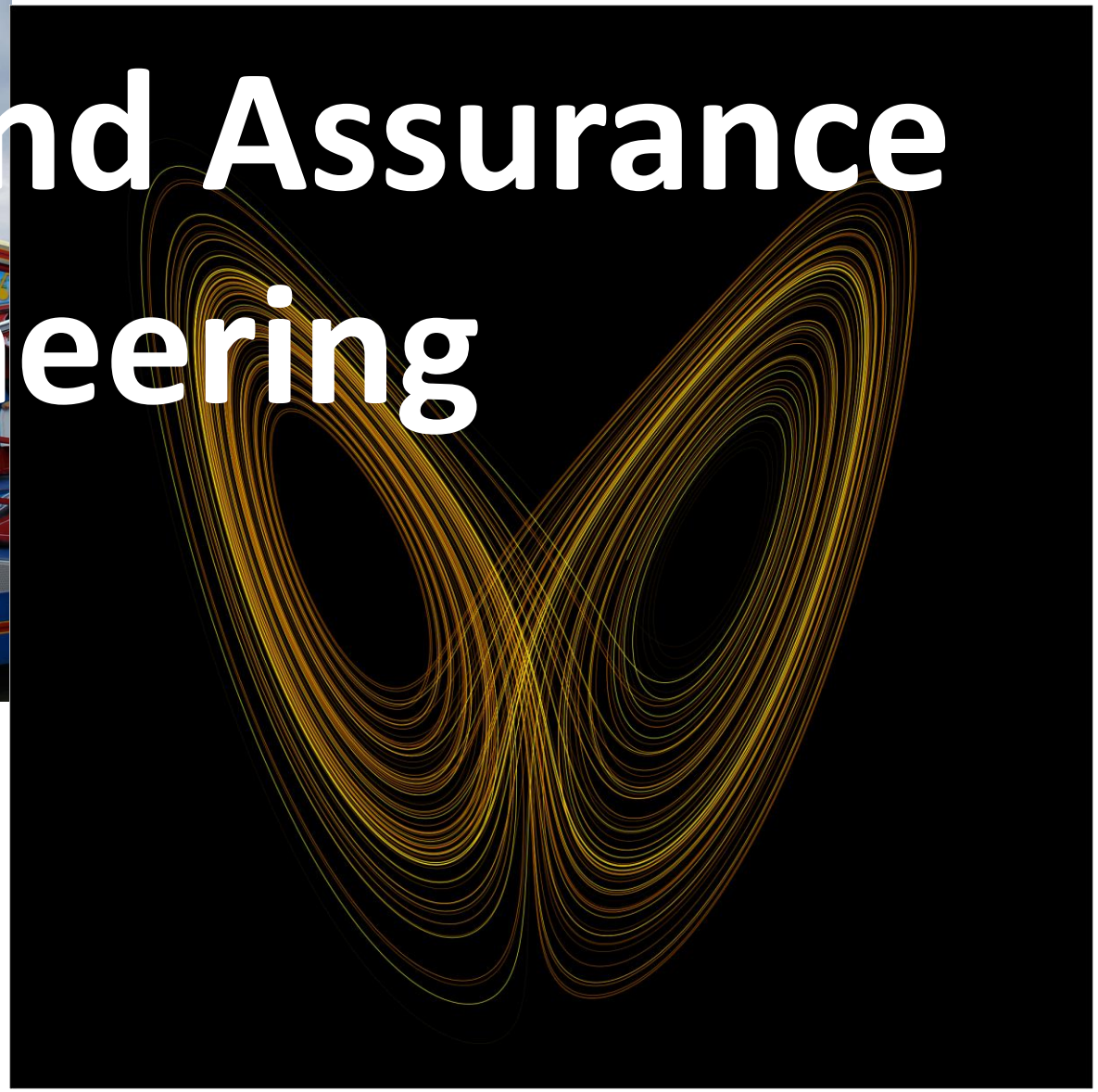
Modeling and Assurance Engineering



Ronnie Knight
Quality Engineering SME
Bastion Technologies

Presentation to Society of Reliability Engineers
1-2 November 2023

Modeling Marshall

BASTION TECHNOLOGIES

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Cullman company workin on space telescope mirror

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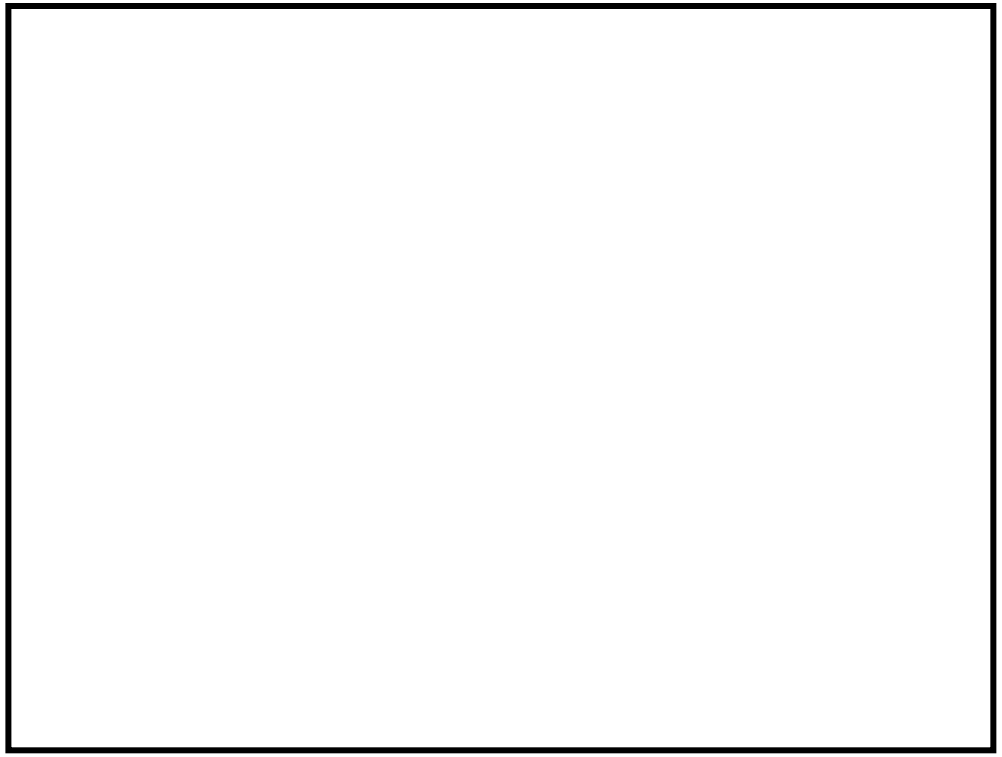

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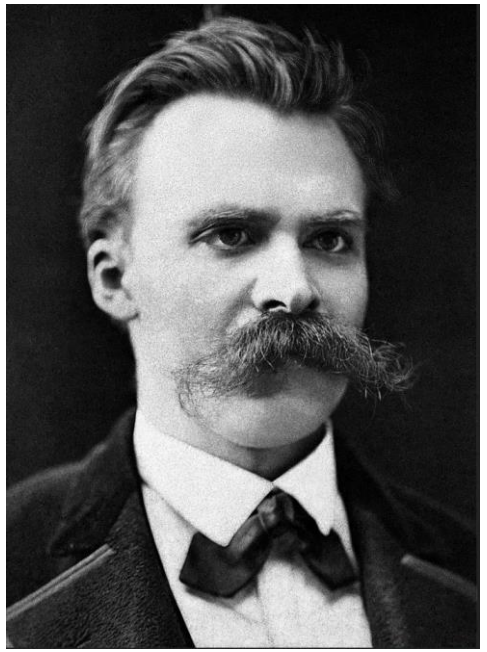

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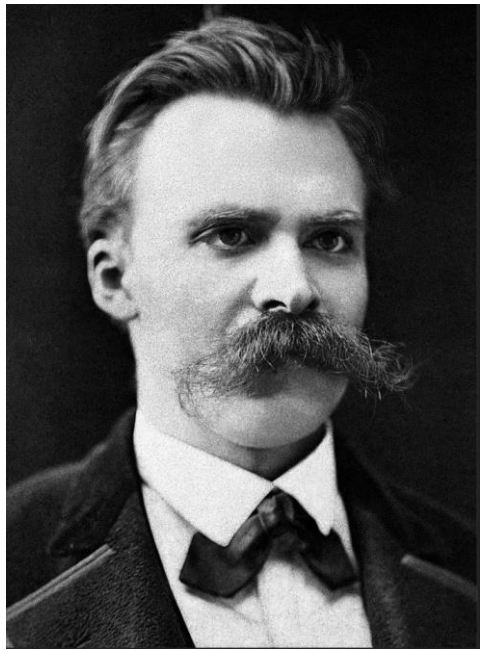

"Man's maturity – consists in having found again the seriousness one had as a child, at play." Nietzsche, Beyond Good and Evil, aphorism 94

MBMA: A Quick History

Modeling Marshall: Conquering Complexity in SMA

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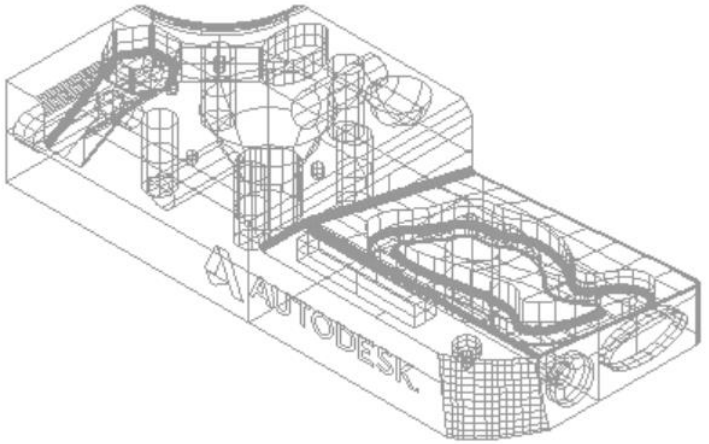

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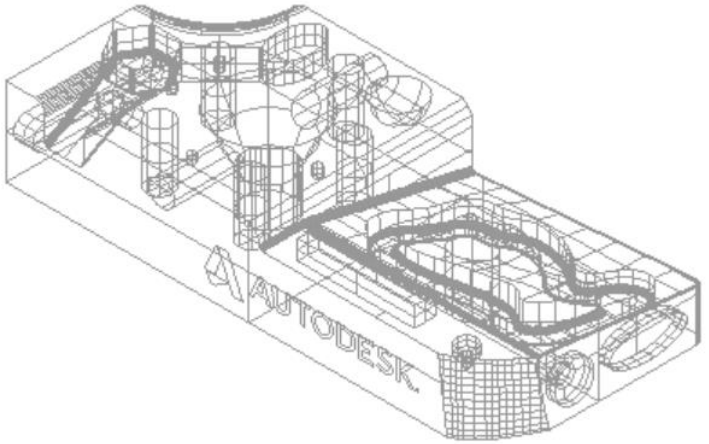

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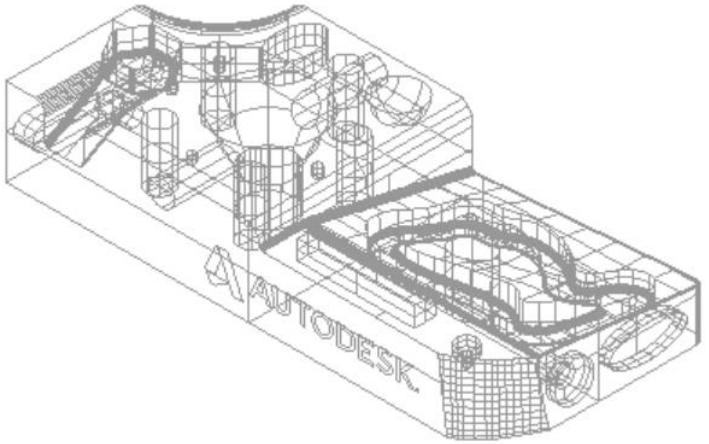

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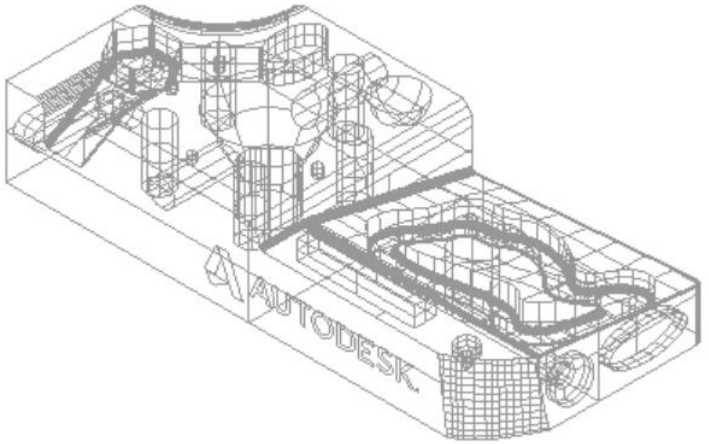

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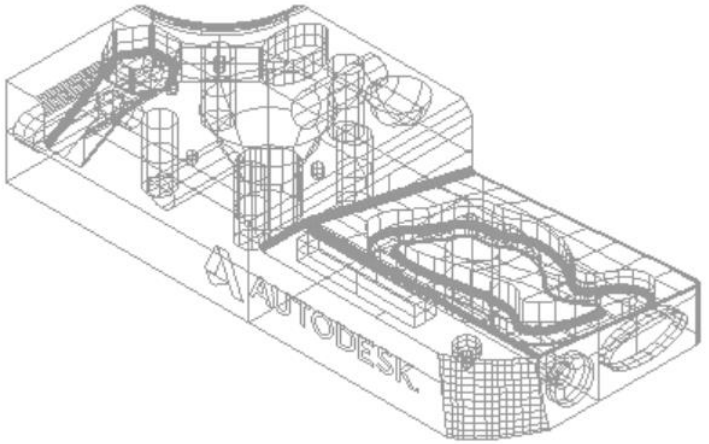

MBMA: Development Stemming from 40 Years of Engineering Practice

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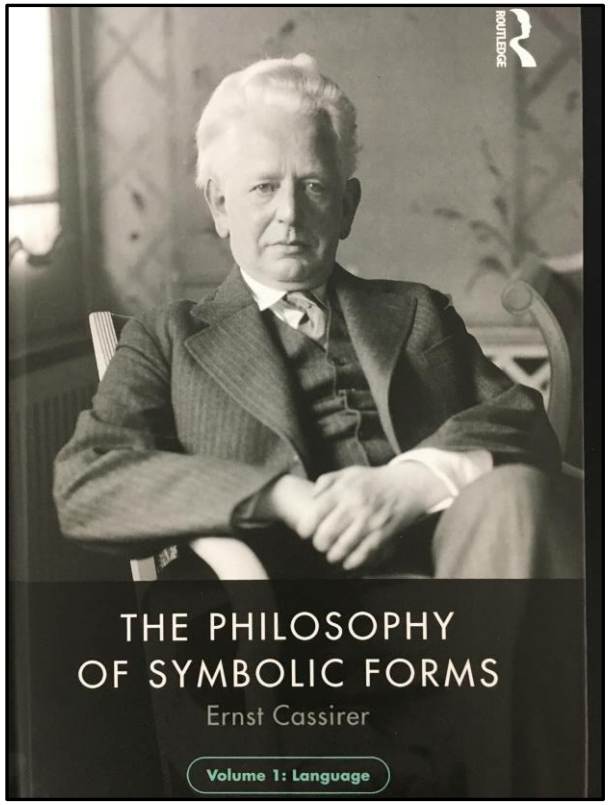

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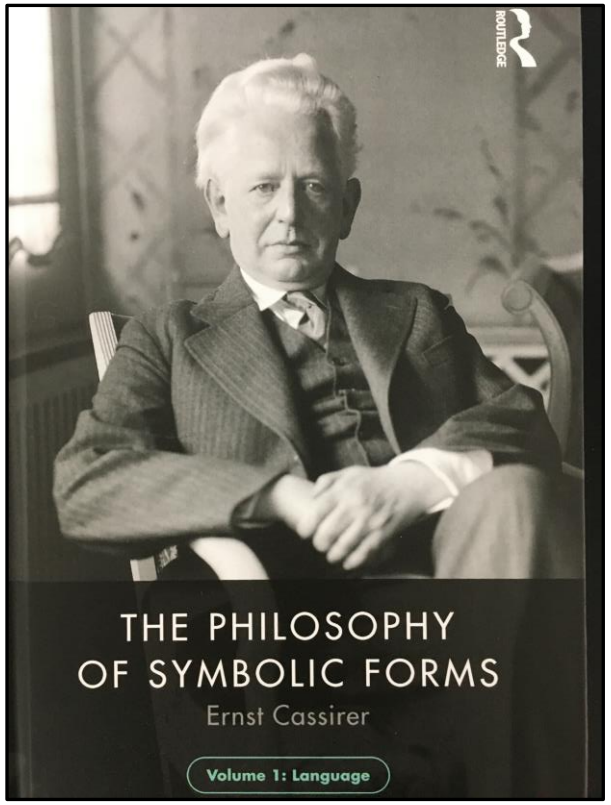

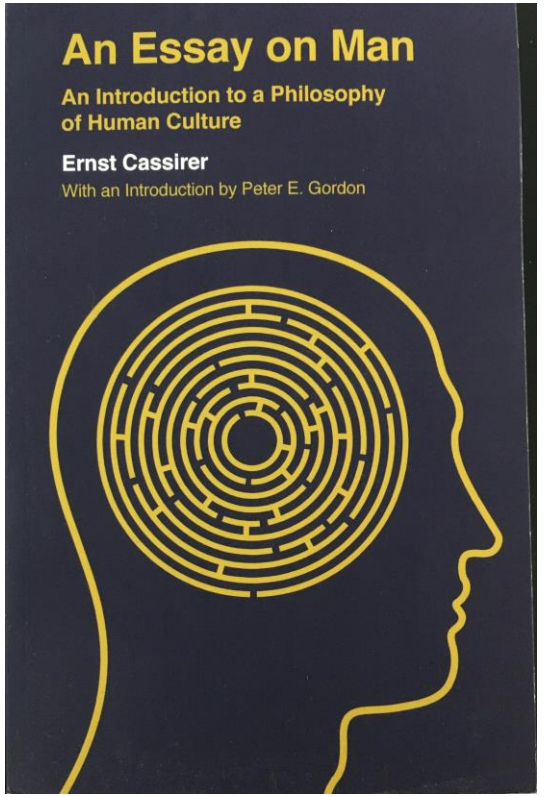

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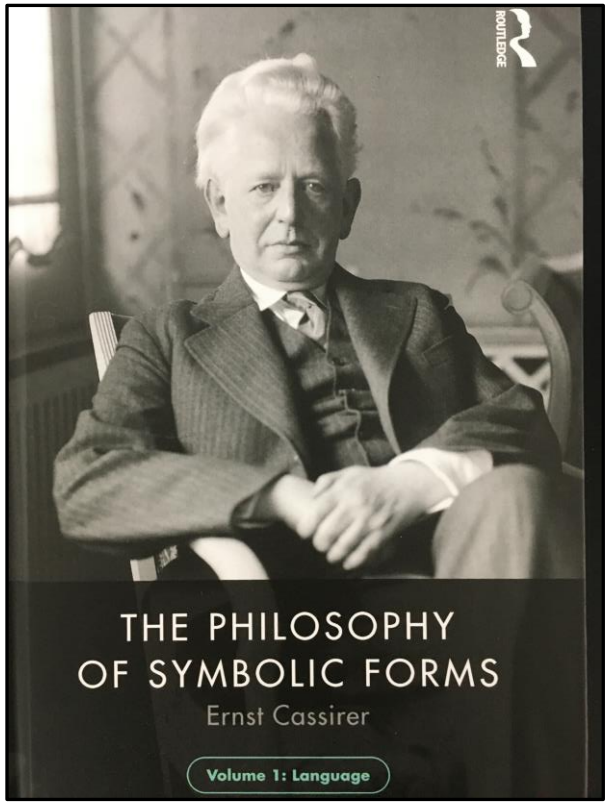

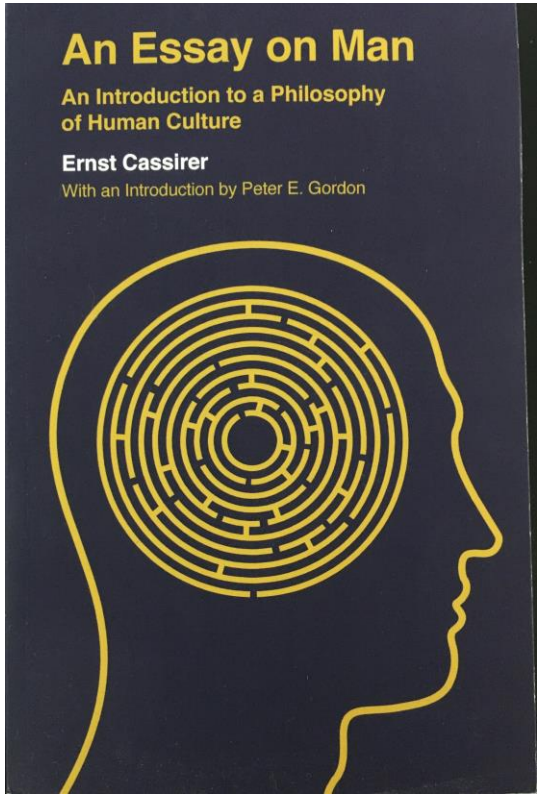

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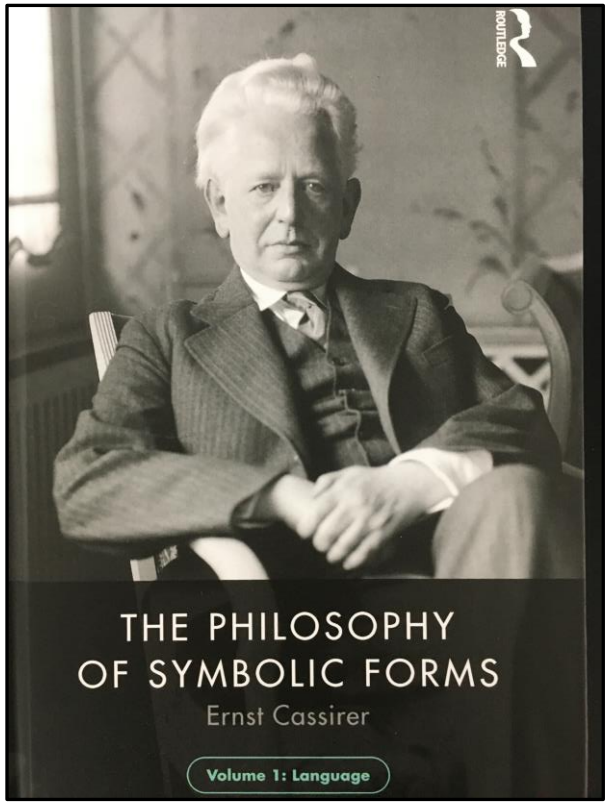

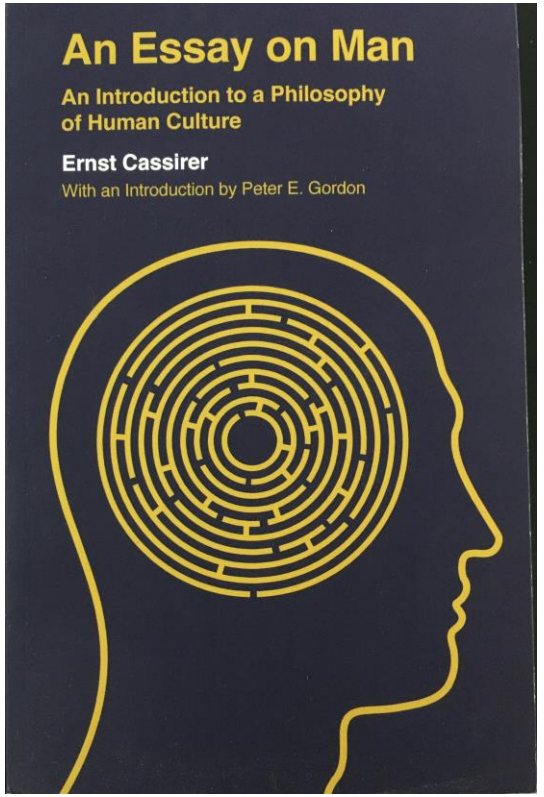

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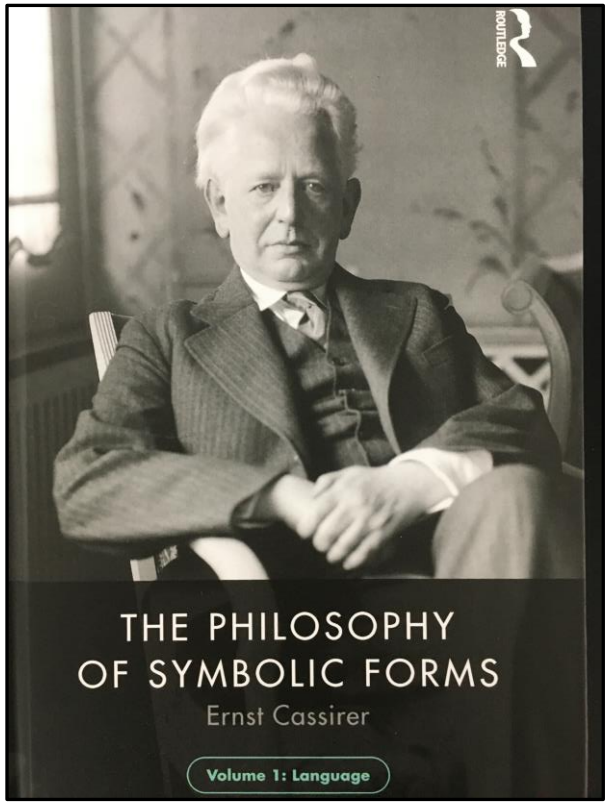

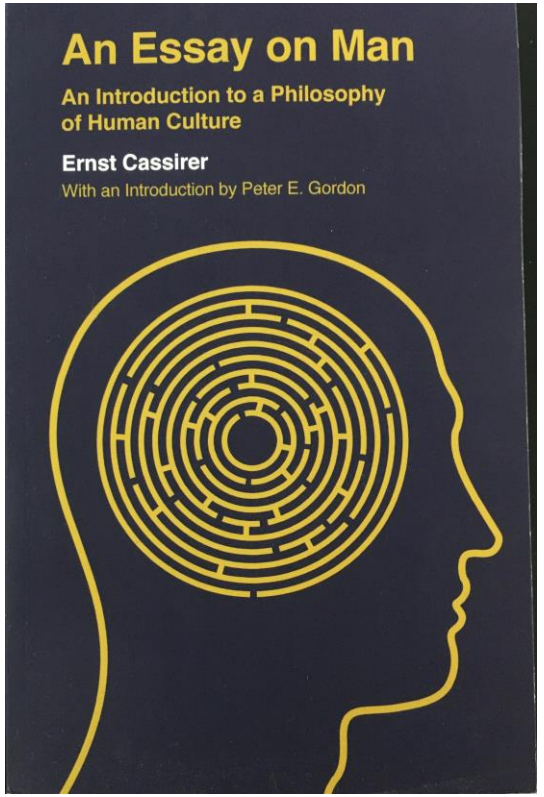

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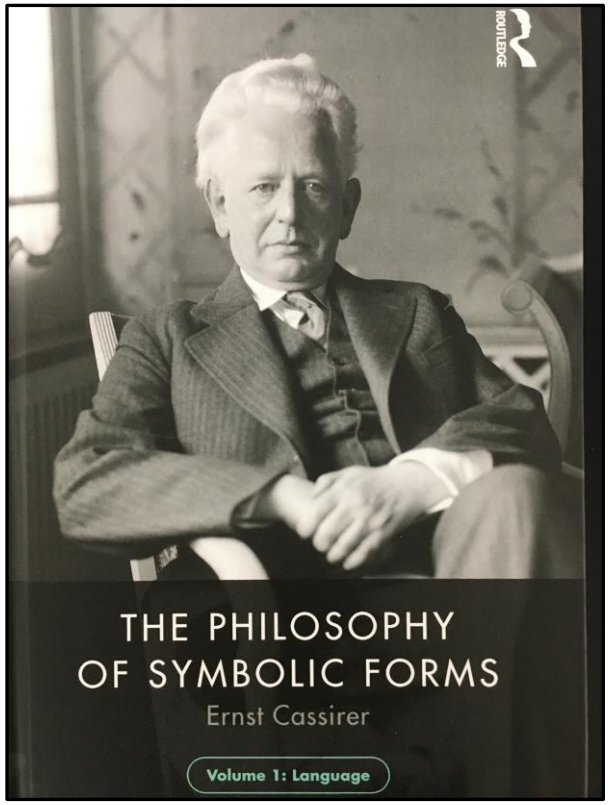

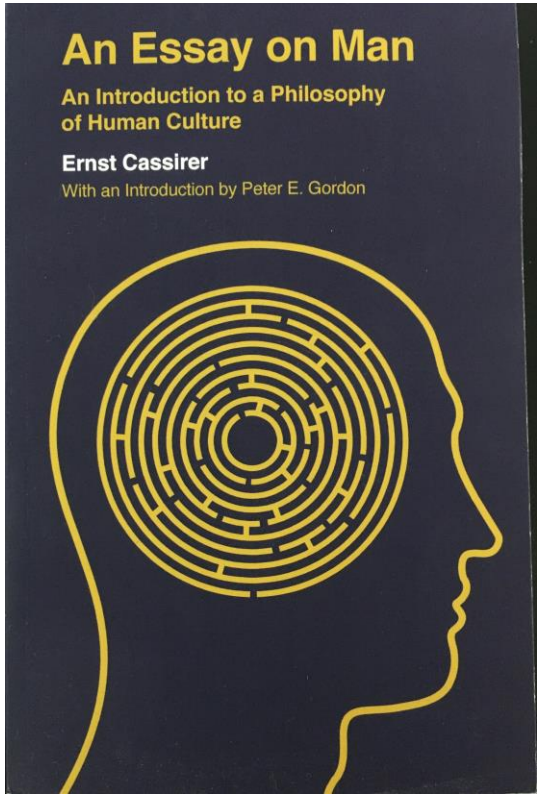

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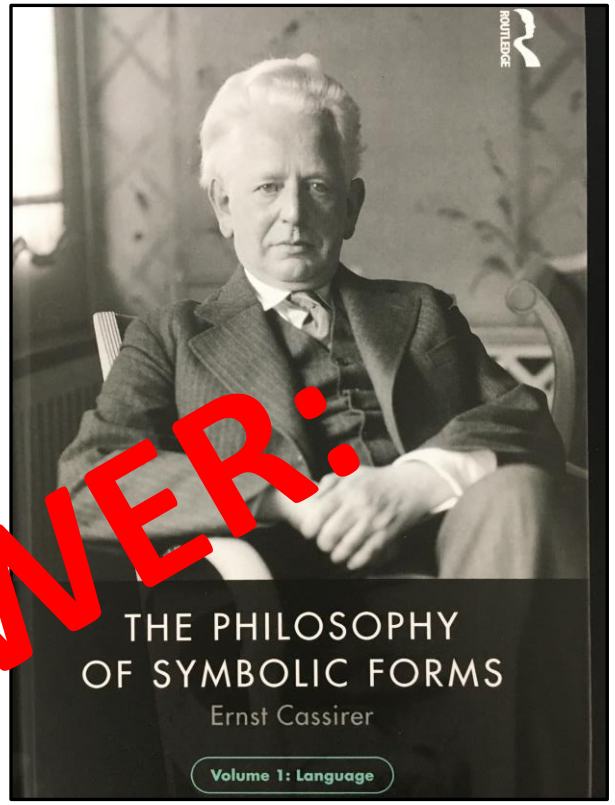

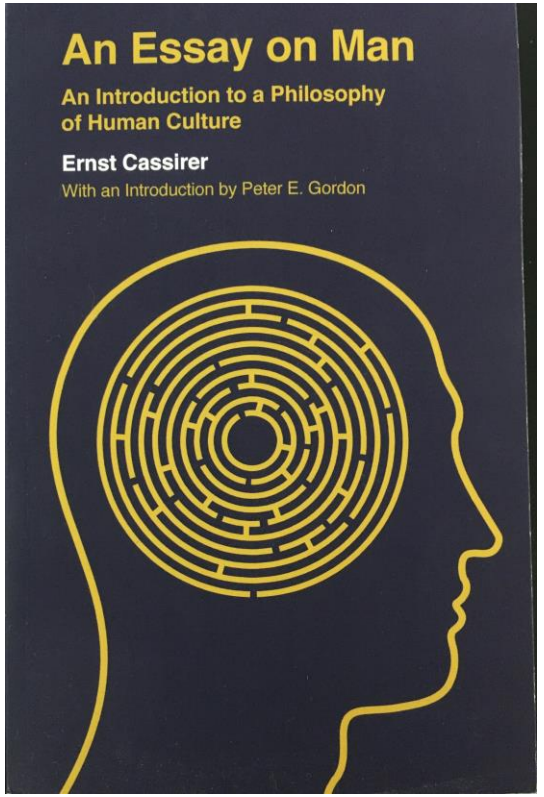

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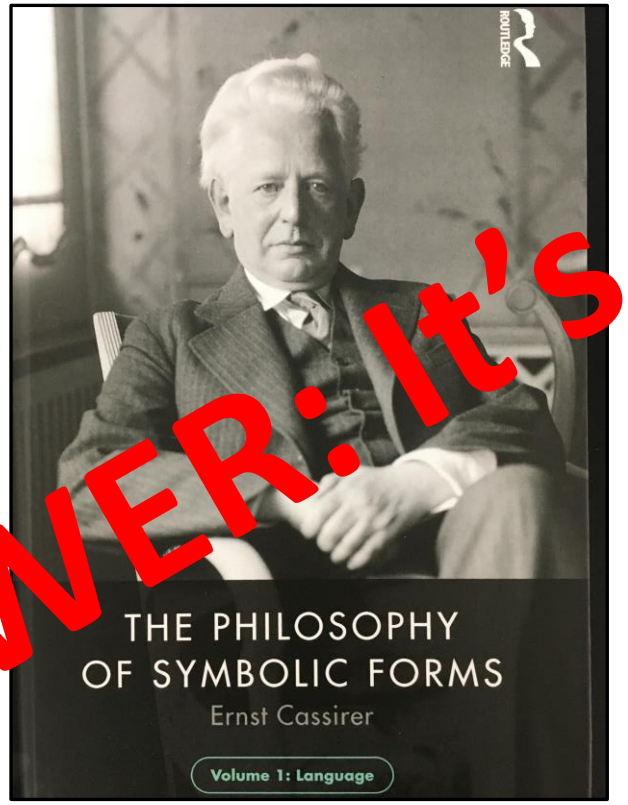

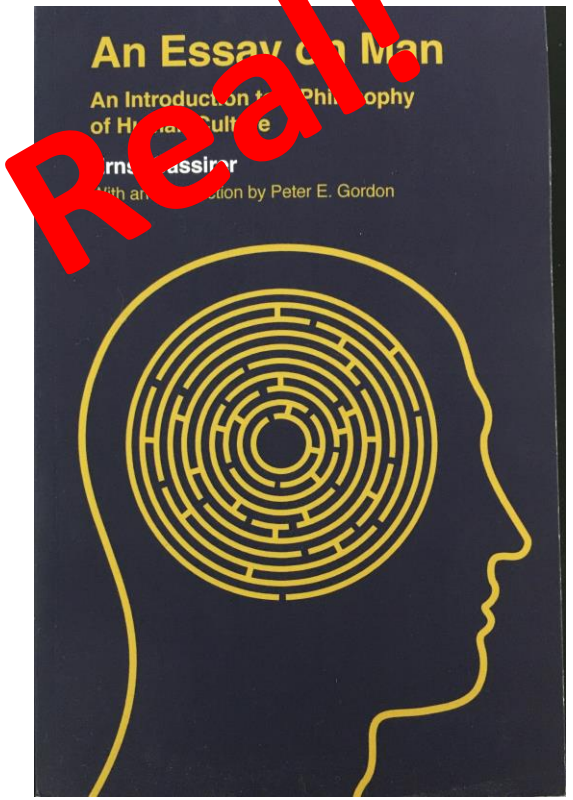

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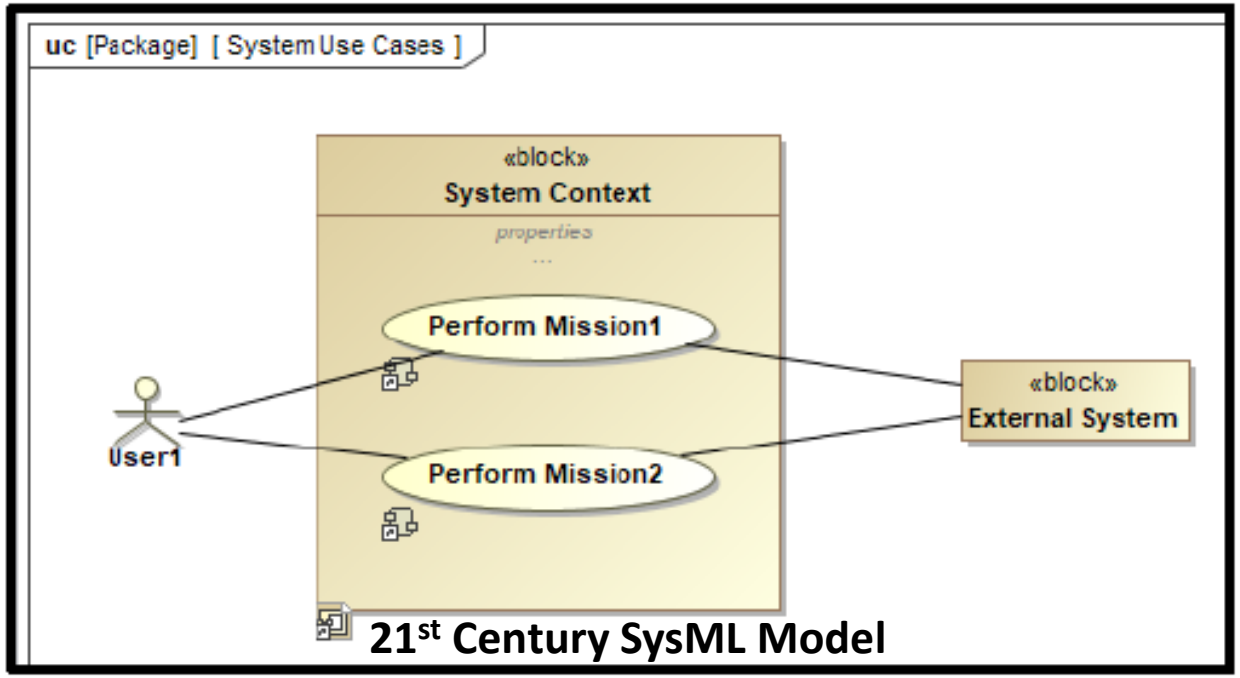

Modeling Marshall: Conquering Complexity in SMA

BASTION TECHNOLOGIES

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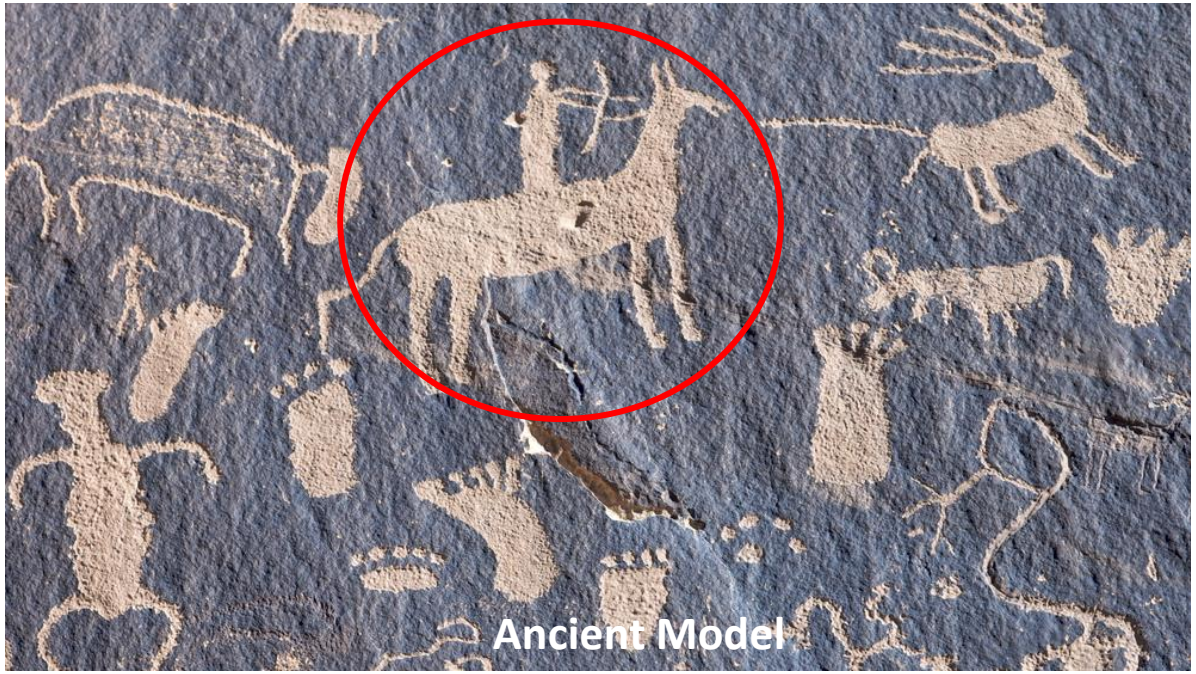

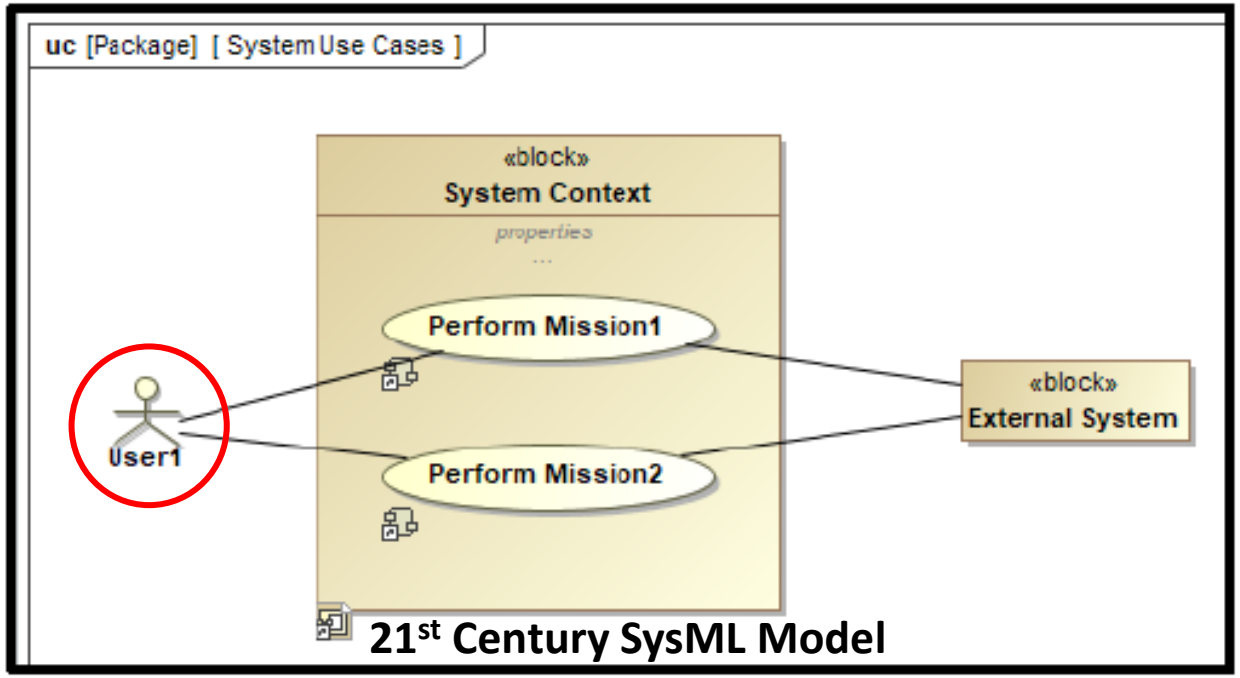

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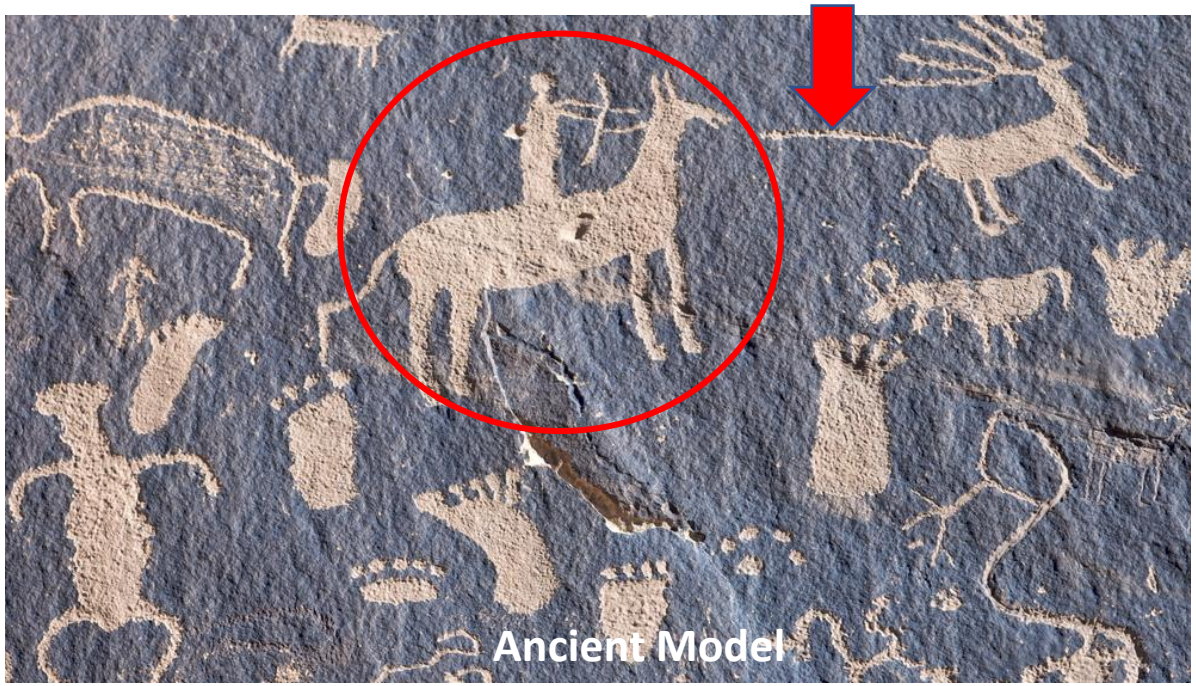

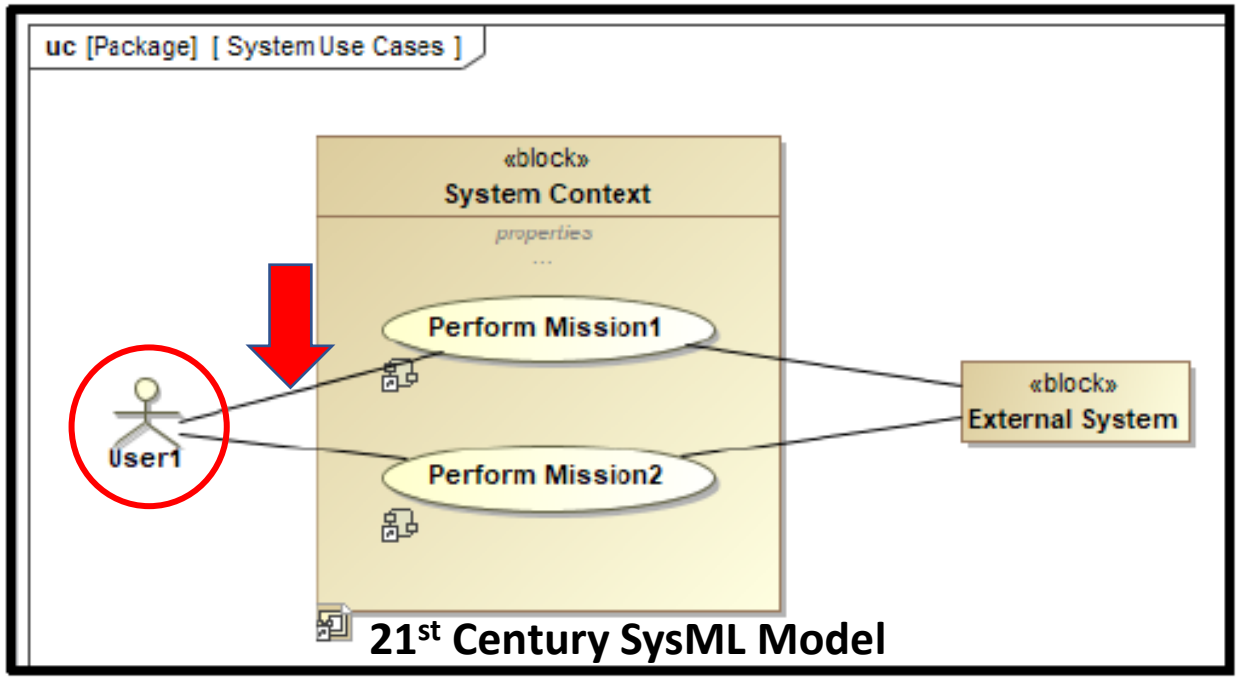

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= Direction of Intent (Abstract "nesting" in SysML)

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BASTION TECHNOLOGIES

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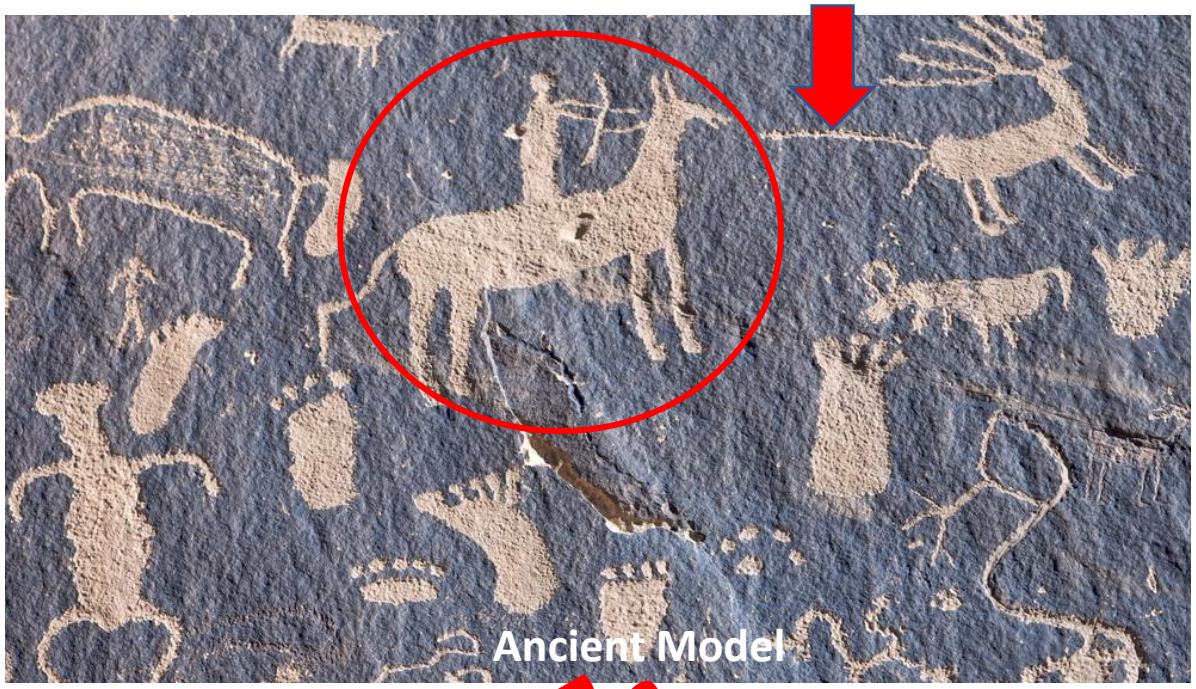

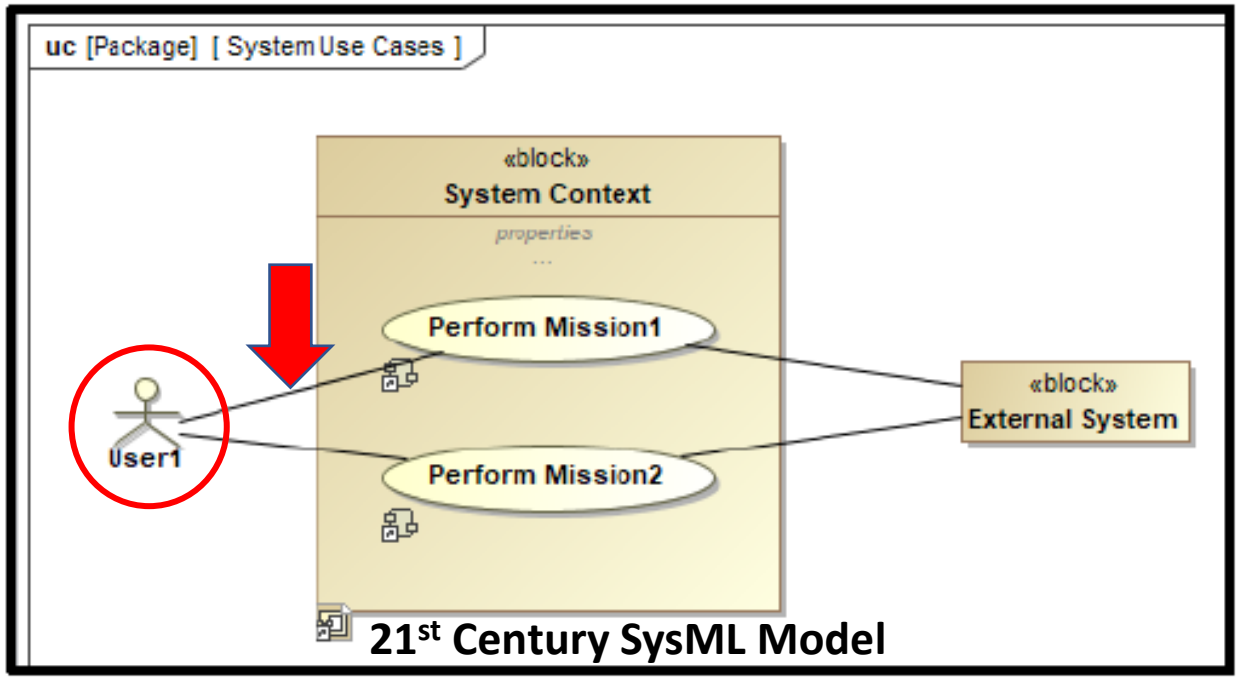

21st Century SysML Model

NOTE:

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BASTION TECHNOLOGIES

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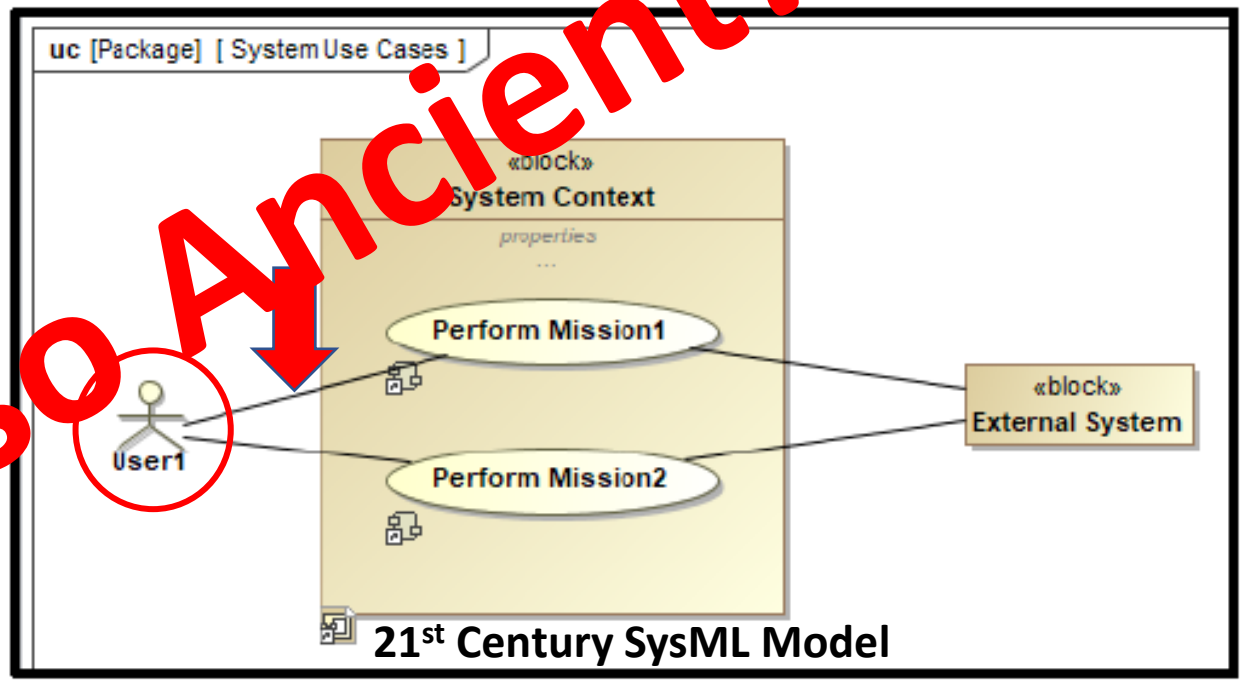

NOTE: It's Also Ancient!

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BASTION TECHNOLOGIES

Where Modeling Can Take Us

Dr. Scott Parazynski

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‘“Unknown unknowns” are the concerning thing’
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What Will It Take To Get Us There?

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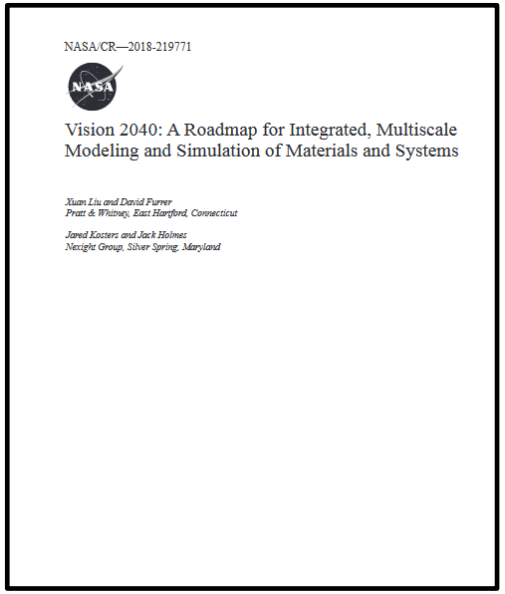

NASA/CR—2018-219771

Vision 2040: A Roadmap for Integrated, Multiscale Modeling and Simulation of Materials and Systems

Xuan Liu and David Furrer
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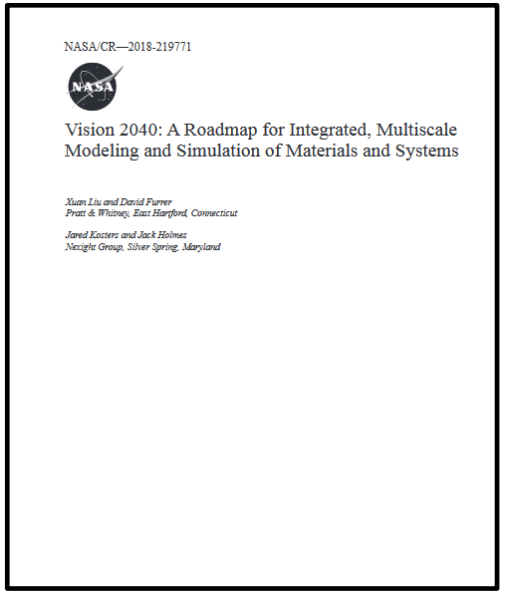

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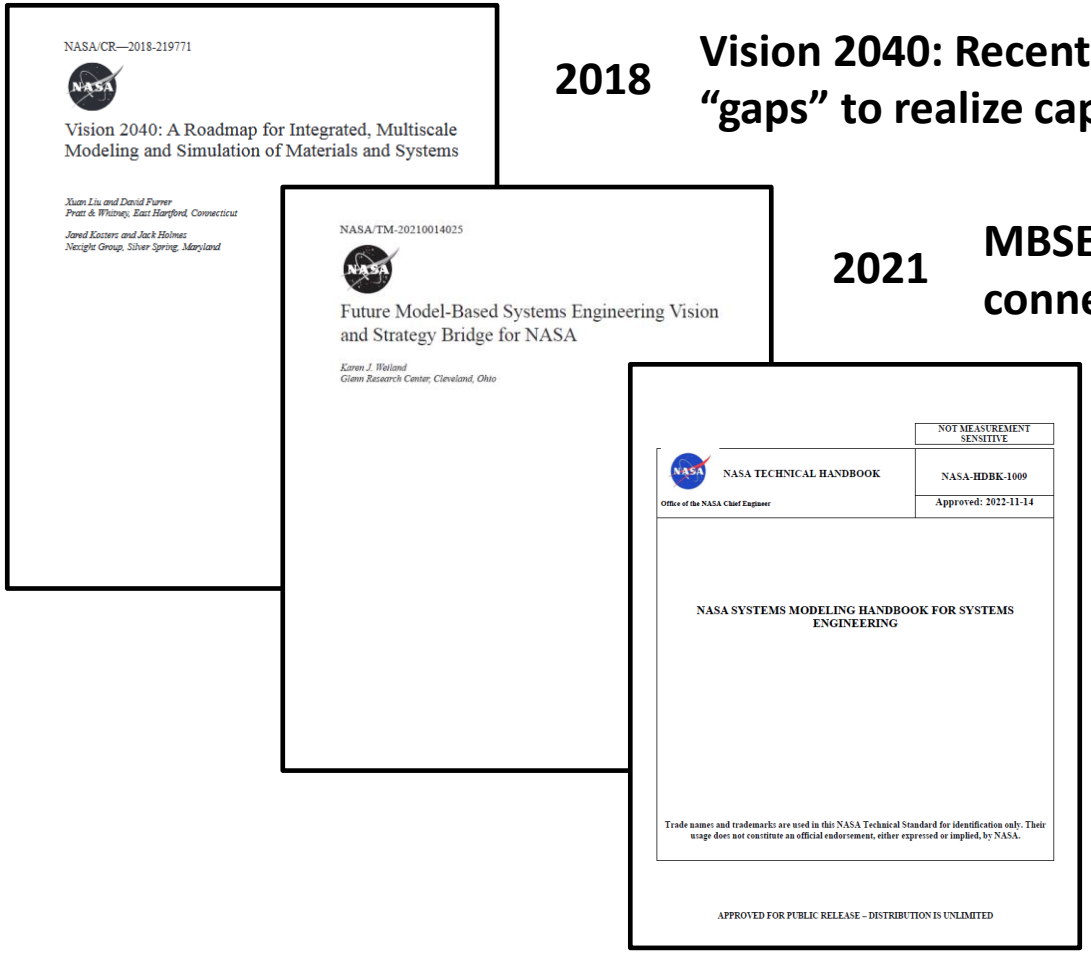

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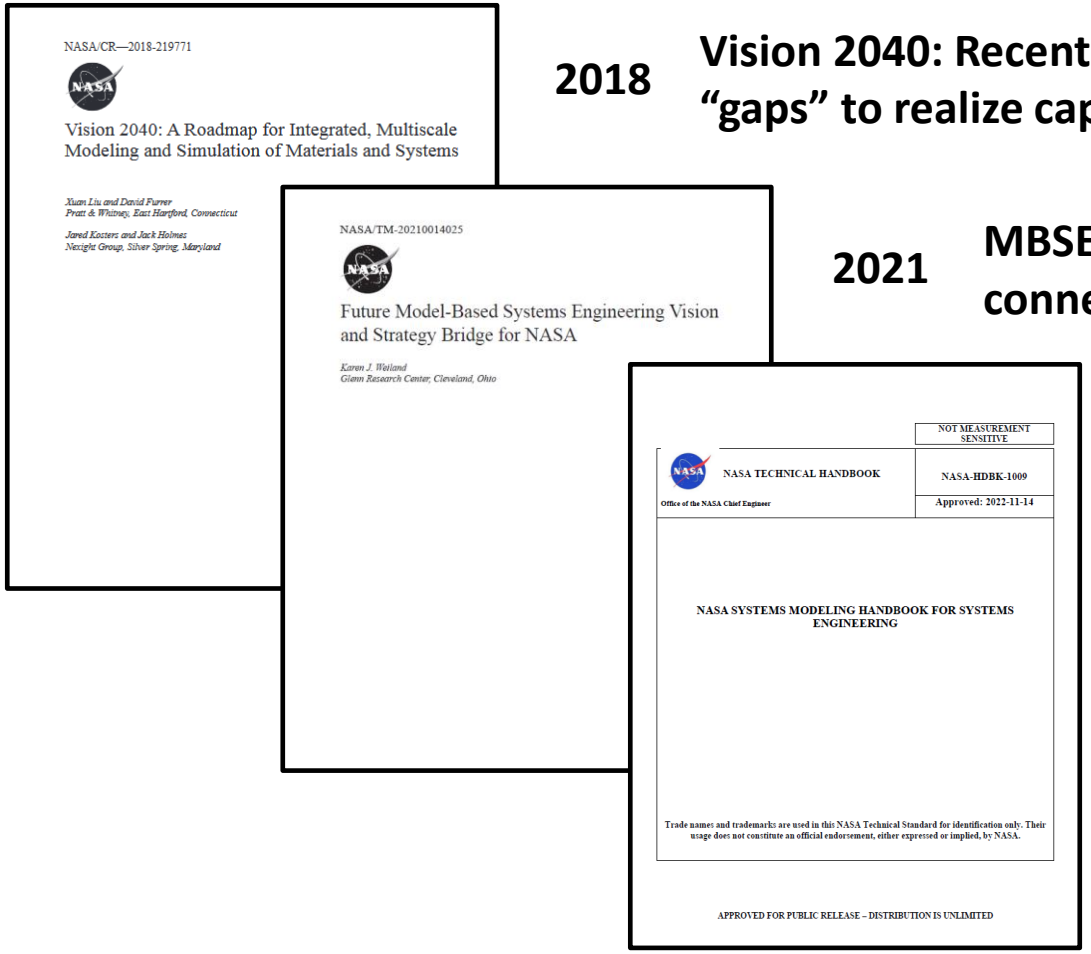

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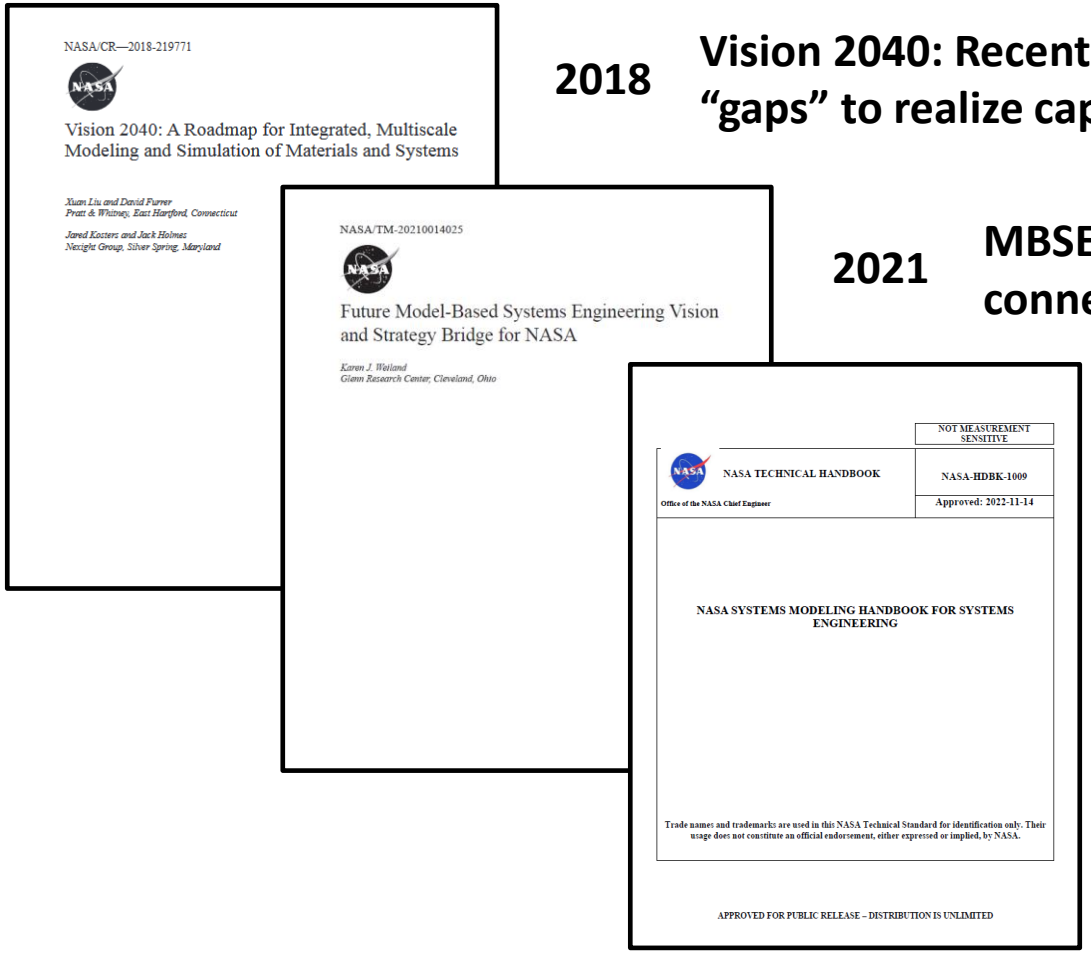

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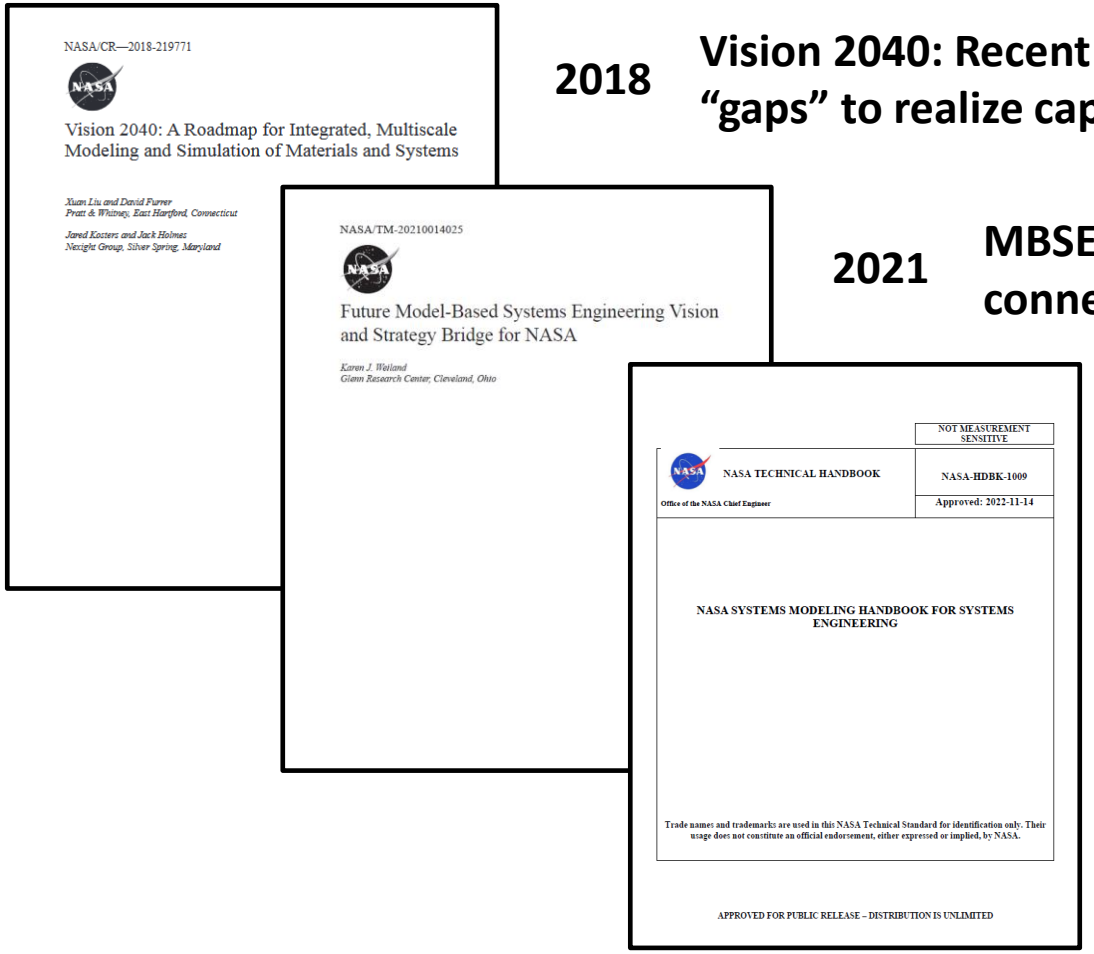

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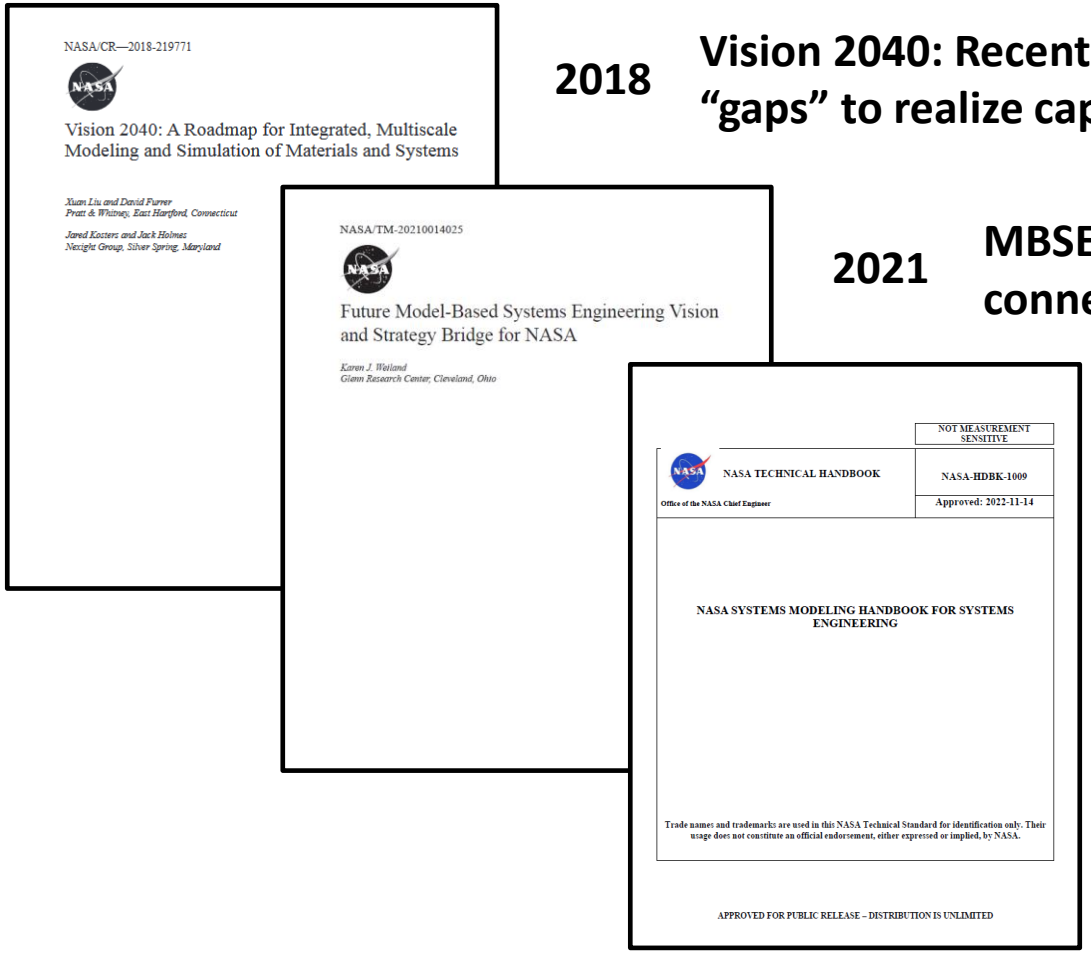

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"Perflexilience"
(persistent flexibility and resilience)

BASTION TECHNOLOGIES

What Is The Common Cause Of These Failures?

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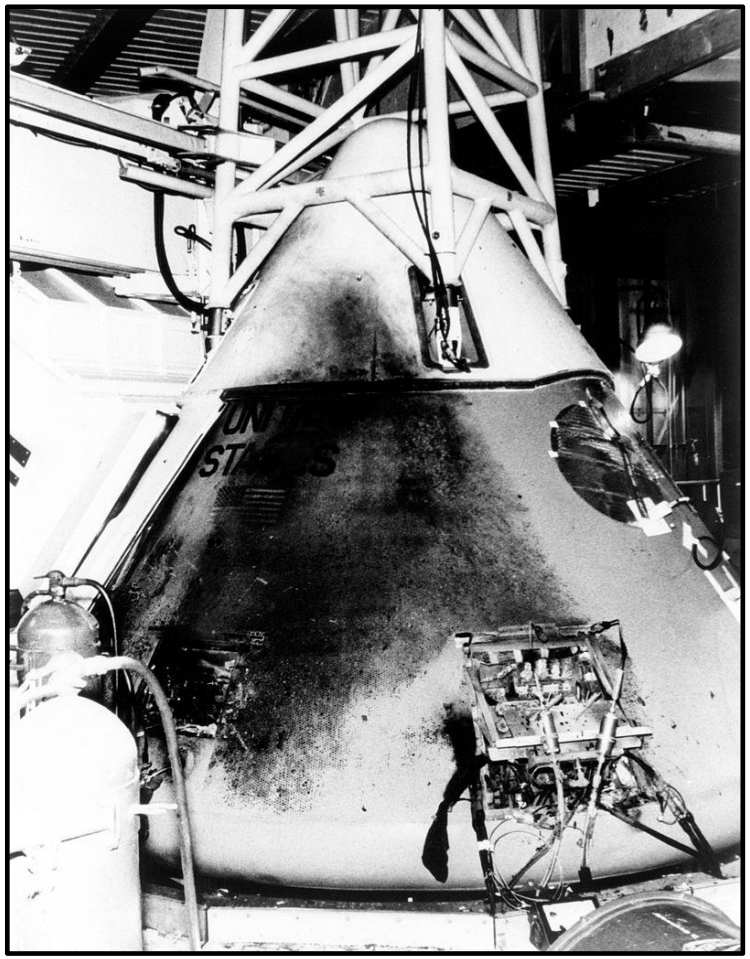

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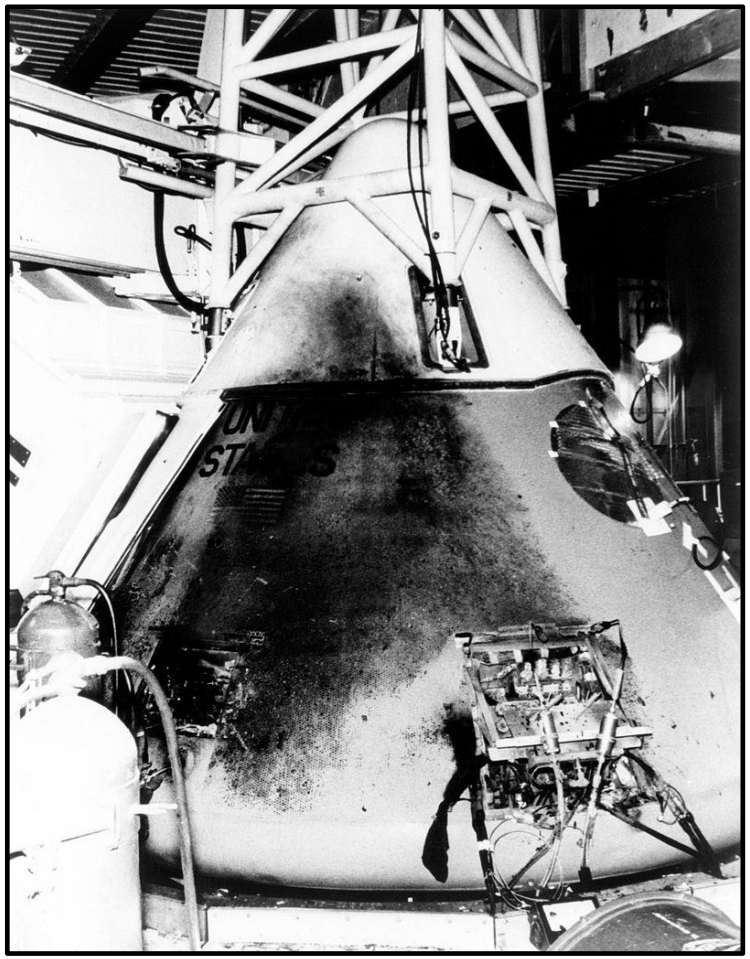

Modeling Marshall: Conquering Complexity in SMA

BASTION TECHNOLOGIES

“Dog Work” and Other Affairs of Plain Living

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The Power of Models: In Connections/Relationships

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The Goal:

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The Goal: No Zombies!

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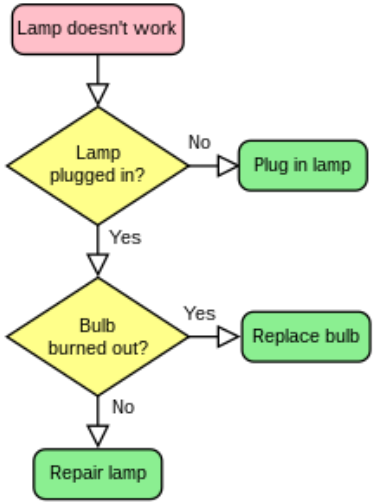

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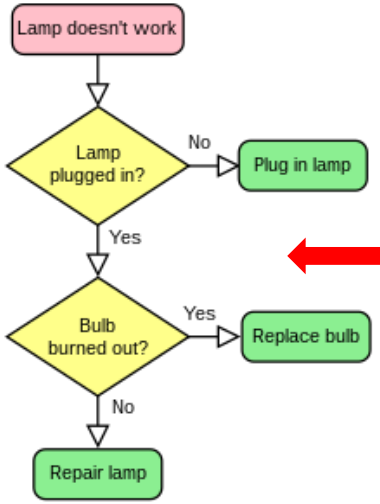

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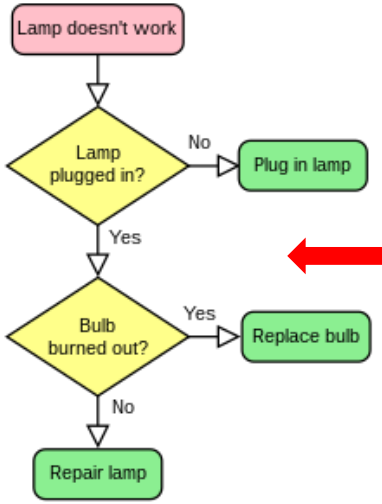

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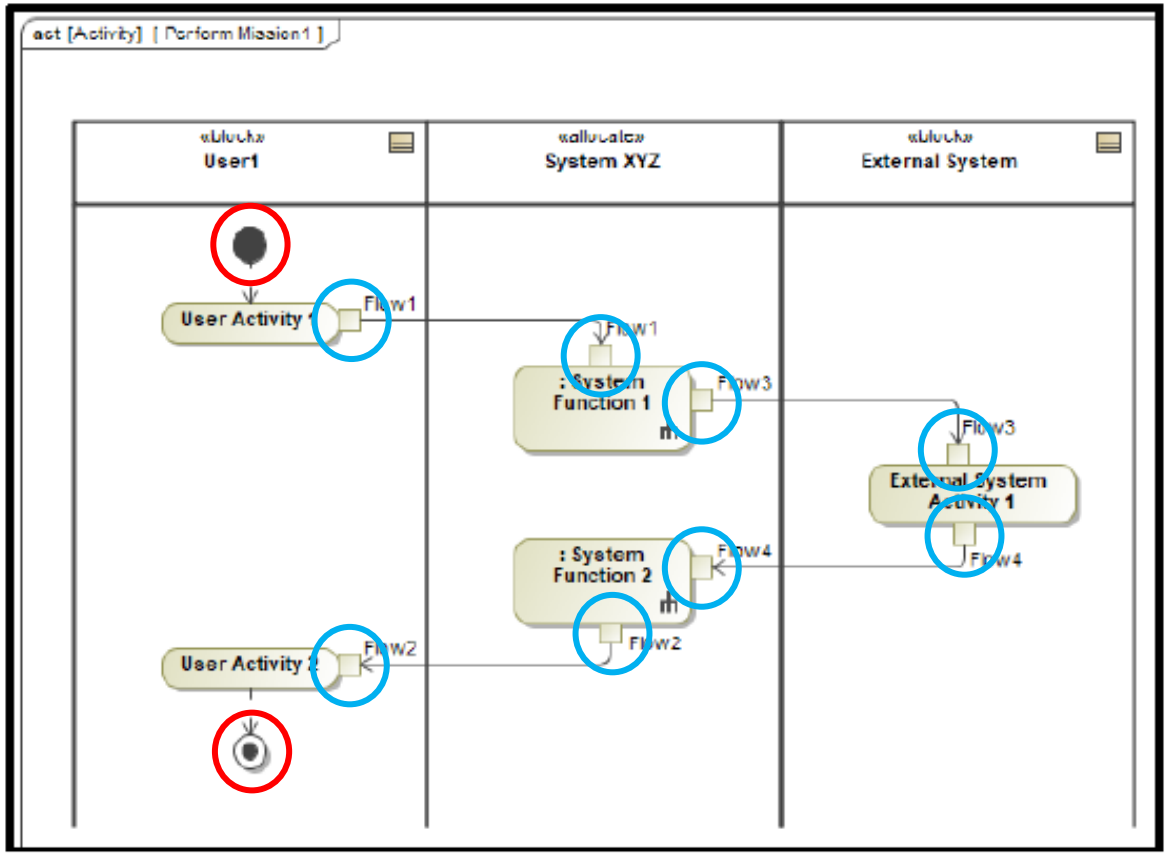

SysML Activity Diagram from NASA-HDBK-1009

Modeling Marshall: Conquering Complexity in SMA

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Why this question is important, taking requirements for the example:

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#	Id	Name	Text	Refined By	Derived From	Verify Method	Verified By	Satisfied By
1	sys-1	System Requirement	The system shall....	System Function 1(contex			verif-1 Verification Requirement 1	System XYZ
2	subsys-2	Subsystem Requirement 2	The subsystem total mass shall.....	Subsytem Function 3(cont Subsystem Function 4(con	sys-1 System Requirement			/mtotal
3	subsys-1	Subsystem Requirement 1	The subsystem shall....	Subsystem Function 1(con Subsystem Function 2(con	sys-1 System Requirement		verif-3 Verification Requirement 3	Subsystem1
4	comp-4	Component Requirement 4	Component 4 shall....		subsys-2 Subsystem Requirement 2			
5	comp-3	Component Requirement 3	Component 3 total mass shall...		subsys-2 Subsystem Requirement 2			mtotal
6	comp-2	Component Requirement 2	Component 2 shall....	Component Function 2	subsys-1 Subsystem Requirement 1	Test		Component2
7	comp-1	Component Requirement 1	Component 1 shall generate x-Watts power.	Component Function 1	subsys-1 Subsystem Requirement 1	Analysis	verif-2 Verification Requirement 2	power value

Figure 22—System Requirements Table

Table from NASA-HDBK-1009

Descriptive To Executable To “Digital Twin”

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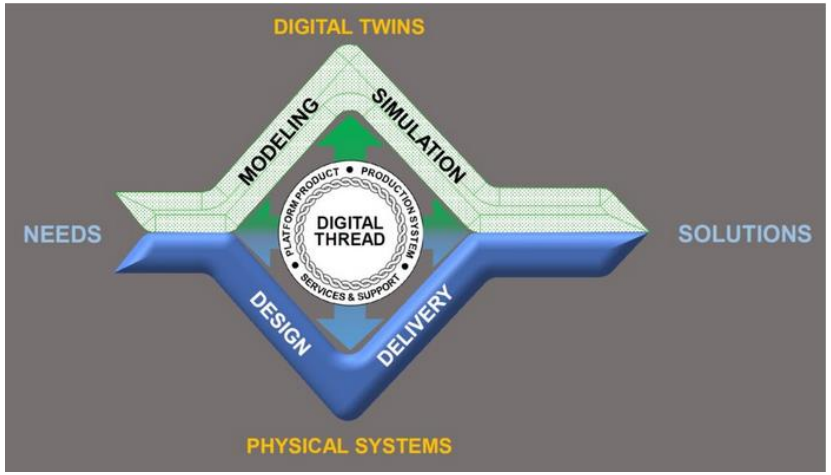

Boeing “Diamond” vs System Engineering “V”

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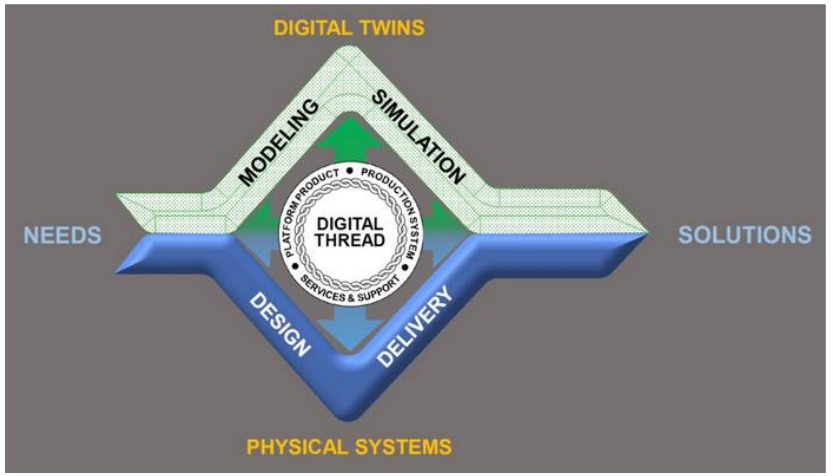

Boeing “Diamond” vs System Engineering “V”

Assurance Engineers Will Need All, As Well As Methods For Each

Modeling Marshall: Conquering Complexity in SMA

BASTION TECHNOLOGIES

As Morris Day would say: Fini!

Open Floor for Hecklers!

Quick! Somebody Tell Me a Question!