Selling SE value & Utilizing Capability Design to establish or enhance organizational SE capability

Presentation to INCOSE Singapore Chapter
August 2016
Outline

• Selling SE value – as establish/enhance SE capability
  • Organizational capability building
  • Expanding to domains outside traditional aerospace/defense

• Utilizing a Capability Design approach
  • Enterprise level capability - applying SE this level
  • Implementation examples

• Discussion & Exchange
SELLING SE VALUE – APPROACH TO DEVELOPING SE ORGANIZATIONAL CAPABILITY

Overall proposition

• Systems Engineering (SE) has the potential to be a ubiquitous discipline, adding value to many domains

• SE can appear rigid, process heavy with a strange language and a significant investment burden, preventing the realisation of value

• We suggest there is a “sweet spot” for SE application – balancing the SE response appropriate to problem and SE capability level in the organisation

Organizational guidance needed – to establish appropriate capability to realise the value of Systems Engineering
Specifics of problem

1. Systems Engineering is a team sport
   • Solo practitioners cannot deliver benefits of SE alone

2. Organizational “brown field” challenge
   • A SE advocate implementing SE needs to blend in with, leverage existing established responsibilities and culture

3. SE reputation for adding overhead, not value
   • Poses barrier to obtaining resource support from PMs, cultivating executive sponsors

4. Terminology barrier
   • “It’s difficult to sell something if you do not use language intelligible to prospective customers”

Specifics of problem – cont’d

5. Over-emphasizing process versus delivered value
   • Can make process replacement for Systems Thinking, rather than enabler/ context for the powerful approach

6. Inappropriate dependency on tools / methods
   • Avoid “pursuit for perfection”

7. Danger of creating another silo
   • Do not perform SE for sake of “doing SE”
What is the “sweet spot”?

Zone 1 **“DANGER”**
Different / more capable SE needed

Zone 2
Warning “losing value”
SE applied > problem needs

Zone 3
The “sweet spot”

**IMPORTANT note**
- The axes are not linear; it's a conceptual model
- Y axis is not simply “tailoring” – it’s the “style” of SE required

Organizational SE capability
(based on organizational SE maturity)
“Sweet spot” key takeaways

• Size of organisation must not be excuse for not adopting the SE approach and principles the situation demands
• Don’t jump to a standard approach or methodology solution!

Systems Engineer the appropriate SE approach to situation
Anecdotes / lessons learned from implementation journey -- Establishing SE capability at MTA NYCT

- Created sense of Need
  - Understanding and communicating the need: capital project delivery issues
  - Then developed business case
    Leveraged benchmarking data from industry peers
Charting the implementation journey for MTA NYCT

Incremental, non-linear journey…
…flexibly aligned to agency, executive needs

• Didn’t start at the beginning of lifecycle process

• Tailored activities, SE application to need – where would demonstrate value
Observing the problem space at MTA NYCT: Generating organizational buy-in and awareness

- Grew awareness for “systems issues”
- Allies generated, momentum and interest in other SE activities — to improve requirements definition, improve engagement with Operations stakeholders

At each incremental step to introduce further SE activities, emphasis remained on delivering value!
Organizational maturity:
How to organize & How implement

Processes
Control work and output of organisation

Organisation
Enable work, integrate, store and manage outputs

People
People have roles and competencies to deliver process. They are controlled by process, enabled by tools / methods

Tools / Methods
Organizational maturity to exploit SE
Key issues for integrated SE capability

• SE as “glue” role
• SE IS a discipline
• Scope expands beyond Engineering to Executives, Operations and Project Management
• SE must make its business case
Recognize it’s a journey, and plan the route

1. Create desire to apply or improve SE
2. Organise to do SE
3. Get (appropriate) SE capability
4. Apply. May be limited initial pilot SE
5. Reflect Outcomes and SE capability

SE must be seen as a capability
Recognize it’s a journey, plan the route

Roles of SE Champion and Advocate

- Roles that define the Journey
- Core team guiding “Organizing to do SE”

**Champion**
- Accepts and pulls for SE application as business benefit

**Advocate**
- Responsible for planning the journey
- Ties SE capability needed to their understanding of 1) organization, 2) domain situation

*Along journey approach must vary from “Prophet, to Pragmatist, to Perfectionist”*  
Kemp and Elphick, 2012
Conclusions for Making SE truly universally applicable

• Create the desire for SE
• Sustain desire: cultivate Advocates & Champions
• Watch your language
• More than tools & process, it’s *Systems Thinking*!
• SE seen as distinct discipline that is **additive** to the other engineering disciplines (as it integrates)
• Tailor SE to specific needs of problem AND to existing capability of organization

**Recommended:** INCOSE produce “Guidance for Development of Organizational SE Capability”
UTILIZING A CAPABILITY DESIGN APPROACH
Dealing with enterprise-level systems

Traditional project level SE ≠ enterprise level SE

• Enterprise SE
  • Uses different techniques
  • Needs to the deal with lack of direct control of the constituent systems
  • Is more complex because of the scale of the work undertaken and the socio-technical nature of the problems

Both types of SE ultimately support building capability:

• Enterprise SE: guide development of SE capability
• Project SE: carry out ‘whole life, whole systems’ practices on each project
Hitchins’ Five-Layer Model
(Adapted from Hitchins, 2007)

- **Layer 1 Product Level**
  - Strategic Planning
  - Capability Design

- **Layer 2 System Level**
  - Capability Acquisition and Through-Life Support

- **Layer 3 Business Level**
  - Layer 3 Business Level

- **Layer 4 Supply Chain Level**
  - Layer 4 Supply Chain Level

- **Layer 5 Socio-Economic Level**
  - Layer 5 Socio-Economic Level

SoSE & Enterprise SE

Traditional SE

SoSE suited to very high levels of complexity

- 25 year Needs analysis
- 10 years Before EIS
- Entry into Service (EIS)
- Support
- Disposal

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Capability design cycle

Technology review, Market surveys, Trade-off studies,

Option #1
Operational needs

System functions

Option analysis & architecture definition

Requirements iteration

Solution iteration

Variant 1
Variant 2
Variant 3

System Solution
Option #1

Variant 1
Variant 2
Variant 3

Variant 1
Variant 2
Variant 3

Option #2

Option #3

Verification

Parametric studies, technical & cost-benefit-risk evaluations, etc.

Operational experience

Strategy
Design questions

- **Why** does it do it?
  - goal and objectives => mission
- **Who** uses it? Who is impacted by it?
  - organization elements and relationships
- **Where** is it used?
  - locations, logical and / or physical
- **When** is it used?
  - time, sequence, major events, cycles
- **How** is it used?
  - processes and procedures, behavior

- What is in it & what does it do? ____________________________
- How is this achieved? ____________________________

Problem Definition
Operational Analysis
“Black Box” context analysis
Solution Concept
Solution Design
From strategy to implementation

Strategy

Operational

System

Strategic Guidance Document

Guidance element

Capability Requirement

Operational Task

Scenario

Top-Level Need

Function

Requirement

documents

guides

basis of

achieved by

achieves

decomposes

refines

decomposes

specified by

refines

Capability Design modelling purpose

Modeling purpose for this Capability Design effort:

To assess and demonstrate alignment, consistency, inter-dependencies between various enabling enterprise initiatives and to identify gaps

<table>
<thead>
<tr>
<th>Enterprise Capability Enablers</th>
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<tbody>
<tr>
<td>Executive strategic management</td>
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<tr>
<td>SE capability design</td>
</tr>
<tr>
<td>Tools and procedures</td>
</tr>
<tr>
<td>Project management framework and governance</td>
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• Maintain alignment, highlight inconsistencies between multiple activities across:
  • Range efforts/expertise across multiple implementation teams, over time
  • Range efforts across departments, liaisons and working teams, over time
Capability design components considered when adding or enhancing enterprise capability

**Governance**
- Leadership
- Accountability

**People**
- Skilling and training
- Team roles and structure

**Processes**
- Technical & model-related processes
- Technical reviews

**Tools**
- Software & Interfaces
- Scripts & libraries

**Information**
- Generated by projects/programs and operations
- Reference knowledge, lessons learned

**Inputs**
- Stakeholders
- Experts
- Source documents (Existing corporate and capability documentation, standards, specs, etc.)

**Outputs**
- Capability documentation, specifications and other reports

**Culture**
- Enterprise interfaces

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Organisational capability needs to implementation

IMPLEMENTATION EXAMPLES
Identifying capability needs

• Western Australia’s Department of Fire and Emergency Services (DFES):
  • Coordinate emergency services for a range of natural disasters and emergency incidents across a huge area
    • Rural and urban fires
    • Hazmat incidents
    • Floods
    • Etc ...

• Difficult problem space – lots of inter-related systems and organisations
  • Modeling to support decisions on what systems to buy or design and build
  • Need to prioritise resources – support to, and justification for, decisions
Capability framework

• Model which *defines, describes* and *documents* organisational capabilities and characteristics and elements necessary to deliver them

• Supports different but consistent *views* of a capability

• Benefits of having one
  • Basis of requirements for projects
  • Capability options analysis
  • Development of robust business cases
  • Informing stakeholders of organizational capabilities
  • Providing justification for organizational capability decisions
Capability viewpoint
Operational viewpoint
Integrated systems viewpoint

Integrated Systems Viewpoint

- Measure of Performance
- Requirement
- People
- Assets
- Information Technology
- Knowledge
- Governance & Accountability
- Item
- Interface
- Functionality
- Capability Element

- Operational Viewpoint
- Operational / End-user Need

- Projects Viewpoint

- Enterprise Futures Strategy:
  - HR Strategy
  - Asset Strategy
  - Capital Investment Plan
  - IT Strategy
  - Operating Plans
  - Governance Strategy

- Measure of Performance refines Requirement, which is specified by People, Assets, Information Technology, Knowledge, and Governance & Accountability.

- Functionality performs Capability Element, which is decomposed by inputs / outputs.

- Item transfers Interface, which is connected to Requirement.

- Projects Viewpoint is supplied by theEnterprise Futures Strategy.
... Systems Viewpoint
Capability Elements
specified by
Requirement
defines

supplied by
accomplished by
manages manages
governs

projects viewpoint

Project
Risk Management
treated by
Business Requirements Database
generates
Project Activity
Project Management
captures ideas for
Innovation system
capability
review process
business operations database
Initiation to funding approval

LESSONS LEARNED FROM THE AUSTRALIAN NAVY’S FUTURE FRIGATE PROGRAM
Role of capability design in program

Take ‘corporate’ guidance (Defence White Paper, Govt direction on shipbuilding, etc.) and translate to concept then to acquisition specifications
Applied to Navy surface fleet

High Level/Strategic Guidance (DWP, DPG, FMOC, IOCD etc.)

Evolving Strategic Needs/Capability Gaps/Deficiencies

Surface Combatant Force 2025-30
Operational Concept Document (OCD)

Evolving Surface Combatant Force
Needs/Capability Gaps/Deficiencies

Joint Force Integration/
Interoperability Needs

ANZAC Class FFH FPS
Hobart Class DDG FPS
Future Frigate FPS

Related ‘Internal’ Projects/Systems

DNPS Framework Surface Combatant FPS

CIWS FPS
SM-2/ESSM FPS
MH-60R FPS

AOR

OCD
FPS

OCV

LHD

MPA

Related ‘External’ Projects/Systems
How does this resonate? Share application experiences

DISCUSSION & EXCHANGE
Additional INCOSE references

INCOSE MBCD WG
Co-chair, David Harvey, Chief SE Shoal Engineering
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