Systems Engineering Advancement Research Initiative

RESEARCH PORTFOLIO **Fall 2008**

Our research portfolio is organized around five major themes that are at the core of advanced systems engineering. Through this research we aim to advance the theory, methods, and effective practice of systems engineering.

SOCIO-TECHNICAL DECISION MAKING. This research area seeks to develop multi-disciplinary representations, analysis methods, and techniques for improving decision making for socio-technical systems. Examples include:

- Studies of decision processes and effectiveness of techniques
- Constructs for representing socio-technical systems for impact analysis on costs, benefits, and uncertainties
- Effective visualization of complex tradespaces
- Understanding and mitigating cognitive biases in decision processes
- Developing dynamic system strategies (e.g. timing technology investments and execution of system change options)
- Methods for representing distribution of costs and benefits to multiple stakeholders of socio-technical systems

DESIGNING for VALUE ROBUSTNESS. This research area seeks to develop methods for concept exploration, architecting and design using a dynamic perspective for the purpose of realizing systems, products, and services that deliver sustained value to stakeholders in a changing world. Examples include:

- Methods for and applications of dynamic Multi-Attribute Tradespace Exploration
- Architecting principles and strategies for designing survivable systems
- Architecting strategies and quantitative tradespace exploration of systems of systems
- Quantification of the changeability of system designs
- Techniques for the consideration of unarticulated stakeholder and latent system value
- Taxonomy for enabling stakeholder dialogue on 'ilities'

SYSTEMS ENGINEERING ECONOMICS. This research area seeks to develop a new paradigm that encompasses an economics-based view of systems engineering to achieve measurable and predictable outcomes while delivering value to stakeholders. Examples include:

- Leading indicators for systems engineering effectiveness
- Analysis and application of real options for systems and enterprises
- Advanced methods for reuse, cost modeling, and risk modeling
- Measurement of productivity and quantifying the ROI of systems engineering
- Quantification of the time-varying cost of carrying and executing multiple and linked real options

SYSTEMS ENGINEERING in the ENTERPRISE. This research area involves empirical studies and case based research for the purpose of understanding how to achieve more effective systems engineering practice in the context of the system being developed, and the characteristics of the associated enterprise. Examples include:

- Engineering systems thinking in individuals and teams
- Collaborative, distributed systems engineering practices
- Social contexts of enterprise systems engineering
- Alignment of enterprise culture and engineering processes
- Socio-technical systems studies and models

SYSTEMS ENGINEERING STRATEGIC GUIDANCE. This research area involves the synthesis of theory with empirical and case based research for the purpose of developing prescriptive strategic guidance to inform the development of policies and procedures for systems engineering practice. Examples include:

- Systems Engineering research guidelines
- Participation in focus groups and pilot-phase reviews
- Position papers on proposed policies
- Recommendations for integrating SE research into curriculum
- Identification of SE research gaps and opportunities

About SEAri

http://seari.mit.edu

The Systems Engineering Advancement Research Initiative brings together a set of sponsored research projects and a consortium of systems engineering leaders from industry, government, and academia. SEAri is positioned within the Engineering Systems Division (ESD) at the Massachusetts Institute of Technology (MIT), a new kind of interdisciplinary academic unit that spans most departments within the School of Engineering, as well as the School of Science, School of Humanities, Arts, and Social Sciences, and Sloan School of Management. This setting offers a robust, interdisciplinary research and learning environment for advancing systems engineering to meet contemporary challenges of complex socio-technical systems. SEAri has strategic relationships with several MIT programs, including the System Design & Management Program (SDM) and Lean Advancement Initiative (LAI).

Massachusetts Institute of Technology