# Saturday session

# Session questions regarding the vision (1/2)

- Do we have a product or set of products that an organization can use to assess its own systems engineering (SE) maturity?
- How can a large number of systems engineers be trained so that the use of methodologies becomes standardized?
- Should we aim for Vision 2035 and work backward to 2025 or start with 2025 and move forward?
- How do we teach logical thinking?
- What methods (e.g., LEAN, agile, Y) could be used and what is our system of interest?
- Is there any method describing how to handle system recursivity in practice (in requirements development, verification and validation, modeling and other SE activities)?
- How can we integrate model-based systems engineering (MBSE) into our vision, and what tools and practices are included? Is there a target domain?
- How does the International Council on Systems Engineering (INCOSE) institutionalize valuable methodology work products, and how is the methodology written at a level that is not too prescriptive, allowing organizations to tailor it to their specific needs?
- How can we expand SE into non-DoD industries? How are we adapting or developing methodologies for emerging technologies (e.g., AI, unmanned systems, concepts of operation, behavioral characteristics)?
- How can we prevent "shelf wars" and communicate the material in a manner that practitioners see its value? How can we systematically apply SE to AI/ML problems when "optimal" solutions to problems are very context dependent?
- How can we tailor SE for evolutionary systems or innovative systems? How can suppliers in the automotive industry advance quicker in a high-risk, low-time-to-respond environment?
- How can we create training programs for all levels within organizations (not just for engineers)? How can we effectively use SE tools?
- Is "methodology" the best word to use for this? When will the "future" become the present? Should we focus on writing/communication tools to help our fellow systems engineers?

# Session questions regarding the vision (2/2)

- How does agility affect the methodology stream? Do we need a unified methodology or multiple methodologies? What is the role, impact and risk of SE methodologies?
- What changes or new SE methods are needed to enable human systems integration? How can we implement a risk management framework into SE methodologies?
- How can we capture the "as-built" implementation space? How will we map current technology products/TPP to Vision 2035 and FUSE outcomes?
- Is the methodology stream focusing on any specific section of Vision 2035? How does FUSE interface with tech ops and working groups?
- 1What are "ontology" and "epistemology" in the context of semantic technologies? How "disruptive" are they? How will we handle a working group product that misaligns with Vision 2035 in FUSE?
- How will requirement management and tools have to evolve? Will we be able to sufficiently define the needed future practices, tools, etc. to be able to assess the current state?
- Why is the newly published competency assessment guide not on your product list? How does the "methodology stream" differ from the "application extension stream"?
- How can we integrate STPA within systems engineering methodologies? How can we ensure MBSF helps systems architects to make discipline engineers walk in consistency?
- What are the systems engineering use cases for the methodology stream? What about "SE Visions" has not yet been fulfilled? What engineering practice are we using? What modeling language are we using?
- Does this cover system homomorphism?

# Session measures of success regarding the vision

- WG and INCO members- increase members and support
- Identify current products that require update and identify needed new products/services to serve our future state
- Product alignment to Vision 2035- evidence, mapping, and plans (TPPs)
- Measure of Success for a Systems Engineer in the White House
- Metrics of success, including whether use cases from different domains are needed to evaluate products
- Consensus on specific methodologies
- Cost of Poor Quality
- Will the digital ecosystem be tied together well into an effective digital approach?
- Number of defects during validation phase and time for reviews as a measurement of stress for the project team
- Vision: The SE methodologies stream integrates the advancement of practices, methods, and tools for the effective engineering of systems to be fit for purpose in the presence of new requirements and emerging cases
- Success: Effective SE for safety, security, and resilience
- Earned value of using methodology versus not using it
- A standardized and accredited SE process that embodies HSI
- Identifying gaps in current plans and addressing them through interaction with SMEs and defining good requirements
- For AI/ML: Ensuring business objectives are aligned with AI/ML model perturbations
- Measures of speed, effectiveness, adoption, and elegance
- Defining KPIs now to establish a baseline and track progress
- Having a list of deliverables, determining the need, showing added value, and determining a domain scope
- Applying to a real system and comparing it to a past system
- Reduction of waste
- Number of candidate TPPs and number of SEPs.

# Session risks of success regarding the vision

- Difficulty in achieving quality improvement in a timely manner
- Disagreements within a group about the theme, sorting and refining ideas, and staying on topic
- Risks associated with projects not aligning with a larger vision, and methodologies not being used consistently
- Limited resources, exclusivity, and a narrow vision among other challenges.
- Difficulty in ensuring safety, security, and resilience in systems
- Lack of engagement and adoption of systems engineering methodologies
- Difficulty in ensuring that methodologies are advancing in reference to the heuristics in science spectrum
- Limited visibility and understanding of systems engineering and the value of Human Systems Integration.
- Difficulty in integrating Model-Based Systems Engineering and Software Development Operations pipeline
- Difficulty in measuring goals in the vision
- Issues with cross-discipline working groups, and challenges with the Model-Based Systems Engineering and the Digitization of Human Systems Integration methods.

# Session activities of success regarding the vision

- Do we know how much engineering scrap and rework we are need? Root cause and impact of change of methodology
- Methodology needs to be holistic regarding human factors, safety, etc. Need to be integrated into core SE methodology
- SE Lab - Mitigation of tool integration issues?
- Activity: Establish an ontology that can precisely express systems, including attributes, functions, performance, risk, etc. It must be sufficiently normalized to enable transfer of information across tools of all project functions and engineering disciplines. It needs to support a digital enterprise, not just digital engineering
- Broaden audience for SE vision product
- Breaking requirements before use cases
- Create a standard format for OEMs to transfer information to their supply base during an RFQ
- More planned, controlled, and documented case studies
- Iterations between business understanding, data understanding, and consulting with SMEs
- Agile - Why not DevOps?
- Research with industry and academia to have structured examples and tutorials
- Opportunity to stand up systems in a secure environment to test integration and migration as part of SE Lab.

# Sunday Session

# Sunday session group 1

| Theme | Conclusion |
|---|---|
| What is preventing the advancement of practices/methods/tools in the presence of new technologies (e.g., AI, digital ecosystems, ...)? | Uncertainty in ecosystem discourages adoption. |
| What is preventing advancement of new technology for systems engineering methodologies? | Even if I had the infrastructure and resources, I have tried before and failed, and I don't have time to learn a new way from people I don't trust. |
| What are obstacles in advancing practices/ method/ tools? | Because resources are limited, we are not able to fully understand stakeholder needs to develop mature methods that are practical and implementable. |
| What are the obstacles in advancing MBSE? | People are incompetent |
| What is preventing the advancement of SE practices and methods? | There are three main causes preventing the advancement of SE methodologies: Organizational leadership willingness to changes, lack of training and best practices; challenges to tool interoperability |
| What are the barriers to integration the socio into the technical, methodologically? | The weirdness of people is not ameadable to the mechanistic, deterministic engineering approach that needs to be addressed by transdisciplinary approaches. |
| What are the attributes of "successful" "methodology"? | Scientific basis with improved intuitiveness is critical to overcoming organizational inertia and leading to rapid organizational acceptance |
| What are obstacles related to practices/ methods/ tools? | Without leadership championing use the methodology there are multiple pitfalls that prevent it successful use. |

# Sunday session group 1

**Theme**

What is preventing the advancement of practices/methods/tools in the presence of new technologies (e.g., AI, digital ecosystems, ...)?

**Conclusion**

Uncertainty in ecosystem discourages adoption.

**Tool Suites lack maturity**
- Tool Suites lack Maturity
- Not address the root causes and needs

**Requires marketplace changes**
- Marketplace inertia resists change
- Requirements-driven engineering can limit innovation
- Buzzword overpromises make evaluating functionality difficult

**Requires organizational change**
- Leadership lacks vision
- Organization inertia resists change

**Difficulty Integration platforms**
- Platform integration difficulties
- Differing terminology and understanding

**Human resources costs**
- Organization lacks skills
- Costs to implement deter adoption

# Sunday session group 2

**Theme**

What is preventing advancement of new technology for systems engineering methodologies?

**Conclusion**

Even if I had the infrastructure and resources, I have tried before and failed, and I don't have time to learn a new way from people I don't trust.

**We don't have time to invest in reuse**
- Reinventing the wheel is inefficient

**People overhype the benefits**
- Hindered by inflated expectations

**We don't have enough supply to implement change**
- Insufficient infrastructure that is secure
- Lack of standards causes interoperability issues
- Lack of or insufficient resources

**We don't trust what someone else has defined**
- We don't want to slow down to think
- My way is better than your way
- Fear of change

# Sunday session group 3

**Theme**

What are obstacles in advancing practices/ method/ tools?

**Conclusion**

Because resources are limited, we are not able to fully understand stakeholder needs to develop mature methods that are practical and implementable.

**Methodology is not mature**
- Problem is ahead of its time
- Methodology is not mature enough to be practiced or implemented

**Implementing change is difficult**
- Change will introduce more conflicts
- It is difficult to harmonize change
- Organizational structure is resistant to change
- There are incentives to stifle change
- Is the change warranted?

**Culture is not supportive**
- Stakeholders don't know what they need
- We are stuck in the past

**Time is money**
- Training is too expensive

# Sunday session group 4

Theme

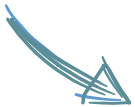
What are the obstacles in advancing MBSE?

Conclusion

People are incompetent

**There is a large barrier to entry**
- Lack of organizational leadership prohibits MBSE
- There is a large barrier to entry MBSE

**People are incompetent**
- People don't like change
- Training is necessary
- People don't understand that MBSE is SE



**There is no money**
- IT Infrastructure is huge effort
- Cost vs. value is not understood

**MBSE needs common guidelines and rules**
- MBSE needs best practices
- MBSE needs standards

**MBSE is not well integrated**
- MBSE tools don't integrate well with existing toolchains

# Sunday session group 5

**Theme**

What is preventing the advancement of SE practices and methods?

**Conclusion**

There are three main causes preventing the advancement of SE methodologies: Organizational leadership willingness to changes, lack of training and best practices; challenges to tool interoperability

**Company leadership is not willing to invest in systems engineering change**

- Organizational leadership is preventing change
- No ROI measured
- Co practices do not align with use of tools

**Business culture does not embrace continuous learning**

- Legacy practices inhibit change
- Lack of methodology knowledge slowing change
- Lack of Training and best practices

**Lack of tool interoperability inhibits methodology change**

- Tool complexity limits advancement
- Interoperability of tools prevent methods change
- Rapid tool changes inhibit ability to change methods

# Sunday session group 6

**Theme**

What are the barriers to integration the socio into the technical, methodologically?

**Conclusion**

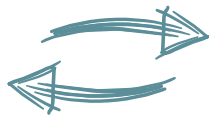
The weirdness of people is not amenable to the mechanistic, deterministic engineering approach that needs to be addressed by transdisciplinary approaches.

**Disparate domains require harmonization**

- Cooperation is not focused on integration
- There are barriers to disseminating existing strong methods
- Weak integration between social sciences and engineering

**SE Methodologies are lacking in the social domain**

- SE is inadequate in the social domains
- Modeling approaches exclude non engineers



**People are difficult to understand**

- People are weird and non-deterministic
- Social requirements are lacking
- People are not included in the boundaries

# Sunday session group 7

**Theme**

What are the attributes of “successful” “methodology”?

**Conclusion**

Scientific basis with improved intuitiveness is critical to overcoming organizational inertia and leading to rapid organizational acceptance

**Scientific foundation**
- Methodology with foundation
- Scientific basis for methodology

**Methodology addresses inherent sources of complexity**
- Methodology addresses system & organizational complexity

**Identification of methodology value**
- Management changes their mind frequently
- Scope of SE responsibility is ambiguous
- Existing company inertia

**New tools to improve intuitiveness**
- Apply new technologies
- Improved intuitiveness

**Acceptance of methodology value**
- Methodology valued by other stakeholders
- Lack/ justified value proposition
- Fast organization acceptance

# Sunday session group 8

**Theme**

What are obstacles related to practices/ methods/ tools?

**Conclusion**

Without leadership championing use the methodology there are multiple pitfalls that prevent it successful use.

**Outcome is predetermined**
- Predetermined outcome

**Leadership fails to provide adequate support for SE activities**
- Lack of leadership buy-in
- Insufficient financial planning
- Leadership induced inhabitants

**Tool interoperation is inadequate for SE activities**
- Tool sets do not fit together

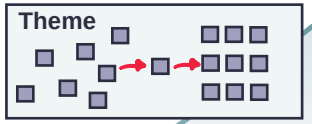
**Available methodology is inadequate to support SE practice**
- Application of standards
- Inadequate methodology

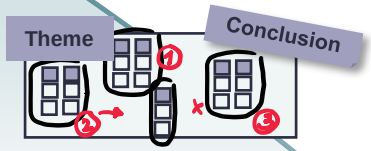
# Monday Session

# Summary Slide of methodologies stream

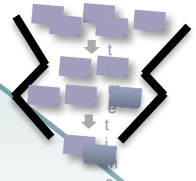
SUNDAY

MONDAY







8 Themes

e.g.:

- What are 3 New Technologies
- What is preventing advancement of new technology for SE methodologies?
- What are the obstacles in advancing MBSE?

240 pain points

8 conclusion

e.g.:

- Uncertainty in ecosystem discourages adoption.
- Even if I had the infrastructure and resources, I have tried before and failed, and I don't have time to learn a new way from people I don't trust.

~10 disrupters

~ 180 concepts

~ 25 favorite concepts

e.g.:

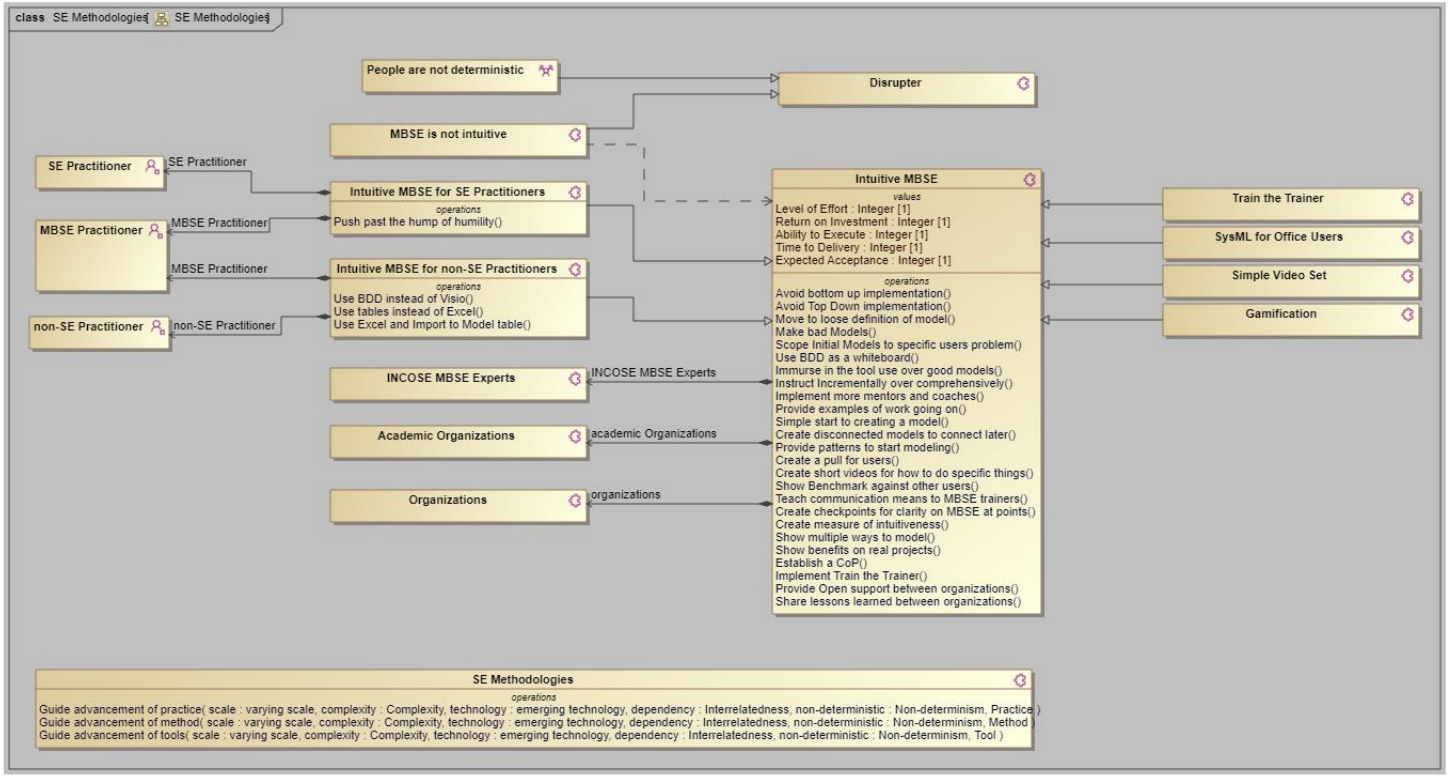
- Create value metrics
- Human-System-Interface model
- Promote & research other MBSE methodology that support interoperability natively
- Procedures for generating models

# Model of a SE Methodologies stream (Monday)

To implement MBSE requires us to use MBSE. Here is capture from one team on MBSE Methodology in a system model.

https://twc.openmbee.org:8443/webapp/collaborator/document/f8bab54b-3771-40d2-90c5-0e5b00e099cd?guest=true

SE Methodologies



# Favorite concepts for disrupters

**We don't really trust people developed new methods**

- A maturity measurement
- Enables case studies
- Resource support
- Decompose lower-level steps
- Evaluate value and performance
- Create value metrics
- Setting expectations
- Understanding reality of standards as community

**People are non-deterministic and their behavior is difficult to model**

- Human-System-Interface model
- Human-Behavior modeling
- System-Behavior Modeling
- Design techniques

**Interoperability of tools prevent methods change**

- Develop and measure forecasting metric for MBSE adoption
- A process/ method of measuring the waste
- Design a means to capture and communicate methodologies that will expose need for adoption
- Address capabilities with processes & methods to expose tool interoperability need
- Focus on transformation of Tabus in an open format
- Incentive of openness
- Promote & research other MBSE methodology that support interoperability natively

**It is tough for new users to understand which architecture / framework to use**

- Big domains guide to architecture framework
- Questionnaire on architecture framework applicability
- Rating site for architecture framework and training
- Venn diagram: maturity of architecture framework
- Do not use architecture framework – only as needed
- architecture framework selection questionnaire
- Info of architecture framework Training videos

**Platform integration difficulties**

- Back to basics what basic scientific principles are
- Systems engineering principles (update needed?)
- Work back to foundations: what are different model approaches and how do they think?
- Procedures for generating models
- Concept to detail
- Need for vertical integration
- Create standards for each phase and domain of lifecycle
- Collaborate on exchanging lessons learned
- Work of standardizating tool patterns not individual tools
- Establish data interfaces
- Tools that work best together