

Streamlining Engineering Methods using Systems Engineering

Information Sheet

Responding and Adapting Rail Manufacturing and Engineering Methods to Greater Demands for Complexity



Like every manufacturing industry, rail supply has benefitted from Lean, Kaizen and continuous improvement methodologies as tools to improve efficiency. But these methodologies have to be adapted to their context, and the context in rail is changing.

The British rail network is being transformed by technologies like cab signalling and condition-based maintenance. The opportunities are there for those ready to step up and take them, but cutting-edge engineering has never been more important.

Improved technology is driving a lot of current growth, but with this comes pressure to look to the bleeding edge and make difficult decisions about unproven innovations.

Which technologies are going to make the most progress toward decarbonisation? Is the industry going to be ready to embrace the full potential of augmented reality and automation? Will the pace of change in smart cities, the Internet of Things and 5G be so fast that rail will have to adapt very soon?

Through all this uncertainty, one thing is clear; rail systems, from the remotest level crossing to the network as a whole, are getting much more complicated.

Every little piece of infrastructure, every part of a train, increasingly needs to be looked upon as a detail in a big picture rather than as something more discrete, with its own discrete maintenance schedule and separately identifiable requirements.

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Manufacturing and engineering production methods like Lean and Six Sigma are effective at reducing waste and providing assurance throughout the manufacturing process, but when developing complex systems, a great deal of waste is introduced prior to completing a detailed design. Providing similar assurance during the development phase requires a different set of tools.

The techniques and processes of systems engineering, especially the ability to model complex systems early in development, can reduce this waste considerably. A global study by the Project Management Institute (PMI) found that for every pound spent on projects and programmes, 5.1 percent is wasted due to poor requirements management.

Effective requirements management allows you to introduce a single source of truth to your development process. A big picture that is being constantly maintained, adapted and used by everyone involved, requires them to think about the needs of others by virtue of how the information is structured.

But the advantages don't stop there. For one thing, Systems Engineering (SE) modelling and requirements management can significantly improve your relationship with your own supply chain by introducing a single source of truth, and clear specifications, which can be passed down to suppliers in a traceable way. But the main benefit of an SE model in the long run, is how easy it makes it to plan for change.

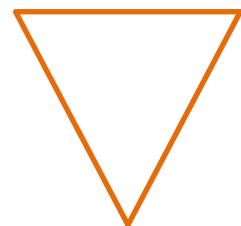
Stakeholder needs can change at any point in the product life cycle, either during development, or as part of a midlife upgrade to the system. By developing and maintaining an SE model, your organisation could have a relatively easy way to adapt to the impact of those changes, and determine quickly and cheaply what those

changes will mean for the functionality of the system as a whole. SE modelling requires appropriate technologies to support engineers, but those technologies are already very mature, thanks to industries which have been using systems engineering techniques for some time. As rail continues to become a more complex environment, the rail supply industry could benefit from using SE modelling in its work.

Thinking in terms of the big picture is more than a cast of mind, it requires a specific set of skills. Embedding those skills throughout your organisation can make your development process considerably leaner and more effective, while enabling project managers to focus on what really matters.

If you could apply these techniques to your business, it could help your engineering process become as lean as your manufacturing process, and allow project managers a view of the whole team.

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This technical article is an excerpt from SyntheSys Technologies White Paper about Managing Complexity in Rail Supply. Read the full White Paper [\[here\]](#).

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