ManTech



Securing the Future™

Developing, Integrating and Adopting Appropriate Agile for Systems Engineering Centric Scenarios

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Executive Summary

ManTech and UL Solutions collaborated to develop Essential SAFe® support within Stages

Rearchitected ManTech processes to integrate Essential SAFe with systems engineering (SE) scenarios

Extended Essential SAFe to support solution debt which is more comprehensive than technical debt

ManTech Who We Are

Trusted Partner Providing Mission-Focused Technology Solutions and Services to the U.S. Federal Government

Overview

1968
Founded

Headquartered in Herndon, VA

~$2.7B
2022 Revenue

~9,800
Employees

73%
Cleared

~45%
Veterans

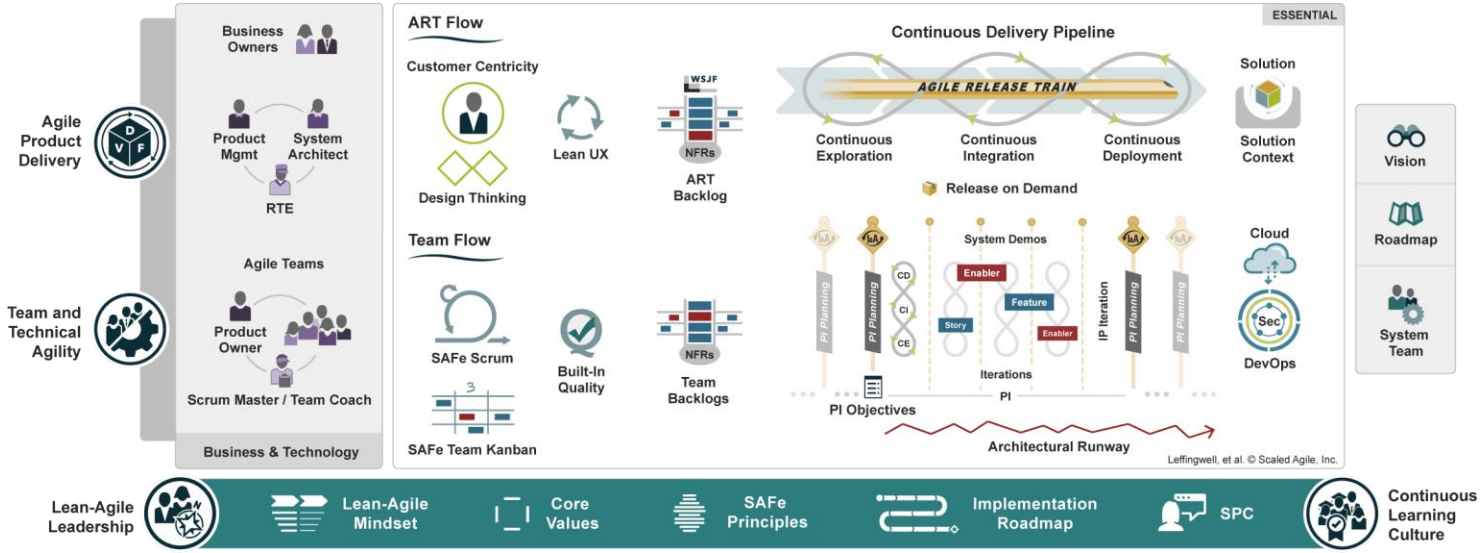
Key Capabilities

- Full-Spectrum Cyber
- Secure Mission & Enterprise IT
- AI and Advanced Data Analytics
- Software & Systems Development
- Intelligent Systems Engineering
- Intelligence Mission Support
- Mission Operations

The Automotive Process Framework (APF) is developed with and for customers to dramatically reduce the time and cost to develop regulatory-compliant product engineering processes

Approach to supporting Essential SAFe within Stages

- Model the minimum but sufficient processes to help the adoption and integration of SAFe
- Focus on the ‘What’ and not the ‘How’
- Link to SAFe pages for additional guidance



- Model the key processes at the Agile Team and Agile Release Train (ART) Team
- Only link to SAFe Foundation, Competencies, Practices, Spanning Palette etc.

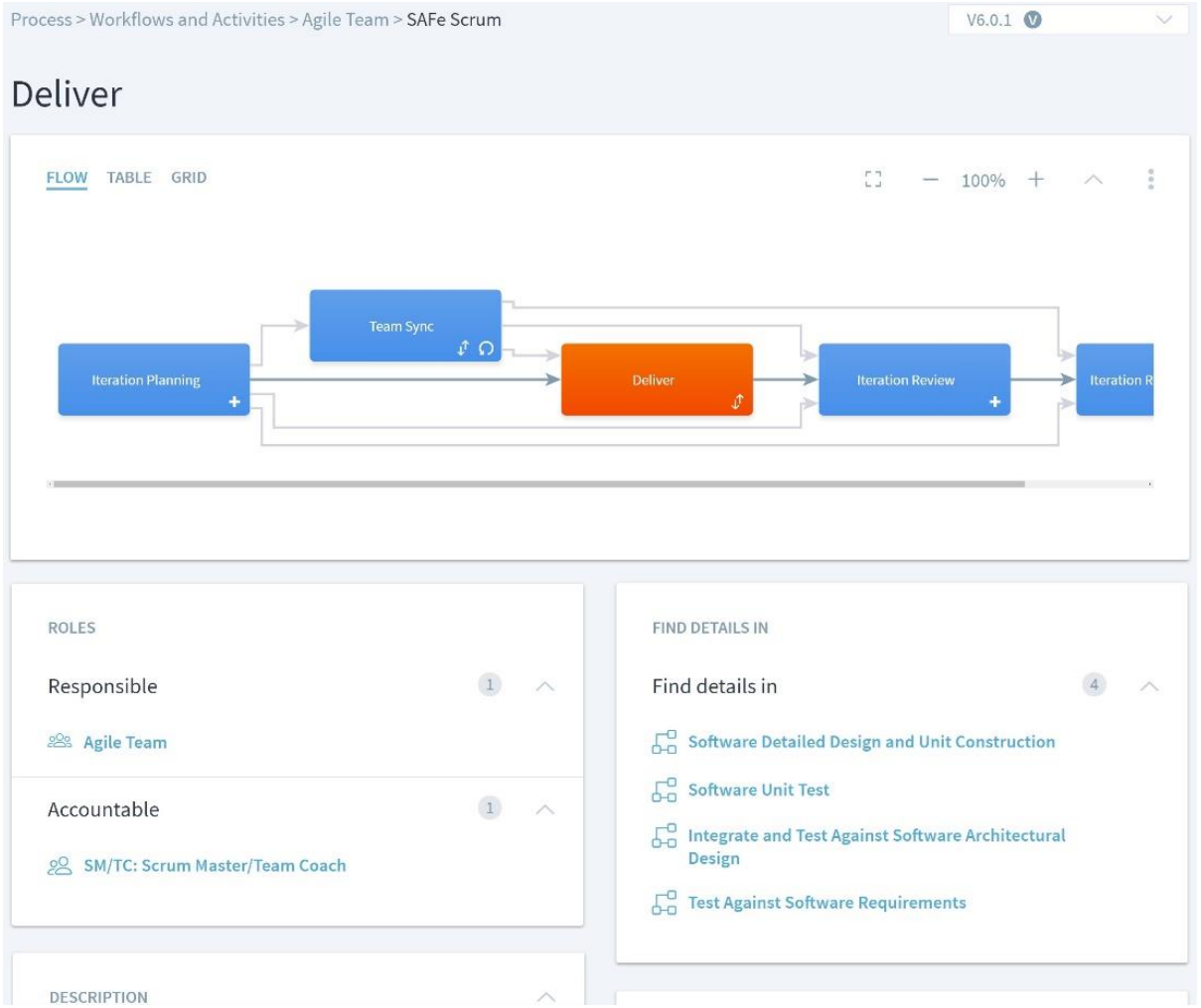
Enable customers to modify, extend and integrate SAFe with their existing regulated product engineering and wider business processes

Community collaboration and expertise in the APF

- The APF harnesses the combined expertise and decades of experience of UL Solutions Software Intensive Systems experts, drawing from the legacy of Method Park, kVA and Kugler Maag Cie
- Our approach to development is highly collaborative with each new module being co-developed with a key customer and reviewed by over ten others, ensuring the process content meets customers' needs
- In a spirit of giving back, our experts actively contribute to the iNTACS Automotive SPICE, ISO/SAE and UL standards committees, helping to shape the standards that the APF supports

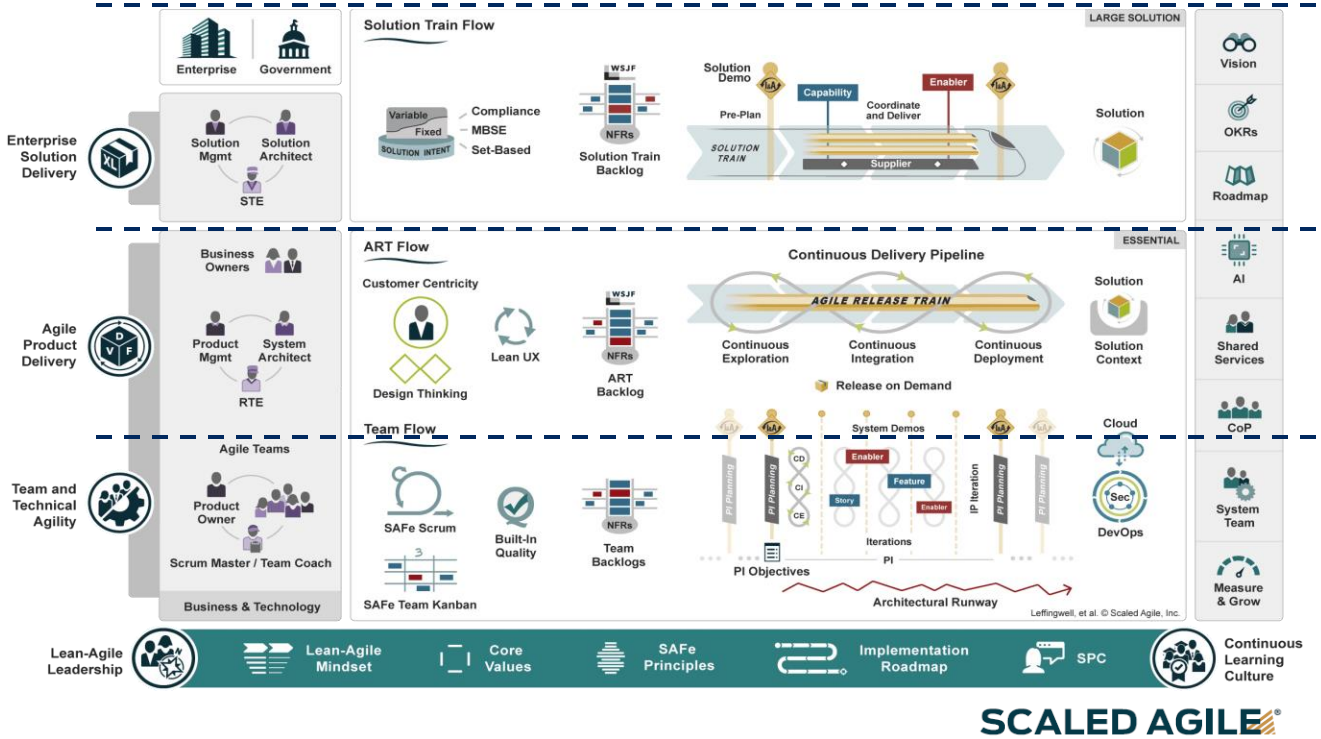
Appropriate Agile

- All projects are iterative and incremental, some are more iterative and incremental, or more Agile than others
- The APF supports both Essential SAFe 6.0 Agile Ways-of-Working (WoW) and conventional Project and Risk Management, allowing a project to choose which approach they want to use



Appropriate Agile is achieving the right balance and integration between Agile WoW and regulatory-compliant product engineering

Large Solution SAFe alignment to ISO/IEC/IEEE 15288:2023(E) Systems and software engineering



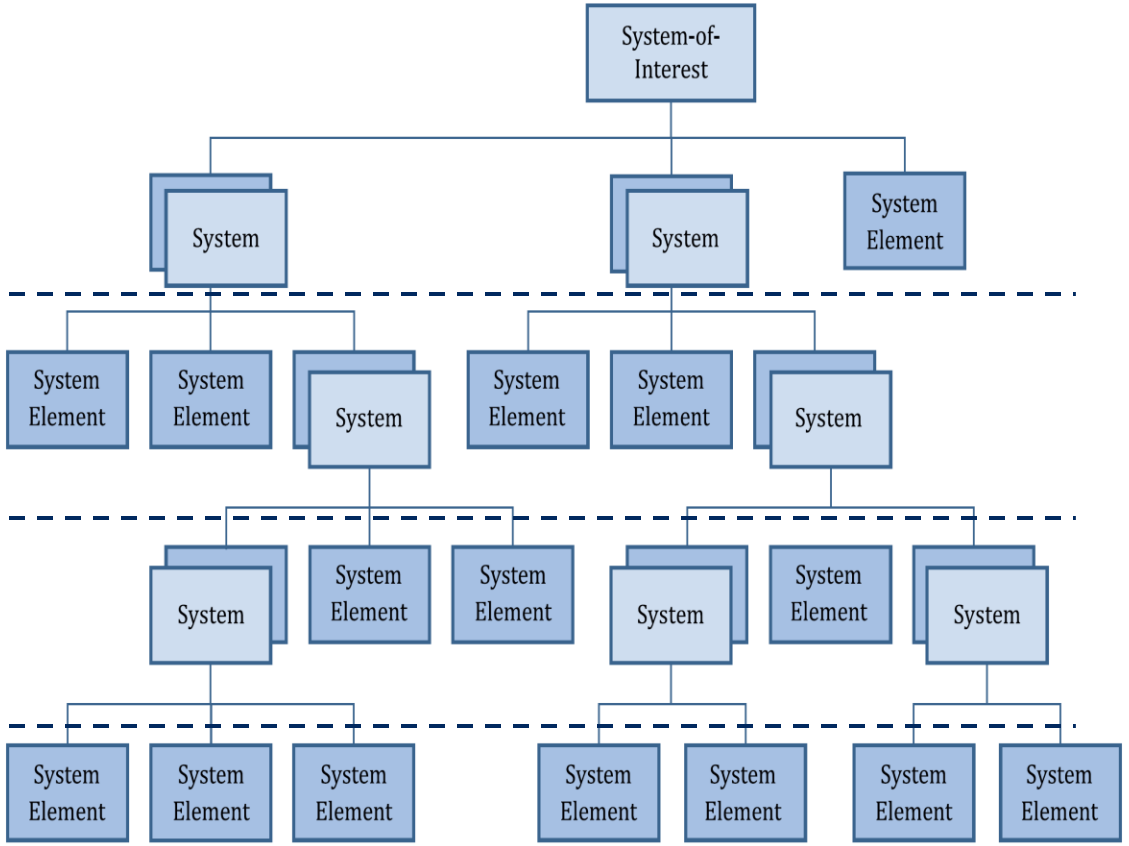
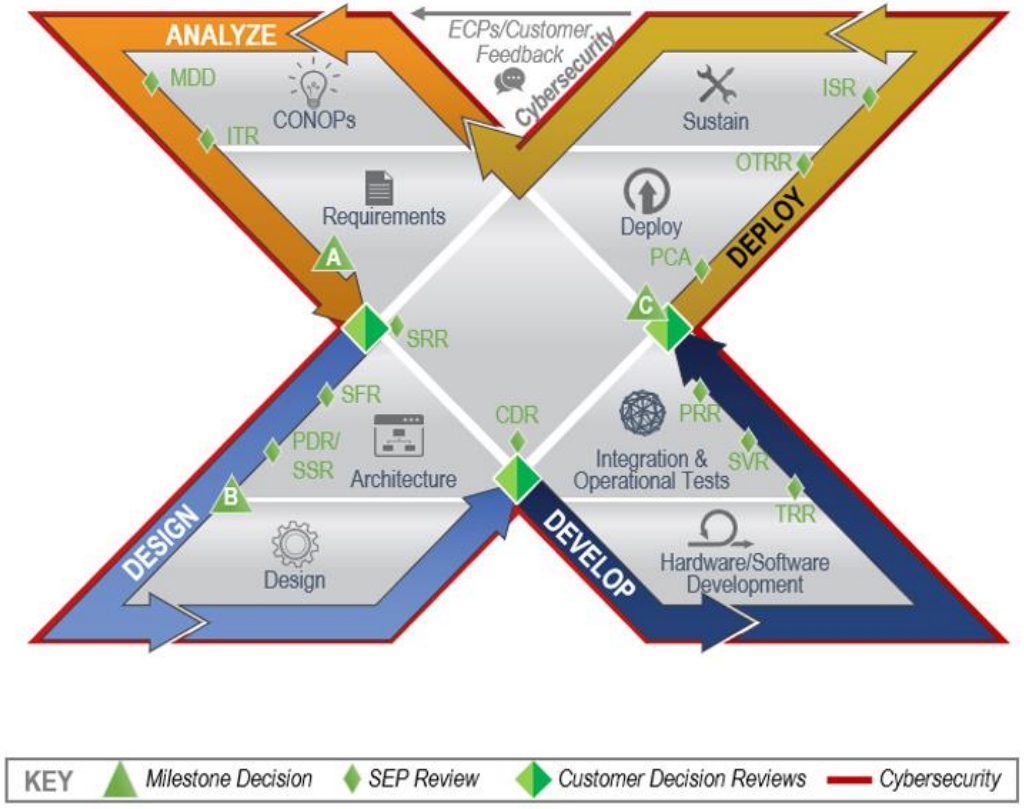


Figure 2 — System-of-interest structure

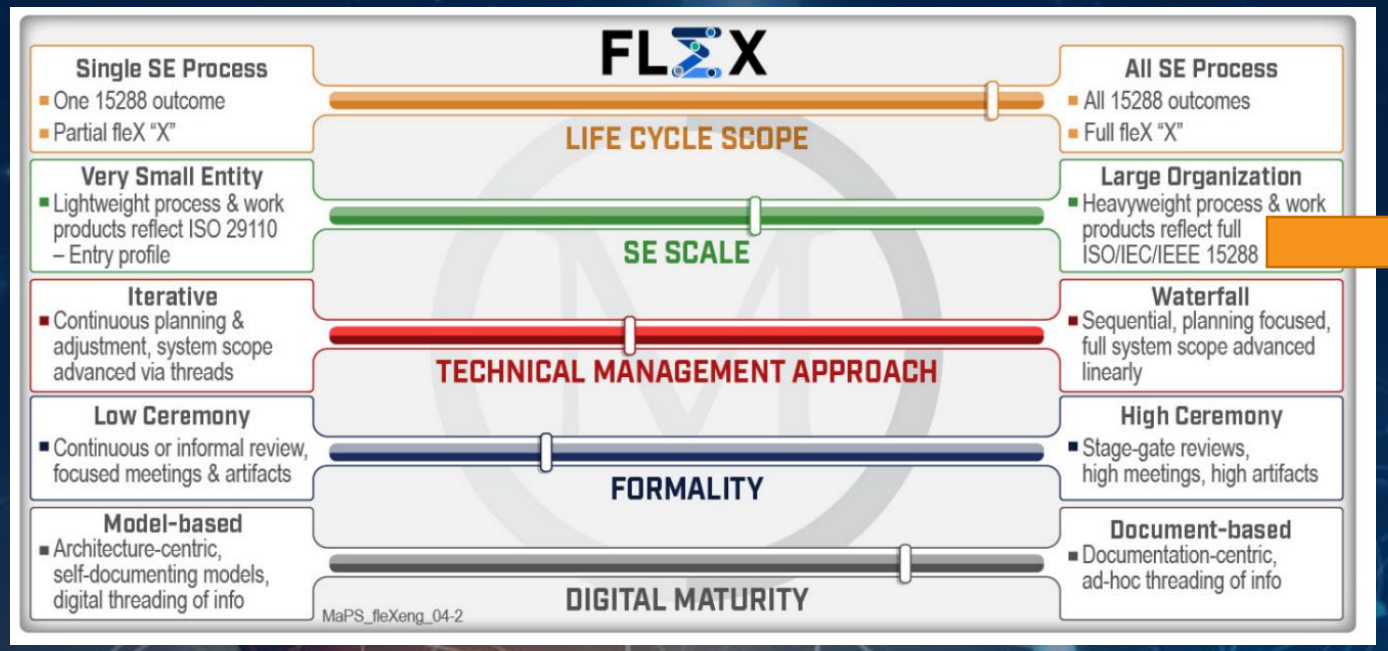
flex-engineering®

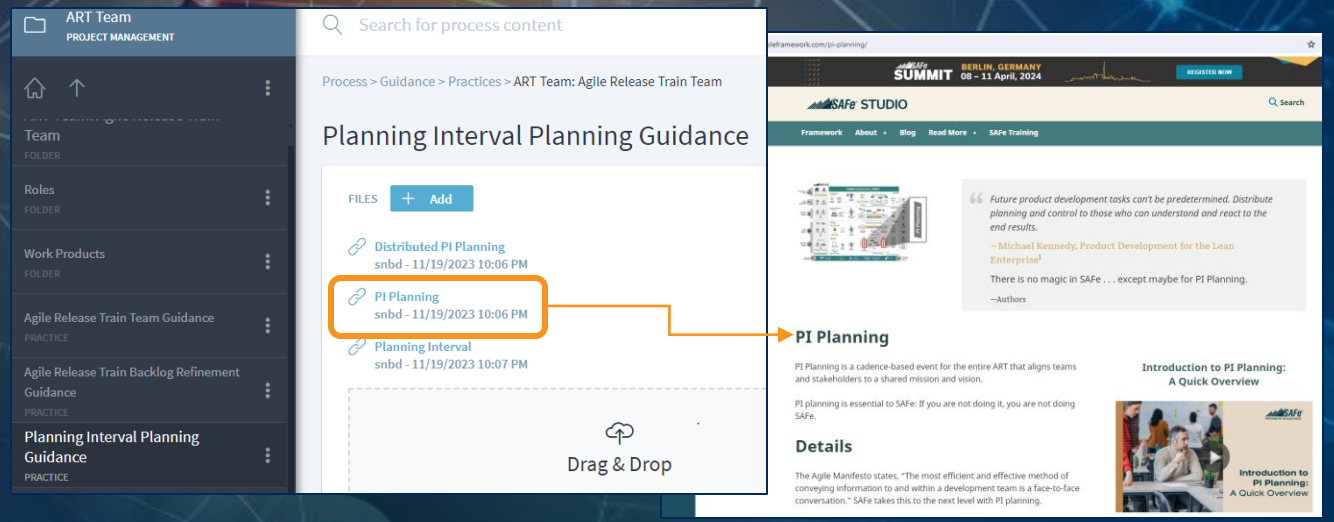
- Approach to system development which is elastic in nature and adapts to customer context
- Includes detailed process definition, tailoring, automated validation
- 5 dimensions of tailorability
- Utilizes Stages with Essential SAFe, Dassault Magic Cyber Systems Engineer

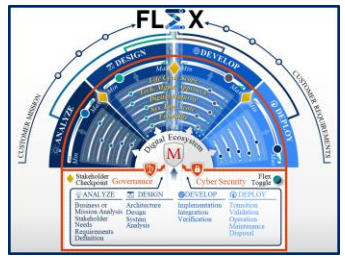


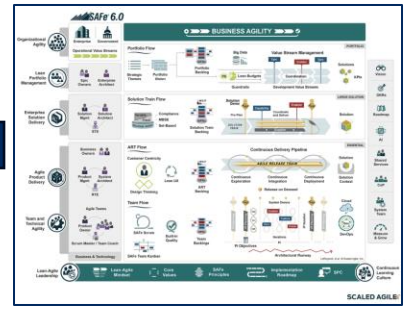
flex-engineering Enables Speed and Flexibility with Discipline

Realizing Flexibility with Discipline: flex-engineering

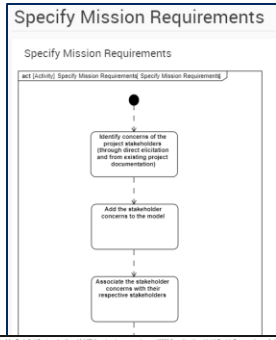


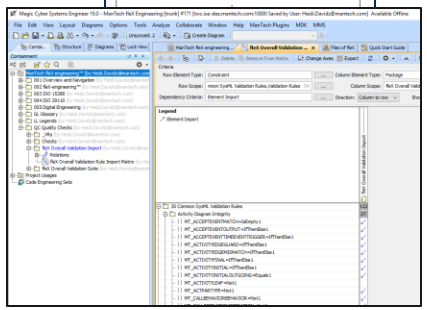






- Process
- Methodology
- Work instructions
- Profiles
- Style guide
- Validation rules
- Templates
- Efficiency widgets
- Governance

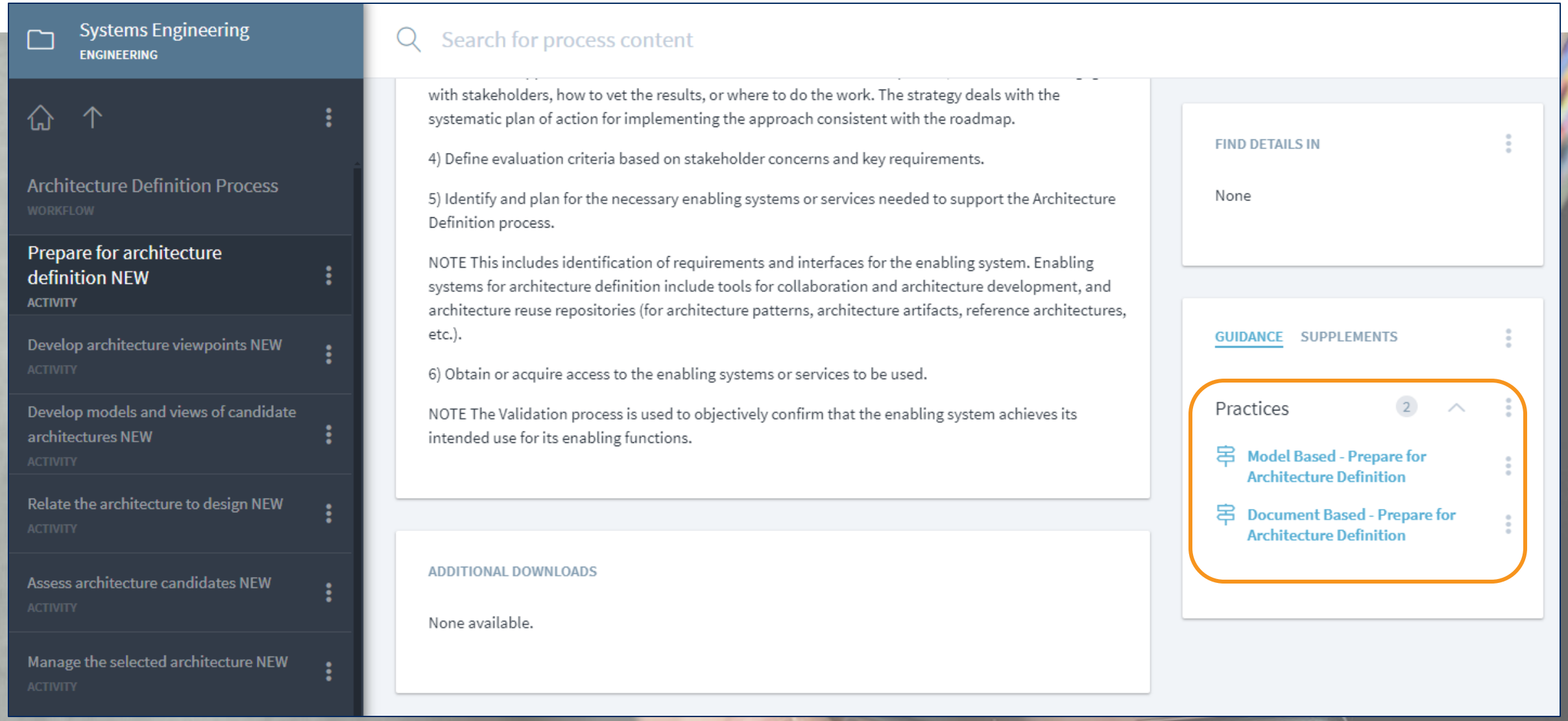




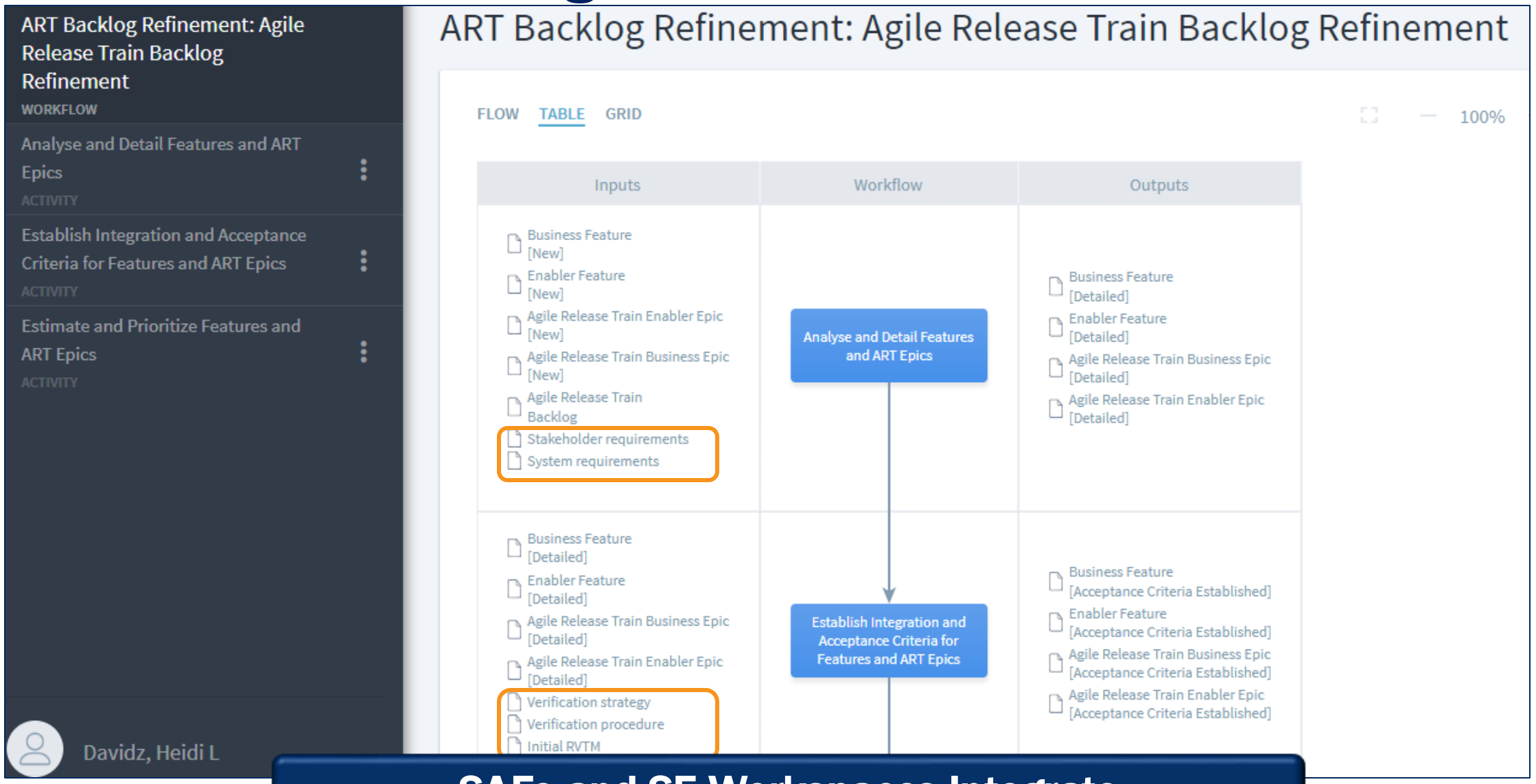
Example Scenarios

Scenario	Title	Description	SAFe Agile Team	SAFe Agile Release Train (ART)	Predictive PM
Scenario #1	Pure Support Services	One or a few SE work products can be the customer deliverable	X	-or-	X
Scenario #2	Small Solution	ManTech developing a small-scale solution; intended for small teams and rapid development (like R&D)	X	-or-	X
Scenario #3	Part of Government Team	ManTech is part of the Government team as a contributor to SE efforts across lifecycle	X	-or-	X
Scenario #4	System Integration	ManTech responsible for robust, rigorous system integration effort	X	+ X -or-	X
Scenario #5	Large System Development	ManTech responsible for development of a large system for the extended product life cycle; may be system-of-system work scope	X	+ X -or-	X

Uses Model-Based and Document-Based Practices



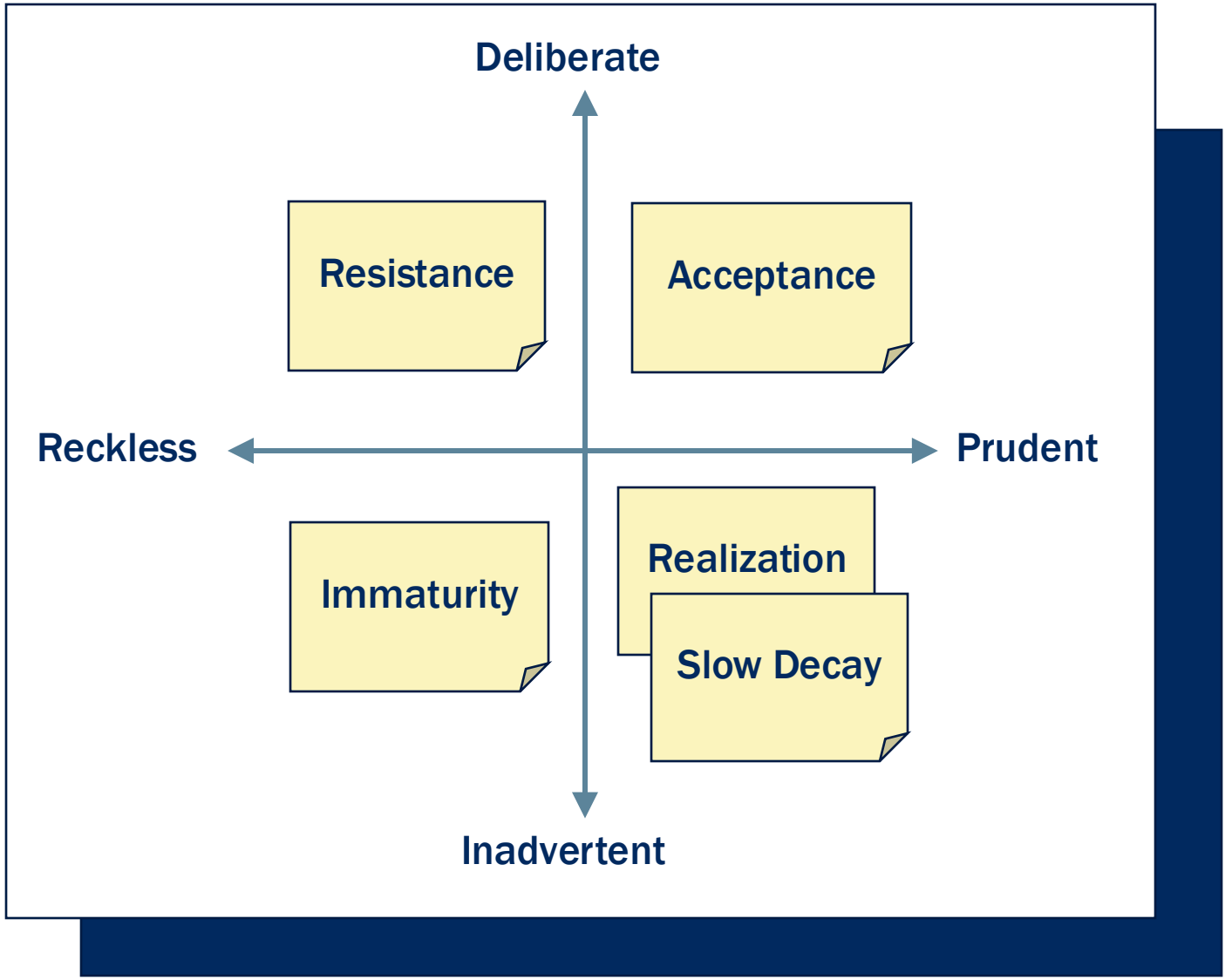
SAFe and SE Integration



SAFe and SE Workspaces Integrate

Solution Debt

- Technical debt literature is focused on software
- Systems engineers worry about debt incurred at the solution level, spanning the lifecycle, solution debt
- Solution Debt – implied cost of additional rework across disciplines and lifecycle caused by choosing a limited solution now instead of using a better approach that would take longer
- Debt literature suggests mechanisms to evaluate debt



Sources: Clark, 2018; Cognopia, 2024; Ladley, 2020

Solution Debt Taxonomy

		Debt	Common Symptoms
Business Debt	Organization Debt	Management Debt	Inconsistent views of roles/responsibilities, Unchecked resistance to change
		Supply Chain Debt	Reliance on single sources, Lack of visibility into supply sub-tiers
		Service Debt	Ill-defined service level agreement, high service switching cost
		People Debt	Poor workforce morale, Missing skills or experience
		Social Debt	Strained interactions with stakeholders, Soiled reputation internally or externally
	Approach Debt	Innovation Debt	Lack of differentiating capability, Unbalanced R&D portfolio, Misapplied skills
		Process Debt	Inefficient process, Undocumented process, Rigid process
		Infrastructure Debt	Insufficient facilities or equipment, Lack of internal/external collaboration capability
Lifecycle Debt	Development Debt	Requirement Debt	Unverifiable requirements, Incomplete traceability, Requirement Quality Issues
		Architecture Debt	Unintended system behavior, Lack of variation management, Incomplete architecture, Lack of or incomplete traceability, lack of interoperability
		Design Debt	Design for export not considered, Lack of design guidance, Multiple sources of truth
		Technical Data Package Debt	Incomplete specification, Inconsistent model methods and style
		Security Debt	Limited cyber recovery planning, Conflicting classification guides
		User Interface Debt	Unnecessary cognitive load on user, Lack of reliable interpretation
		Build & Validation Debt	Lack of automated validation suite, Ill-defined dependencies
		Code Debt	Duplicate code, Poor code metrics, Unmaintainable code, Inefficient code
	Sustainment Debt	Production Operation	Uncharacterized value streams, Inability to meet contracted volumes, Unvalidated requirements
		Defect Debt	Unmanaged backlog, Uncorrected major defects
		Test Debt	Lack of control and observability points, Unrepeatable test results
		Technology Debt	Ad-hoc technology adoption, Solution no longer effective in intended environment
		Obsolescence Debt	Surprise lifetime buys, Obsolete inventory
		Data Debt	Ad-hoc data controls, No data disposal plan, Dark data
		End of Life Debt	Lack of plan for removal from service

Adapted from Source: Alves, et al, 2014.

Solution Debt Management

Solution Debt Matrix

Source	Debt Type	Observation	Impact	Fix Cost ($K)	Contag Facto
Machine XYZ Replacement	Process Debt	New process and roles	3	$250	3
Machine XYZ Replacement	Security Debt	Increased attack surface	2	$500	4
Machine XYZ Replacement	End of Life Debt	Must create a plan	3	$50	1
Machine XYZ Replacement	People Debt	Training required	4	$100	2
Machine XYZ Replacement	Data Debt	Determine handling of new data	5	$250	5
PLC 123 Upgrade	Process Debt	New process and roles	3	$20	3
PLC 123 Upgrade	People Debt	Training required	4	$120	2
PLC 123 Upgrade	Security Debt	Increased attack surface	2	$400	4

Table of Contents

Overview of solution debt
- Traditional definitions
- Common causes
- Solution debt taxonomy with de
- Program risk management vs.

Step 1: Identify current debt
- Identify current program debt
- Characterize debt type

Step 2: Evaluate debt
- Assess impact
- Assess fix cost
- Assess contagion factor
- Assess source and recipient of
- Assess who pays / who benefit
- Assess ability to impact
- Determine quadrant for improv
- Determine structural context

Step 3: Link to program assets
- Link evaluated debt to program and enterprise risks
- Link evaluated debt to guardrails

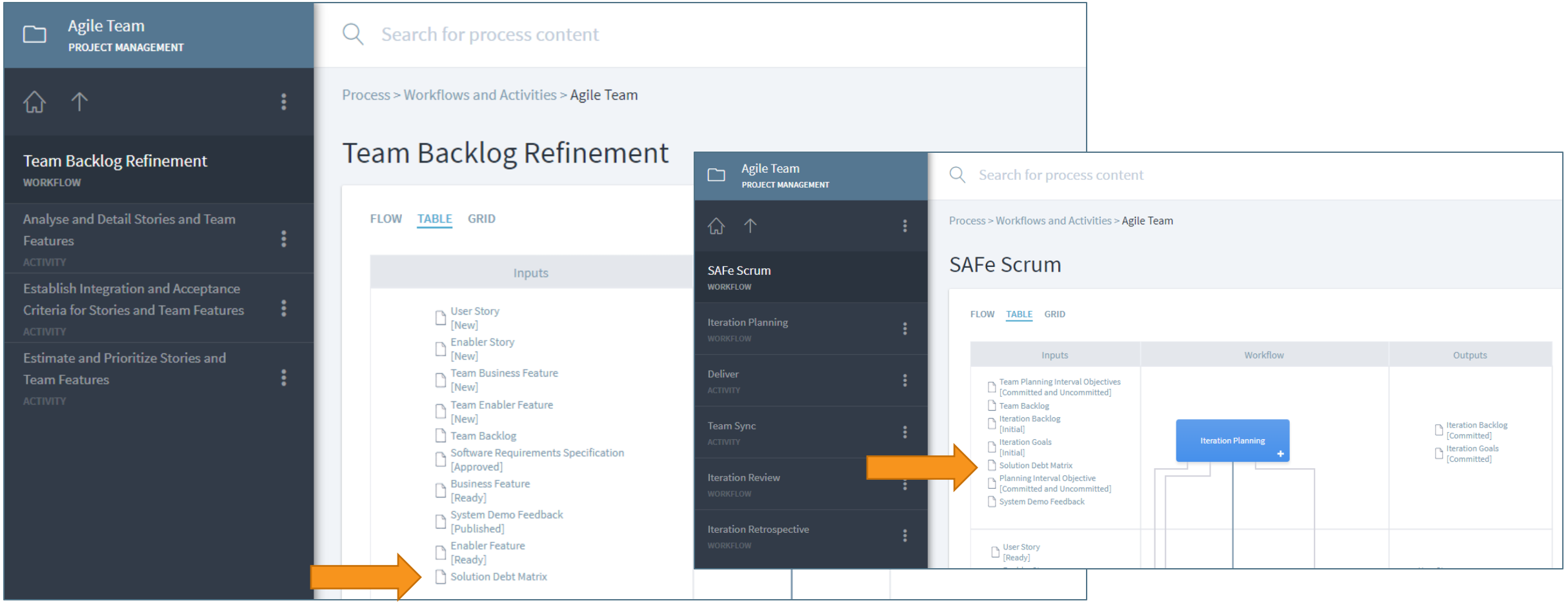
Step 4: Develop debt reduction plan
- Develop debt reduction activities
- Assess timeline and resourcing
- Document debt reduction plan

Step 5: Execute the debt reduction plan
- Program and enterprise metrics
- P-D-C-A Cycle

Solution Debt Playbook Information in Solution Debt Matrix

Solution Debt Management Implementation

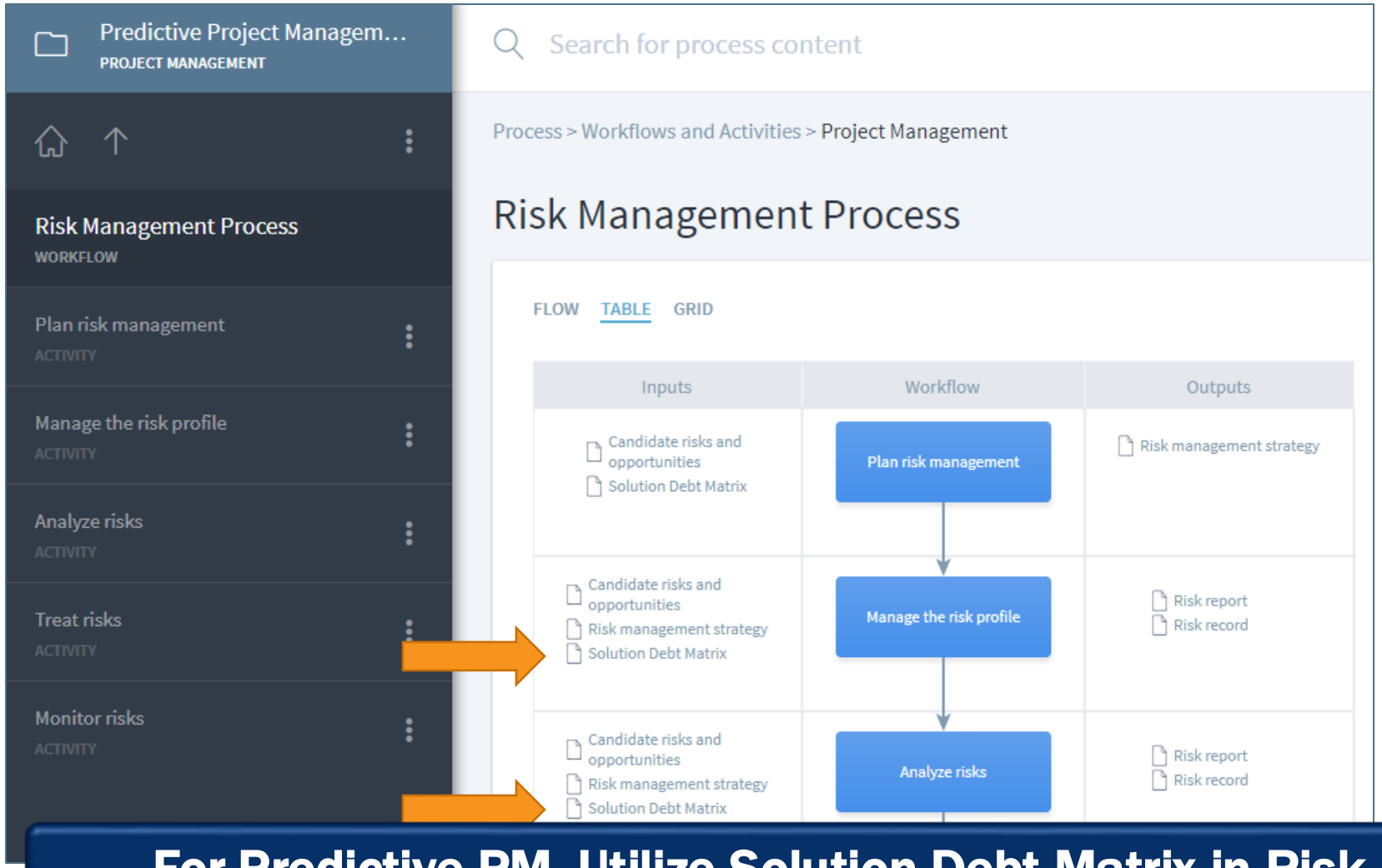
Example for Scaled Agile Framework (SAFe)



For SAFe, Utilize Solution Debt Matrix in Backlog Refinement

Solution Debt Management Implementation

Example for Predictive Project Management



For Predictive PM, Utilize Solution Debt Matrix in Risk Management

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Extended Essential SAFe to support solution debt which is more comprehensive than technical debt

References

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