Specification
- Issued by Eng. Spec. Panel
- Functional Requirements
- Scheme Layouts
- Engineering Reqmts
- Process Reqmts

Project Teams:
- Produce designs
- Produce engineering deliverables
- Stage gate review by ESP

Enhancement Engineering

Maint. & Ops. Requirements

Rail Systems Modelling

Asset Condition & Renewals

Engineering Asset Policies
### Engineering Deliverables

- **Standard set of Engineering Deliverables**
- **Tailored to needs of each project**

#### Systems Engineering

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People
Engineering Core Competence Framework (ECCF)

• Started in August 2007
• Facilitate getting right people in the right posts, understand individual competence vs. competence required by a post and inform development needs
• Includes all professional engineering posts in Infrastructure Group.
Engineering Core Competence Framework

**Technical Competence**
- Systems Modelling
- Reliability Engineering
- Ergonomics
- EMC

**Technical Process**
- Requirements Management & Specification Writing
- Verification
- Validation

**Business Skills**
- Project Management
- Managing Change
- Decision Making

**Leadership Capabilities**
- Achieving / Inspiring

**Specific railway discipline competency & knowledge**

**General technical competency & knowledge**

**Non-technical competency & knowledge**
## ECCF Generic Competence Maturity Levels

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<th>Applying</th>
<th>Leading</th>
<th>Expert</th>
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<td>‘Critical Reviewer’</td>
<td>‘Trusted Advisor’</td>
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<td>Basic comprehension of</td>
<td>Routinely applies technical</td>
<td>Routinely makes complex technical</td>
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<td>Awareness of</td>
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<td>Provides strategic framework and</td>
<td>applied knowledge and experience</td>
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Network Rail
Role Profiles
Engineering Directorate (>500 posts)

% of posts

- Requirements Management & Specification
- Verification
- Validation

- N/A
- Understanding
- Applying
- Leading
- Expert

Network Rail
<table>
<thead>
<tr>
<th>Technical Competencies</th>
<th>Role Profile</th>
<th>Personal Profile</th>
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<td>Role Profile</td>
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<td>Railway System Modelling (RAIL)</td>
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<td>Safety Management (VISION + CI)</td>
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<tr>
<td>System Architecture Design &amp; Functional Analysis</td>
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<tr>
<td>Application of Technology Solutions</td>
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<td>On Track Plant Operation</td>
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<td>Role &amp; Personal Profile Mapping</td>
<td>Competency Gaps identified and personal development plan agreed</td>
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• On the job training
• Process workshops
• Internal training courses
• Internal briefings
• External courses
• Rail Systems MSc course
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Tools
• Enterprise Agreement covering DOORS / System Architect / CM Synergy

• Leading to significant increase in Doors application across business:
  – Engineering (Projects & Company Stds)
  – Infrastructure Investment (Delivery Projects)
  – Information Management

Planning & Regulation
c300 regular users of DOORS
Embedding SE within Network Rail
So where are we?

- Systems Engineering accepted by company leaders as the way forward to achieve CP4 outputs and beyond
- GRIP based development cycle has been a great SE enabler
- System Models used as matter of course
- SE skills development across all functions

- We have come a long way since West Coast!
Embedding SE within Network Rail
So where are we?

Forming
Storming
Norming
Performing