

Steampunk System of Systems Engineering: A case study of successful system of systems engineering in 19th century Britain

Duncan Kemp (Ministry of Defence) - duncan@17media.co.uk

Rhianne Evans (University of Birmingham) - rhianne.evans@gmail.com

Jon Elphick (Atkins) - Jon.Elphick@Atkinsglobal.com

David Camm (Ministry of Defence) - stuff@17media.co.uk

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Abstract. There has been an explosion of interest in the development of System of Systems engineering approaches in the last ten years. Going from an average of 10 papers a year at the end of the 1990s, there has been over 250 papers a year published on the topic each year for the past five years. The vast majority of these papers present System of Systems_ (SoS) challenges as novel and challenging at the edge of our understanding of systems engineering. The general consensus is that the explosion of SoS is unprecedented, and therefore requires unprecedented approaches to SoS engineers. Whilst the authors do not disagree that SoS are challenging and require a different approach than product systems engineering techniques, we do not believe that SoS are unprecedented. This paper describes the development of a large and complex SoS as it was established, evolved and then eventually merged into a single large system. This evolution took place from the early 1830_s through to the early 1950s. The SoS was the British rail network. This paper: _ Describes the growth of the British rail network from 150 independent railways through to one integrated network; _ Describes the key operational, business and technical changes needed to move the network from a virtual SoS, through a collaborative SoS to a directed single system; _ Evaluates the SoS against three basic SoS approaches/taxonomies: the US DoD SoS classifications, the UK MOD SoS Approach and the UK Department for Transport engineering assurance framework; _ Identifies the lack of importance of global technical standards in delivering SoS effectiveness; _ Identifies gaps in the frameworks, in particularly with respect to the economic drivers for creating an SoS. Much like the artistic and literary genre of Steampunk, this case study is a mixture of familiar SoS concepts and approaches in an unfamiliar Victorian setting. Unlike Steampunk this case study is not only amusing and entertaining, it is also educational.