

Abstract

"Lean Enablers for Systems Engineering"

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Lean Thinking is the paradigm that enabled Toyota to rise to the best and largest auto company in the world. The paradigm includes not only Lean manufacturing but also extraordinary effective Product Development and Systems Engineering, as well as a culture based on Respect for People.

Systems Engineering is regarded as a technically sound process but often burdened with waste and inefficiencies. Lean Systems Engineering is a new body of knowledge applying the wisdom of Lean Thinking to Systems Engineering. Systems Engineering and Lean have overlaps and differences, but both represent processes that evolved over time with the common goal of delivering product or system lifecycle value to the customer. Lean Systems Engineering represents synergy of the two, leading to superior systems engineering process.

Most emphatically, Lean Systems Engineering is not a "re-packaged FBC or Acquisition Reform". Lean Systems Engineering does not mean "less Systems Engineering"; it means more and better Systems Engineering, with better preparations, planning, front-loading, training, and more common sense, leading to better program execution.

Lean Enablers for Systems Engineering is a product designed by 14 experts from industry, academia, and U.S. and foreign governments, supported by 115+ strong Lean Systems Engineering Working Group of INCOSE. Lean Enablers are formulated as 194 "do's" and "don'ts" of Systems Engineering practice focused on Mission Assurance/Product Success and elimination of waste.

The workshop will cover of three parts:

- 1) Description of the development process of Lean Enablers for SE
- 2) Presentation of 194 Lean Enablers organized into six Lean Principles: Value, Value Stream Mapping, Flow, Pull, Perfection, and People.
- 3) "Validation" of the Lean Enablers by surveys, and by benchmarking with recent studies by NASA and U.S. Government Accounting Office.

Bohdan "Bo" W. Oppenheim is the founder and Co-Chair of the Lean Systems Engineering Working Group of INCOSE, and leader of the development effort of Lean Enablers for Systems Engineering. He is a Professor of Mechanical and Systems Engineering and Graduate Director of Mechanical Engineering at LMU in Los Angeles, California. He serves as the local Coordinator of the Educational Network of the Lean Advancement Initiative consortium at MIT. He is on the Steering Committee of the Lean Education Academic Network. For seven years he served as a Director of the U.S. Department of Energy Industrial Assessment Center assessing 125 U.S. industrial plants for productivity. He consulted Boeing, Northrop Grumman, Raytheon, Airbus, EADS, Telekomunikacja Polska, and 50 other firms on Lean, Systems Engineering and Quality. He has \$2.5 million in externally funded grants on his credit. He teaches graduate courses on Lean Systems Engineering, Lean Manufacturing, Lean Product Development, Lean Final Engineering, Lean Office, Lean Supply Chain, and Quality. He authored 25 journal papers.

Bo was born in Warsaw, Poland. His engineering degrees include Ph.D. from Southampton, U.K. in Systems Dynamics; Engineer's Degree from MIT in Ocean Systems; MS from Stevens Institute of Technology; and B.S. (equiv.) from Warsaw Technical University in Aeronautics. His professional experience spans space, naval, mechanical, software, and manufacturing industries.