The Use of Mini-Case Studies to Illustrate Key Systems Engineering Principles

Jonathan Weaver, Ph.D.
Michael J. Vinarcik, P.E., CSEP-Acq (Presenter)
University of Detroit Mercy

Abstract

Robust systems architecture (SA) and systems engineering (SE) processes are necessary for the development of successful engineering systems. Many notable product failures can be traced to breakdowns in the architectural or systems engineering practices of the design team.

Despite the increased emphasis being placed on systems engineering, many systems engineering textbooks and references focus on specific tools (such as requirements or interface management systems). The few case studies included in these works are typically not exhaustive.

However, for individuals in a given working environment, developing expertise in a specific tool not used by one's workgroup adds little value. The presenters believe that it is more useful to help individuals cultivate an intuitive understanding of architectural and systems engineering issues. For that reason, they have augmented traditional SE textbooks and teaching resources with mini- and maxi-case studies.

Using topics drawn from throughout human history (from ancient tombs and medieval cathedrals to the Airbus A380/Boeing 787 and NASA space missions), the presenters showcase both notable successes and failures. This enhances learning and retention of key topics and enables students to internalize key SA/SE principles.

Cases may be presented using a variety of media (including PowerPoint slides, audio-visual presentations, or show-and-tell artifacts). They may be used as lead-ins to a traditional classroom lecture or as the kernel of a roundtable discussion among peers in the workplace.

This tutorial will demonstrate the principles the presenters use to identify case study candidates, research methods used to develop the framework of the presentations, and techniques used to develop a holistic SE mindset. Several case studies will be interleaved with the presentation; one maxi-case (intended to be the focus of an entire class period) will be presented as the capstone of the tutorial.

The Use of Mini-Case Studies to Illustrate Key Systems Engineering Principles

Jonathan Weaver, Ph.D.
Michael J. Vinarcik, P.E., CSEP-Acq (Presenter)
University of Detroit Mercy

Outline

Case Study Development

- Identifying case study candidates
- Researching the case
- Developing the outline
- Assembling backup material
- Formulating the case

Case Study Assimilation

- How to identify key SE principles in cases and news items
- Developing heuristics
- Fostering in-class discussion

Biography

Michael J. VINARCIK, P.E, CSEP-Acq, FESD is an Associate at Booz Allen Hamilton and adjunct faculty member at the University of Detroit Mercy. He is a systems engineer with eighteen years of experience in the automotive and defense industries. His background includes metallurgical engineering, testing, failure analysis, value engineering, 6 Sigma, and systems architecture and engineering. As an adjunct faculty member at UDM he has assisted with the MS Product Development (MPD) program's January Experience, taught Systems Architecture & Engineering, and assisted with the development of SE and technical entrepreneurship case studies.