

Lessons from High Technology Development Projects:

an MPA Seminar held at the Royal College of Pathologists, London on 26 February 2003

Participants

More than 60 participants attended the seminar and the following organizations were represented:

AEA Technology Rail, Arup, BAA Plc, BMW Hams Hall Motoren GmbH, Caterpillar (UK) (Bristol University), CJ Associates Ltd, CSE International Ltd, Freshfields Bruckhaus Deringer, Henley Management College, IBM Business Consulting Services, Integrated Systems & Strategies, Kellogg Brown & Root, Lockheed Martin UK Ltd, Ministry of Defence, Mott MacDonald, Mouchel, MTR Corporation Ltd, National Audit Office, PA Consulting, Pilkington Plc, Rolls-Royce Naval Marine, Rolls-Royce Plc, Scott Wilson, Singapore Technologies Engineering, Sir Robert McAlpine Ltd, Strategic Rail Authority, Templeton College (Oxford), UMIST, University College London, Virgin Trains, Washington Group International Ltd

High technology development projects entail high levels of risk. To manage a complex project against a background of innovation, uncertainty and, in some cases, massive budgets requires project management of the highest calibre.

This seminar took four projects from different sectors: defence, the railways, glass manufacture and the construction of an engine factory for the automotive industry. A further presentation set out the broader lessons learnt from integrating military capabilities, lessons that have an applications across most industries.

Some themes were raised over and over again by the different speakers. The following were some of them.

People

Successful project management depends on leadership, conceptual thinking and technical knowledge.

Choose your project manager very carefully and give continuity and consistency to the project by keeping the same core team members as far as is possible. Ownership of the project by team members is crucial.

Make sure that everyone in the project team has the necessary competencies. If any team member lacks competence in any area, provide training and development.

Establishing a formal process for extracting lessons learned and making sure those lessons are fed back through the organization. Build "corporate memory" into training programmes, hold learning-from-experience seminars and on a cultural level ask people what lessons they have learnt to drive those lessons home.

Conceptualization and design phase

Many clients use ambiguous terms in their specifications. Hunt down any such words and replace them with precisely defined ones.

All safety critical components must be identified as an integral part of and run concurrent with the design phase.

Testing and customer acceptance is not always recognized as an upfront activity. It can be a significant driver of cost and needs to be considered right at the outset of the project.

Many customers now wish to minimize the cost of ownership throughout a product's life cycle; therefore ensure that products can be easily supported and integrate supportability in the design phase.

Keeping major projects to cost and time

A problem of English law is that you cannot contract directly for schedule compliance, as you can for cost and performance. Needless to say, with cost and performance being effectively tied by contract, schedule acts as a relief valve.

Counting back from the planned delivery date imposes effective discipline on any project. Set the stage gates accordingly. Stage-gate process

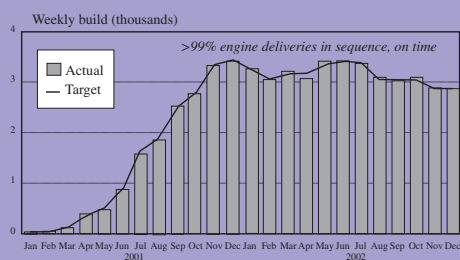
Building the BMW Hams Hall engine factory

Hams Hall, a new purpose-built engine factory within the the BMW group in the UK, was launched in February 2002. It currently makes about 20 per cent of the engines for BMW cars. An engine comes off the end of the track every 39 seconds.

The BMW philosophy is to make those responsible for the delivery of the factory and equipment, subsequently run the factory.

The project, to build and equip the factory, was worth about £400 million. The size of the factory is 83,000m² and cost approximately £70 million. The working environment is better than most Whitehall offices yet the cost per metre is the same as most industrial buildings.

Hams Hall is recognized as a benchmark within BMW and it delivers the highest quality engines of any of their engine factories.



Project outcome: engine deliveries

Joint Strike Fighter (JSF)

The JSF is the world's largest defence contract, with a total acquisition cost of US\$250 billion. The aircraft will come into service in 2008, and 5,000 aircraft are expected to be sold.

Three variants are to be built, one of which is a short take-off and vertical landing (STOVL) aircraft for the US Marine Corps and the Royal Navy. STOVL has a strong technological advantage that converts to a competitive advantage on the battlefield.

It is an internationally run programme, with a Joint Program Office in Washington DC. The UK is uniquely involved as a tier 1 supplier and therefore is a full partner in that office. Rolls-Royce is working in two specific areas: on the lift system, allowing the aircraft to operate vertically in land-based and sea-based environments and on an alternative main propulsion system. The value of the JSF work to Rolls-Royce on an annual basis is about £100 million per year.

The programme has a 40-year life cycle, with a break-even point some 10 to 15 years into the project. Significant amounts of investment therefore have to be made in the early stages of the programme. With such a long life-cycle continuing capability acquisition and technology insertion are very important.

Management and control come together through the Rolls-Royce earned value process. Here they use tools that enable measurement of schedule variance and cost variance. Progress is shown through graphs and charts that track milestone achievement against cost incurred compared to plan. With this rigorous approach they have made progressive improvements in their schedule performance.

Risk is reviewed on a continuous basis (at least once a month). They use two tools: a programme probability impact grid and a computer-based tool to help them track the retirement of risk.

Rolls-Royce use a classical matrix-type structure for their teamwork organization. The programme director is responsible to the company for delivering the programme on time, to specification and cost.

Supply management: a global extended enterprise team was established with open communication. The team shared the risks and all bought into the strategy.

Attention has been paid to building up the skills and experience of their team. Focused training extends competencies across the team.

Through a strategy of rigorous management and control, Rolls-Royce has been able to exceed their customer's expectations.

milestones must be met before you move on to next one. Measure progress by outcomes, not by how much effort has gone into the project. Continually revisit milestones to make sure that their predictions are soundly based. An independent eye is necessary for this activity; but how can the same individual stay independent when revisiting the project at each stage gate?

Overruns, whether of cost or time, are symptoms of poorly managed projects. Unpleasant surprises can be avoided by good planning and management.

Monitor the work of subcontractors to find out the current status of schedule and risk.

Process

Process brings discipline and consistency to projects. It must be flexible, user-friendly and easy to change. Don't hesitate to change it, if it doesn't work successfully.

Systems engineering and integration

Many major projects involve the integration of software and hardware. Such projects can be bedevilled with flawed interfaces and hence problems with performance and timing. Plan testing early in product development and encourage experimental releases of software, if that is possible.

Project management disciplines

Have a robust and flexible change control process.

Maturity of technology: you must not pursue technological advance at the expense of timely delivery or vice versa. A balance has to be struck between introducing innovation and achieving certainty of cost and delivery. Trade-off analysis can be of help.

Organizations today suffer from a proliferation of information. Centralize data in a shared data environment and/or with web-based systems. The latest data needs to be clearly marked and readily accessible on every team member's desktop.

Focus on key relationships to ensure success of the project.

Managing risk

Risk management has to be integrated in the main management structure of the project. Be sure that you have a risk manager who really understands what risk is about.

Hold workshops with partners to look ahead for potential problems. Establish mitigation plans and review them continually.

Intellectual property rights

These can be an area of concern. Any contract must be explicit on what rights a customer is buying. Partners in any project have to have sufficient information to do their part but not so much that they can replicate work.

Conversely make sure that you don't infringe anyone else's intellectual property rights.

Learning lessons from others who have been there before, in other projects, is fundamental. Do things differently because of what you have learnt from them.

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