Advancing Specification Compliance Through Model-Based Cognition and AI

Darwin Petersen *Spirit AeroSystems*
Jeff Moffa *AurosIQ*
Terra Mullis *AurosIQ*

GLOBAL PRODUCT DATA

INTEROPERABILITY

SUMMIT 2025

BOEING ELYSIUM LOCKHEED MARTIN NORTHROP GRUMMAN Parker PDES, Inc.® Connecting the Digital Enterprise

Presenters Bio

DARWIN PETERSEN

SPIRIT AEROSYSTEMS

- DIGITAL THREAD
- DATA PROCESS & ARCHITECTURE
- KNOWLEDGE MANAGEMENT TO ENABLE AUTOMATION

Boeing/Spirit 35 Years

Manufacturing Engineer

Technical Fellow

Tools, Processes & Governance

JEFF MOFFA

auros|Q

- KNOWLEDGE MANGEMENT
- AI
- KBE – DESIGN AUTOMATION
- MODLE BASED EVERYTHING

Ford Motor Company
Production Engineering
Manufacturing Engineering
Systems Engineering

Knowledge management and Design Automation

AursoKS
President and CEO

TERRA MULLIS

auros|Q

- SPECIFICATION AUTHORING
- COMPLIANCE
- DIGITAL THREAD
- MANUFACTURING & RISK MANAGEMENT

Puget Sound Energy
Safety Communications & Integrity Management

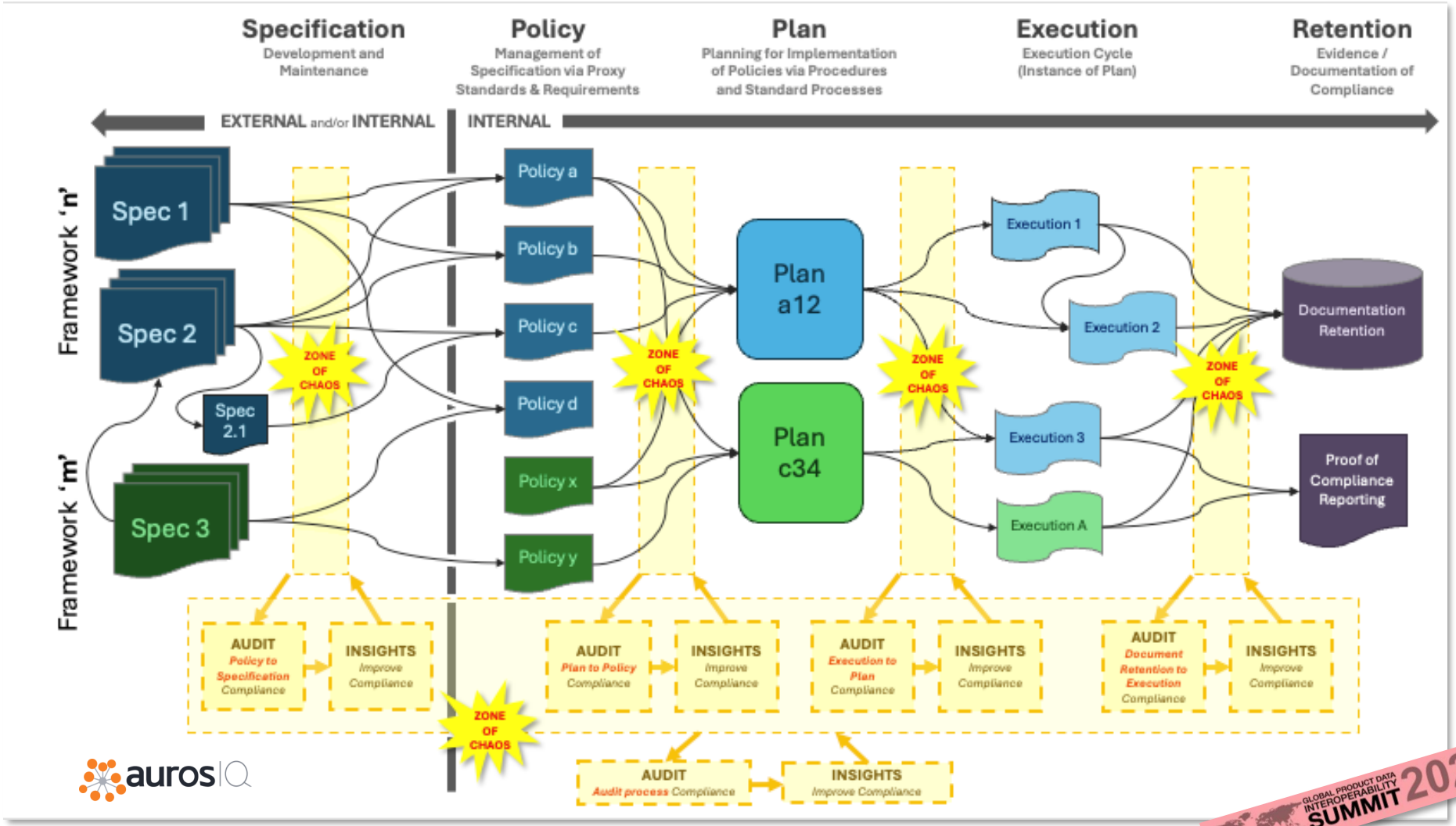
Cyera Strategies
Utility Compliance Consulting

Common Grounds Alliance
Federal Data Committee

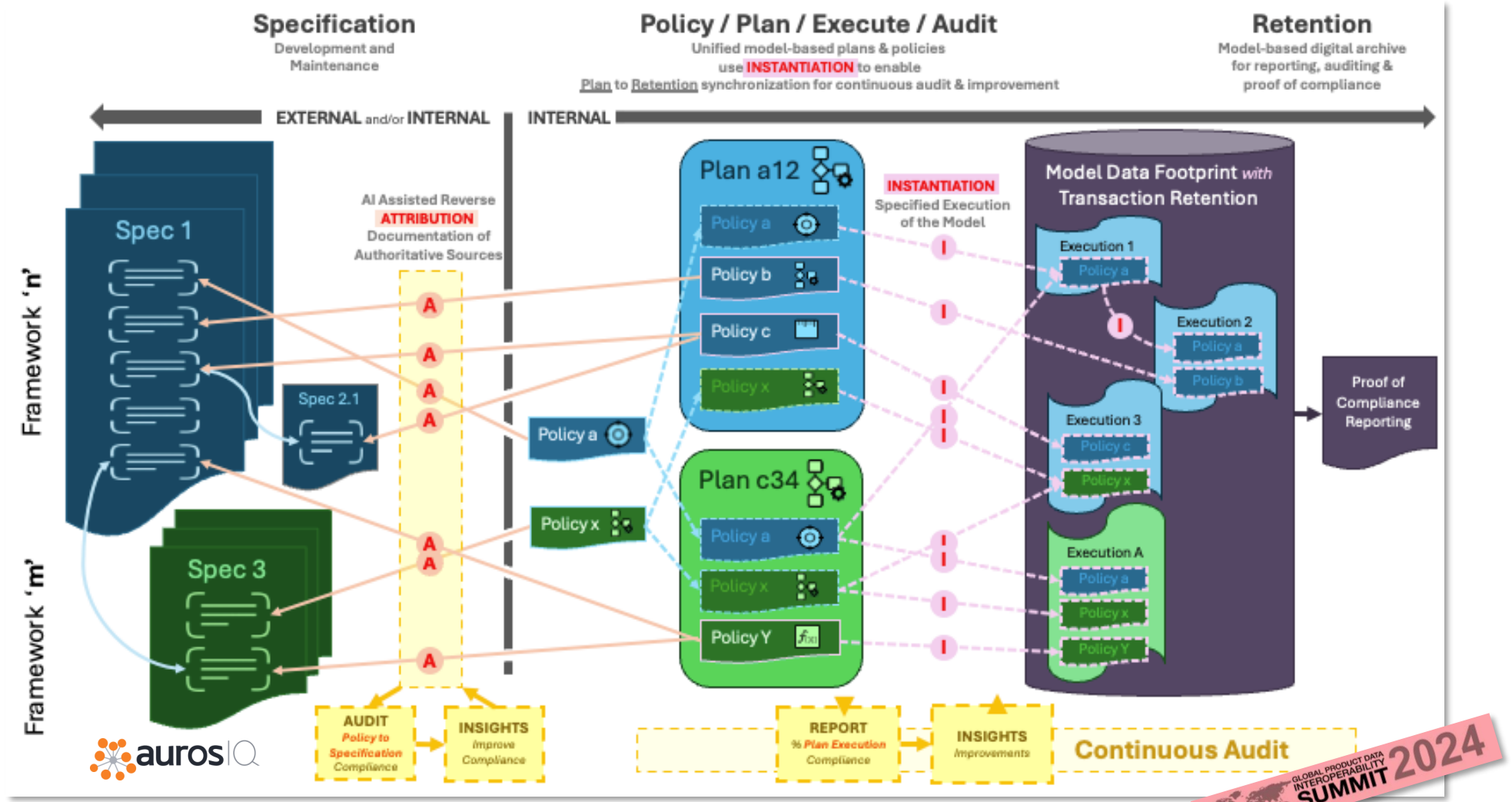
Boeing Industrial Engineering, Information & Technology, and Quality Engineering

AurosIQ Senior Aerospace Consultan

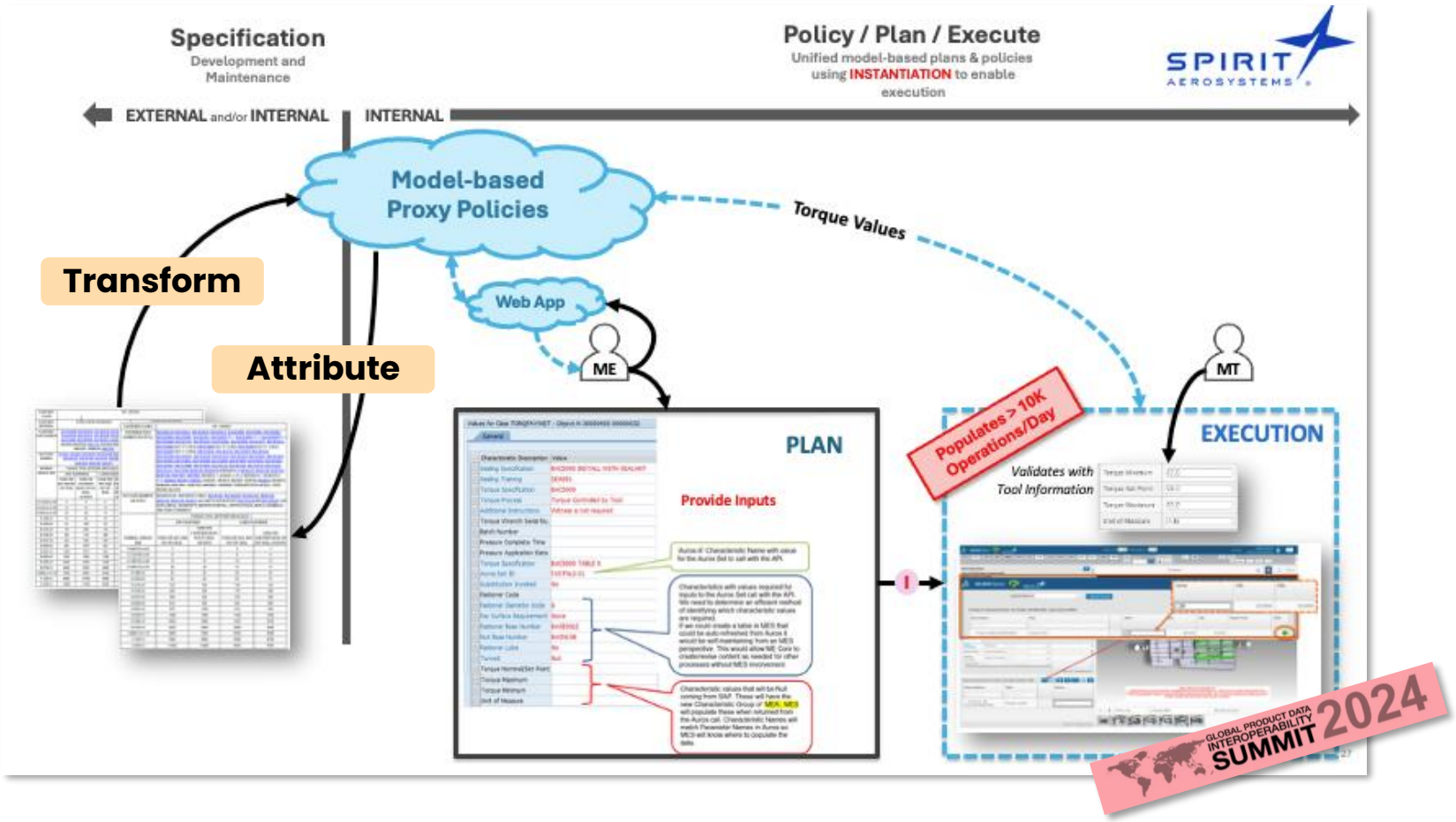
Analog, Document-based Specification Compliance



Hybrid, Document-Attributed Model-Based Specification Compliance



Hybrid Specification Compliance @ Spirit Aerosystems



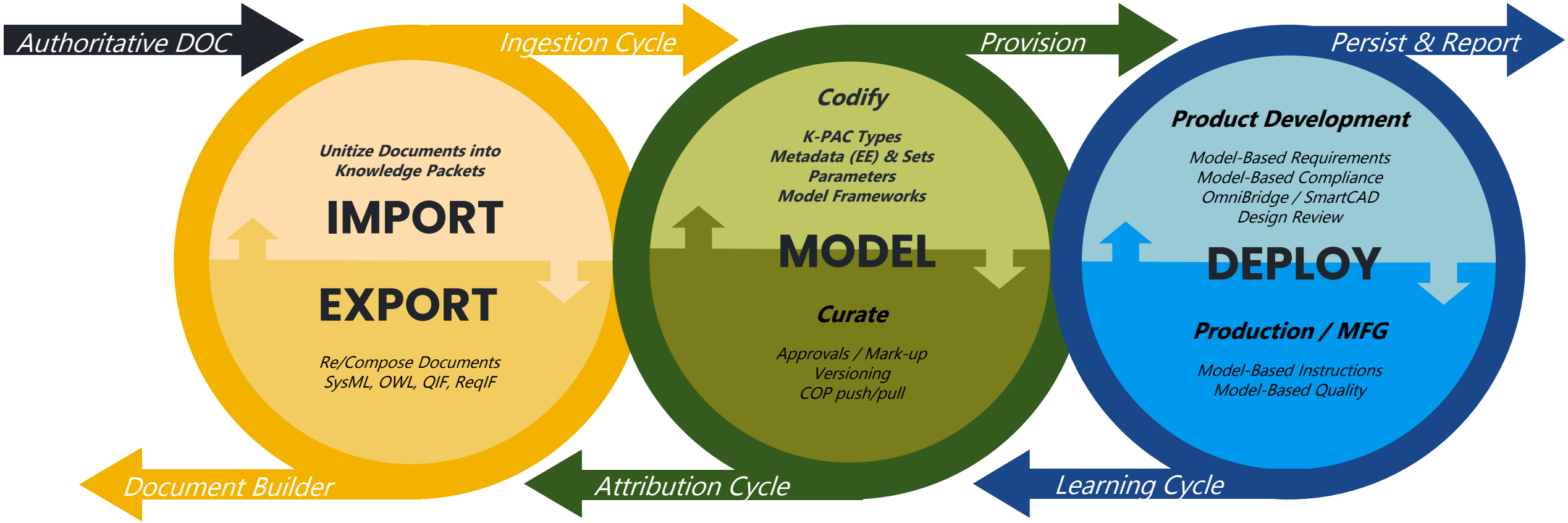
Transformation Activity:

1. Model **content** (requirements) discretely (parameters + operator/qualifier)
2. Model **context** (applicability) discretely (e.g.: logical/conditional factors)

Benefits:

1. Content relationships & reuse **transparent** and **iterable**
2. Content and Context **executable** and **traceable** during an instantiation of the models

Transform *Analog Documents → Digital Models*

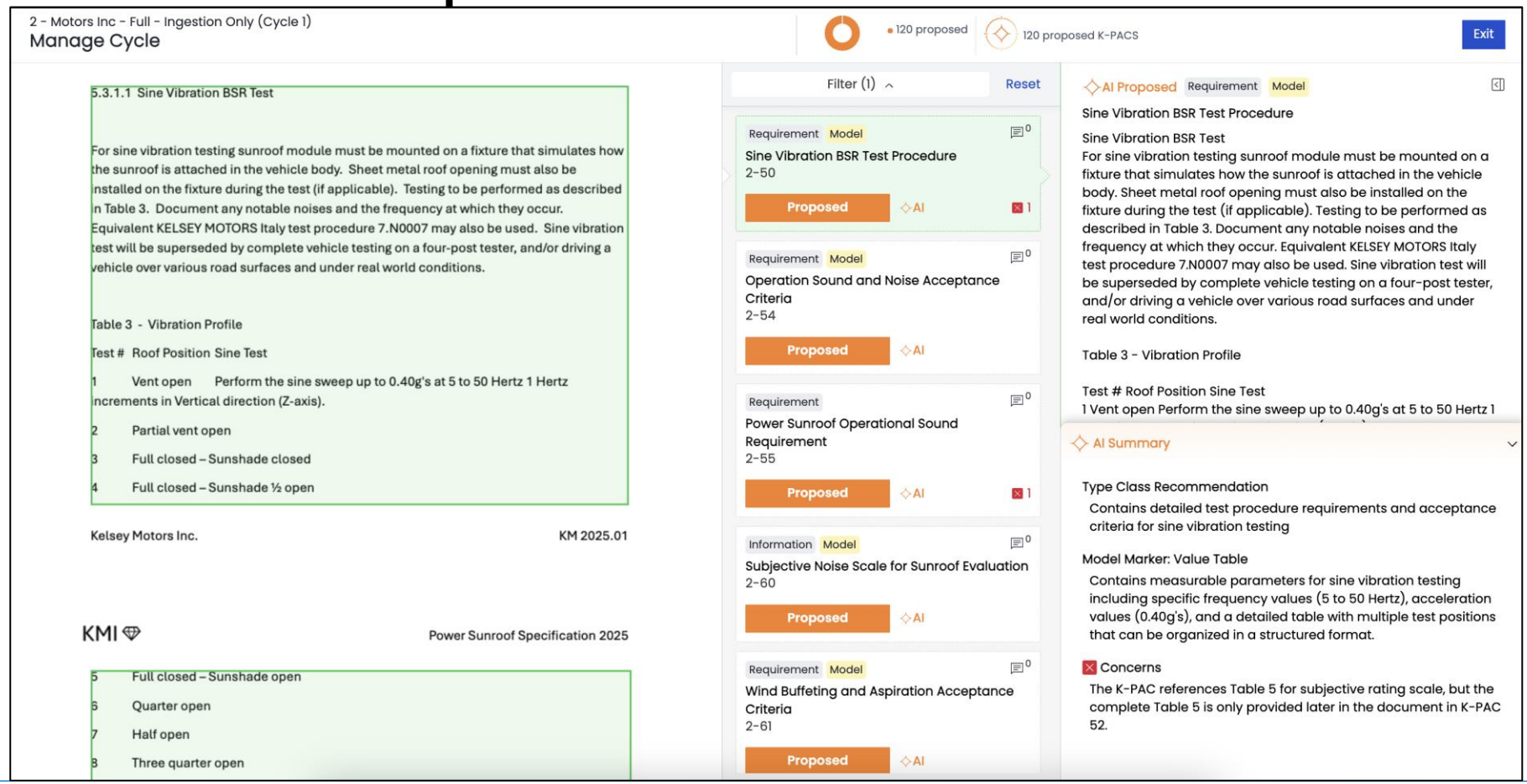


Transform *Analog Documents → Digital Models*

Discover

Modularize

- Begin evaluation
- Deconstruct analog information into logical discrete reusable units
- Consider Use Case contexts



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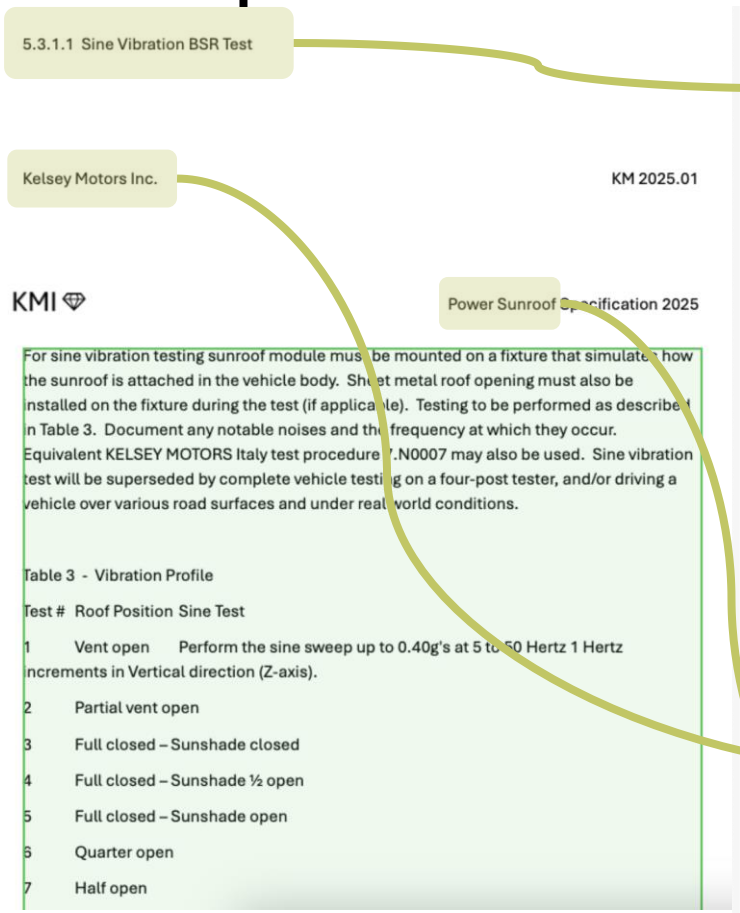
Classify

- How things are alike
- Both Art & Science
- Foundation of learning and understanding
- Top down and bottom up
- Contextual Frameworks: Owner, System/subsystem, responsible, domain, etc.



5.3.1.1 Sine Vibration BSR Test

Kelsey Motors Inc. KM 2025.01

KMI

Power Sunroof Specification 2025

For sine vibration testing sunroof module must be mounted on a fixture that simulates how the sunroof is attached in the vehicle body. Sheet metal roof opening must also be installed on the fixture during the test (if applicable). Testing to be performed as described in Table 3. Document any notable noises and the frequency at which they occur. Equivalent KELSEY MOTORS Italy test procedure .N0007 may also be used. Sine vibration test will be superseded by complete vehicle testing on a four-post tester, and/or driving a vehicle over various road surfaces and under real world conditions.

Table 3 - Vibration Profile

Test #	Roof Position	Sine Test
1	Vent open	Perform the sine sweep up to 0.40g's at 5 to 50 Hertz 1 Hertz increments in Vertical direction (Z-axis).
2	Partial vent open	
3	Full closed – Sunshade closed	
4	Full closed – Sunshade ½ open	
5	Full closed – Sunshade open	
6	Quarter open	
7	Half open	

Requirement

Original Requirement Number	5.3.1.1
Rationale	
Fit Criterion	Sunroof must not exhibit any objectionable form of noise (buzzes, squeaks, rattles, creaks, jingles, chucks, rumbles, etc…) before, during or after testing. The sunroof must be fully functional after sine vibration testing.
Requirement Description	For sine vibration testing sunroof module must be mounted on a fixture that simulates how the sunroof is attached in the vehicle body. Sheet metal roof opening must also be installed on the fixture during the test (if applicable).
Customer Requirement Analysis	
CRA available	
Requirement Changes	

Attributes

Pushed To (CoP)	
CRA K-pac Link	
Customer	Kelsey Motors Inc.
Customer Requirement Document K-PAC	
Technology	Power Sliding Sunroof

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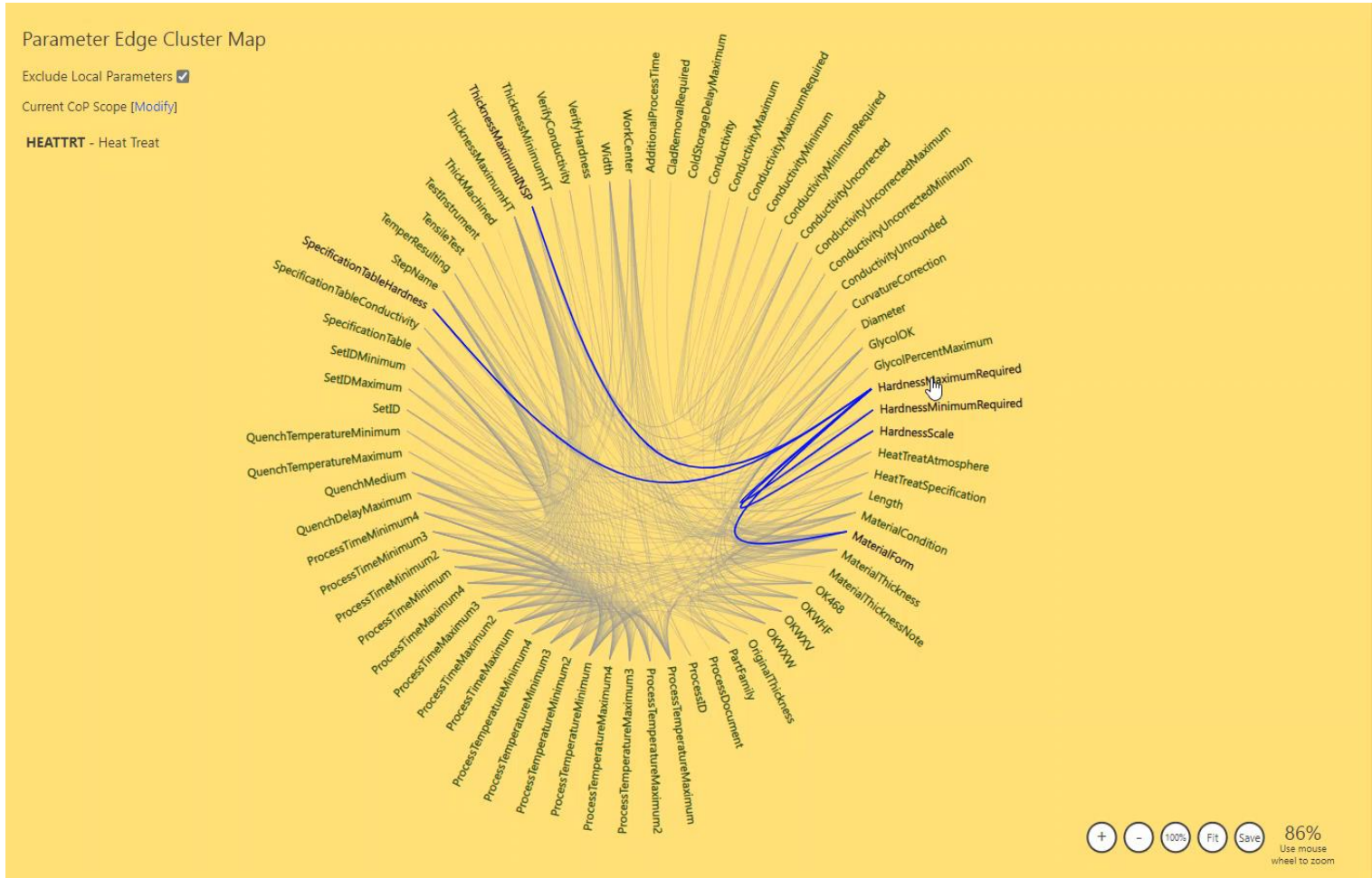
Parameterize

- How things are different
- Foundation of Modeling
- Define parameters for re-use across enterprises.
- Name, Description, UofM, Kind, Data Type, attachments, Metadata - more than a label



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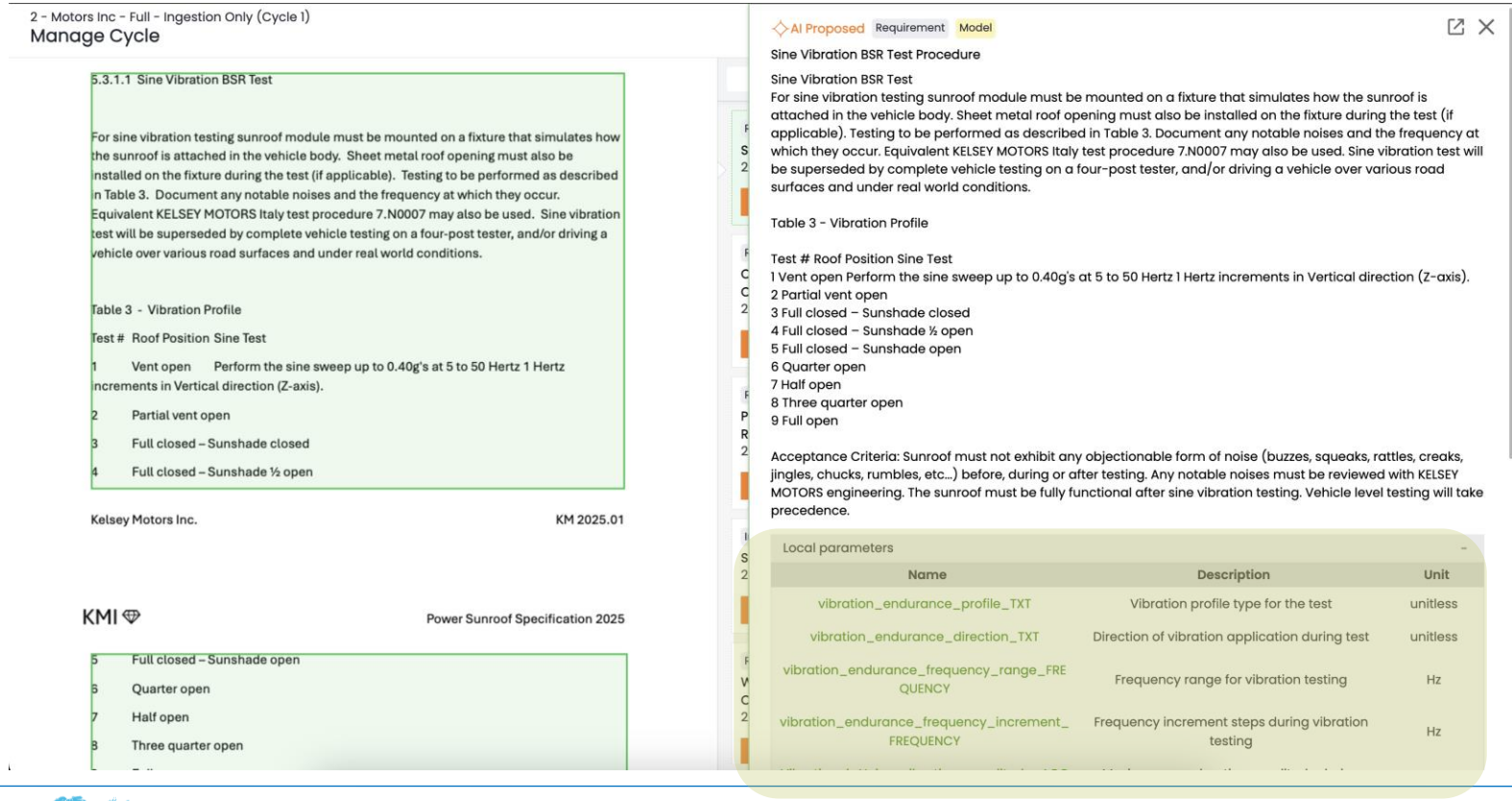

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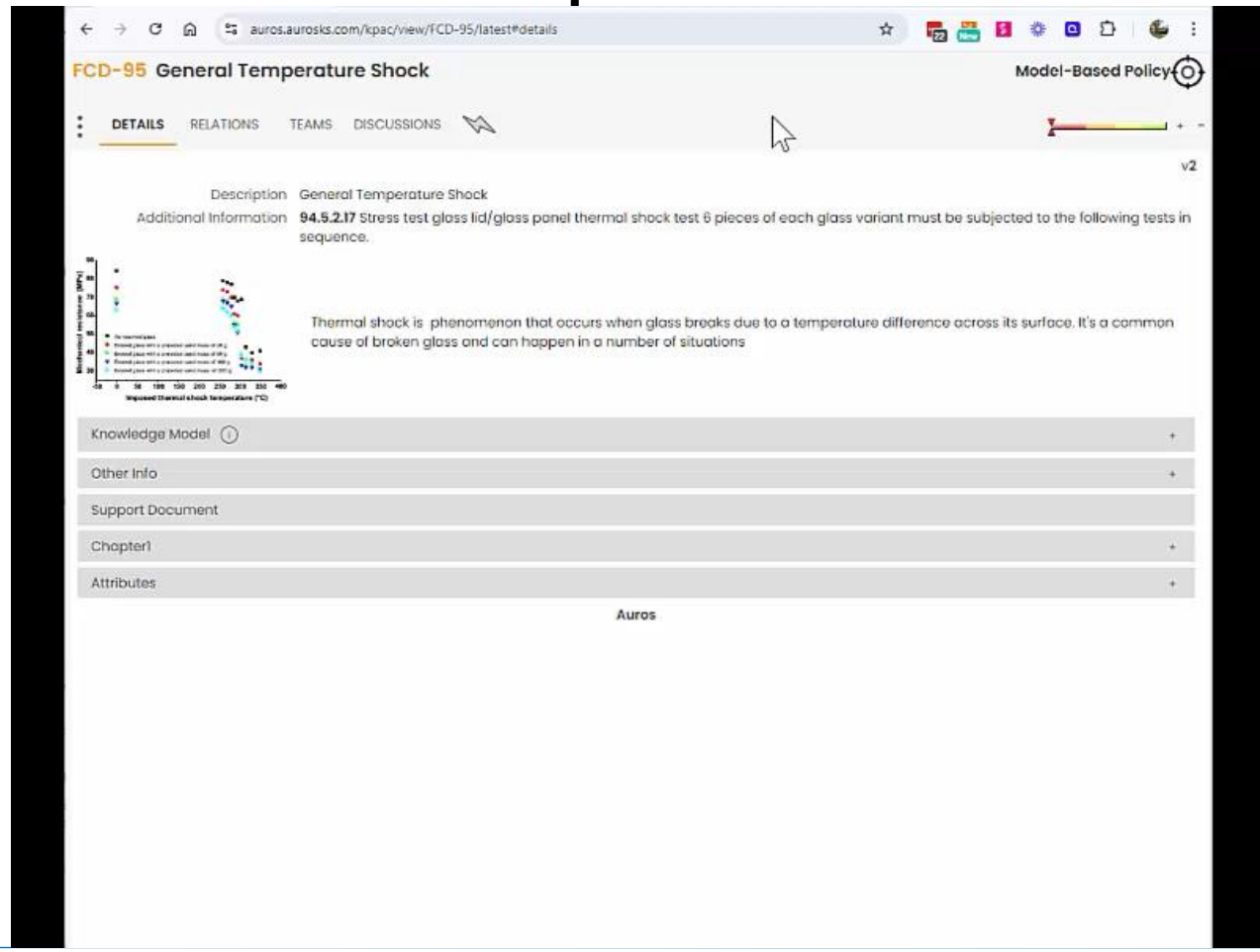
Build

Model *Components*

- Abstraction using defined parameters
- Structured neutral representation
- Intent: usable in any process or tool
- Cause/Effect or Input/Output of prior two steps



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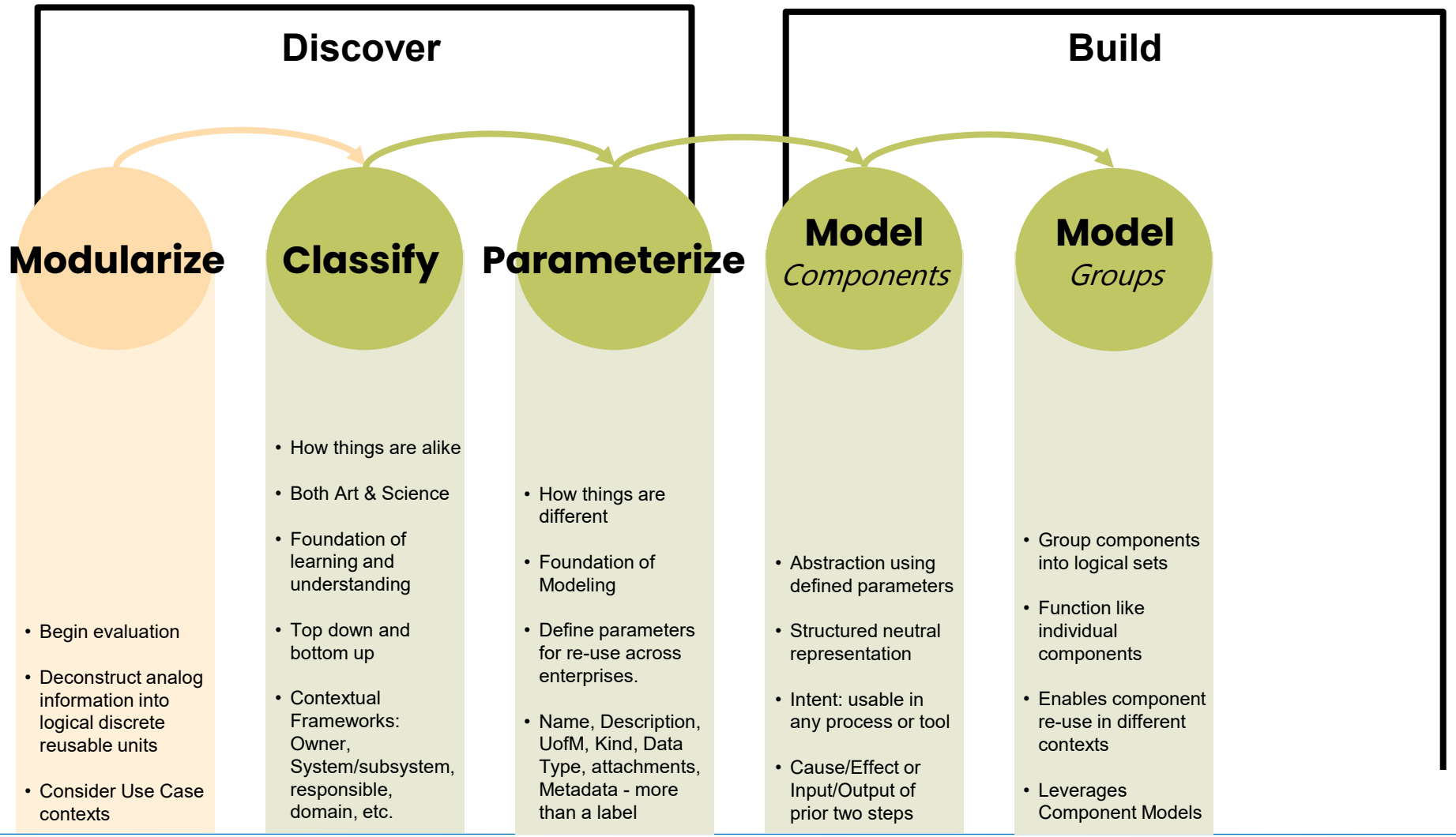

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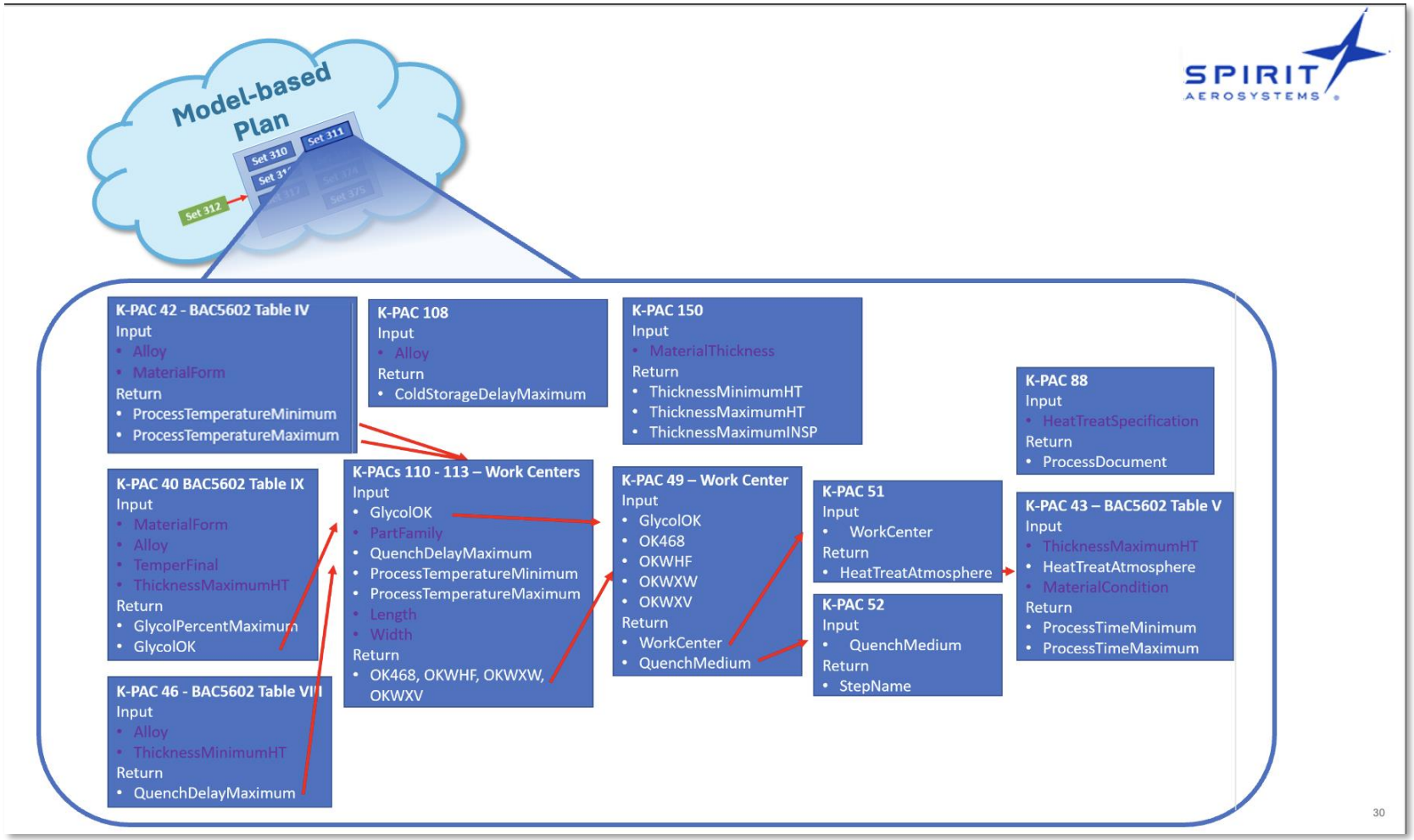

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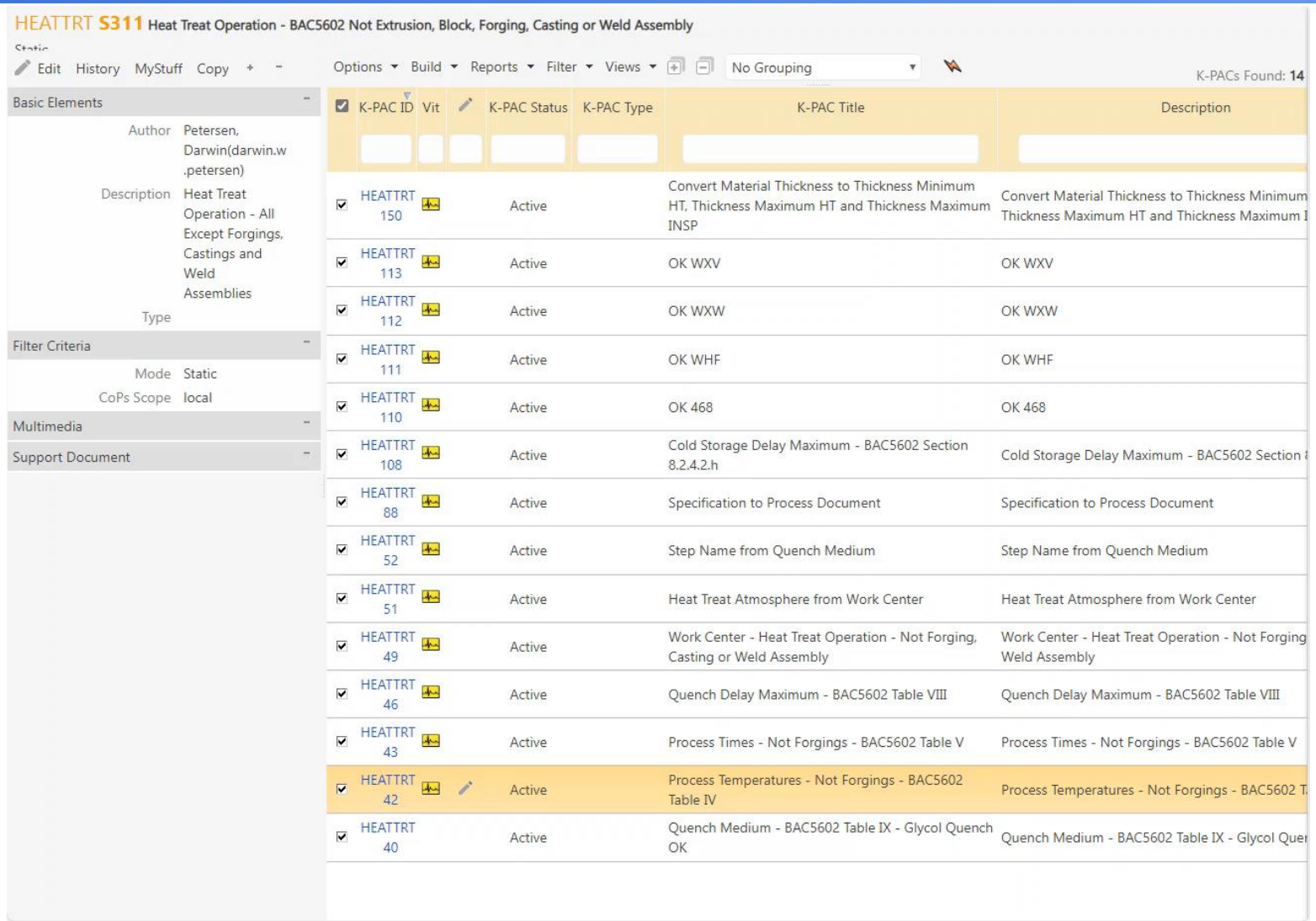

HEATTRT **S311** Heat Treat Operation - BAC5602 Not Extrusion, Block, Forging, Casting or Weld Assembly

Static

Edit | History | MyStuff | Copy | + | −

Options | Build | Reports | Filter | Views | No Grouping

K-PACs Found: **14**

Basic Elements

Author: Petersen, Darwin(darwin.w.petersen)

Description: Heat Treat Operation - All Except Forgings, Castings and Weld Assemblies

Type:

Filter Criteria

Mode: Static

CoPs Scope: local

Multimedia

Support Document

K-PAC ID	Vit	K-PAC Status	K-PAC Type	K-PAC Title	Description
HEATTRT 150		Active		Convert Material Thickness to Thickness Minimum HT, Thickness Maximum HT and Thickness Maximum INSP	Convert Material Thickness to Thickness Minimum Thickness Maximum HT and Thickness Maximum I
HEATTRT 113		Active		OK WXV	OK WXV
HEATTRT 112		Active		OK WXW	OK WXW
HEATTRT 111		Active		OK WHF	OK WHF
HEATTRT 110		Active		OK 468	OK 468
HEATTRT 108		Active		Cold Storage Delay Maximum - BAC5602 Section 8.2.4.2.h	Cold Storage Delay Maximum - BAC5602 Section
HEATTRT 88		Active		Specification to Process Document	Specification to Process Document
HEATTRT 52		Active		Step Name from Quench Medium	Step Name from Quench Medium
HEATTRT 51		Active		Heat Treat Atmosphere from Work Center	Heat Treat Atmosphere from Work Center
HEATTRT 49		Active		Work Center - Heat Treat Operation - Not Forging, Casting or Weld Assembly	Work Center - Heat Treat Operation - Not Forging Weld Assembly
HEATTRT 46		Active		Quench Delay Maximum - BAC5602 Table VIII	Quench Delay Maximum - BAC5602 Table VIII
HEATTRT 43		Active		Process Times - Not Forgings - BAC5602 Table V	Process Times - Not Forgings - BAC5602 Table V
HEATTRT 42		Active		Process Temperatures - Not Forgings - BAC5602 Table IV	Process Temperatures - Not Forgings - BAC5602 T
HEATTRT 40		Active		Quench Medium - BAC5602 Table IX - Glycol Quench OK	Quench Medium - BAC5602 Table IX - Glycol Quer

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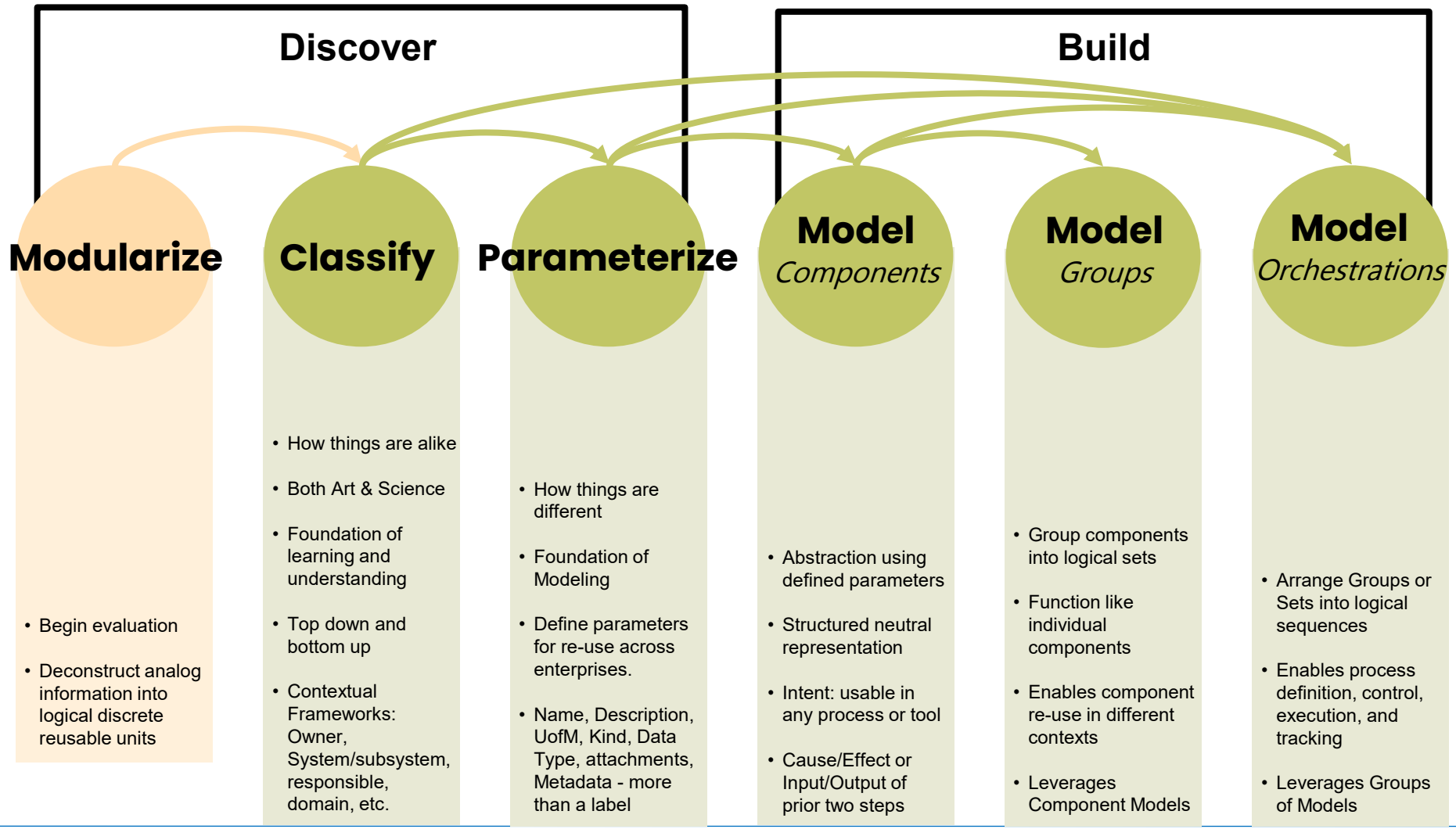
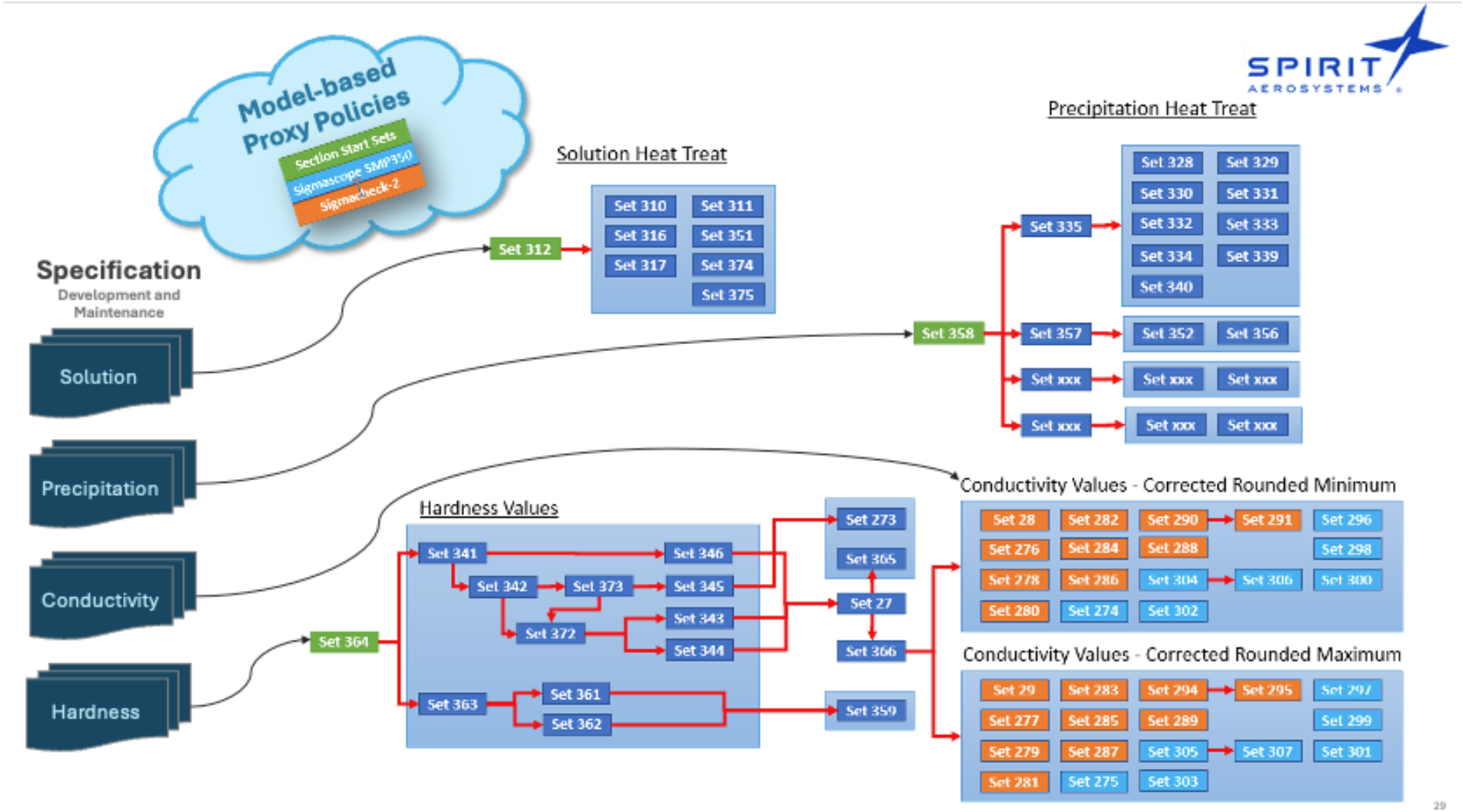


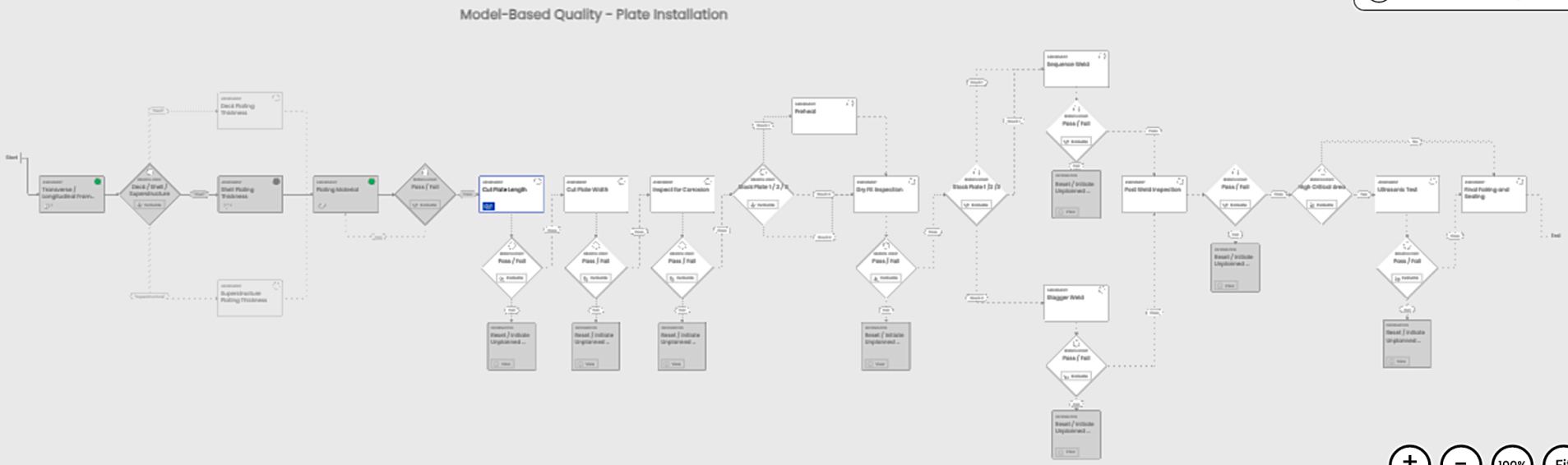
Model Orchestration



Model Orchestration

Measurement Plan

Method Output State: Gray



+ − 100% Fit Save

20%
Use mouse wheel to zoom

Parameter Sheet

Measurement Type	Input Parameters	End User Message	Action	
Plating Material	Material	"H30"		Reset
Plating Material	stock_thickness	7		Reset

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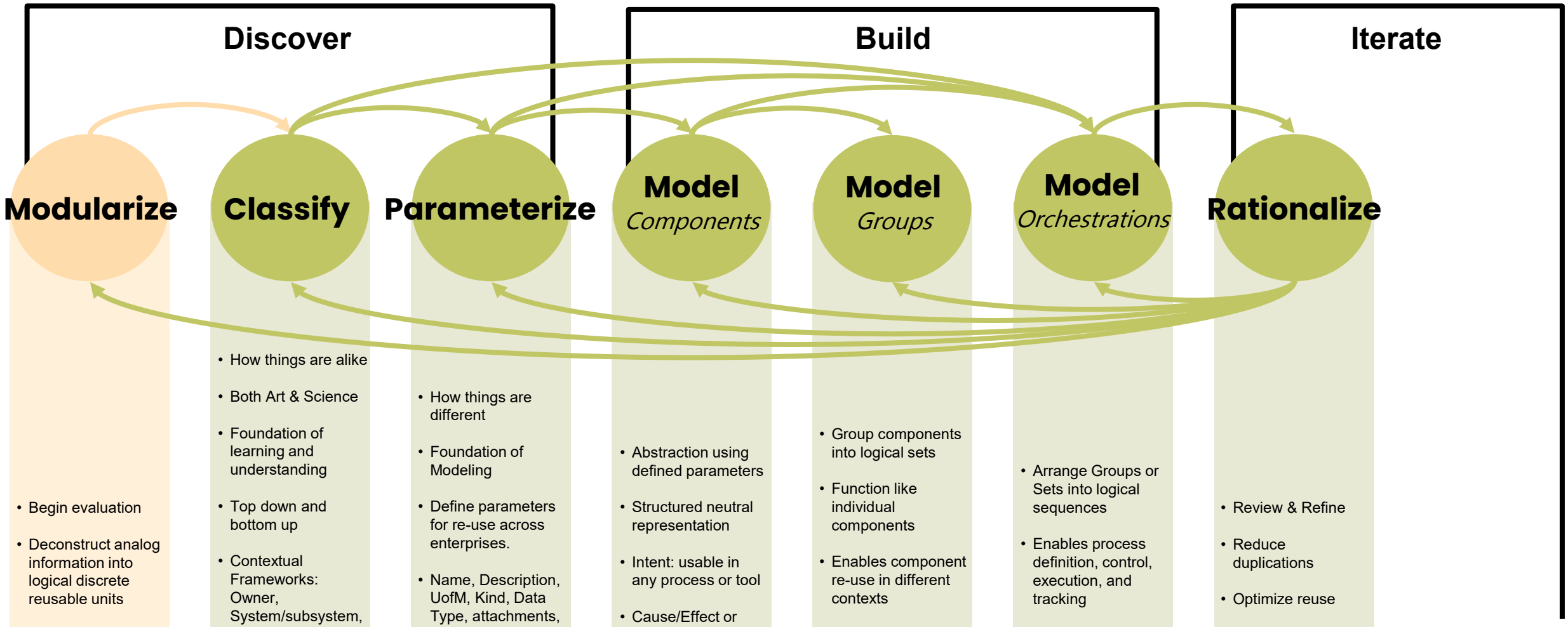

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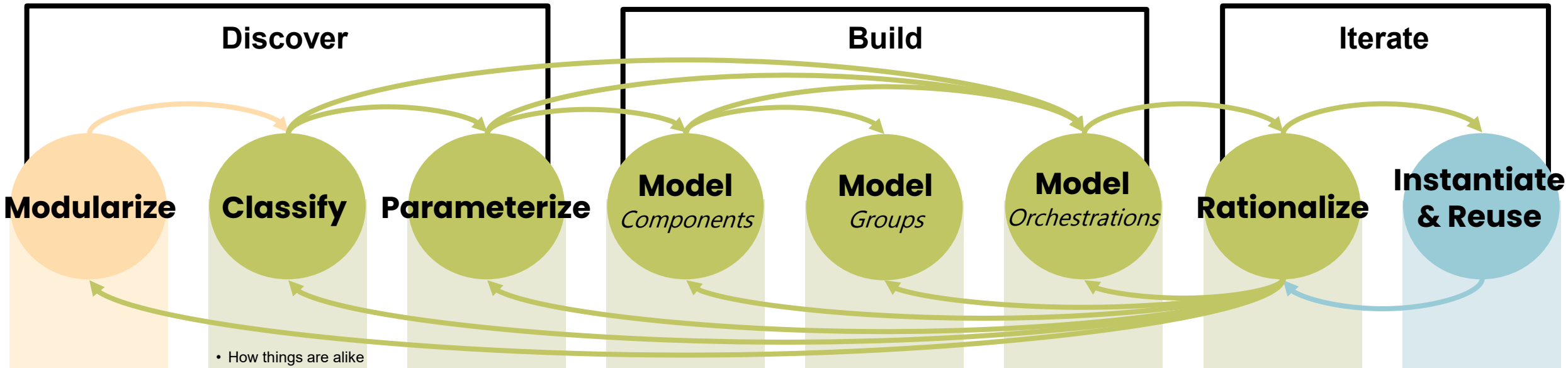

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- Abstraction using defined parameters
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- Intent: usable in any process or tool
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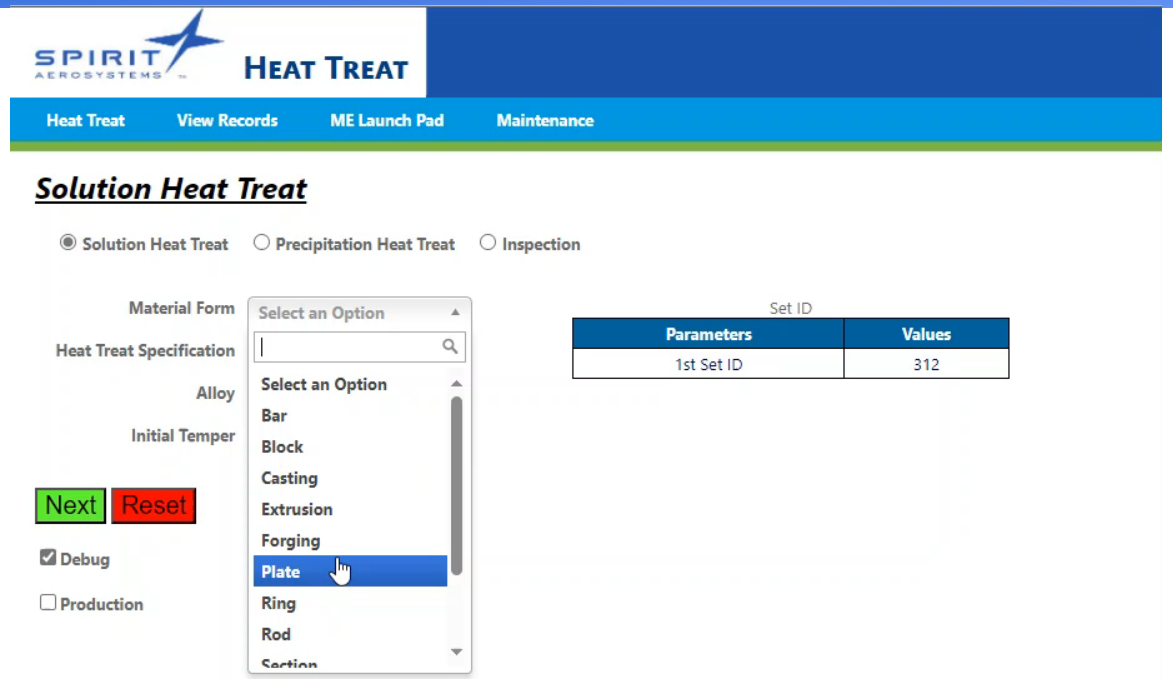
- Group components into logical sets
- Function like individual components
- Enables component re-use in different contexts
- Leverages Component Models

- Arrange Groups or Sets into logical sequences
- Enables process definition, control, execution, and tracking
- Leverages Groups of Models

- Review & Refine
- Reduce duplications
- Optimize reuse
- Enforce Consistency

- Expose or publish as service(s)
- Enables insertions into workflows

Instantiate & Reuse



Questions