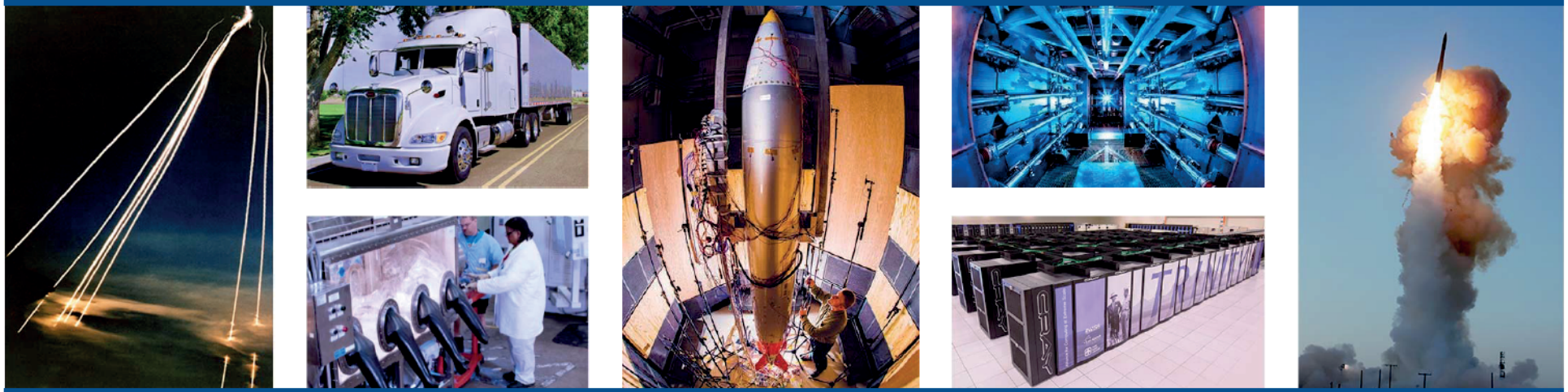
NOTE: Slides 14, 16, and 17 modified to better reflect concept of qualified terms, in lieu of compound terms. This was done to avoid confusion between what was originally presented and how we actually used the relationship in the working group.

MBE Lexicon Framework and Approach
ASME MBE Committee, Terms Working Group

Jeffrey Winter
Program Management Consultant to NA-122.1, Stockpile Services Division
11/13/2019



Agenda

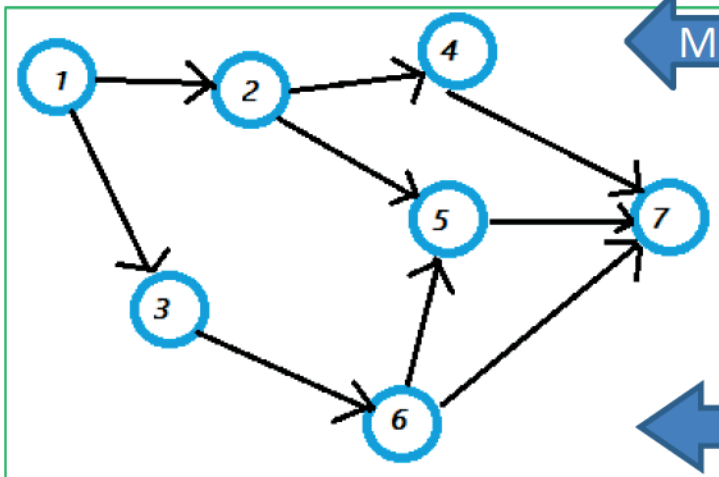
- Summarize the approach developed at NNSA
- Briefly discuss the migration to ASME
- Skip through the specification

Value Statement for a Controlled MBE Vocabulary

- **MBE practitioners need a reliable lexicon**
  - Common vocabulary of terms and phrases used in a domain
  - Validated terms and concepts in context
  - Managed
- **…for collaboration**
  - Precision (remove ambiguity)
  - Ease (I understand you)
- **… as a foundation for developing MBE practices…**
  - More confidently (no more meandering)
  - More rapidly (less paralysis and contention resolution)
  - More collaboratively (move forward together)
- **…that are …**
  - More assuredly integrated
  - Achieve common goals

Develop and Present Effectively

Semantic Graph



Must comport

Single source

Thesaurus Entries

ABSORPTION

The retention and conversion into another form of energy of rays, waves, or particles by a substance.

UF ABSORPTIVE PROPERTIES
BT **SORPTION**
NT **BIOLOGICAL ABSORPTION**
RESONANCE ABSORPTION
TWO PHOTON ABSORPTION
X RAY ABSORPTION ANALYSIS

Interoperable Format

My_Concept rdf:type skos:Concept.
skos:broaderTransitive owl:inverseOf skos:narrowerTransitive.
ex:cat skos:broaderTransitive ex:mammal.
Ex:mammal skos:narrowerTransitive ex:dog.
ex:broaderPartitive rdfs:subPropertyOf skos:broader.
ex:narrowerPartitive rdfs:subPropertyOf skos:narrower.
skos:broaderPartitive owl:inverseOf skos:narrowerPartitive.
ex:broaderInstantive rdfs:subPropertyOf skos:broader.
ex:narrowerInstantive rdfs:subPropertyOf skos:narrower.
skos:broaderInstantive owl:inverseOf skos:narrowerInstantive.

Index and means for lookup

abbreviations, 10, 31, 45
for relationship indicators, 43
abstract concepts, 29
access vocabularies *see* entry terms
acronyms, 10, 30-31
activities as terms, 24, 29
addition of terms, 96
adjectives, 26-27
see also modifiers in compound terms

Approach

- Identify standards
- Determine and enforce scope control
- Identify terms
- Methodically develop definitions through semantic relationships
- Prove terms
- Test in communities of interest
- Disseminate

What's Been Done

- **Defined Approach**
  - Identified standards
    - ANSI/NISO Z39.19-2005, Guidelines for Construction, Format, and Management of Monolingual Controlled Vocabularies (http://marciazeng.slis.kent.edu/Z3919/index.htm)
    - SKOS Simple Knowledge Organization System (https://www.w3.org/TR/2009/REC-skos-reference-20090818/)
    - Resource Description Framework (RDF) and Ontology Web Language (OWL)
  - ISO/IEC 19501:2005(E), Unified Modeling Language 1.4.2
  - Identified gaps
    - OWL and SKOS have certain limitations or constraints.
    - VOWL: Visual Notation for OWL Ontologies is unsuitable
    - Software tools are insufficient. No single tool does the job.

Developing specifications

- **Defined Scopes of Control**
  - Inner: We want to control and can control.
  - Near: We might want to control, but might not be able to.
  - Outer: We do not wish to control.
  - Out of scope: We will not control or use.
- **Discovered Concepts/Terms and candidate terms**
  - Site practices
  - ASME, DLA, NNSA DPBSP
  - MBE community
  - Internet sources
- **Iteratively Defined Refined, and Proved Key Terms**

Rules for Good Definitions

1. **Be minimally sufficient. Focus on the essential qualities to ensure the term is defined and differentiated.**
2. **Identify what type of thing it is.**
3. **Use other terms in lexicon; express relationships using our vocabulary.**
   - Relationships between terms must be reciprocal.
4. **Use simple syntax.**
5. **Don't editorialize.**
6. **Choose the right scope/context.**
7. **Qualify only as needed to differentiate (e.g., purpose, outcome).**
   - Focus of universality within chosen scope, leaving instances for usage.
8. **Establish preferred term among equivalent terms.**
9. **Prove using structured methods (semantic relationships).**

Rules for Conceptual Relationships

1. **At least one supertype**
2. **Pertinent sub-types**
3. **Associative relationships used in definitions**
4. **All Equivalencies.**
   - Establish preferred term among equivalent terms.
5. **Consider linguistics and indexing!**
6. **Prove using structured methods.**

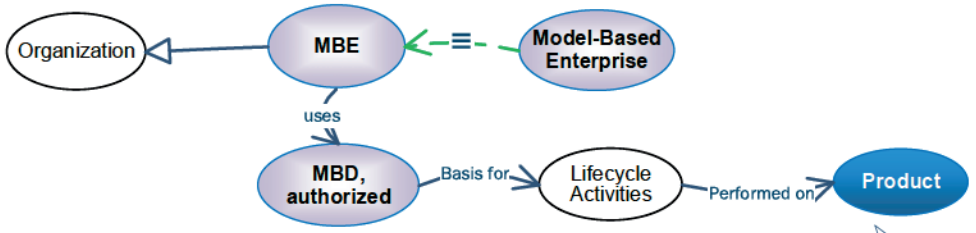
Next Steps within the NNSA

- Test in communities of interest
- Continue developing specifications
- Acquire better software tools
- Expand list of consensus terms

Sample format of an Entry Term

Model-Based Enterprise (MBE)

An organization that uses authorized model-based definitions as the basis for the lifecycle activities of a product.



Thesaurus Entries

MBE
- USE-FOR Model-Based Enterprise
- BT Organization
- RT [uses] MBD, authorized
  - RT [basis for] Lifecycle activities
    - USE-FOR <a collection of lifecycle activity>
    - RT [performed on] Product

We've used formatting on terms to identify scopes of control.

Usage

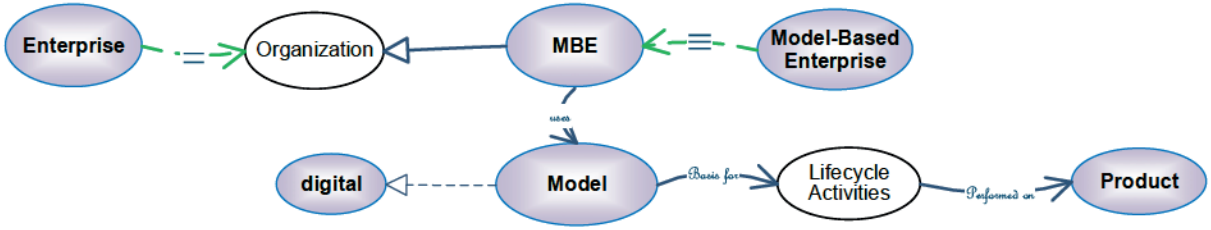
TBS

Discussion

TBS

Model-Based Enterprise (MBE)

An organization that uses digital models as the basis for the lifecycle activities of a product.



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  - RT [basis for] Lifecycle activities
    - USE-FOR <a collection of lifecycle activity>
    - RT [performed on] Product

Next Steps

- **Re-start with a head start**
  - ASME Y14.41, Digital Product Definition Data Practices
  - NNSA lexicon
- **Verify scope**
- **Identify and reach consensus on core terms**
- **Expand list of consensus terms**

Overview of the Specification

Semantic Relationships Establish Linguistic Meanings

- **Hierarchical:**
  - Relate terms from general (superordinate) to specific (subordinate) within a scope
  - ***Generic:*** Relates a genre to its species (abstraction, "Is-a", inheritance, generalization)
  - ***Part-of:*** Relates a part to a whole (aggregation, containment, "Has-a")
  - ***Instance:*** Relates a class to an actual instance ("Is-a")
- **Equivalence:**
  - Relate terms that refer to the same concept
  - Lexical variant: Identical ≡ $_{8801}$ (MBD ≡ model-based product definition)
  - Synonym: functionally equivalent; interchangeable $=_{61}$ (cat=feline)
  - Near-synonym: equivalent in a context, non-interchangeable ≈ $_{(8776)}$ (3D CAD model ≈ model)
  - Congruence: corresponding position, meets spec., etc. in different hierarchy ≅ $_{(8773)}$
  - Antonyms: conceptual opposites (model/drawing)
- **Compound, Qualified terms:**
  - pre-coordinated (integral concept) vs. post-coordinated (terms stand adjacent) (authorized model vs. model, authorized)
- **Associative:**
  - Relate terms that contextualize each other across hierarchies. Reflexive.
  - Term A predicates something about Term B / Term Beta is predicated by RT Alpha

All relationships must be reciprocal

Special Considerations: Compound Terms

- **Refer to Z39-19 section 7.**
- **Consists of a focus term and one or more qualifiers.**
- **Pre-coordination**
  - The words together mean something very specific.
  - Terms are those where the compound term stands on its own, without the reader needing definitions of the constituent terms.
  - Will increase the size of the vocabulary, it tends to make lookup by the user easier or more direct.
  - Example: “Source Model” is pre-coordinated, because that has a particular, procedural meaning.
- **Post-coordination**
  - Combines terms ad hoc, during lookup, to maintain independence of constituent terms used to qualify each other.
  - Reduces size of vocabulary, but might require addition specification or less direct lookup.
  - Example: “Digital model” is post-coordinated, because those terms do not represent a particular genre or instance.

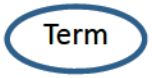
Structured Text Notation

- **General format:**
  - <Subject term> <relationship operator> <Object term>
- **Hierarchical:**
  - Broader Term (BT) is more general than, or aggregates, a Narrower Term (NT)
  - For BT, NT is a subtype / For NT, BT is a supertype. `Fruit NT Apple / Apple BT Fruit`
  - Whole-Part: suffix 'P'. A BTP has a NTP / A NTP belongs to a BTP. `Car NTP Wheel / Wheel BTP Car`
  - Instance: suffix 'I'. For BTI there's an instance NTI / NTI is an instance of BTI.
    `CAD Software NTI Creo / Creo BTI CAD software`
- **Equivalency:**
  - <preferred term> USE-FOR <non-preferred term>. <non-preferred term> USE <preferred term>
    `3D Model USE Model / Model USE-For 3D Model`
  - Antonym: `Drawing NOT Model / Model NOT Drawing`
- **Qualified:**
  - Post-coordinated Term JOINS terms
    - `MBD JOINED-BY Authorized / Authorized JOINED-TO MBD`
- **Associative:**
  - One term predicates something about a different Related Term (RT)
  - `Design Authority RT [authorizes] MBD. MBD RT [authorized by] Design Authority`
- **For all semantic links (future):**
  - Can overload with optional predicates and/or equivalency symbols
    `MBD NT ≅ [realizes] product definition`

Blue represents allowed (may) tailoring.

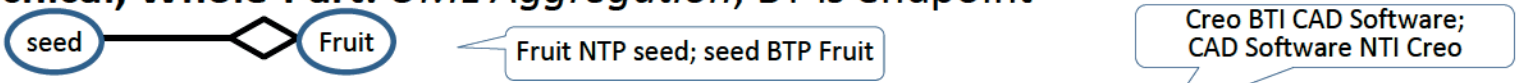
For "3D model", use "model. Use "model" for "3D model"

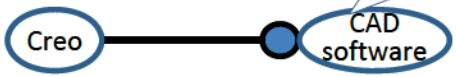
Graphical Notation

- **Term:** Ellipse. 

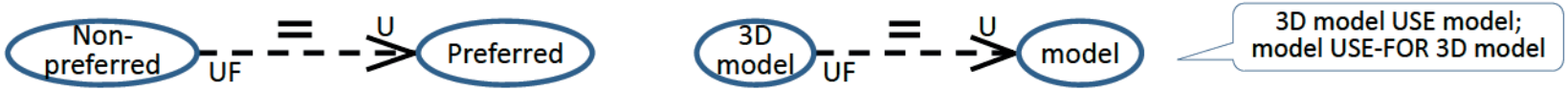
- **Hierarchical, Generic:** *UML Generalization*, Broader Term is endpoint

- **Hierarchical, Whole-Part:** *UML Aggregation*, BT is endpoint



- **Hierarchical, Instance:** *non-UML*, BT is endpoint 

- **Equivalence:** Use one term instead of another
  - *UML Substitution*, endpoint at the preferred term



- **Qualified term, post-coordinated:** *UML Realization*, inheritance, dashed

- **Associative:** *UML Association* (communicates with), labeled with a predicate

- **Any:** Equivalency symbol or predicate *can* adorn any line 

Narrative Elements of the Thesaurus

Feature	RelOp	Description	Examples
Scope Note	SN	Any note about term.	Use when referring to a 3D CAD model, instead of all other forms, and in opposition to drawing. May use other form on first callout.
Definition	SN:DEF	Defines the term.	Model is a 3D representation of a part.
Usage	SN:USE	Explains the usage of the term.	Use when referring to a 3D CAD model, instead of all other forms, and in opposition to drawing. May use other form on first callout.
Example	SN:EX	Provides an example use of the term.	Create a model of the part.
History	SN:HIST	Describes significant changes in meaning or form.	Formerly used 3D CAD model as preferred form
Editorial	SN:ED	Provides administrative information to editors only.	This term needs scrubbing.
Changes	SN:CH	Provides a change journal, visible to editors only.	Modified <date> by <fred>