




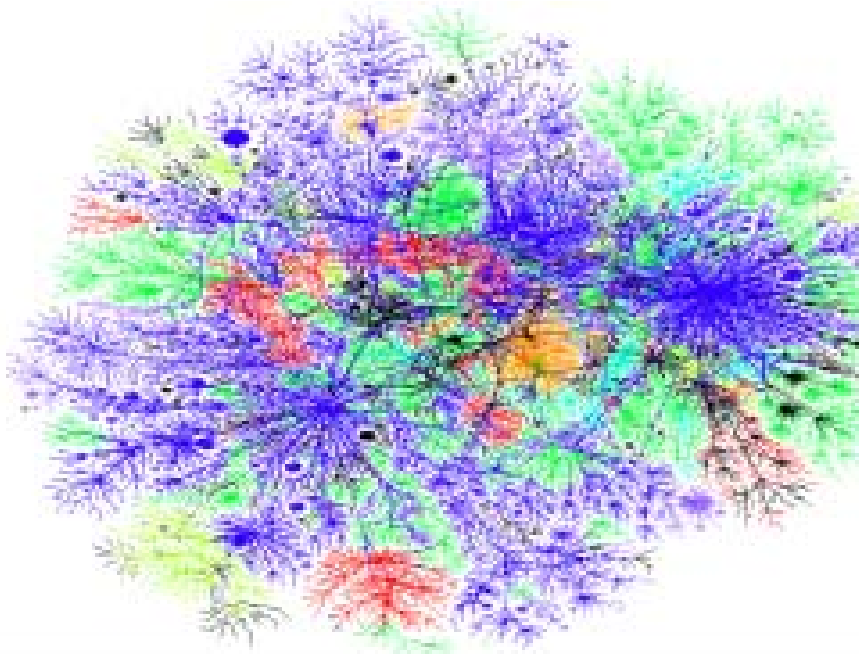
Findings of Case Studies on Enterprise Systems Engineering

1st Annual IEEE Systems Conference
April 9-12, 2007

Kimberly A. Crider
Joseph K. DeRosa



The Systems We Engineer Today are complex ... and adaptive enterprises



Containing

**People
Processes
Technology**

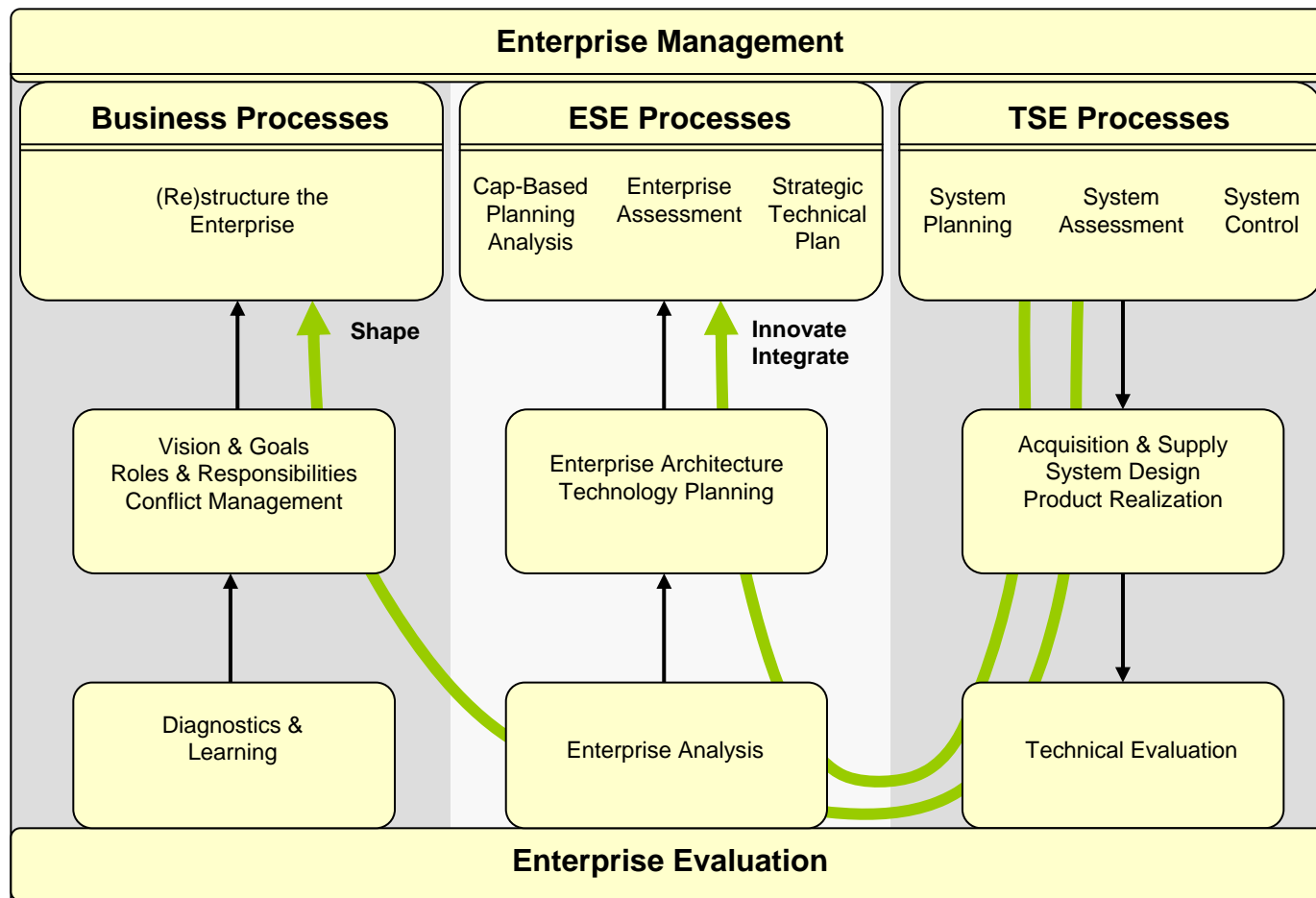
The Systems We Use to Engineer Them are complex and adaptive enterprises



Overview

- **This paper reports on case studies in Enterprise Systems Engineering (ESE)**
- **It follows a new ESE Process**
 - **Based on evolutionary principles and complexity theory**
 - **Combining business and engineering sub-processes**
- **It makes recommendations based on these finding for Industry and Academia**

New Process* for ESE



* J.K. DeRosa, G. Rebovich and R. Swarz, "An Enterprise Systems Engineering Model,"

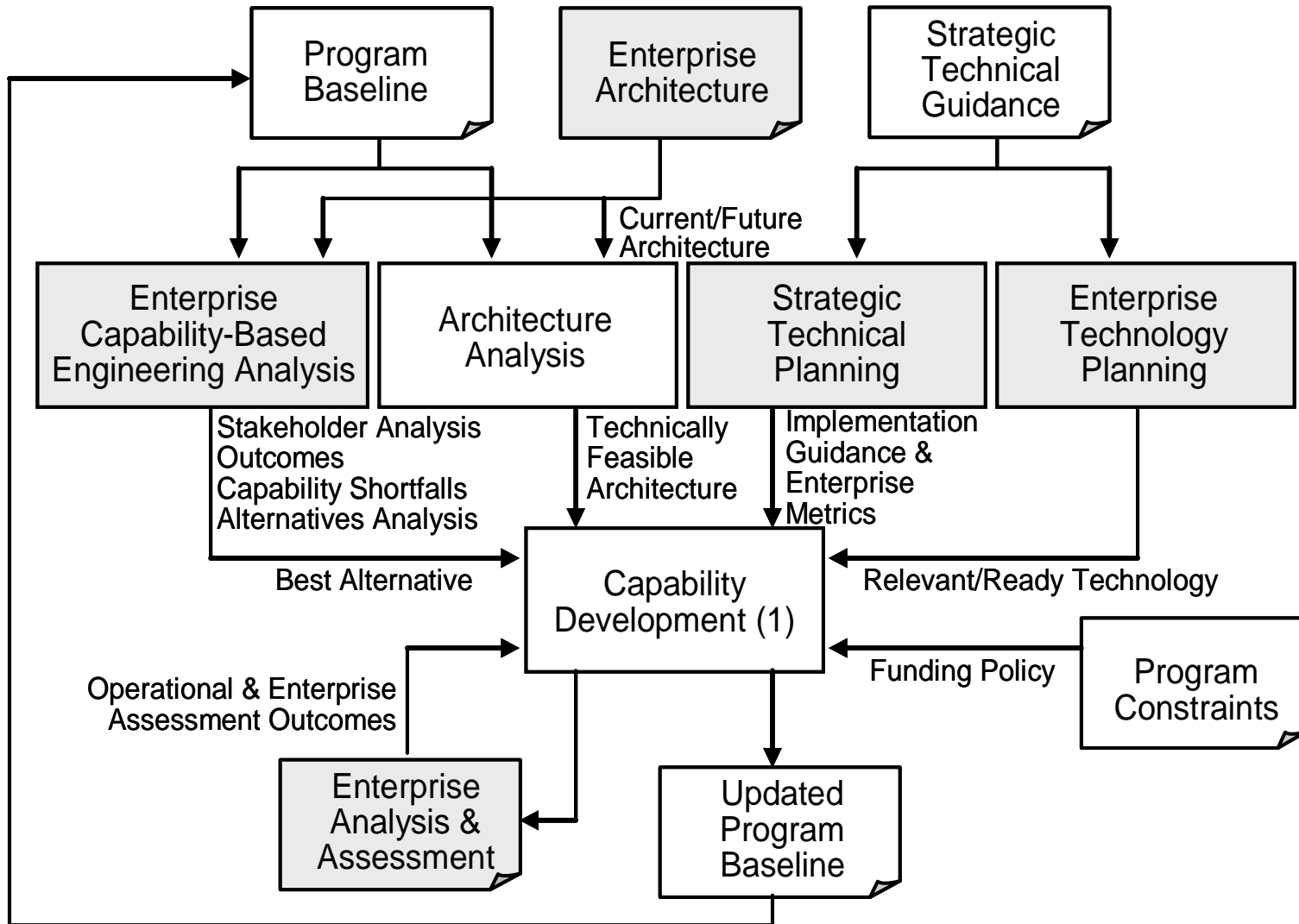
Proc. of 16th Intl. Symp, INCOSE, Orlando, FL, Jul 2006, paper 10.3.2



The Five ESE Sub-processes

- **Technology Planning** develops and assesses technical opportunities in the marketplace. Development favors innovation, assessment favors integration.
- **Capabilities-Based Planning Analysis** helps evolve operational goals and vision. It promotes a "variation-pull" from the customer side.
- **Enterprise Architecture** represents the vision, strategy, and implementation at the enterprise scale. It promotes self-synchronization for both developers and managers.
- **Strategic Technical Planning** sets the technical strategy that establishes the balance between adoption of standards and use of new technologies.
- **Enterprise Analysis and Assessment** helps shape the environment and select options by measuring progress towards realizing the vision

The Processes in Perspective





The Case Studies

- **A total of eighteen case studies were commissioned.**
- **wide range of projects**
 - **Command Center operations**
 - **surveillance and situation awareness**
 - **logistics and support**
- **Multiple perspectives**
 - **Retrospectives – evaluated how ESE concepts may have played a role in shaping program outcomes (even if the Chief Engineer may not have knowingly done so)**
 - **Forward-looking – tested how the processes actually affect program performance**
- **Theory and practice of ESE were linked.**



Methodology

- **We provided a number of engineering artifacts**
 - ESE sub-process toolkits
 - Tutorials on the processes,
 - Community share sites with all material
 - Quarterly group meetings to share findings
- **The objectives were clearly stated**
 - Improve program performance through the application of ESE
 - Improve the ESE processes through feedback as a result of their application
- **To encourage candor in the analysis, the focus group established a ground rule that the programs would not be named publicly**



Results

- **The ESE Processes proved useful in the Practice of Complex Systems Engineering and Complemented TSE**
- **Stakeholder Analysis is a logical sixth ESE Process and an important enabler to ESE is active stakeholder participation.**
- **ESE does not follow a linear path**
- **Effective ESE requires a deliberate investment of resources above the scale of individual systems**
- **Context is key and architecture can help**
- **ESE Must Look at the Interdependency of People and Processes that Result When Innovation is Introduced Within an Enterprise**
- **Strategic Technical Plans Can be Pervasive and Effective**
- **ESE Requires New Socio-Cultural Skills**
- **Opportunity is the Other Side of Risk**



Summary and recommendations

- **Build a set of ESE process toolkits within the professional community**
 - e.g., through INCOSE or GEIA working groups.
 - Focus on the six ESE processes outlined here
- **Build and promulgate a set of tools to support these processes.**
- **Document and publish ESE use cases illustrating successes and failures**
- **Advocate the need for ESE with both customers and senior management.**
- **Support education and training in ESE**