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Transformation of Systems Engineering

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Corporate Advisory Board Update

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Report Contents

- Reminder: What is the Transformation?
- Transformation Progress & Status Report
- Example Transformation Products
- CAB Connection to the Transformation

- Discussion from CAB

Transformation to a Model-Based Discipline

Objective: *INCOSE accelerates the transformation of systems engineering to a model-based discipline*

- Advance and mature the MBSE Practice **(MA3)**
- Mainstream Model Based Systems Engineering **(MA3)**
- Evolve to a cohesive MBSE language, applicable to multiple domains **(MA3:O1)**
- Promote and advance the role of MBSE in global Model Based Engineering (MBE) **(MA2:O1)**
- Connect to other MBE cross domain standards like Building Information Modeling (BIM) **(MA1:O3)**
- Get authoritative information on MBSE out to practitioners and the broader community **(O3)**
- Infuse MBSE into SEBoK **(MA1:O1)**
- Align with SE Vision 2025 (see page 38-39) **(All)**

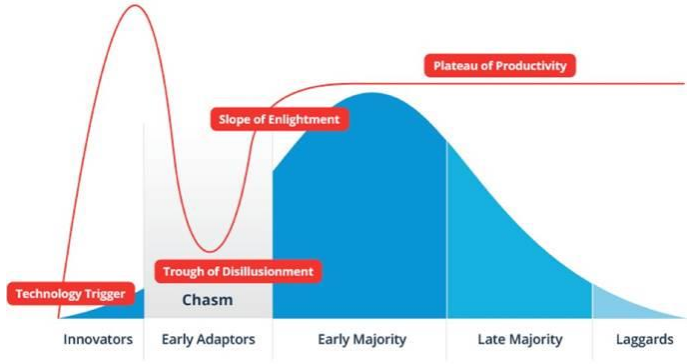
From the Transformation Strategy—
MA: Mission Area
O: Objective

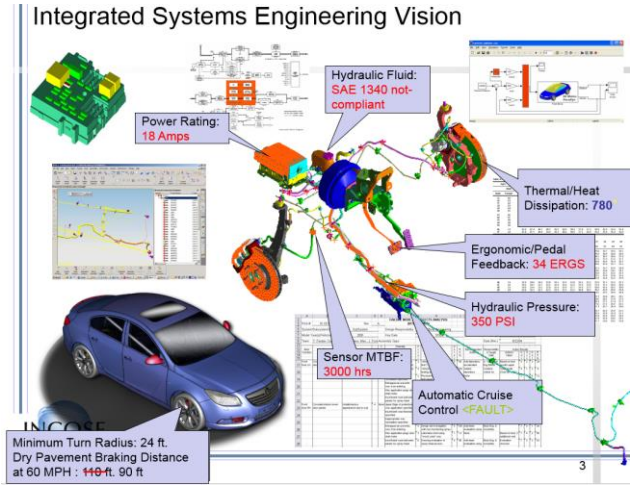
Transformation to a Model-Based Discipline

Objective:

INCOSE accelerates the transformation of systems engineering to a model-based discipline.

- Accelerates:
  - Understand the hype cycle[1] and bridge the chasm[2]…
  - Empower others to enlighten and influence adoption
- Transformation:
  - A marked change, as in appearance or character, usually for the better[3]. e.g. prose to models
  - Lead and support the community in crossing the chasm
- Model Based Discipline
  - *System models of all types*
  - Modeler Collaboration and Model Integration

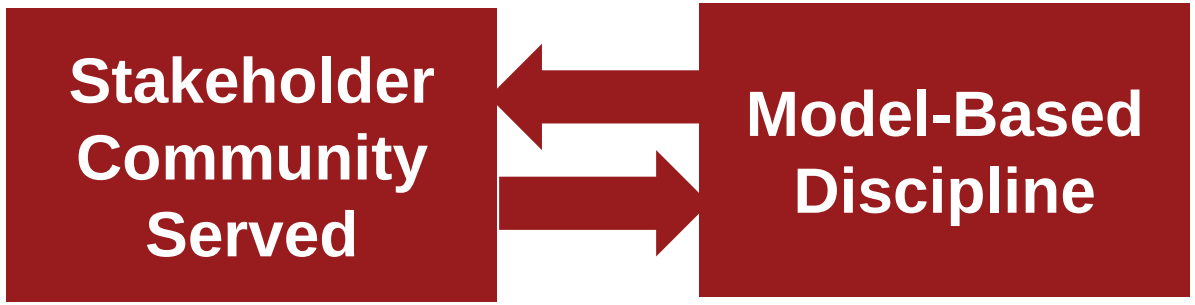




1. Hype Cycle is a branded graphical presentation developed and used by IT research and advisory firm Gartner
2. Moore, Geoffrey A. “Crossing the Chasm – and Beyond” Strategic Management of Technology and Innovation Third Edition 1996
3. Excerpted from The American Heritage Dictionary of the English Language, Third Edition 1996 by Houghton Mifflin Company
4. Friedenthal, Sandy and Sampson, Mark - MBSE Initiative Overview - http://www.omgwiki.org/MBSE/doku.php

Transformation to a Model-Based Discipline

- Key considerations
  - Broadening connection to the stakeholder community that must be reached and served by Transformation
  - Change management is essential to a focus on the human dimension
  - Activity and progress can and is occurring across many fronts, not always well connected
  - Provide the business case and value story and encourage coordination of technical, other activities
  - The transformation is not just one-way:
    - Not just increasing use of models as we currently view them, or advancing technical modeling practices alone
    - It also includes the Stakeholder Community influencing our discipline to be relevant to them



Model-Based Transformation Stakeholders

Population Size <--	
Model Consumers (Model Users):	
****	Non-technical stakeholders in various Systems of Interest, who acquire / make decisions about / make use of those systems, and a re informed by models of them. This includes mass market consumers, policy makers, business and other leaders and executives, investors, product us ers, voters in public or private elections or selection decisions, etc.
**	Technical model users, including designers, project leads, production engineers, system installers, maintainers, and users/op erators
Model Creators (including Model Improvers):	
*	Product visionaries, marketers, and other non-technical leaders of thought and organizations
*	Systems Engineering practitioners, system technical specifiers, engineers, designers, testers, theoreticians, analysts, scien tists
*	Students (in school and otherwise) learning to describe and understand systems
*	Educators, teaching the next generation how to create with models
*	Academics & Researchers who advance the practice
*	Those who translate model content/information into formalized models/structures etc.
Complex Idea Communicators:	
**	Marketing professionals
**	Academics/Educators, especially in complex systems areas of engineering and science, public policy, other domains, and includ ing curriculum developers as well as teachers
**	Leaders of all kinds
**	Leaders responsible to building their organization's MBSE capabilities and enabling MBSE on their projects
Model Infrastructure Providers, Including Tooling, Language and Other Standards, Methods:	
*	Suppliers of modeling tools and other information systems and technologies that house or make use of model-based information
*	Methodologists, consultants, others who assist individuals and organizations in being more successful through model -based methods
*	Standards bodies (including those who establish modeling standards as well as others who apply them within other standards)
INCOSE and other Engineering Professional Societies	
*	As a deliverer of value to its membership
*	As seen by other technical societies and by potential members
*	As a great organization to be a part of
*	As promoter of advance and practice of systems engineering and MBSE

The purpose of the Vision 2025 is to *inspire and guide* the direction of systems engineering across diverse stakeholder communities, which include:

- **Engineering Executives**
- **Policy Makers**
- **Academics & Researchers**
- **Practitioners**
- **Tool Vendors**

This vision will continue to evolve based on stakeholder inputs and on-going collaborations with professional societies.

Progress & Status Report

Example Products & Other Deliverables

INCOSE Transformation Plan Developed (Reported Already):

1. Stakeholder Community Identification
2. Strategy & Action Plan
3. Enablers & Roadblocks

Pilot Products Developed and Available for Beta Test Use:

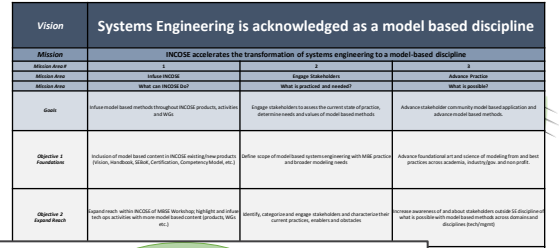
1. MB Roadmap Planning and Assessment Tool
2. Model Features Planning and Packaging Framework

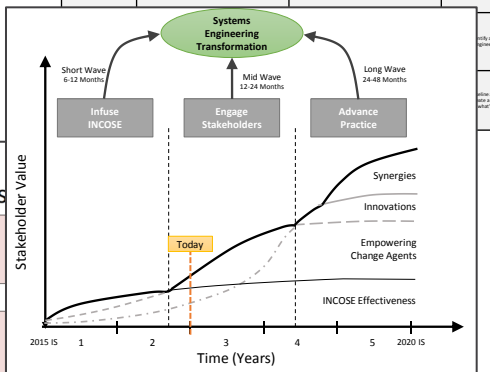
Products Under Development

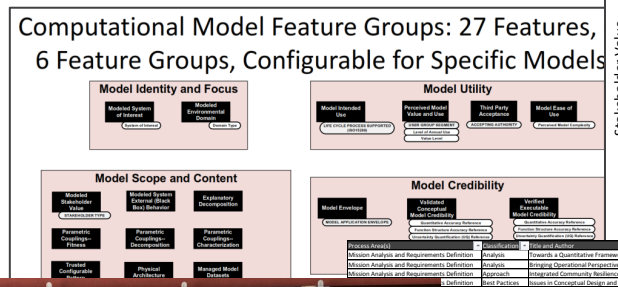
1. Model Based Exemplars
2. Requirements for VVUQ of Credible Models
3. INCOSE MBSE Primer
4. Value Briefing / Case Studies / ROI
5. Webinar
6. IS2018 MBSE Workshop

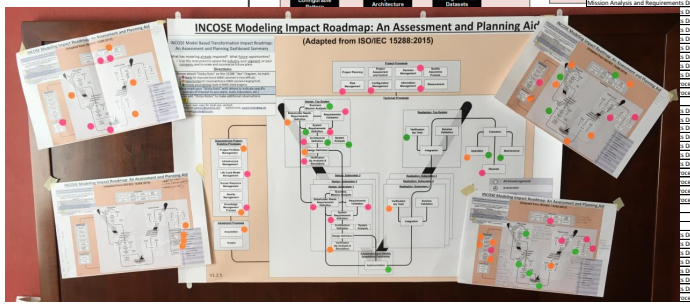
Emerging Activities, Partners We're Supporting:

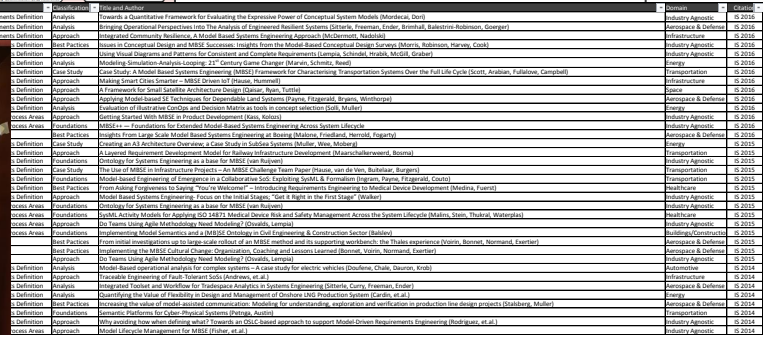
1. OMG SysML 2.0
2. ASME Model VVUQ Effort
3. SE Ontology Effort with SERC, JPL, et al.
4. Two New MBSE Challenge Teams:
   - Digital Artifacts
   - Production & Logistics Systems Modeling

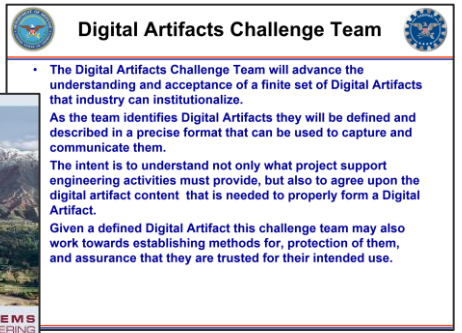


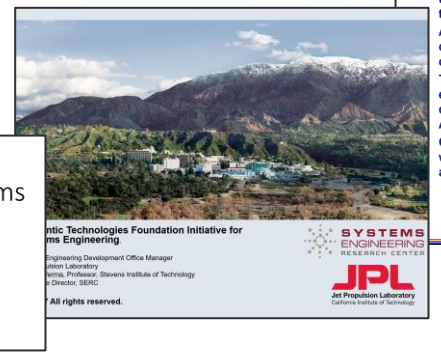






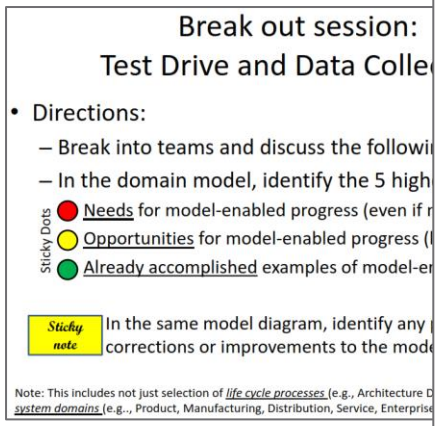


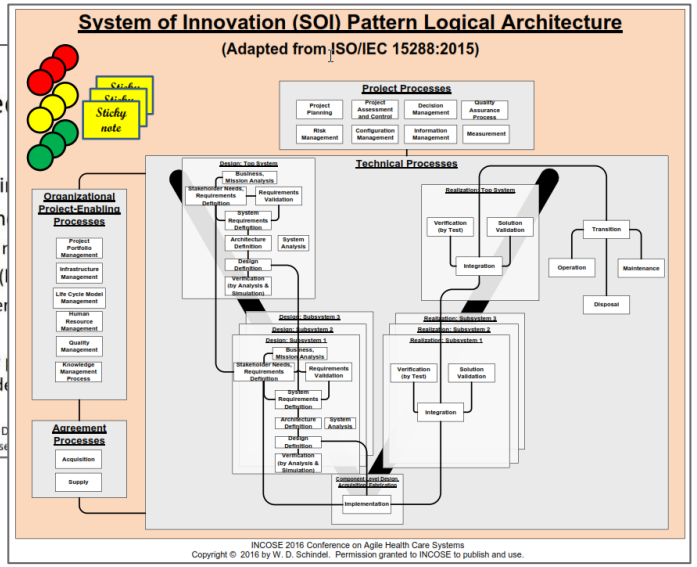


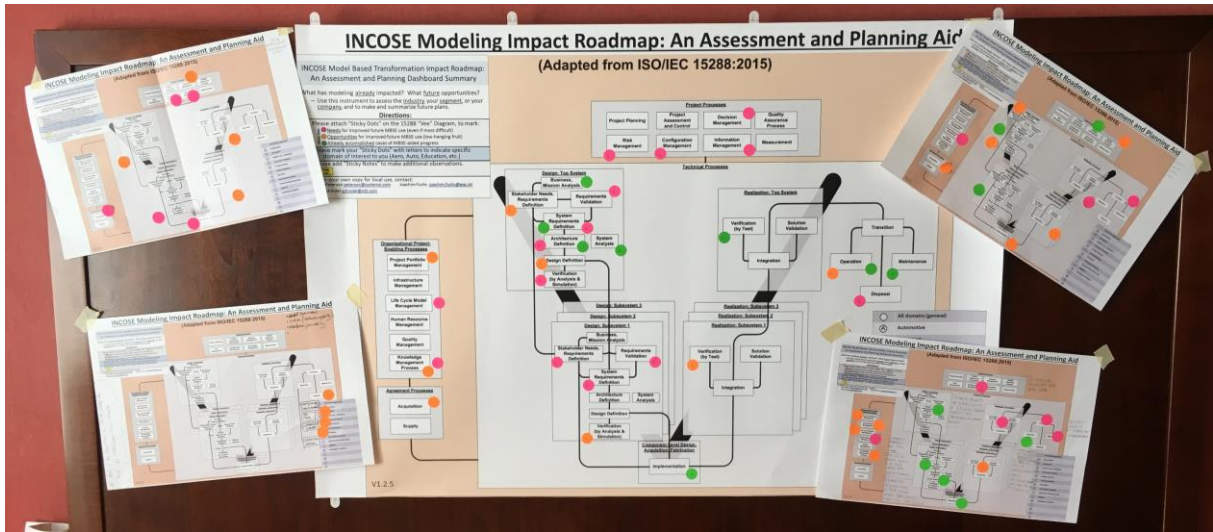


Example Transformation Products, for Beta Test Use:
MB Roadmap Planning and Assessment Tool

- **Product Concept**: Drive “one level below” the declaration that “we want to start using Model-Based Methods” , or the assertion that “we already use Model-Based Methods”:
  - Drills down “one level”, to the granularity level of the ISO15288 processes, but not lower than that
  - Provides a **light-weight tool** for (a) making a plan to incorporate Model-Based Methods, or (b) overviewing the relative perceived extent of Model-Based Method use and its degree of impact, challenge
- Not a detailed maturity model
  - Meant to be easy to use, but more challenging than “we are going to use model based methods”, or “we already do”
  - Resulting display instrument suitable for use in leadership briefings as well as technical audiences.
- **For use by:**
  - An enterprise
  - A project
  - An individual person
  - A multi-company team
  - A trade group
  - And especially by . . . CAB members!

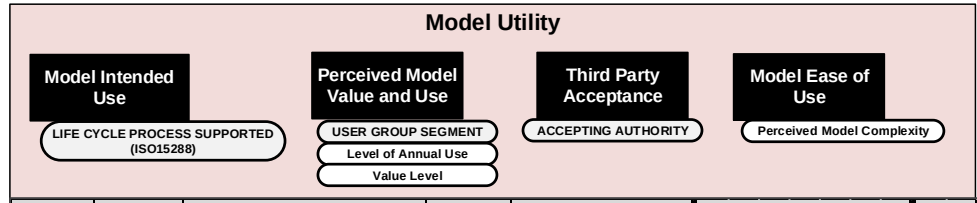




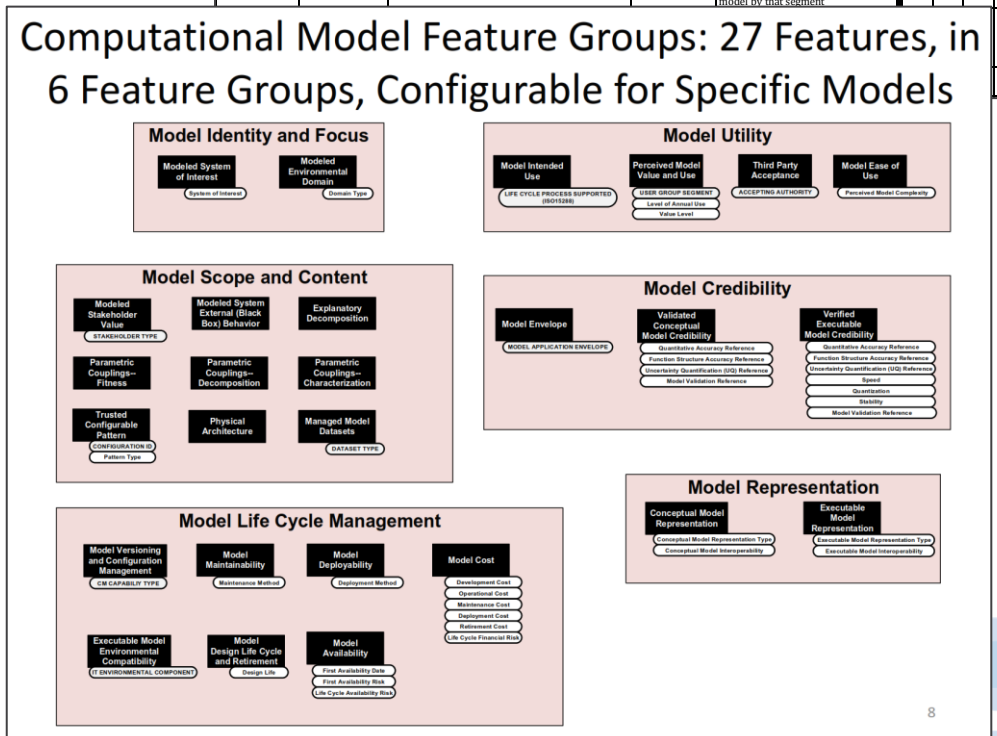


Example Transformation Products, for Beta Test Use:
Model Features Planning and Packaging Framework

- **Product Concept:** What are the stakeholder features of the model we are planning, the model we are building, the model we are using? Is it fit for its intended use?
- A more detailed, but entirely stakeholder-level, framework for describing the full spectrum of stakeholder issues, expectations, and outcomes for the full life cycle (development through use, maintenance, retirement) of any type of model.
- Explicitly connected to the ISO15288 process areas, but drills further into what stakeholders expect and actually receive.
- Tied to the joint effort with ASME on Computational Model Credibility (Model VVUQ) guidelines and standards, supported by INCOSE.
- Tied to (separate tool) Model Requirements to follow separately, as the basis for determining the credibility of models.
- Resulting data is suitable for creating views bridging from business stakeholders to technical practitioners.
- For use by:
  - An enterprise
  - A project
  - An individual person
  - A multi-company team
  - A trade group
  - And especially by . . . CAB members!



Feature Group	Feature Name	Feature Definition	Feature Attribute	Attribute Definition	Feature Stakeholder: Model User	Model Developer	Model Maintainer	Mdl Deployer-Distributor	Model Use Supporter	Regulatory Authority	Mdl Investor-Owner	Model Type: Physics Based	Data Driven
Describes the intended use, utility, and value of the model													
Model Utility	Model Intended Use	The intended purpose(s) or use(s) of the model.	Life Cycle Process Supported	The intended life cycle management process to be supported by the model, from the ISO15288 process list. More than one value may be listed.	X					X	X	X	X
	Perceived Model Value and Use	The relative level of value ascribed to the model, by those who use it for its stated purpose.	User Group Segment	The identify of using group segment (multiple)	X					X	X	X	X
			Level of Annual Use	The relative level of annual use by the segment	X					X	X	X	X
			Value Level	The value class associated with the model by that segment	X					X	X	X	X
										X		X	X
										X		X	X



CAB Connection to the Transformation

- The Model-Based Transformation must be relevant for CAB Members:
  - Are you interested in using these Beta Products? The Products Under Development? The Emerging New Activities?
  - Do you wish to participate in their development, test, and use?

- The CAB Members must be relevant for the Model-Based Transformation:
  - Do you have requests for questions for us?
  - Additional direction? Concerns?
  - Suggestions of other groups we should be networking with?

Discussion -- CAB

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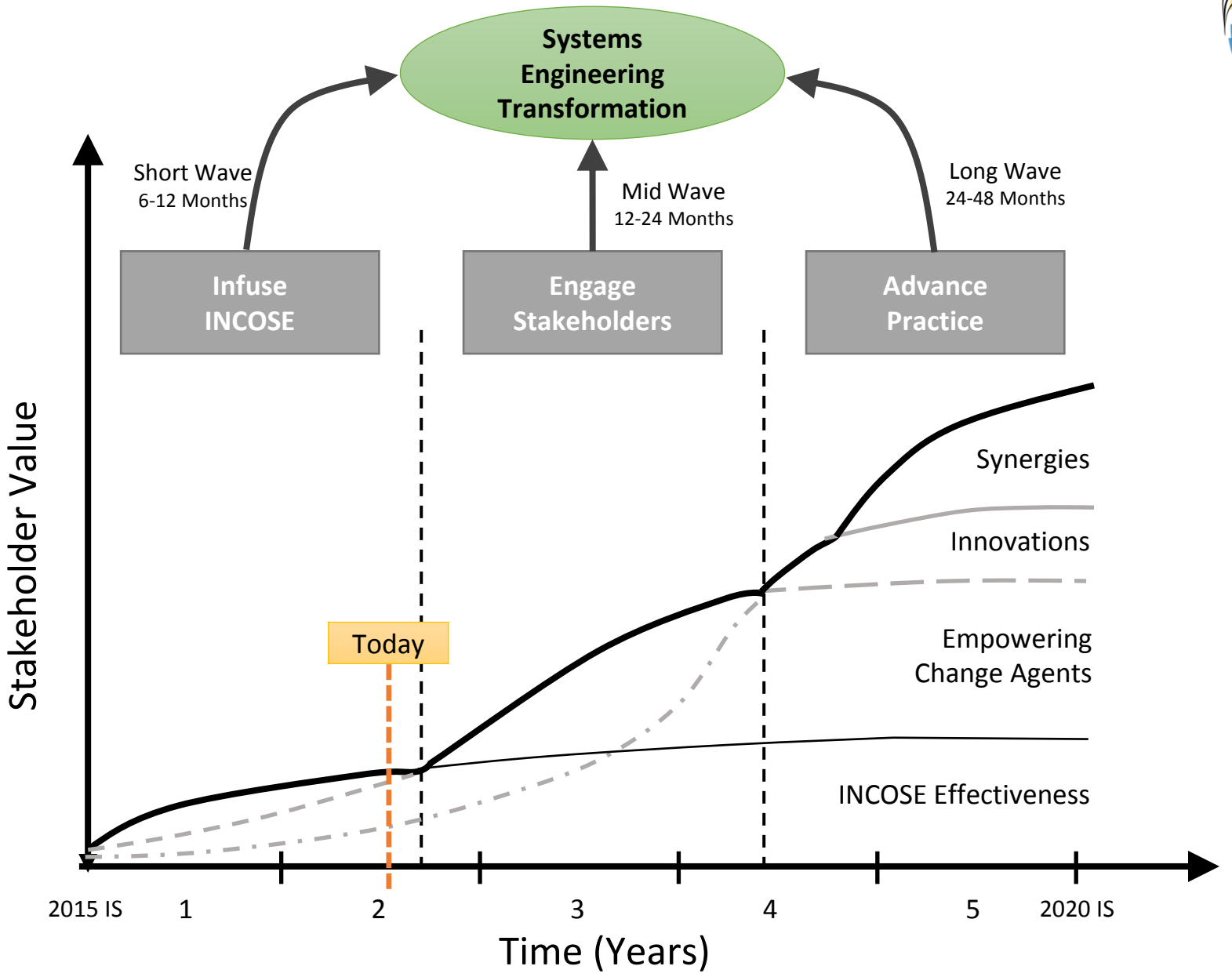
www.incose.org/symp2017

Backup

Strategy Notional Timeline

- Mission Areas
- Internal Short Wave
- External Mid Wave
- Advancing Long Wave
- Waves Run Concurrently
- Activities build on each other
- Important to fully engage stakeholder this next year. Pilot Assessment & Roadmap this CY and kick-off more broadly at 2017 IW.

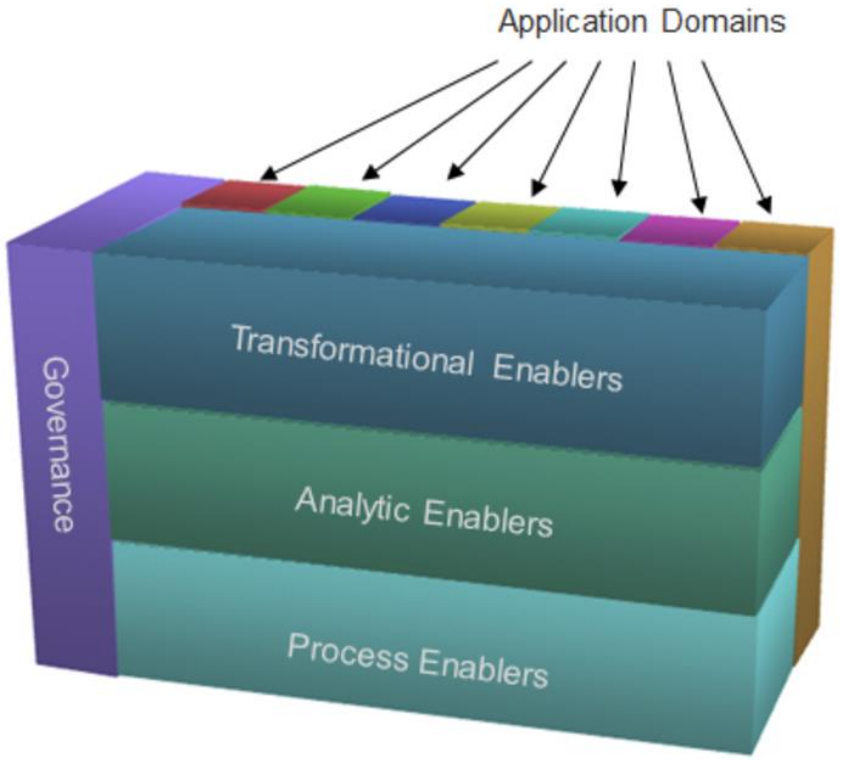


Strategy Overview

- Vision
- Mission
- Mission Areas
- Goals
- Objectives

Vision	**Systems Engineering is acknowledged as a model based discipline**		
Mission	**INCOSE accelerates the transformation of systems engineering to a model-based discipline**		
Mission Area #	**1**	**2**	**3**
Mission Area	**Infuse INCOSE**	**Engage Stakeholders**	**Advance Practice**
Mission Area	**What can INCOSE Do?**	**What is practiced and needed?**	**What is possible?**
Goals	Infuse model based methods throughout INCOSE products, activities and WGs	Engage stakeholders to assess the current state of practice, determine needs and values of model based methods	Advance stakeholder community model based application and advance model based methods.
Objective 1 Foundations	Inclusion of model based content in INCOSE existing/new products (Vision, Handbook, SEBoK, Certification, Competency Model, etc.)	Define scope of model based systems engineering with MBE practice and broader modeling needs	Advance foundational art and science of modeling from and best practices across academia, industry/gov. and non profit.
Objective 2 Expand Reach	Expand reach within INCOSE of MBSE Workshop; highlight and infuse tech ops activities with more model based content (products, WGs etc.)	Identify, categorize and engage stakeholders and characterize their current practices, enablers and obstacles	Increase awareness of and about stakeholders outside SE discipline of what is possible with model based methods across domains and disciplines (tech/mgmt)
Objective 3 Collaborate	Outreach: Leverage MOUs to infuse model based content into PMI, INFORMS, NAFEMS, BIM, ASME and others, sponsoring PhD Students, standardization bodies, ABET	Build a community of Stakeholder Representatives to infuse model based advances into organizations practicing systems engineering.	Initiate, identify and integrate research to advance systems engineering as a model based discipline
Objective 4 Assessment/ Roadmap	Assess INCOSE's efforts (WG, Objectives, Initiatives etc.) for inclusion of model based methods across the Systems Modeling Assessment/Roadmap	Engage stakeholder community with Systems Modeling Assessment/ Roadmap to better understand the state of the practice of MBSE. Push and pull content from stakeholders (change agents and the "to be convinced")	Provide baseline assessment framework, Systems Modeling Roadmap, to create a concrete measure of current state of the art of what's possible/what's the potential.

Transformational Working Groups



Transformational Enablers

Home / Chapters & Groups / Working Groups / Transformational

Transformational Enablers - Troy Peterson

Working Groups with public content pages managed on the INCOSE public site:

- Agile Systems & SE
- Lean Systems Engineering
- MBSE Initiative
- MBSE Patterns
- Model Based Concept Design
- Object-Oriented SE Method
- Very Small Entities (VSE)
- Systems Science
- Tool Integration and Model Lifecycle Management
- INCOSE-NAFEMS Collaboration
- Ontology

http://www.incose.org/ChaptersGroups/WorkingGroups