SE Workforce Development and the Systems Engineering Body of Knowledge

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Agenda

1. **Workforce Development Use Case**
2. Enabling Systems Engineering
3. Enabling Individuals
4. Enabling Teams
5. Enabling Businesses and Enterprises
6. Q&A

How SEBoK Can be Used to Support Workforce Development

- Systems engineering activities are enabled by a high-performing workforce
- A high-performing workforce is influenced by many factors at the individual, team, and business/enterprise level
- There are many ways to enable SE performance and each organization's approach is unique
- SEBoK is structured to provide pointers to common practices, methods, and considerations organizations use for workforce development

SEBoK Purpose

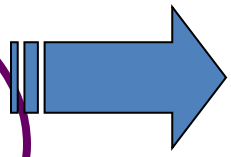
To provide the boundaries, terminology, content, and structure needed to systematically and consistently *support* the following*:*

Purpose	Description
Inform Practice	Inform systems engineers about the boundaries, terminology, and structure of their discipline and point them to useful information needed to practice SE in any application domain
Inform Research	Inform researchers about the limitations and gaps in current SE knowledge that should help guide their research agenda
Inform Interactors	Inform performers in interacting disciplines (system implementation, project and enterprise management, other disciplines) of the nature and value of SE
Inform Curriculum Developers	Inform organizations defining the content that should be common in undergraduate and graduate programs in SE
Inform Certifiers	Inform organizations certifying individuals as qualified to practice systems engineering
Inform SE Staffing	Inform organizations and managers deciding which competencies that practicing systems engineers should possess in various roles ranging from apprentice to expert

Guide to the literature, not all the content of the literature

Part 5 – Enabling of Systems Engineering (When, Who)

- Part 1: Introduction
- Part 2: Systems
- Part 3: Systems Engineering and Management
- Part 4: Applications of Systems Engineering
- **Part 5: Enabling Systems Engineering**
- Part 6: Related Disciplines
- Part 7: Examples



- SE Organizational Strategy
- Enabling Individuals to perform SE
- Enabling Teams to perform SE
- Enabling Businesses and Entreprises to perform SE

Strategies for individuals, teams, and the business/enterprise;
Determining Competencies/Capabilities, Organizing for, Assessing, Developing

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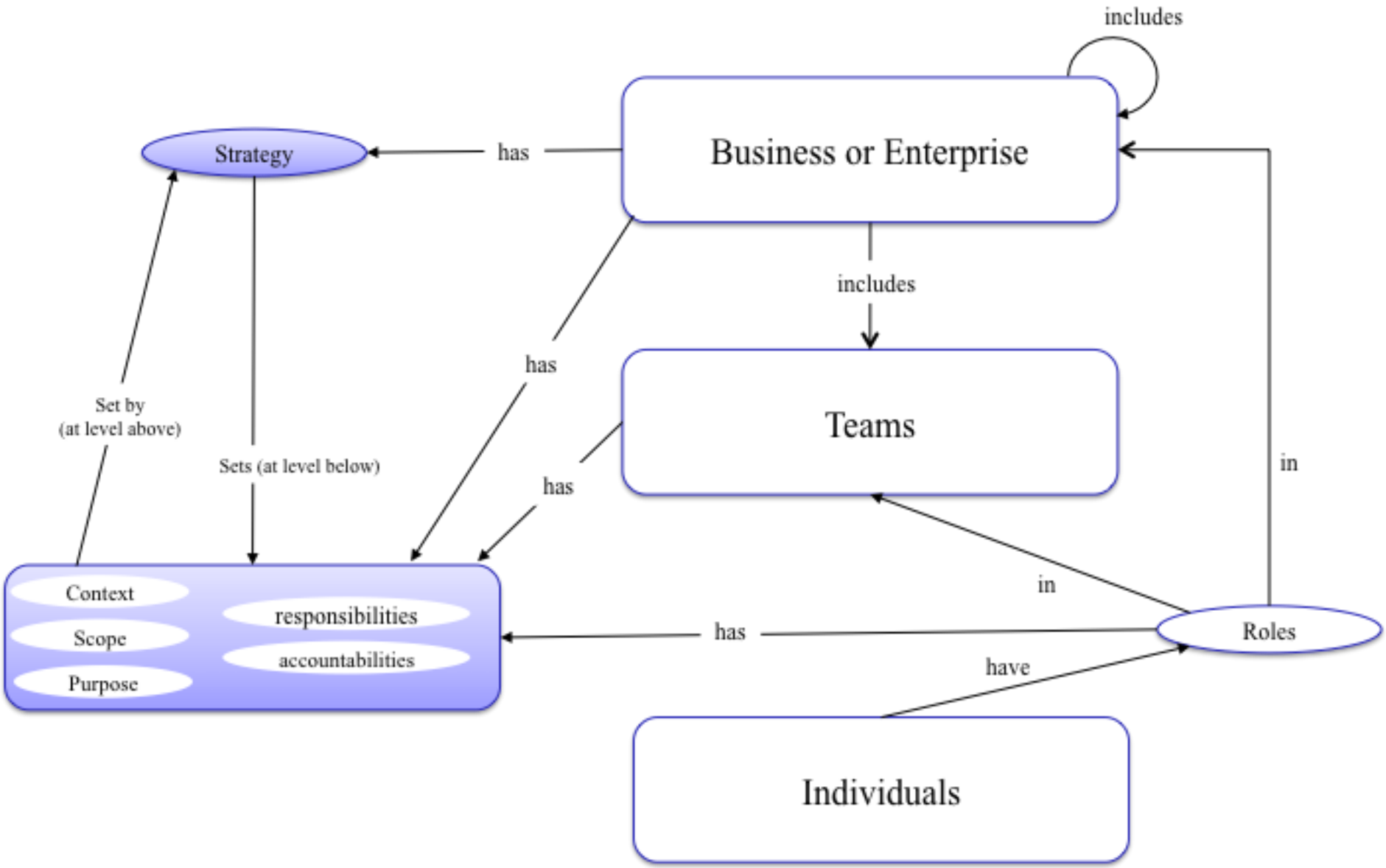
SEBoK Part 5 Structure

Part 5

- Part 5: Enabling Systems Engineering
  - Knowledge Area: Systems Engineering Organizational Strategy
    - Topic: Organizational Purpose
    - Topic: Value Proposition for Systems Engineering
    - Topic: Systems Engineering Governance
  - Knowledge Area: Enabling Businesses and Enterprises to Perform Systems Engineering
    - Topic: Deciding on Desired Systems Engineering Capabilities within Businesses and Enterprises
    - Topic: Organizing Business and Enterprises to Perform Systems Engineering
    - Topic: Assessing Systems Engineering Performance of Business and Enterprises
    - Topic: Developing Systems Engineering Capabilities within Businesses and Enterprises
    - Topic: Culture
  - Knowledge Area: Enabling Teams to Perform Systems Engineering
    - Topic: Determining Needed Systems Engineering Capabilities in Teams
    - Topic: Organizing Teams to Perform Systems Engineering
    - Topic: Assessing Systems Engineering Performance of Teams
    - Topic: Developing Systems Engineering Capabilities within Teams
    - Topic: Team Dynamics
  - Knowledge Area: Enabling Individuals to Perform Systems Engineering
    - Topic: Roles and Competencies
    - Topic: Assessing Individuals
    - Topic: Developing Individuals
    - Topic: Ethical Behavior

Key Relationships



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Enabling Individuals to Perform Systems Engineering (1 of 2)

- Understand why competency models are used
  - Recruitment and Selection
  - Human Resources Planning and Placements
  - Education, Training, and Development
- Review existing SE competency models as reference in developing your list of desired competencies
  - International Council on Systems Engineering (INCOSE) UK Advisory Board
  - SPRDE-SE/PSE model
  - NASA Academy of Program/Project & Engineering Leadership (APPEL)
  - Citations for other competency models and lists
- Understand how SE competencies compare to other competencies
- Perform External benchmarking

Enabling Individuals to Perform Systems Engineering (2 of 2)

- Identify common strategies to close competency gaps
- Use SE Competency Development Framework to map development objective to method
- Understand the importance of maintaining competency plans
- Decide, Organize, Develop, Assess

SE Competency Development Framework

Goal	Objective	Method
PRIMARY GOAL= Delivery of excellent system to fulfill customer needs	Focus on successful performance outcome	Corporate initiatives
	Focus on performance of project team	Team coaching of project team for performance enhancement
SECONDARY GOAL= Competency to deliver excellent system to fulfill customer needs	Develop individual competency	Training courses
		Job rotation
		Mentoring
		Hands-on experience
		Develop a few hand-picked individuals
		University educational degree program
		Customized educational program
		Combination program - education, training, job rotation, mentoring, hands-on experience
		Course certificate program
	Ensure individual competency through certification	Certification program
	Filter those working in systems roles	Use individual characteristics to select employees for systems roles
	Ensure organizational competency through certification	ISO 9000
	Develop organizational systems competency through processes	Process improvement using an established framework
		Concept maps to identify the thought processes of senior systems engineers
		Standardize systems policies and procedures for consistency
		Systems engineering web portal
		Systems knowledge management repository
		On-call organizational experts
		Rotating professor who works at company 1/2-year and is at university 1/2-year
	Alter organizational design to support competency	Create organizational home and support for particular competency
	Shorten product lifecycle to build competency	Build new system every two years to maintain system competency

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Enabling Teams to Perform Systems Engineering

- Understand the main team concepts:
  - Team capability requires both competency and capacity to accomplish assigned tasks
    - Team competency requires the needed collective set of aptitudes, intelligence, and skills distributed among the team members
    - Team capacity relates to the number of team members and the time within in their schedules to perform their assigned tasks
  - Team capability depends on morale and attitudes at both the individual and team levels
- Acknowledge and accommodate team constraints (time, money, resources)
- Build cohesive teams that have a common vision and work in a cooperative manner to achieve shared objectives
- Understand approaches to enable teams to perform systems engineering efficiently and effectively
- Decide, Organize, Develop, Assess

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Enabling Businesses and Enterprises to Perform Systems Engineering

- Understand the Organizational Purpose
- Determine the value of systems engineering in achieving that purpose.
- Capability at this level includes:
  - Competent personnel
  - Adequate time
  - Sufficient resources
  - Appropriate policies and procedures
  - Social Dynamics
  - Culture
- Decide, Organize, Develop, Assess

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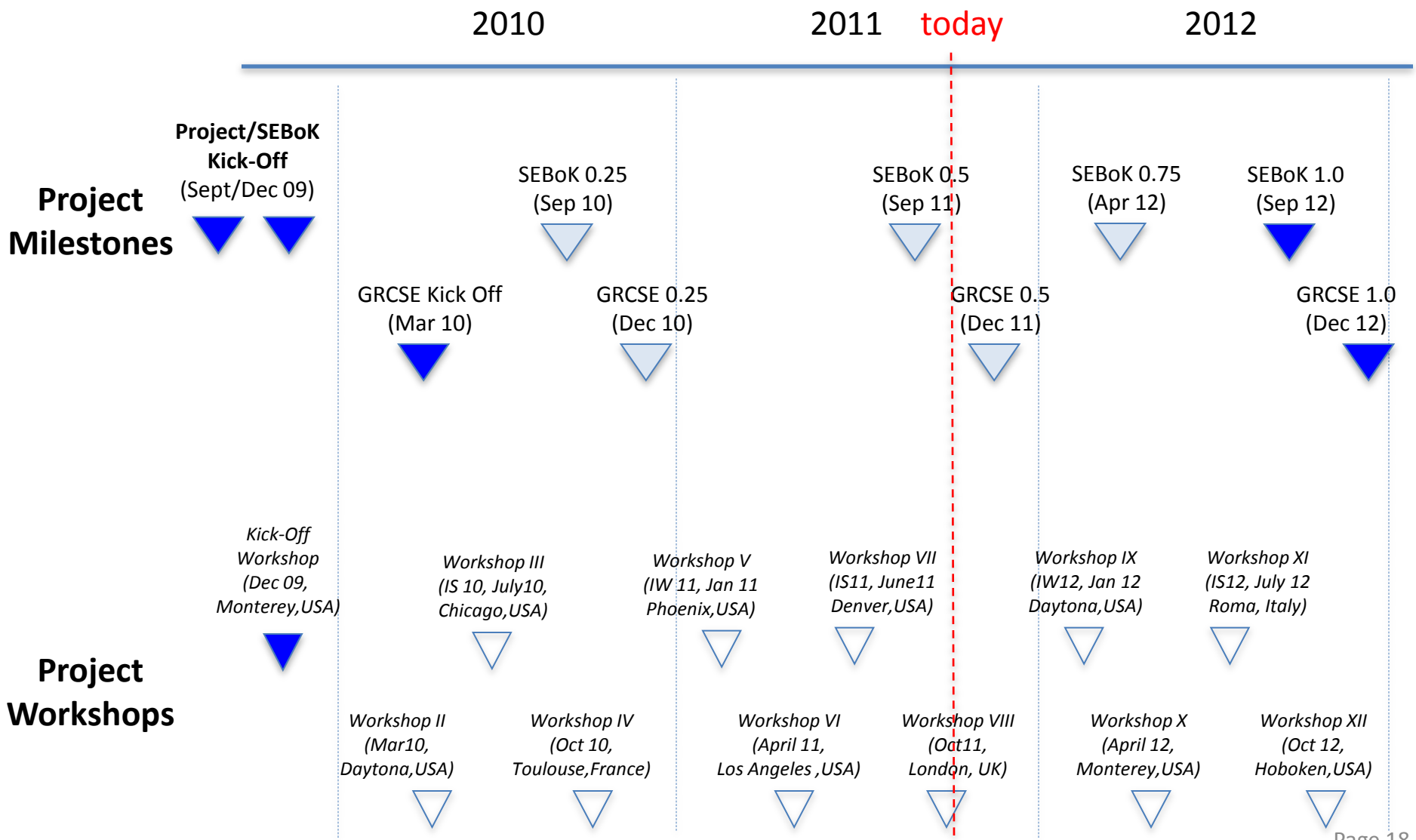
Example: Planning, Overseeing, Performing Across the System Life Cycle

- System Definition
  - Mission Analysis and Stakeholder Requirements
  - System Requirements
  - Architectural Design
  - Systems Analysis
- System Realization
  - Implementation
  - System Integration
  - System Verification
  - System Validation
- System Deployment and Use
  - System Deployment
  - Operation of the System
  - System Maintenance
  - Logistics
- Product and Service Life Management
  - Service Life Extension
  - Capability Updates, Upgrades and Modernization
  - Disposal and Retirement

BKCASE Project Schedule



SEBoK 0.5 Wiki Outreach Sessions

- Access the SEBoK: sebokwiki.org
- To help orient the community to the wiki delivery of the SEBoK, the BKCASE team has planned 3 outreach sessions
- Sessions will provide participants with:
  - An overview of the SEBoK
  - Instructions on the spirit and mechanics of review
  - An opportunity to ask general questions regarding the SEBoK
- Sessions to be held Nov 7-9
- For additional details or to register for a session, please email bkcase@stevens.edu

Questions?

www.BKCASE.org

bkcase@stevens.edu