An MBE Manifesto

In April, 2018, a small group of systems engineers, scientists, and researchers assembled at the 19th International Federation for Systems Research (IFSR) Conversation in Linz, Austria, to use systems analysis methods to model a Systems Engineering approach that would optimize modern model-based engineering methods and tools.

One result of that Conversation was a manifesto on model-based engineering. The purpose of the manifesto is to summarize and make explicit key values and principles motivating the transformation to model-based engineering (MBE). While we started with the concept of model-based systems engineering, we now feel that the values and principles in the manifesto are relevant to all engineering disciplines. We will present the manifesto at the upcoming 2018 INCOSE International Symposium, with the specific intent to seek feedback and input from across the INCOSE community.

The IFSR Conversation

The International Federation for System Research sponsored the Nineteenth IFSR Conversation, this year in Linz, Austria. Conversations were introduced by Bela H. Banathy around 1980 as an alternative to the classical conferences. In a Conversation a small group of scientists meets for several days to discuss in a self-guided way a topic of scientific and social importance. No papers are presented; the participants discuss their topic face-to-face. Teams of four to eight members meet for five days to develop conceptual models and intensify their understanding of the session topic. After the Conversation the teams document their findings in the proceedings of the Conversation. The manifesto is the output from the sessions that discussed Data Driven Systems Engineering Approaches at the 2018 Conversation.

Data Driven Systems Engineering Goals

This Conversation session explored the application of analytic and modeling techniques to the Systems Engineering problem space. Systems Sciences can be described as the application of a systematic approach (systems thinking) that includes tools and techniques from systems analysis, data analysis, computer science, efficiency/ecology, human factors, systems dynamics, and complexity theory towards topics in nature, society, health, and engineering. The application of systems science toward engineering the total system (Systems Engineering), particularly the analysis of high fidelity data to drive engineering decisions in complex systems, systems of systems, and massively complicated systems is of particular interest. Research shows that many of the systems we take for granted, such as automobiles and airplanes, and the infrastructures that support these systems (system of systems) are becoming increasingly more complicated. The automobile of today contains over a million lines of code (LOC); an airplane can contain over 10 million LOC. At the same time, economic and political pressures are being applied to drive down cost and reduce schedules. Systems analysis and data analytic methods are being used effectively in many business use cases. Systems Engineering is held responsible for the understanding and control of complex systems.

Systems Engineering as an engineering discipline is based on assumptions from supporting disciplines such as systems analysis, systems science, and systems thinking. Therefore, it should be natural to think of Systems Engineering as being data driven. However, experience finds the contrary. Engineering programs (Products, technology, processes, and people organization) are often based on the processes, organization, technology and product plans of previous programs, whether (or not) those past programs were successful. And little consideration is given to whether those past program processes, tools, technology, people, or organizations are optimally suited for the new product or processes. If Systems Engineering is a true engineering discipline, then we should use our Systems Engineering methods to design our engineering programs. That is, to use systems analysis and modeling methods to systematically model and optimize the program approach.

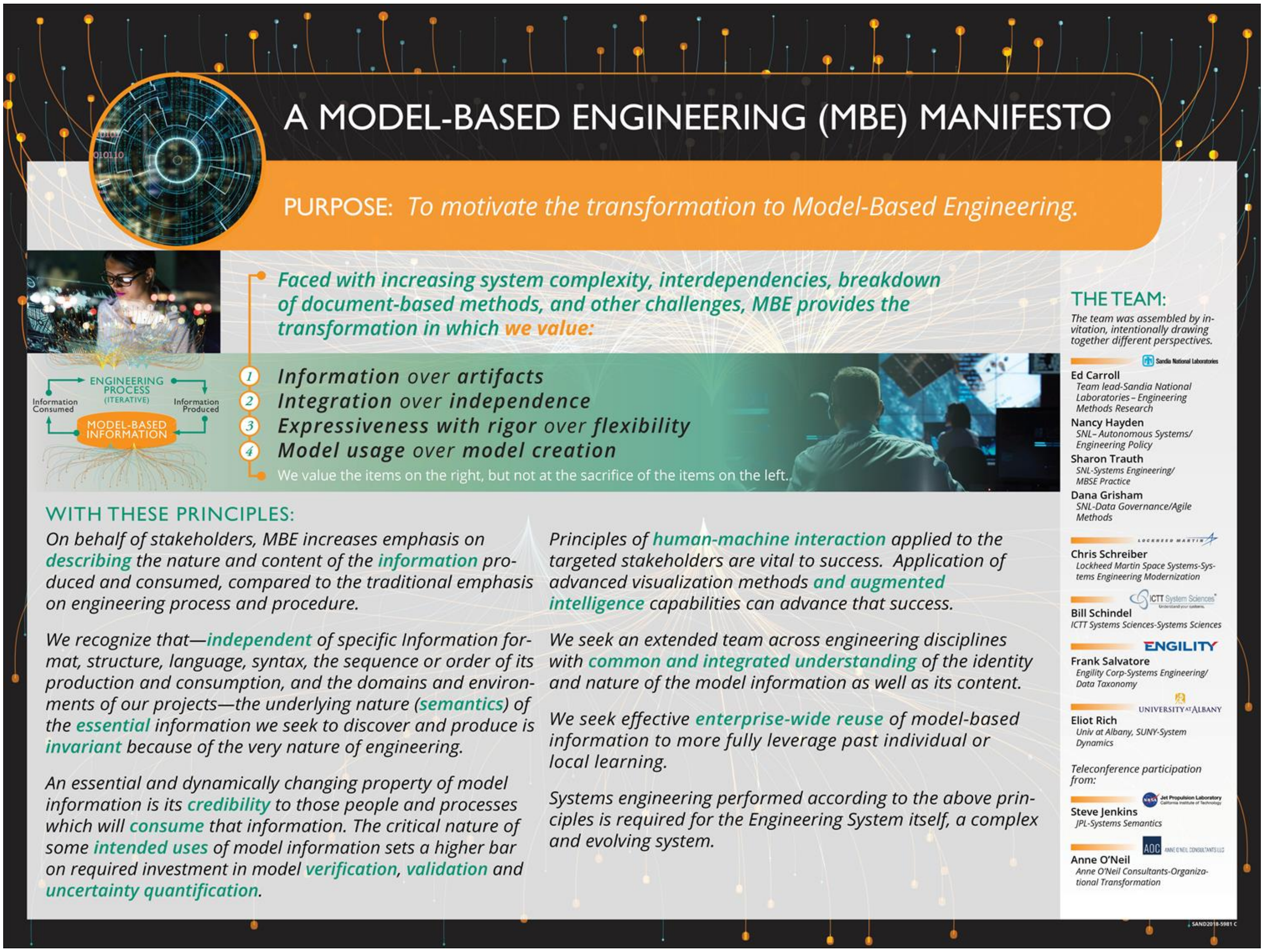
Agenda:

In the months prior to the Conversation, the team collaborated extensively on the agenda. The final agenda that emerged encouraged conversation flowing through the S*Space paradigm, starting with the system model of the target system (S_1), working upward toward the model of life cycle domain system – the system that manages the target system model (S_2), and then on to the model of system of innovation – the system that evolves the life cycle domain system (S_3).

Subtopics included:
Model Credibility:
SE knowledge Representation (Ontology):
Constraint Definition:
What is the Smallest Model?:
Using Data:
Model Patterns, or Pattern-based Systems Engineering (PBSE):
Model Integration/Continuous Integration:
Configuration Management of Models:
Modeling in Support of an Agile Method:
Culture Change - A Model-based Manifesto:

We successfully culminated this week-long conversation with a Value Statement and Model-based Engineering (MBE) Manifesto. below.

We sincerely hope to start a conversation, receive feedback and input to the manifesto. While we recognize that not everyone will share our views or appreciate the nuance of our wording, our hope is that the MBE manifesto will embody our full collective values and principles on where the engineering industry is moving forward into the next decades.



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