

MODEL BASED SYSTEM ENGINEERING

Introduction

Model Based System Engineering ([MBSE](#)) is one of a number of applications that could be used to capture an [Electronic Safety Case](#), or to map the key processes and information that are used to develop the safety case. Though the definition and purpose of MBSE is discussed in this document, the application of MBSE in the nuclear sector has been considered within a separate research task.

The International Council on Systems Engineering ([INCSE](#)) define MBSE as: *'The formalised application of modelling to support system requirements, design, analysis, verification, and validation activities from concept to decommissioning'*. INCOSE Systems Engineering Vision 2020 ([INCSE-TP-2004-004-02](#)).

An MBSE approach models, or uses models, to facilitate the system engineering activities which are traditionally performed using a document based approach (e.g. textual requirement specification, functional analysis, decomposition and allocation). MBSE emphasises rigor and precision and supports the integration across the system life cycle and across multiple disciplines.

The primary aims of taking an MBSE approach are generally to increase engineering design quality and design process efficiency. MBSE can support these in a number of ways but primarily they are achieved by:

- Providing context through a clear narrative (from top to bottom) of the purpose of the system of interest and where it sits within the whole system.
- Ensuring clarity by using unambiguous language to describe system design and behaviours which in turn will support clarity of design and the early detection of defects (at different and appropriate levels for the given party through the development of specific views and viewpoints).
- Facilitating efficient information exchange through the provision of a central source of information with up to date and fully traceable design / requirement / management information.

The use of MBSE tools and methods is becoming increasingly commonplace across a range of industries, particularly those related to safety critical applications. In the industry sectors in which it is established, MBSE offers a quicker, more reusable and less ambiguous representation of the design and compliance of a system when compared to traditional document-based approaches. It also offers the opportunity to improve quality (with a focus on early defect identification), reduce risk and create a design process which is more easily certifiable, all of which should support through-life cost reduction.

Based on these potential benefits it is recognised that MBSE could support design activities within the nuclear sector, and in particular support the commitment within the Nuclear Sector Deal ([NSD](#)) of a 30 percent reduction in the cost of new build projects by 2030.

Additional Information & Guidance

- [INCSE, INCSE-TP-2004-004-02, Systems Engineering Vision 2020, September 2007.](#)