

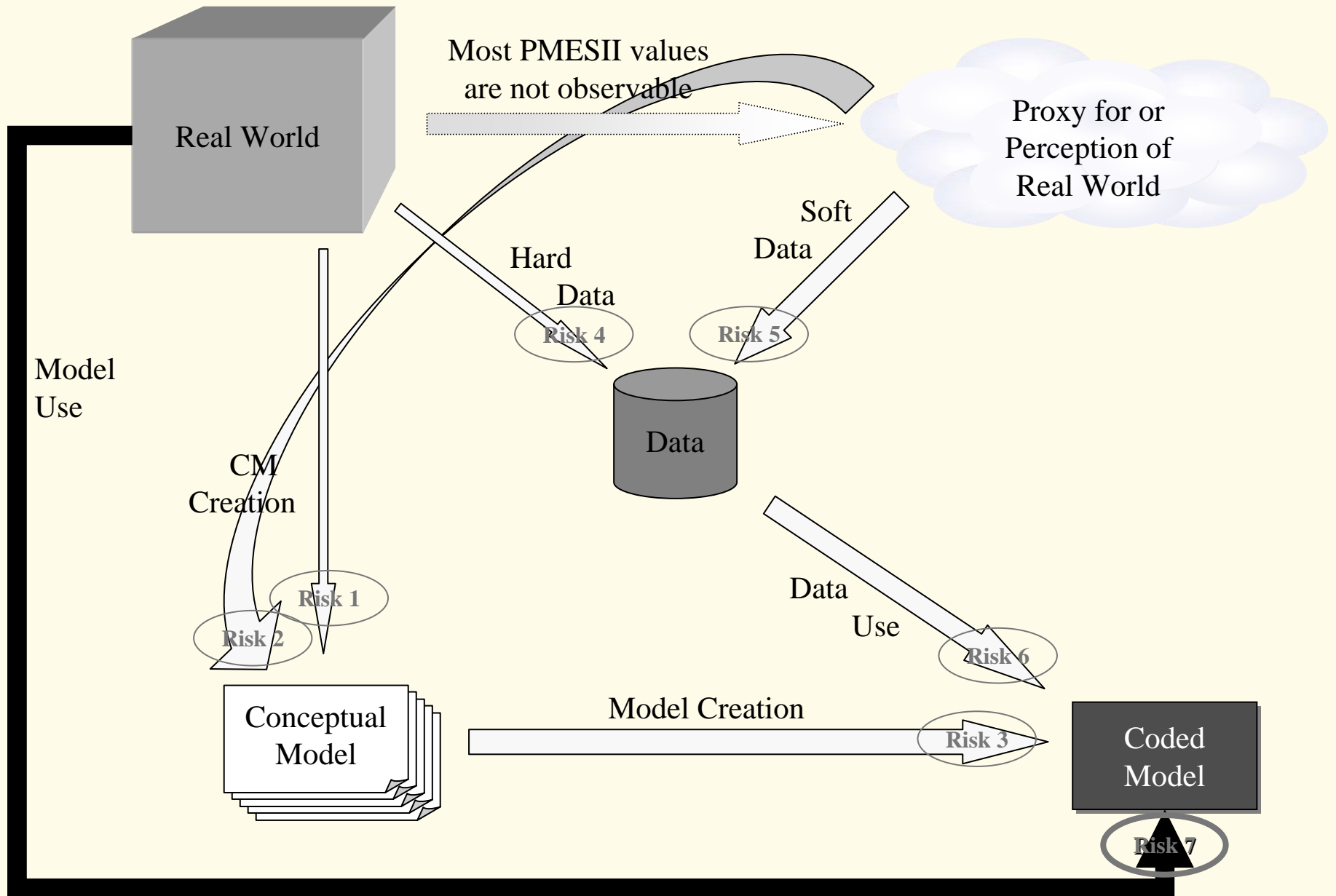
The background of the slide is a sepia-toned photograph of a tropical coastal scene. In the foreground, there is a calm body of water. The middle ground features a silhouette of a mosque with a prominent minaret on the right side. To the left of the minaret, there are several palm trees. The background consists of rolling hills or mountains under a clear sky.

# **VV &A of DIME/PMESII TOOLS**

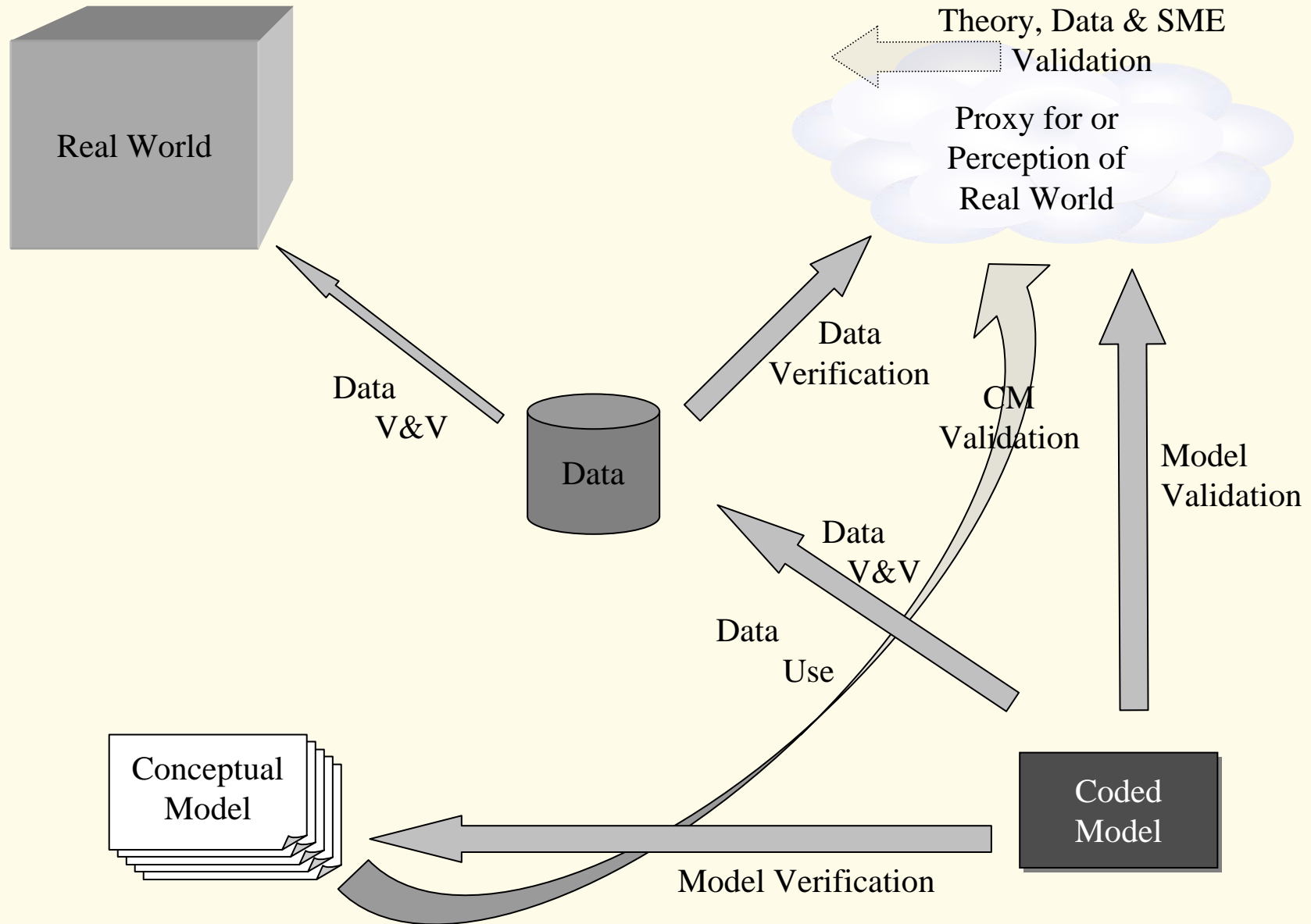
Dean Hartley

January 21, 2008

# Building and Using a Model



# Verifying and Validating a Model

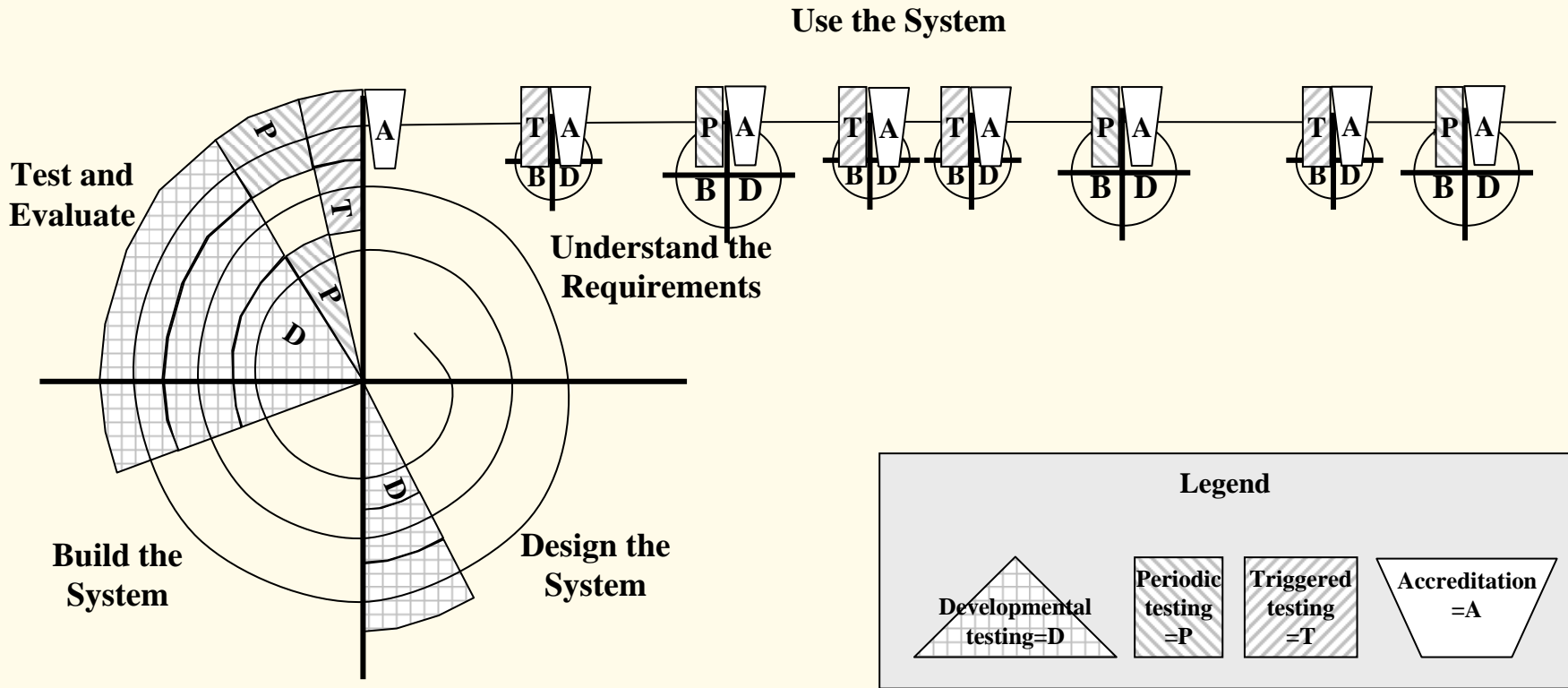


# Entrenched VV&A

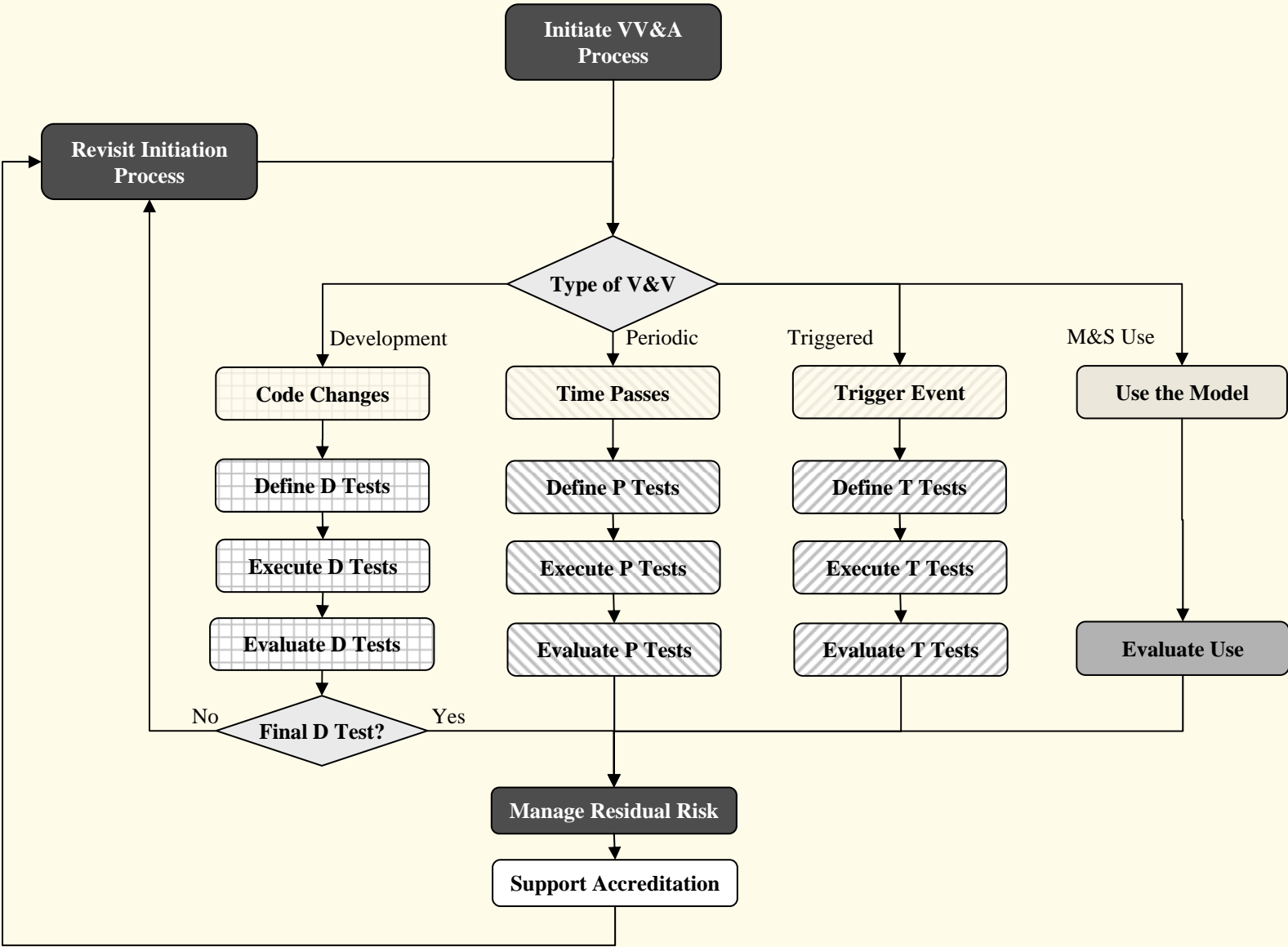
Accreditation	Formal Process
Periodic testing	Periodic Supplemental Tests Tests with different data sets, Tests of different functionality
Triggered testing	Changed-Environment Processes*
	Changed-Tool Processes*
	New-Tool Processes*
Developmental testing	Multi-model-System Processes*
	Standard Model-Acceptance Processes Alpha testing, Beta testing, Acceptance testing, etc.
	Standard Model-Creation Processes Design Walkthroughs, Code Review, Debugging, etc.

\* e.g., Interface testing, Special input testing, Full system testing

# Entrenched VV&A as Part of the Lifecycle



# Simplified Entrenched VV&A Process Flow



# Verification Metrics Example

Date	06/01/06	11/01/06	12/01/06	07/01/07	11/01/07	12/01/07
Event	Alpha Test	Beta Test	Final Test	Alpha Test	Beta Test	Final Test
Version Number	1	1	1	2	2	2
Successful Tests	81	106	109	99	116	119
Unresolved Problems	6	3	0	3	3	0
Total Tests	87	109	109	102	119	119
New Tests	87	68	0	65	79	0
Repeated Tests	0	41	109	37	40	119

System Tests						
Successful Tests	20	25	25	25	30	31
Unresolved Problems	1	0	0	2	1	0
Total Tests	21	25	25	27	31	31
New Tests	21	10	0	17	19	0
Repeated Tests		15	25	10	12	31

Name 1						
Version Number	2	2	2	3	3	3
Successful Tests	30	40	42	35	41	42
Unresolved Problems	3	2	0	1	1	0
Total Tests	33	42	42	36	42	42
New Tests	33	34	0	24	29	0
Repeated Tests		8	42	12	13	42

Name 2						
Version Number	3.1	3.1	3.1	3.7	3.7	3.7
Successful Tests	31	41	42	39	45	46
Unresolved Problems	2	1	0	0	1	0
Total Tests	33	42	42	39	46	46
New Tests	33	24		24	31	0
Repeated Tests		18	42	15	15	46

# Coded Model Validation Preliminaries

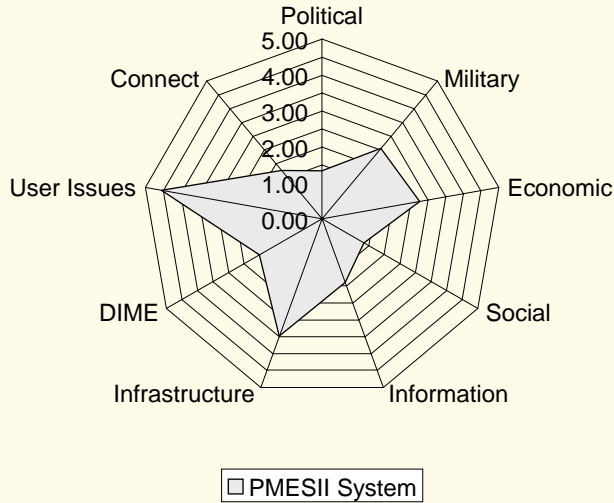
Name 2

Use A

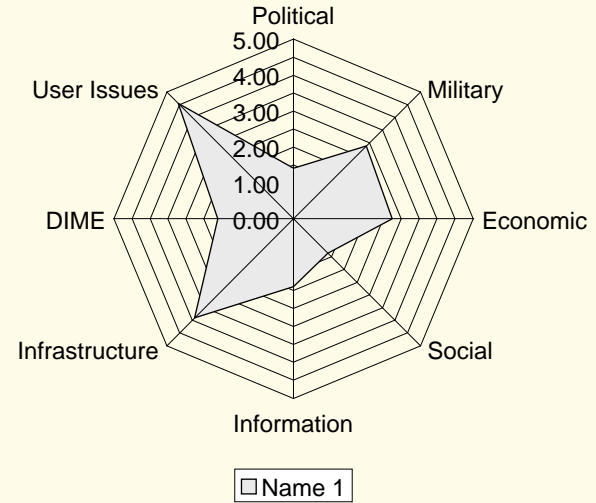
			Relevant for this model? (0=no, 1=yes)	Theory (1=WAG, 2=SWAG, 3=Peer Rvw, 4=Accepted, 5=Proved)	Model Raw Score	Suitability for Use Fraction from Testing (granularity match, model match, right direction of change, right order of magnitude change)	Model Use Score
<b>PMESII</b>							
<b>DIME PMESII Variables and DIME Functions</b>							
Political-Gov	DIME	Conducting nationwide elections	1	1	0.20	0.90	0.18
Political-Gov	DIME	Create local governments	1	1	0.20	1.00	0.20
Political-Gov	DIME	Educate local governments	1	1	0.20	0.90	0.18
Political-Gov	DIME	Establishing a mechanism for constitutional reform	1	1	0.20	0.90	0.18
Political-Gov	DIME	Establishing, staffing & funding effective transition national govt	1	1	0.20	0.90	0.18
Political-Gov	DIME	Providing advisors to national govt officials	1	1	0.20	1.00	0.20
Political-Gov	DIME	Supply local governments	1	1	0.20	0.90	0.18
Political-Gov	DIME	Training newly elected national political leaders	1	1	0.20	0.90	0.18
Political-Gov		Central authority is effective	1	1	0.20	0.90	0.18
Political-Gov		Central government exists	1	1	0.20	0.95	0.19
Political-Gov		Social services are adequate	1	1	0.20	0.90	0.18
	<b>Sums</b>		11		2.20		2.03
	<b>Scaled Scores</b>				1.00		0.92
Political-Pol	DIME	Maintaining compliance with peace accord milestones & conditions	1	1	0.20	0.90	0.18
Political-Pol	DIME	Mediating & negotiating w/ conflicting parties	1	1	0.20	0.90	0.18
Political-Pol	DIME	Monitoring government powersharing arrangements	1	1	0.20	0.90	0.18
Political-Pol	DIME	Transferring control of government functions to host nation officials	1	1	0.20	1.00	0.20
Political-Pol		Opposition party does not espouse force	1	1	0.20	0.90	0.18
Political-Pol		Opposition party doesn't attempt to dominate by force	1	1	0.20	1.00	0.20
Political-Pol		There are charismatic leaders advocating peace and stability	1	1	0.20	0.90	0.18
Political-Pol		There are no charismatic leaders advocating dissension	1	1	0.20	0.90	0.18
Political-Pol		There are no external forces advocating conflict	1	1	0.20	0.90	0.18
	<b>Sums</b>		9		1.80		1.66
	<b>Scaled Scores</b>				1.00		0.92
Political-ROL	DIME	(Re)building & monitoring new police force	0	3	0.00	0.00	0.00
Political-ROL	DIME	Assisting in establishing humane penal systems	0	1	0.00	0.00	0.00
Political-ROL	DIME	Assisting in establishing/reforming legitimate legal system	0	1	0.00	0.00	0.00
Political-ROL	DIME	Conducting constabulary operations	0	1	0.00	0.00	0.00
Political-ROL	DIME	Conducting war crimes investigations, tribunals, etc.	0	1	0.00	0.00	0.00
Political-ROL	DIME	Monitoring and reporting on corruption by govt officials	1	1	0.20	1.00	0.20
Political-ROL	DIME	Monitoring human rights practices	1	1	0.20	0.90	0.18

# Coded Model Validation Display

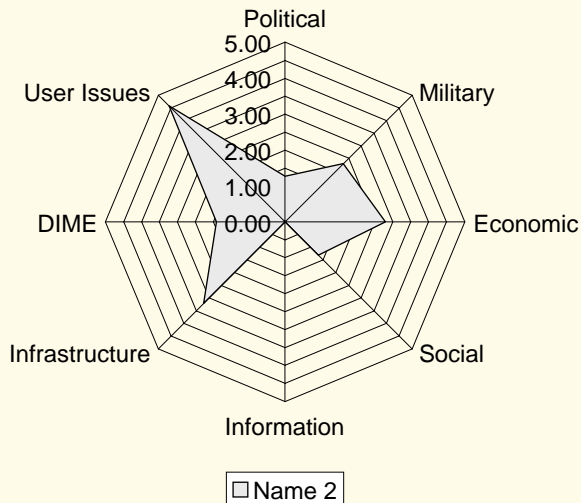
## System Validation Metrics



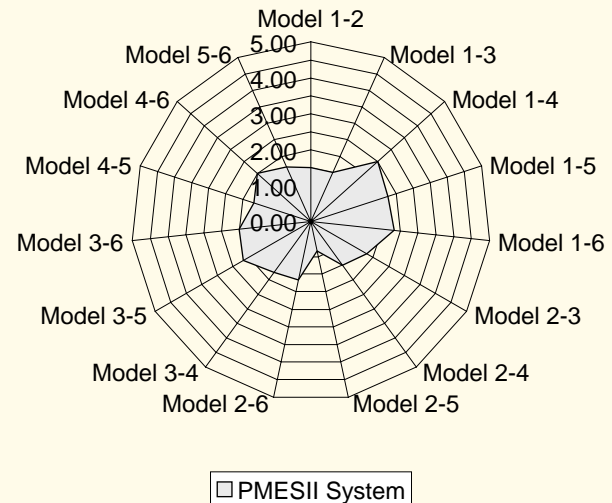
## Model Validation Metrics



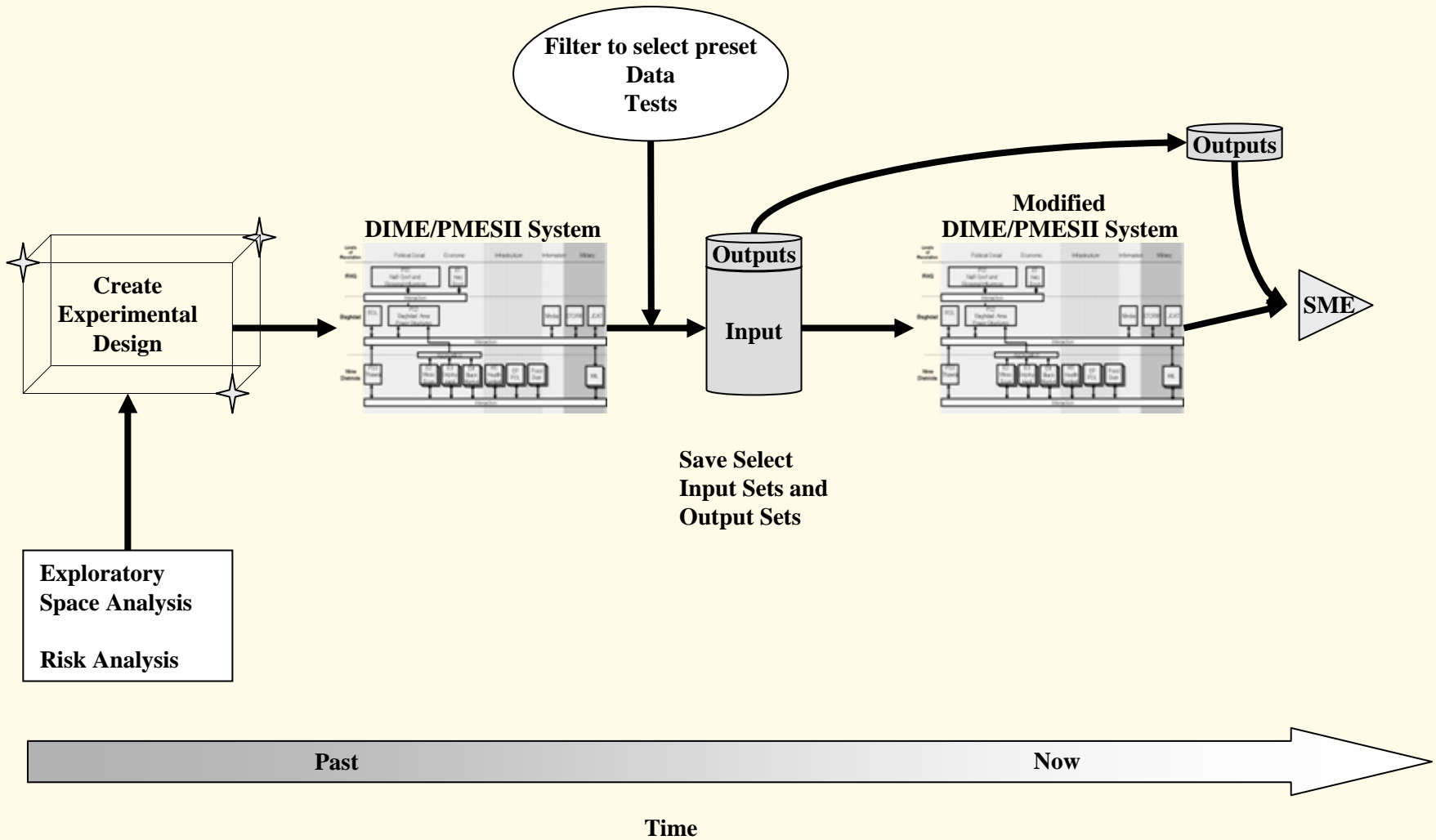
## Model Validation Metrics



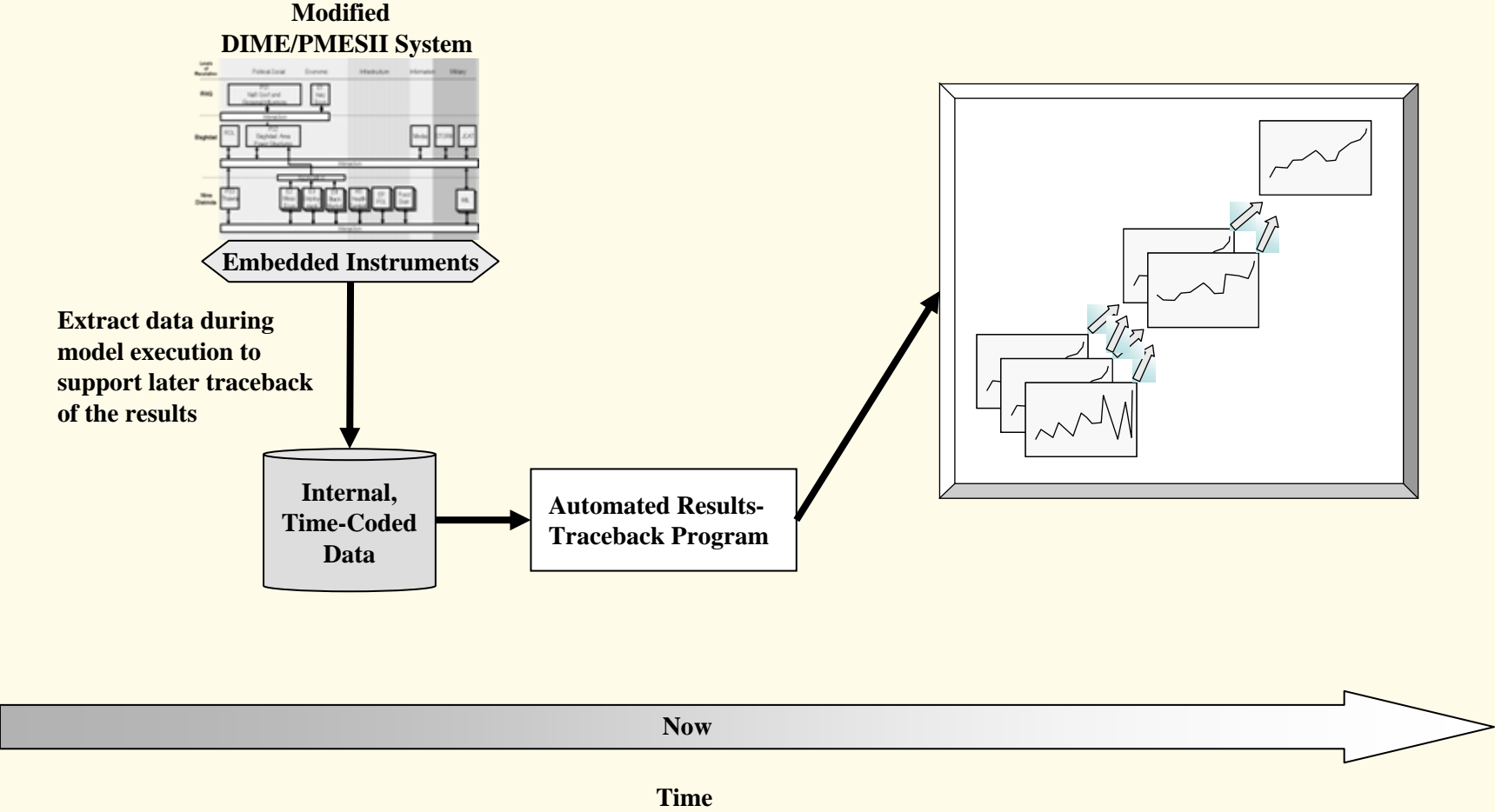
## Inter-Model Connections



# Experimental Design

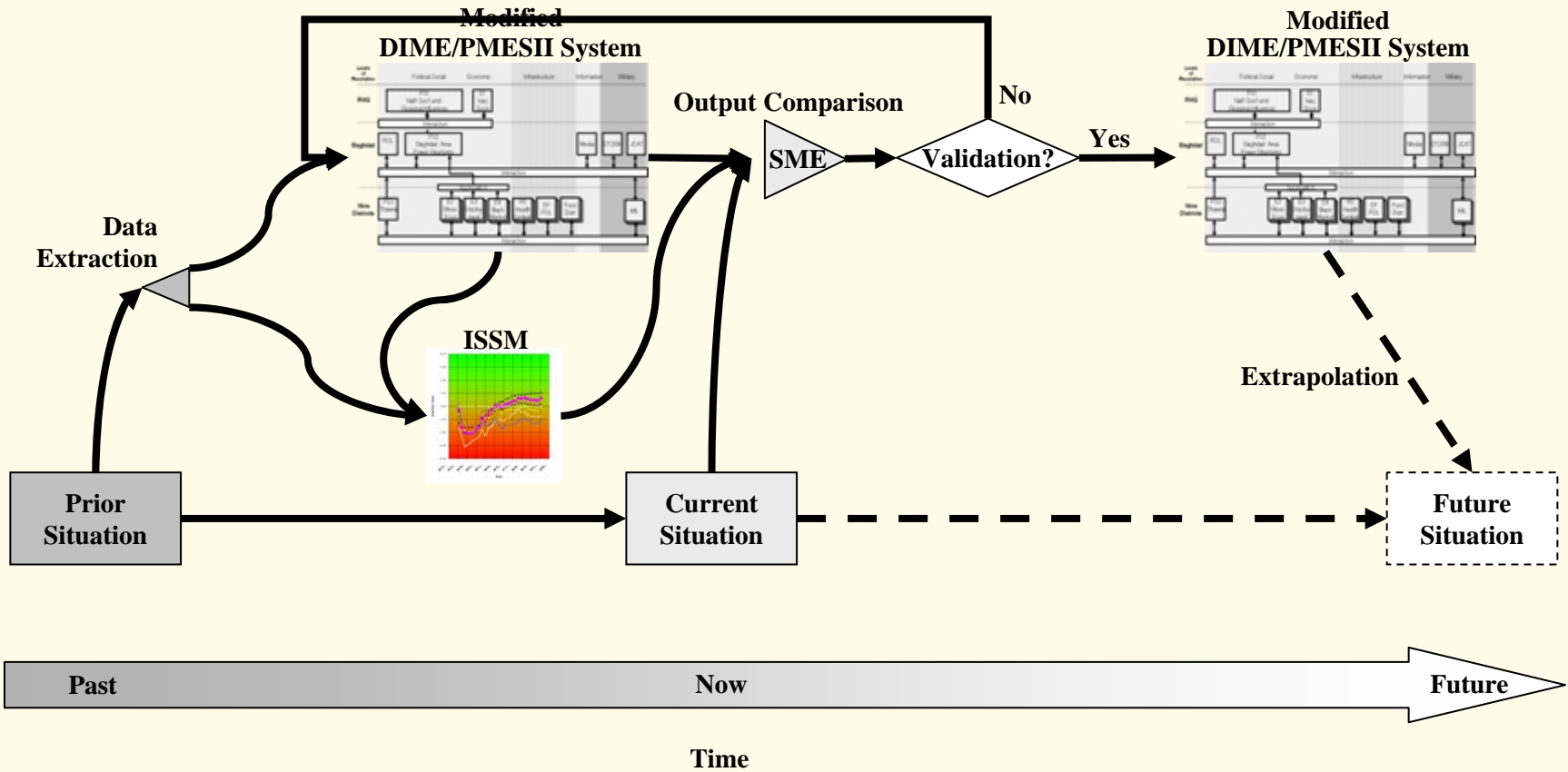


# Embedded Results-Traceback System



# Model Comparison

Calibrate DIME/PMESII System



# From the hills of East Tennessee

**Questions?**



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# Backup

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January 21, 2008

# CM Risks and Mitigations (1 of 2)

Risk CM Val Lev	Methodology		Intellectual Capital			Data			
	Intended use	CONOPS maturity	User experience	SME availability	SME quality	Particular Data		General Data	
						Bad input data	Mis- interpreting results	Wrong format	Content nature
Level-5	Medium M: Train users	Medium M: Train users	Minor	Minor	Minor	Major M: V&V data	Major M: Train users; Use peer review	Medium M: Train users	Minor
Level-4	Medium M: Train users	Medium M: Train users	Medium M: Train users	Medium M: Train users	Medium M: Train users	Major M: V&V data	Major M: Train users; Use peer review	Medium M: Train users	Minor
Level-3	Major M: Enforce caveats	Major M: Train users; enforce caveats	Medium M: Train users	Medium M: Train users	Medium M: Train users	Medium M: Use parametric data exploration	Medium M: Use peer review	Medium M: Train users	Medium M: Use parametric data exploration
Level-2	Major M: Enforce caveats	Major M: Train users; enforce caveats	Major M: Train users	Major M: Train users	Major M: Train SMEs; train users	Medium M: Use parametric data exploration	Medium M: Use peer review	Medium M: Train users	Major M: Use parametric data exploration
Level-1	Major M: Enforce caveats	Major M: Train users; enforce caveats	Major M: Train users	Major M: Train users	Major M: Train SMEs; train users	Medium M: Use parametric data exploration	Medium M: Use peer review	Medium M: Train users	Major M: Use parametric data exploration; use peer review

# CM Risks and Mitigations (2 of 2)

Risk	Tool										
	Individual Model			Model Interactions				General Tool			
	Model is biased	Model is incomplete	Model is wrong	Interactions are not traceable	Interaction is biased	Interactions are incomplete	Interaction is wrong	Maturity of component	Maturity of composed M&S	Prior V&V	Configuration management
Level-5	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Medium M: Institute Conf Mgmt
Level-4	Minor	Medium M: Add SME opinions	Minor	Minor	Minor	Medium M: Add SME opinions	Minor	Minor	Minor	Medium M: Institute V&V	Medium M: Institute Conf Mgmt
Level-3	Medium M: Use parametric data exploration	Major M: Add SME opinions	Medium M: All to the left	Medium M: Use parametric data exploration	Medium M: Use parametric data exploration	Major M: Add SME opinions	Medium M: All to the left	Medium M: All to the left	Medium M: All to the left	Medium M: Institute V&V	Major M: Enforce Rigorous Conf Mgmt
Level-2	Major M: Use parametric data exploration; try weighting results	Major M: Add SME opinions	Major M: All to the left	Major M: Use parametric data exploration	Major M: Use parametric data exploration; try weighting results	Major M: Add SME opinions	Major M: All to the left	Major M: All to the left	Major M: All to the left	Major M: Enforce entrenched V&V	Major M: Enforce Rigorous Conf Mgmt
Level-1	Major M: Use parametric data exploration; try weighting results; use peer review	Major M: Add SME opinions	Major M: All to the left	Major M: Use parametric data exploration	Major M: Use parametric data exploration; try weighting results; use peer review	Major M: Add SME opinions	Major M: All to the left	Major M: All to the left	Major M: All to the left	Major M: Enforce entrenched V&V	Major M: Enforce Rigorous Conf Mgmt

# VV&A Process Maturity Metric

Level	Validation Criteria	Referent	Conceptual Model	Development Products	Simulation Results	Documentation Consistency	Testing Standards	Configuration Management Standards
0	none derived	none chosen	none constructed	verified enough to support development	not validated at all	little or no documentation	no standard practices	no standard practices
1	represented by SME opinion	represented by SME opinion	none constructed	verified enough to support development	validated by SME observing simulation results	little or no documentation	no standard practices	no standard practices
2	defined from user statements as entities represented, their attributes & the dependencies among them	represented solely by SME opinion, <b>based on intended use of the model/system</b>	validated against the validation criteria by the SME	verified against the conceptual model inventory	validated by SME against the validation criteria	standard documentation produced, but limited in scope	standard practices with developer performing the V&V tests	manual configuration management, but not standardized
3	defined from user statements as Level 2 terms plus attribute ranges, domains & errors	derived from a single source, <b>based on intended use of the model/system</b>	validated by objective party from validation criteria & referent	verified against the conceptual model	validated by objective party from validation criteria & referent	standard documentation produced, with nearly complete scope	standard practices with someone other than the developer performing the V&V tests at acceptance or accreditation time	standardized manual configuration management
4	defined from user statements as Level 3 terms plus confidences	sampled from multiple independent sources, <b>based on intended use of the model/system</b> , & correlated statistically with estimates of uncertainties	validated by objective party from validation criteria & referent; analyzed to suggest results sampling space & estimate the confidence associated with the sampling	verified against the conceptual model; provides information to guide results sampling & estimate the confidence associated with that sampling	sampled from guidance developed from CM & verification analyses; validated by objective party from validation criteria & referent	standard documentation produced, with complete scope and database	standard practices with a disinterested party performing the V&V tests at acceptance or accreditation time	standard computer based configuration management
5	Level 4 terms formally derived from user statements using causality arguments	rigorously derived from multiple independent sources, <b>based on intended use of the model/system</b> , & characterized statistically with estimates of uncertainties	formally stated & validated automatically from validation criteria & referent; analyzed to define results validation sample space	verified against conceptual model & used to define results validation sample space & the confidence associated with that sampling	automatically sampled from guidance developed from CM & verification analyses; validated automatically from validation criteria & referent	standard documentation produced, with complete scope and database and complete retrieval system	standard practices with a disinterested party performing the V&V tests at acceptance or accreditation time	standard computer based configuration management with check-out, check-in safeguards

Probable Current Level

Probable Achievable Level

Red font indicates additions to the Youngblood VPMM