Major Projects Association

Systems Integration for Major Projects. An MPA seminar held at the Royal College of Pathologists, London on12 March 2002.

MPA events are confidential, although this summary has been compiled so as not to breach confidentiality. Full proceedings and entry to MPA events are available only to members.

Participants

More than 90 participants attended the seminar and the following organizations were represented:

AEA Technology, Association of Train Operating Companies, BAA Plc, Baker & McKenzie, Balfour Beatty Major Projects, Bechtel, Bovis Lend Lease, British Energy, BT Plc, CMS Cameron McKenna, CSE International Ltd, E C Harris, Electronic Data Systems, Freshfields Bruckhaus Deringer, Halcrow Group Ltd, Halliburton Kellogg Brown & Root, Herbert Smith, Home Office, Imperial College, Integrated Systems and Strategies, Jacobs Gibb, Joint Intelligence Organisation – Cabinet Office, Linklaters & Alliance, Lockheed Martin UK, London Underground Ltd, Loughborough University, Ministry of Defence, Morgan Est Plc, Mott MacDonald Ltd, Mouchel Consulting Ltd, National Audit Office, National Air Traffic Services Ltd, National Grid Company plc, NHS Shared Services Task Force, Ove Arup & Partners, PA Consulting Group, Police Information Technology Organisation, PricewaterhouseCoopers, Rail Link Engineering, Railtrack Thameslink 2000, Risk Solutions, Rolls-Royce Naval Marine, Strategic Rail Authority, Thames Water Utilities, Trade Partners UK, UKAEA, Union Railways, University College London, Virgin Trains, Willis Ltd, WSP Group Plc

With advances in technology, major projects have become hugely complex. Great engineers of the past like Stephenson and Brunel could conduct an entire project with a manageable “headfull” of information. This is no longer possible: modern projects are made up of a network of interoperating systems with a multiplicity of functions, technology and commercial imperatives. The complexities of interfaces and tradeoffs have to be carefully managed, together with risk, over the project’s entire life cycle.

Disciplined Systems Integration techniques provide the key to managing complexity across a broad range of industries and offer additional benefits when implementing organizational systems and process changes in todays multi-owner, multi-stakeholder environment.

The MPA seminar considered various kinds of system integration and put forward ideas for best practice…but first back to basics.

What is a system?

A system comprises two or more components operating together, with an interface and an emergent property. A nut and a bolt form a simple system. They have an interface, the screw thread. They have an emergent property, a large compressive force on any components through which the bolt has been threaded. A combat aircraft is a structured hierarchy of multidisciplinary systems, made up of subsystems, assemblies and components. All systems have a purpose, a boundary, a structure with multiple components and an emergent property.

And systems engineering?

Systems engineering is a branch of engineering which concentrates on the design of the whole as distinct from the parts, looking at a problem in its entirety.

And systems integration?

Systems integration is the practice of ensuring that the parts of a complex system work together to deliver the desired outcomes.

Types of integration

Various integration projects were covered:

- London Underground
- commonization of systems to streamline procurement at General Motors
- setting up shared services in the NHS
- establishing a common infrastructure in defence
- ensuring interoperability between defence equipment projects

The need for effective systems integration

Major projects have become so complex that the multitude of interfaces must be meticulously managed. So how complex are projects today?

1. The Australian New Submarine project has prime contract documentation running to 22,000 pages of text and drawings, 600 subcontracts, production in nine countries, 1,500 work packages and 250,000 events to be scheduled. A mega-project with multiple hard and soft interfaces.

2. Aircraft carrier project—a naval project with 30 million parts (a submarine has only 8 million parts).

Case study 1: **Integrating two European car manufacturing businesses**

As part of its global strategy, two General Motor's companies, Opel and Vauxhall, were integrated in a commonization project in 1987–1990.

Project aim: To reduce supply-chain costs and convert the two UK plants into standard European plants.

Project problems: High risk, short window of opportunity for implementation, cultural clashes between the German and UK companies, shortage of IT workers and various industrial issues.

Project outcome: Delivered on schedule, within budget and with no disruption to operations. An unexpected bonus was that the UK plants could help meet new demand after the fall of the Berlin Wall (200,000 vehicles exported in 18 months). Project payback achieved in only 4 months and business processes were improved.

- train protection systems and
- a generic model for initiating and managing systems integration.

Guidance on best practice

The seminar covered management practice across a range of industries and offered guidance:

- Systems thinking starts in the boardroom—make sure you have top-level support for your strategies.
- In systems integration for improving company organization or product manufacture, have a clear vision of the overall solution and articulate the value to the enterprise.
- Make sure that your objectives are driven by the needs of the business, not by a love of the technology.
- Identify the interfaces of the systems and quantify risk at the interfaces. Make an early start, particularly if you are dealing with legacy systems, where old systems have to be integrated with new ones.
- Identify the systems and subsystems most vulnerable to technology change and build in flexibility at the front end.
- Partitioning allows complex problems to be divided up so that they become simple—but be sure you "divide and conquer" and don't "divide and confuse". And remember that each act of partitioning creates another interface.
- Investment or ownership structures may change over time (e.g. PPP on London Underground)—another good reason for flexibility.
- Allow adequate time for testing. Suboptimal have been delivered when projects had to meet a hard date for whatever reason.
- When procuring a new system, find out how developed the system actually is—new systems at the cutting edge of IT may not be as developed as the supplier makes out and may need further development as they are customized.
- Consider developing a system of systems—some organizations (such as the defence Integration Authority) find it helpful.
- Descope wisely if you have to at all. If you have to cut out systems or parts of systems, be aware of the repercussions.
- Industry and academia will have to produce more systems engineers—is it up to the challenge?

Case study 2: **Shared services in the NHS**

The NHS, the largest employer in Europe, needs to realize efficiencies and economies of scale by developing common systems and services.

Project aim: To provide a small number of business support units nationally for the whole NHS.

Project methods: Feasibility study, pilots, common coding, off-the-shelf software, phased rollout.

Project problems: Sheer size and scale of project, fragmentation of current systems, scepticism, cultural/organizational difficulties of any major change programme.

Project outcome: Project still to be delivered, first in finance and human resources; benefits will be significant.