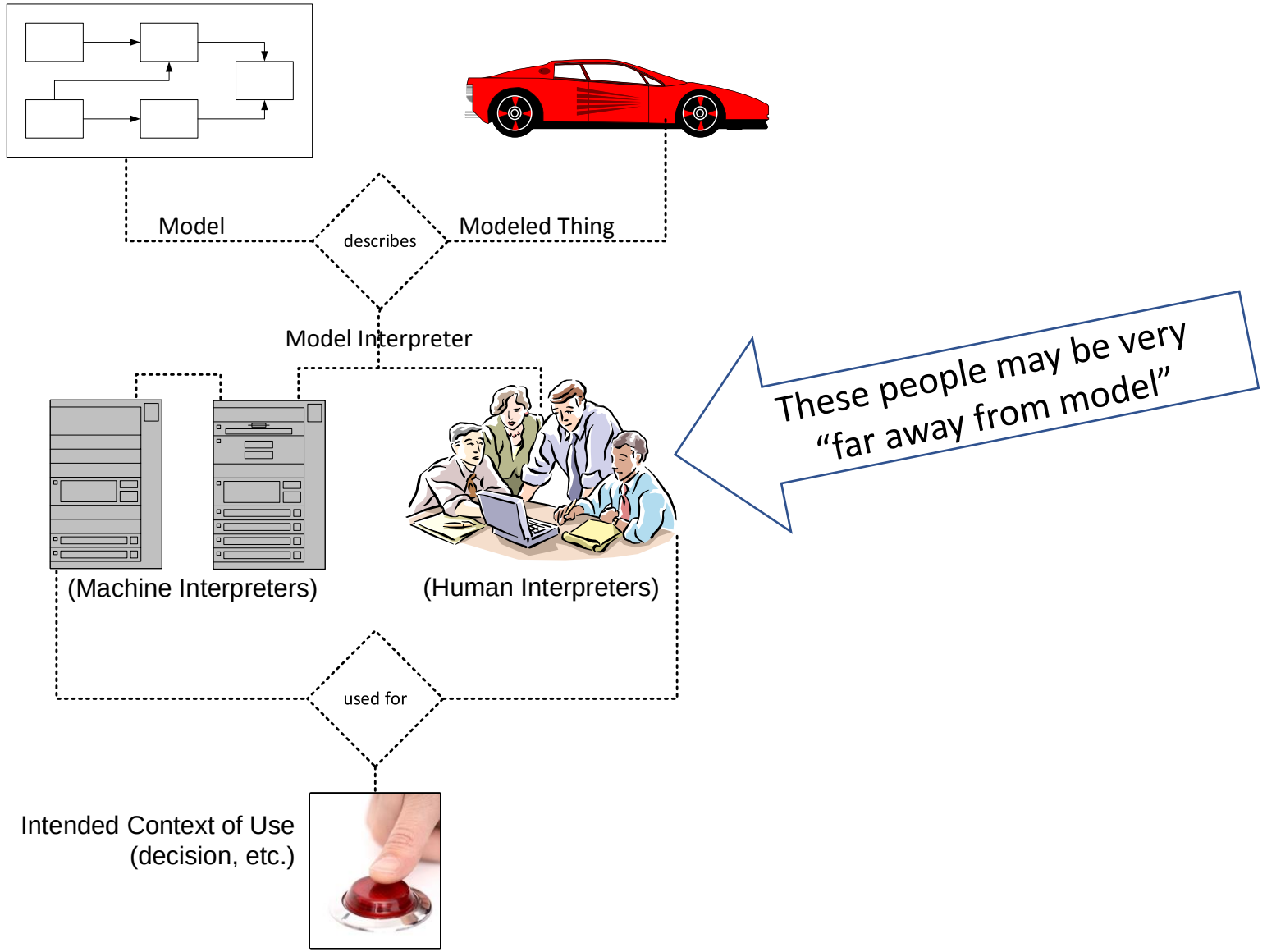
Two IFSR 2018 Topics

- Credibility of Models (Monday)
- Smallest Model of a System (Tuesday)

A. Referenced general contextual setting
B. Offered assertions for discussion (1 slide)
C. Existing conceptual frames, terms, standards
D. Conversation (the main thing)
E. Supporting references

Referenced general contextual setting



Offered assertions for discussion

1. **Model VVUQ**: The SE community can learn from the specific engineering disciplines (e.g., ME), as to the VVUQ of models—including importance of overall practice as well as specific methods.
2. **Model Enthusiasm**: The SE community's enthusiasm for modeling encourages creating models "from scratch", or at least without much formality as to how to use what is already "known"—a source of risk.
3. **Enterprise and Industry Learning**: At an enterprise or industry level, model refinement and model VVUQ become a form of organizational learning, and a place explicitly manage inherent uncertainty related risks (more than just thinking of models as "truth' or "valid" or "wrong").
4. **Pressure Increasing**: As models become more pervasively exchanged and applied for more critical uses, the true cost of learning (or forgetting, or re-learning) becomes more visible, increasing the pressure to use MBSE methods that effectively incorporate and utilize learned model content (model-based patterns).
5. **Adaptive System Framework**: Comparable to the historical scientific method loop and the STEM revolution it helped drive, the INCOSE ASELCM Pattern illustrates a framework in which enterprise or other complex system learning and adaptation may accrue on a managed basis. Of particular importance to this meeting and INCOSE is the System 3 understanding and improvement of System 2—not just System 1.
6. **Optimal Estimation and Control**: Thorough use of S1 models transforms agile methods "next increment" selection strategy heuristics into optimal estimation and control as a basis for managing risk in Hilbert space.
7. **Learning Is Not Flat:** It occurs in abstraction hierarchies of patterns. This incudes not just System 1 Patterns for engineered systems, but also System 2 Patterns for engineering, production, other processes, including Model VVUQ itself. This provides the foundation for the Model VVUQ Pattern being used in the ASME Model VV standards work.
8. **Regulated Markets:** MBSE Patterns, with both general shared upper levels and company-specific lower level, offer a medium for facilitated collaboration across regulated domains, streamlining innovation.

Population <-- Size (Log)	Stakeholders in A Successful MBSE Transformation (showing their related roles and parent organizations)
Model Consumers (Model Users):	
****	Non-technical stakeholders in various Systems of Interest, who acquire / make decisions about / make use of those systems, and are informed by models of them. This includes mass market consumers, policy makers, business and other leaders, investors, product users, voters in public or private elections or selection decisions, etc.
**	Technical model users, including designers, project leads, production engineers, system installers, maintainers, and users/operators.
*	Leaders responsible to building their organization's MBSE capabilities and enabling MBSE on their projects
Model Creators (including Model Improvers):	
*	Product visionaries, marketers, and other non-technical leaders of thought and organizations
*	System technical specifiers, designers, testers, theoreticians, analysts, scientists
*	Students (in school and otherwise) learning to describe and understand systems
*	Educators, teaching the next generation how to create with models
*	Researchers who advance the practice
*	Those who translate information originated by others into models
*	Those who manage the life cycle of models
Complex Idea Communicators (Model "Distributors"):	
**	Marketing professionals
**	Educators, especially in complex systems areas of engineering and science, public policy, other domains, and including curriculum developers as well as teachers
**	Leaders of all kinds
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

Existing conceptual frames, terms, standards

V1.2.1

2018 Annual INCOSE international workshop
Jacksonville, FL, USA
January 20 - 23, 2018

INCOSE Collaboration In an ASME-Led Standards Activity

Standardizing V&V of Models

Bill Schindel, ICTT System Sciences
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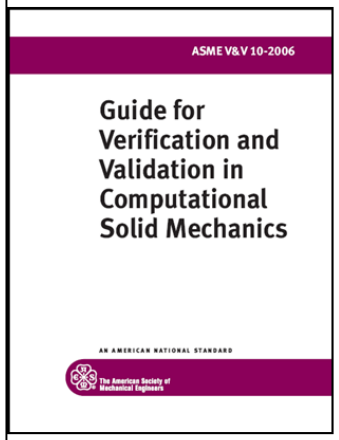
www.incose.org/IW2018

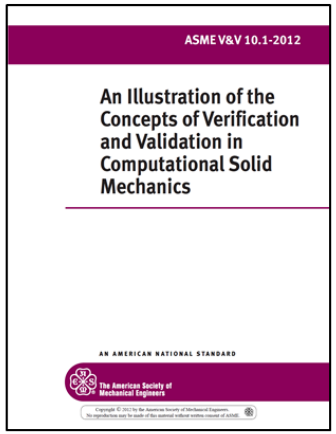
Existing conceptual frames, terms, standards

ASME Committee on V&V in CM&S

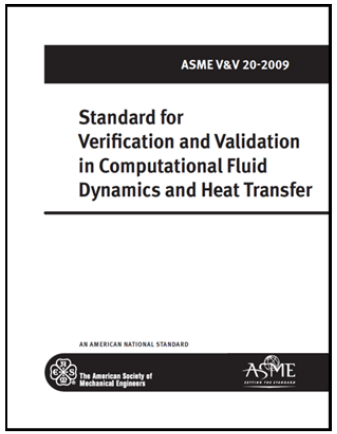
Codes & Standards — V&V VERIFICATION AND VALIDATION IN COMPUTATIONAL MODELING AND SIMULATION



ASME V&V 10



ASME V&V 10.1



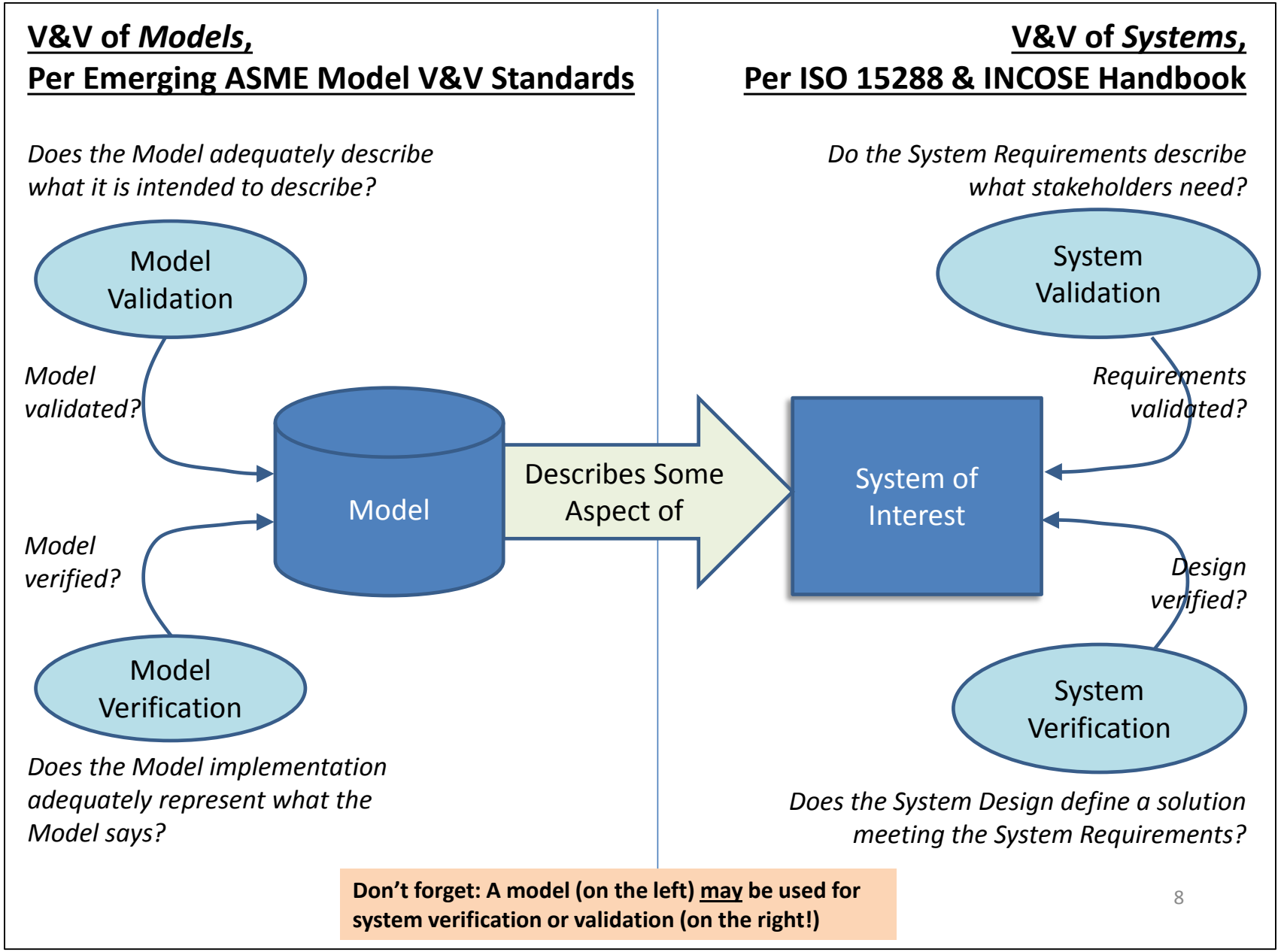
ASME V&V 20

V&V Standards Committee in Computational Modeling and Simulation

- **V&V 10** - Verification and Validation in Computational Solid Mechanics
- **V&V 20** - Verification and Validation in Computational Fluid Dynamics and Heat Transfer
- **V&V 30** - Verification and Validation in Computational Simulation of Nuclear System Thermal Fluids Behavior
- **V&V 40** - Verification and Validation in Computational Modeling of Medical Devices
- **V&V 50** - Verification and Validation of Computational Modeling for Advanced Manufacturing

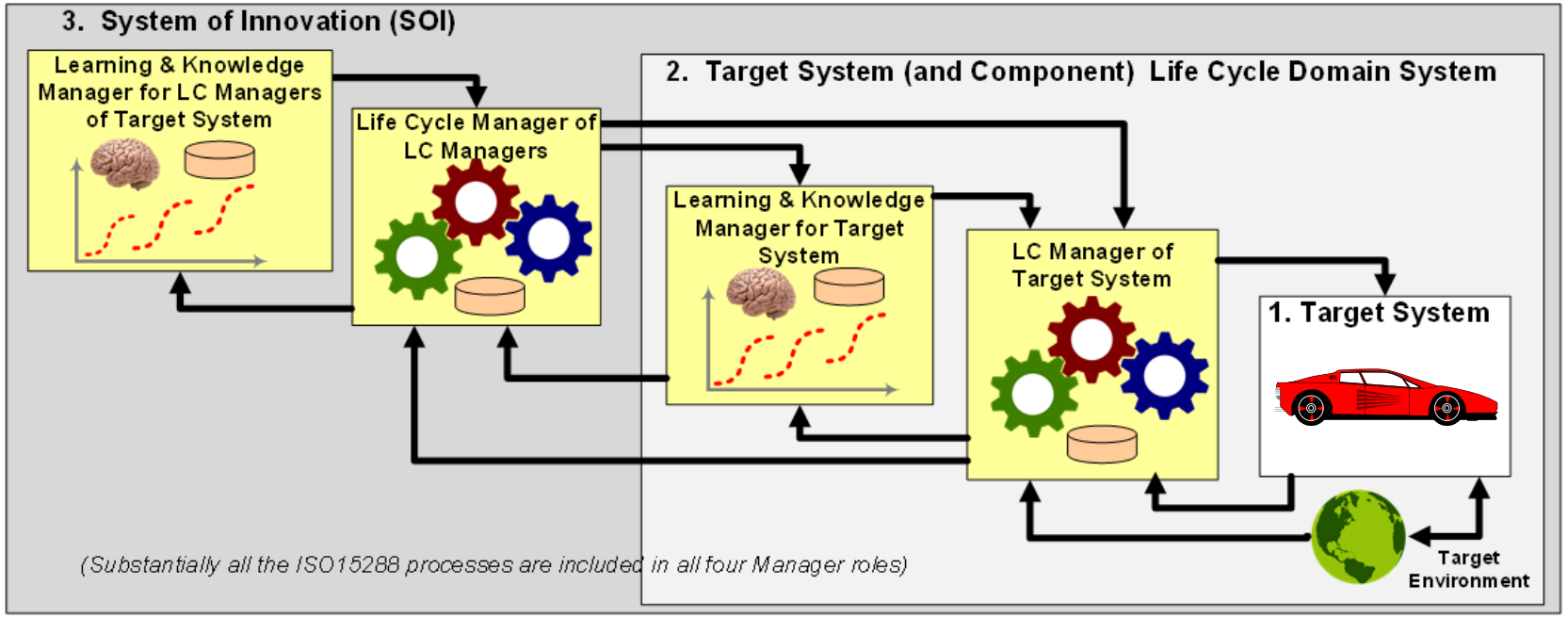
Numerous other resources not listed: NASA, Sandia, NAFEMS, etc.

Existing conceptual frames, terms, standards



Existing conceptual frames, terms, standards

INCOSE ASELCM Pattern

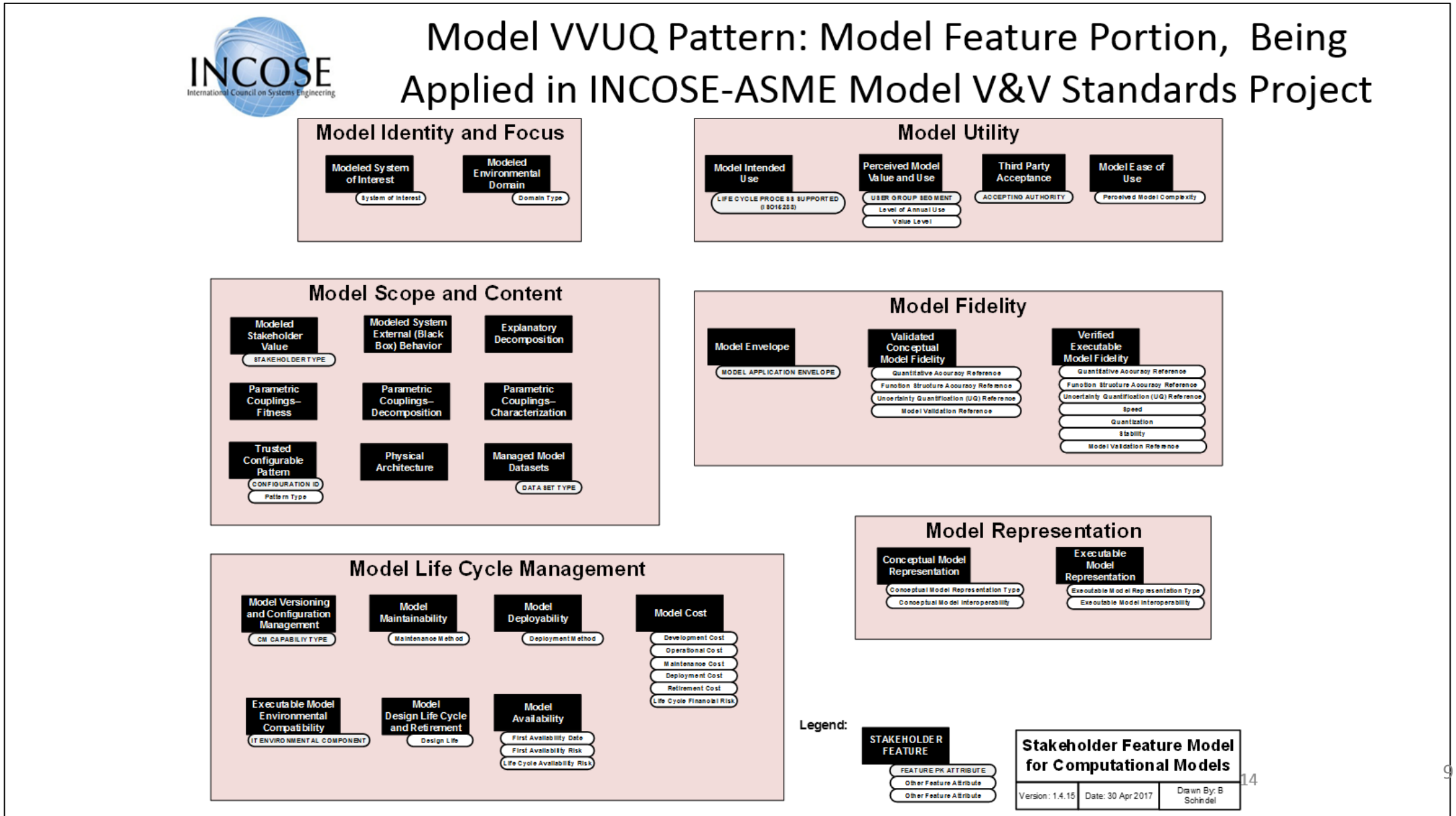


System 1: The target system of interest (e.g., a product system)

System 2: The (ISO 15288) life cycle management systems for System 1, along with the rest of System 1's target environment

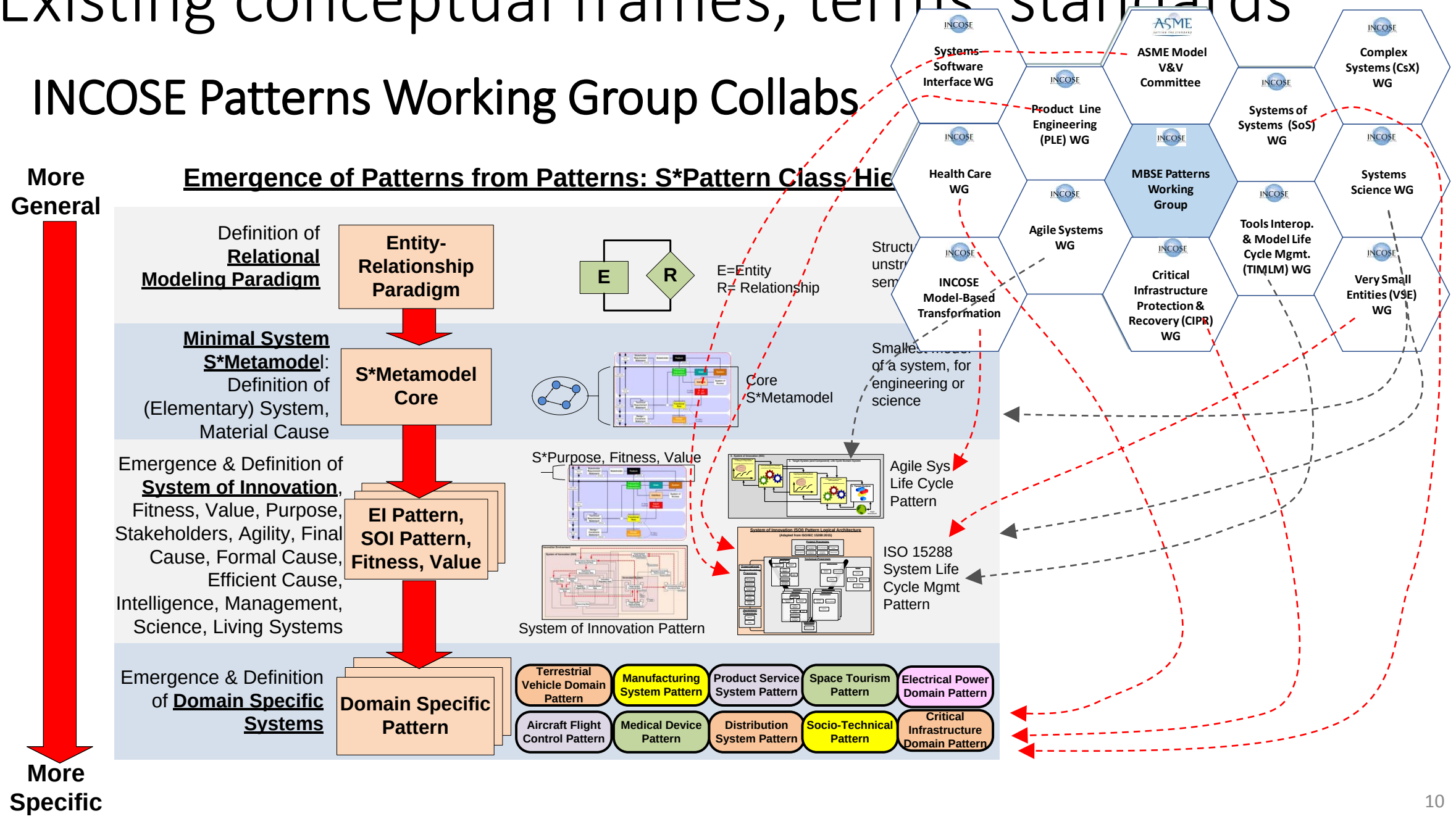
System 3: The life cycle management systems for System 2

Existing conceptual frames, terms, standards



Existing conceptual frames, terms, standards

INCOSE Patterns Working Group Collabs



Existing conceptual frames, terms, standards

V1.5.2

28th annual INCOSE international symposium
Washington, DC, USA
July 7 - 12, 2018

Accelerating Innovation Effectiveness: Model-Facilitated Collaboration by Regulators, Technical Societies, Customers, and Suppliers

INCOSE International Council on Systems Engineering
ASME SETTING THE STANDARD
FDA
FEDERAL AVIATION ADMINISTRATION
NAVAIR
SAE INTERNATIONAL

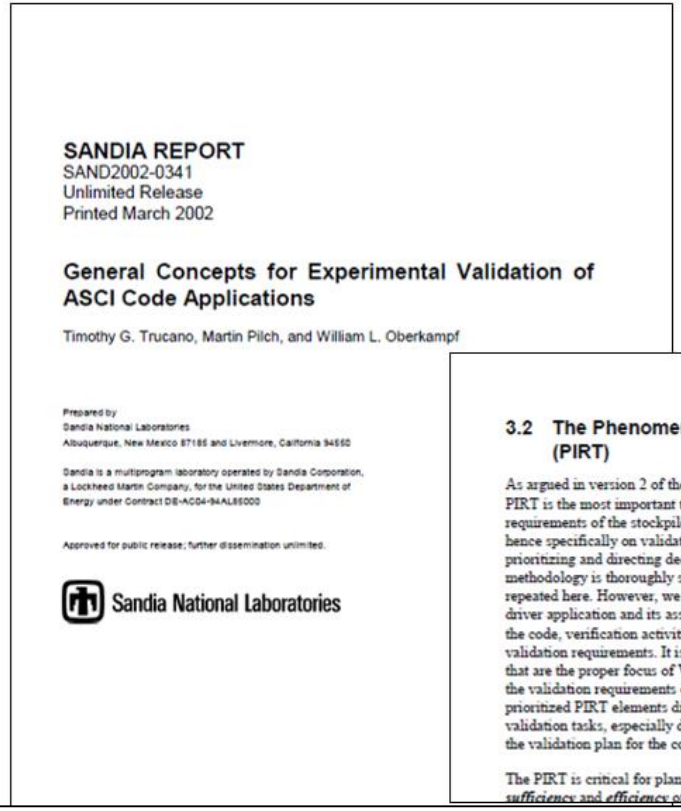
28th Annual INCOSE International Symposium
Delivering Systems in the Age of Globalization
July 7 – 12, 2018 Washington, DC

Existing conceptual frames, terms, standards

20

PIRT and the System Phenomenon

- Are “system” models really so different from “computational models”?
- Can/should “system” models be subject to VVUQ as in “computational models”?
- Does the credibility of “system models” matter less than the credibility of “computational models”?
- Read about PIRT (Phenomena Identification and Ranking Table) to realize that confidence in the structure of a “system model” is connected to confidence in the identification and ranking of “phenomena”.



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General Concepts for Experimental Validation of ASCI Code Applications

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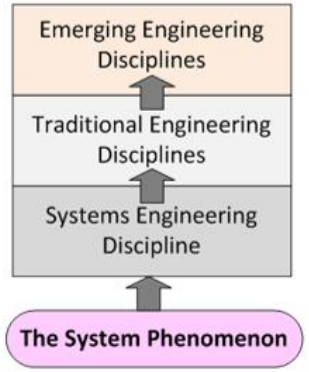

3.2 The Phenomena Identification and Ranking Table (PIRT)

As argued in version 2 of the Sandia V&V planning guidelines (Pilch et al. 2000a), the PIRT is the most important tool in our V&V planning process for translating requirements of the stockpile driver application into requirements on usage of the code, hence specifically on validation activities. The PIRT is particularly important for prioritizing and directing dedicated validation experiment tasks. The intended use of this methodology is thoroughly specified and elaborated in Pilch et al. (2000a) and is not repeated here. However, we do point out that the PIRT is designed to convert the DSW driver application and its associated requirements into specific technical requirements for the code, verification activities, validation activities, and consequent experimental validation requirements. It is the code technical requirements for the driving application that are the proper focus of V&V activities. As a result of a well-executed PIRT process, the validation requirements of the code application are rank ordered in importance. The prioritized PIRT elements directly create the definition and prioritization of the specific validation tasks, especially dedicated validation experiments, which are performed under the validation plan for the code application.

The PIRT is critical for planning validation experiments because it helps establish both *sufficiency* and *efficiency* of the validation activities. To demonstrate *sufficiency*

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