

Building a Systems Engineering Capability



Background

Effective systems engineering is critical to the next generation of transport systems. Conventional engineering and program management alone will not deliver safe rail with significantly higher capacity, better customer experience at lower cost and carbon footprint.

Systems engineering is not, however, a 'silver bullet' that can be implemented overnight. It requires changes to processes, people and culture across your whole organization. This document explains how to achieve the benefits of systems engineering in your organization.

Clarifying why you need Systems Engineering

Different organizations implement different aspects of systems engineering to meet different needs. The first thing you need to do is define why you want systems engineering for your organization and why you need it now.

Do you have difficulty integrating different assets into your railway, maturing technology or inserting new technology into legacy assets? Does your new technology work with operations? Do your projects grow in scope? Do you keep changing your contracts with suppliers? Do solutions in one area cause problems in another?



Know where you are starting from

A lot of systems engineering is applied common sense, so you may be doing some systems engineering already. Do you have an overall process for project control and governance, with major decision points where projects are approved or rejected? Do the decision points have clear entrance and exit criteria, and look for a whole of life, whole railway approach? Does the process integrate desired business benefits, requirements definition, trade-offs, design, and verification and validation? Do you have people able to run the process? Do you actually follow the process – even when it appears to give the wrong result?

An open and honest self assessment is the first step.

Building the foundations



How much change do you think it will be? What level does it need to be championed at – engineering director, chief operating officer or chief executive officer? Who can be relied upon to support the introduction of systems engineering – and who has concerns?

You need to build a group of key players who are emotionally committed to making systems engineering work in your organization. What is the vision for systems engineering in your

organization? Tell the story of the changes you are looking to make, the benefits of making them and the implementation approach you are taking.

Once you have defined your vision you need to communicate it to everyone – again, again and again.

Developing a balanced systems engineering capability

You need to place ‘whole life, whole railway’ decision-making at the heart of your organization.

What process changes do you need to make? Do you need overarching project governance? Or do you need to introduce specific systems engineering processes? What skills, knowledge and attributes does everyone require? What are the organizational and governance implications? What methods and tools do you require?

The changes need to balance people, processes, governance and tools. Too much focus on one aspect will lead to an unbalanced systems engineering capability.

It's the people that matter

Systems engineering needs to be a basic skill for everyone and a specialty for a few. You will probably want to build up a center of excellence to focus on your key issues. This is likely to be a mixture of internal staff and consultants.

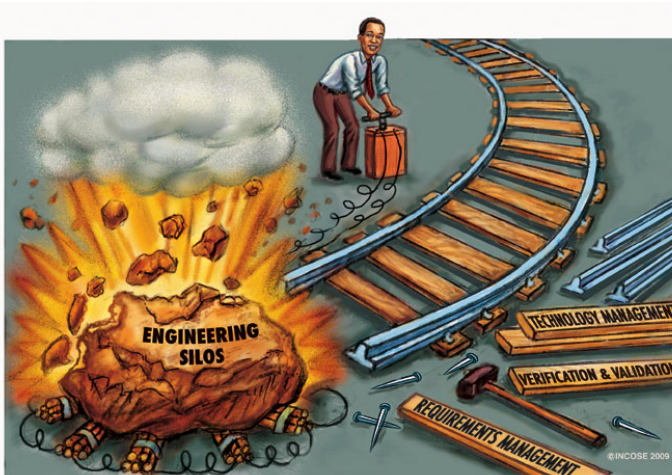
No matter how you get your systems engineers, you need to get the right ones. What type of systems engineers do you need? Specific experts in requirements analysis, systems integration or verification and validation? A systems engineering manager to recruit and build a team? Or someone to introduce systems engineering across your organization?



These require different skill sets. A specialist needs to have strong technical skills. A systems engineering manager needs to be a good manager first, with sufficient technical skills to be credible. A change leader needs to have strong transformation and change management skills.

Being competent at rail systems engineering requires much more than having a systems engineering degree. It requires: knowledge of the rail industry and systems engineering; systems thinking, specific technical systems engineering skills and softer interpersonal skills. Probably the most important required attributes are humility, seeing things from multiple perspectives and building rapport.

Managing the transformation



All successful change starts small and builds upon success. There is no blueprint that can be applied to guarantee success – the systems engineering capability needs to be tailored to your specific organization.

Introducing systems engineering is a journey that everyone needs to go on – a large number of small steps is much more likely to succeed than one giant leap. Pick an area where the benefits are large, the payback timescales short and the barriers low.

Successful systems engineering is as much about what you don't do as what you do. Removing barriers to successful systems engineering is often the critical senior management role. What can you do to help clear the path for good systems engineering?