SETDB: the Systems Engineering Tools Database
John Nallon Chair TIMLM WG
UPDATE: Systems Engineering Tools Database

- INCOSE and PPI-Int joint project to bring the Systems Engineering Tools Database (SETDB) back to the INCOSE Web Site!!

- Collaboration and Support: the SETDB WG, RWG, CM WG, Architecture WG and TIMLM WG members developing the initial vendor questionnaires (surveys)

- The SETDB is an Emerging Working Group: Charter submitted in the 3rd quarter of 2019 for approval

- Communication: Weekly Project Team Meetings; Monthly TechOps Meetings; Monthly Newsletter Updates to the SETDB WG and TIMLM WG
SETDB: Systems Engineering Tools Database

• **SETDB Team Accomplishments:**
  – Operational Concept Document (OCD) completed and released, updated as CapSySRS evolved
  – Developed and Released Capability System Requirements Specification (CapSySRS)
  – Constructed SETDB UIF Prototype MockUps
  – System Use Cases and System Model (SySML) developed and updated as CapSySRS evolved
  – Analyzed CapSySRS using the Mockups and the System Models and Use Cases
  – Initiated V&V Plan development
  – In conjunction with INCOSE IT, developed Mock-ups and a working prototype for IW 2020

• **Prototype is Available at IW 2020!!!**  [www.incose.org/setdbtest](http://www.incose.org/setdbtest)

• **Product First Release Scheduled for IS 2020 in Cape Town, South Africa**
TIMLM - Tool Integration and Model Lifecycle Management

Integrate Models with Tools
What is MBSE?

1) define BIG M (MBSE)
   *all of the* digital thread, all domains, all models, the digital twin enabler

2) define little m (mBSE)
   **RFLB** (Behaviors), not defined by CAD model,
   **Concept Design to Physical Implementation** (not spatial)
MBSE is achieved if the models are consistent, and are used downstream **without recoding or recreation**
Give me my mBSE!

- the slow implementation of mBSE is an industry problem that can be partially attributed to the absence of data standards.
- but Data Standards are not an island - dependency on process standards and tool implementations.
MBSE Standards Roadmap

Static

<table>
<thead>
<tr>
<th>Today</th>
<th>2021</th>
<th>2023</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADL</td>
<td>UAF</td>
<td>PKF</td>
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<tr>
<td>SysML</td>
<td>RDF</td>
<td>SysMLv2</td>
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<td>ReqIF</td>
<td>OSLC</td>
<td>SysMLv3</td>
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<tr>
<td>XMI</td>
<td>SPARQL</td>
<td>STEP 23x</td>
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Maturing/Implementing

<table>
<thead>
<tr>
<th>AP210</th>
<th>AP209</th>
<th>AP242</th>
<th>AP232</th>
<th>AP233</th>
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<tr>
<td>UML</td>
<td>SysPhS</td>
<td>Modelica</td>
<td>FMI</td>
<td>MIL-STD-31000</td>
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<tr>
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<td>OWL</td>
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<td>AP239</td>
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<tr>
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<td>RDFOntology</td>
<td>LOTAR Protocols</td>
<td>DCP</td>
<td>STEP 23x</td>
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Planning Evolving

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<thead>
<tr>
<th>LOTAR Protocols</th>
<th>STEP 23x</th>
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<tr>
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<td>Analysis and Simulation</td>
</tr>
<tr>
<td>Architecture Authoring</td>
<td>Integration and Linking</td>
</tr>
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Partners

- ISO
- MODELICA
- OMG
- OASIS
- W3C

PDES, LOTAR, AFNet, prostep ivip, INCOSE, NASA, NAFEMS, AIA, ASD

Reference ASD Radar Chart for detailed descriptions

from PDES-LOTAR MBSE Conference, May 8th, 2019. Revised Dec 11th, 2019
# MBSE Standards Roadmap

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- **Analysis and Simulation**
- **Architecture Authoring**
- **Integration and Linking**

**Partners**
- ISO
- MODELLICA
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**References**
- SmartSE

**Profiles**
- PDES, LOTAR, AFNeT, prostep ivip, INCOSE, NASA, NAFEMS, AIA, ASD

**From**

Reference [ASD Radar Chart](#) for detailed descriptions
What to do?

• Practice, advocate and participate
• Connect the dots in your product designs and enterprise process documentation
• Recognize good work. Count/measure the exchange of text documents vs model integration discoveries. *(reduce models to text?)*
• Collect metrics, calculate statistics
What to measure?

Measure time, nodes, labor, authors, links, files, revisions, complexity, reused elements/ components/ models, licenses, licenses per org, consumption, verifications, validations, management interventions, un-modelled elements, document matches, approximations, errors, corrections, tools, revisions, versions, test requirements, copies, automations, integrations, dependencies, translations, conversions, reusable objects, populated metadata parameters.

A savings justification before commitment is **bad business**!
MBSE is a FAD!

You earn $500 mil for every 50 models you reuse. (not including overhead savings or error reduction)

Treat MBSE investments like stocks vs bonds. Risk vs reliability.

Summary:

- What can INCOSE do to accelerate your business?
- Do you discuss data standards with your tool vendors?
- Recognize that processes must accompany your data standards
- Can you collect metrics and measure your progress for mBSE?
- *How do we, as an industry, converge on a consistent approach?*
- Join us on Monday at 1PM, Salon F
LOTAR MBSE Data Standards

- **500**: Fundamentals and Concepts
- **510**: Requirements management “text, graphics, tables”, “parameter based”, and coded information
- **515**: Validation and Verification requirements information
- **520**: Lumped parameters models for behaviours and controls described by specification or executable code, containing differential, algebraic and discrete equations
- **530**: Models defined using architecture description languages (ADLs), ISO 42010, e.g. industry standards: AADL, SysML, UML
Archive/Exchange a Behavior Model Package

Create Model (tool x)

Create Manifest

Contrast/Compare the Manifest with the AP243 (MoSSEC) standard.

Generate FMU1,2,x (zipfile)
- Binaries (dll, so)
- resources
- extra
- xml

Generate SSP (zipfile)
- FMU1
- FMU2
- extra
- xml

Repository
- FMU1
- SSP1
- SSP2

AIP
- (derived AIP from Manifest Summaries)

Parent Manifest

LOTAR Provisions

System Analyst

Consumer

zlib (deflation)

Examines AIP - (identifies model content)

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slide 2: I don't want to be controversial, but the following two statements are often mis-understood. bigMBSE is the consumer of MBX. mBSE is how we initiate new products.

slide 2: To kick-off the MBSE workshop, Mark Sampson made an important comment: "If your enterprise is still text based you will not survive."

slide 3: The magic dust: Allocate and integrate the Requirements within the architecture models and validate/optimize with the Behavior models.

V&V is supported by the decomposition of the requirements through the process (LH of the VEE) and the big MBSE completes the V&V process (RH of the VEE)

slide 4: We don’t teach the University students about data standards. They generally get a little CAD and Behavior Modeling, and rarely any architecture and requirements decomposition

slide 4: So the problem begins in the curriculum and extends into our enterprises. The enterprise needs that expertise so the focus is employee training

slide 5: Not just SysML, but how many times do you use AP243 or SSP in your discussions. Process standards are not included on this chart, but are an equally important feature of our MBSE implementations.

slide 5: The arrows have different meanings inferring evolution, and relationships thru time

slide 6: Data standards vs language standards, they are complimentary. And you can’t choose just one to demonstrate mBSE. The glue between standards is the model.

slide 7: Practice the arts, advocate for the tool vendors to deliver exchangeable capability, and participate in the creation of the standard specifications.

slide 7: Evaluate the design process you use, and compare it with your documentation (if any exists). Nothing beats hard numbers and a score card, but the most valuable recognition is at the Peer level.

slide 9: The FAD may include an ROI, if you invest with a total market long range view.