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**AI-Infused Integrated Digital Maturity Pathway (IDMP)
User-Story Framework for Defense Acquisition
Transformation**

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AI-Infused Integrated Digital Maturity Pathway (IDMP) User-Story Framework for Defense Acquisition Transformation

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Abstract

The 2025 Acquisition Transformation Strategy requires the Department of War to adopt faster, mission-centric, and data-enabled acquisition methods that strengthen both acquisition and mission readiness. This paper presents preliminary findings from an ongoing R&E through Systems Engineering Research Center (SERC) funded project, led by the Center for Mission Engineering at Old Dominion University, to advance this mandate using an AI-infused Integrated Digital Maturity Pathway (IDMP) User-Story Framework. The project engages government and industry stakeholders including acquisition executives, program managers, engineers, and industrial base partners through structured workshops to surface operational challenges, identify capability gaps, and develop user stories reflecting real decision needs. An AI/ML component explores how pattern detection and machine reasoning enhance user-story analysis, maturity assessment, and readiness scoring. A targeted survey supplements workshop data, capturing perspectives on readiness barriers, decision bottlenecks, workforce needs, and digital transformation opportunities. Expected findings include a validated set of acquisition executive user stories aligned with the strategy, evidence that AI-enabled analytics improve clarity and decision value, an enhanced IDMP maturity model, and a scalable, practitioner-ready method for translating policy objectives into actionable, mission-focused acquisition decisions.

Introduction

The contemporary defense environment is characterized by accelerating technological change, rapidly evolving threats, and increasing demands for operational adaptability. In response, the Department of War (DoW) has undertaken significant reforms aimed at modernizing its acquisition enterprise, emphasizing faster capability delivery, reduced bureaucratic barriers, strengthened industrial base capacity, and integrated digital technologies (DoW, 2025a). These efforts reflect a growing recognition that traditional acquisition models often optimized for stability and predictability are increasingly misaligned with the pace of modern warfare (DoW, 2025b).

At the core of these reforms is a shift toward mission-centric acquisition, in which the primary organizing principle for capability development is the operational mission rather than individual platforms or isolated programs. Mission-centric approaches require acquisition organizations to evaluate how systems contribute to mission outcomes across integrated operational environments (Dahmann & Parasidis, 2024). This perspective has been reinforced through initiatives such as Mission Engineering Integration Activities (MEIA), Capability Portfolio Management (CPM), and the growing role of Portfolio Acquisition Executives (PAEs).

However, operationalizing mission-centric acquisition requires new forms of decision support that extend beyond traditional program management tools. Acquisition leaders must identify capability gaps across portfolios, assess readiness across multiple dimensions including technology, manufacturing, workforce, and integration, and evaluate how proposed solutions affect mission outcomes. This demand has accelerated interest in digital engineering, which



uses model-based systems engineering, digital twins, and advanced data analytics to support decision-making across the acquisition life cycle (Paulo & Beery, 2019). In parallel, acquisition organizations are increasingly exploring data-driven portfolio management approaches that leverage analytics to prioritize investments and align resources with strategic objectives.

This paper presents preliminary findings from an ongoing R&E through SERC funded research effort that investigates how structured user stories, combined with integrated maturity pathways and AI-enabled analysis, can provide a practical mechanism for operationalizing acquisition transformation and supporting mission-centric decision-making.

2. Acquisition Transformation Context

The 2025 Acquisition Transformation Strategy reflects a deliberate shift toward faster, more mission-focused, and data-enabled acquisition practices intended to accelerate the delivery of warfighting capabilities. Issued pursuant to Executive Order 14265, Modernizing Defense Acquisitions and Spurring Innovation in the Industrial Base (The White House, 2025), the strategy acknowledges that traditional acquisition processes are increasingly misaligned with the pace of technological change. The strategy prioritizes three overarching outcomes: (1) fielding technology at a rate that outpaces adversaries; (2) increasing production capacity and surge capacity; and (3) putting the acquisition system on a wartime footing with urgency to accept more risk and transition from a culture of compliance to one of speed and execution (DoW, 2025a).

Central to this effort is the expansion of Portfolio Acquisition Executives (PAEs), who are responsible for managing portfolios of capabilities rather than isolated systems. Under this structure, PAEs evaluate investments across programs, balance competing priorities, and ensure that acquisition decisions collectively advance mission outcomes. Closely related is Capability Portfolio Management (CPM), which emphasizes the management of capabilities as interconnected elements of mission performance (DoW, 2025b).

Another important component is the integration of Mission Engineering Integration Activities (MEIA). Mission engineering has emerged as a critical discipline for understanding how systems interact within complex operational environments (Dahmann & Parasidis, 2024; DoW, 2023). By analyzing mission threads, mission engineering identifies dependencies among systems and reveals where capability gaps may affect mission performance.

The transformation strategy also emphasizes digital acquisition initiatives, including digital engineering, model-based systems engineering, and AI-enabled analytics to modernize the analytical infrastructure supporting acquisition decision-making. Recent SERC research has outlined strategies for driving the digital transformation of defense acquisition, emphasizing the convergence of engineering workflows, collaborative digital contracts, and data-integrated acquisition processes (SERC, 2023).

While these reforms represent important steps, a persistent gap remains between policy intent and operational implementation. Existing readiness frameworks Technology Readiness Levels (TRLs), Manufacturing Readiness Levels (MRLs), Integration Readiness Levels (IRLs), and Human Readiness Levels (HRLs) each address important aspects of system maturity but are typically applied independently (Sauser et al., 2009; See, 2021). Without a mechanism to synthesize these inputs into a mission-oriented readiness assessment, acquisition leaders may lack the situational awareness necessary to fully realize the transformation strategy's objectives.

Research Problem

Despite significant policy initiatives, a persistent challenge remains in translating strategic reform objectives into practical decision-making mechanisms. Acquisition leaders are



increasingly expected to make portfolio-level decisions that accelerate capability delivery and strengthen mission readiness. However, these expectations often exceed the analytical tools available to support such decisions.

At the center of this challenge is the absence of a systematic method for identifying readiness gaps that affect mission performance. While individual programs assess technical maturity through TRLs and MRLs (DoW Office of the CTO, 2025; Joint Defense Manufacturing Technology Panel, 2025), these assessments typically occur within program boundaries. They do not reveal how multiple readiness factors interact across portfolios to influence operational capability delivery.

Several structural issues contribute to this gap. First, the defense acquisition community employs numerous maturity models that were not designed to function as an integrated decision-support system (Sausser et al., 2009). When applied independently, they create a fragmented landscape difficult for leaders to synthesize. Second, decision transparency remains constrained by process complexity and reliance on informal judgment rather than systematic analysis. Third, operational user perspectives are often underrepresented in formal decision processes, despite policy emphasis on warfighter needs (Kasauli et al., 2021).

This research investigates the following central question:

How can acquisition leaders operationalize transformation policy through a repeatable framework that integrates user needs, maturity assessment, and AI-enabled decision support?

Literature and Conceptual Foundations

Maturity Models in Defense Acquisition

Maturity models have long been used to assess developmental progress. The TRL framework, originally developed by NASA and adopted by the DoW, provides a structured scale for evaluating technology maturity from basic scientific principles to fully operational systems (DoW Office of the CTO, 2025). MRLs assess production capability, process stability, supply chain readiness, and quality assurance (Joint Defense Manufacturing Technology Panel, 2025). HRLs evaluate personnel, training systems, and human-system integration factors (See, 2010, 2021). IRLs evaluate system interfaces and the ability of components to function within system-of-systems architectures (Sausser et al., 2009).

While each model provides valuable domain-specific insights, their application remains fragmented. This siloed structure obscures the relationships among technological maturity, manufacturing capability, workforce readiness, and system integration limiting the ability to identify systemic readiness gaps (Lavin et al., 2022).

User Stories and Operational Perspectives

User stories, originating in agile software development, offer a method for articulating stakeholder needs in a concise, actionable format: “As a [role], I need [capability], so that [mission outcome]” (Cohn, 2004). Within agile environments, user stories translate stakeholder needs into development priorities through iterative engagement and rapid feedback. Recent systematic reviews confirm that user stories are widely used in practice but that the research base is still comparatively limited, especially regarding quality, consistency, and analytical reuse (Amna et al., 2022; Kuhail et al., 2022).

The concept has increasingly been applied beyond software development to complex systems and organizational processes. In defense acquisition contexts, user stories can capture the perspectives of acquisition executives, program managers, engineers, and operational



users. When systematically collected and analyzed, they serve as a rich source of qualitative data informing decision-support frameworks and capability roadmaps (Sporsem et al., 2025). Recent work also shows growing interest in treating user stories as analyzable artifacts using NLP or AI methods to assess quality and extract structure (Hallmann et al., 2025; Qian et al., 2023).

Mission Engineering and Mission-Centric Analysis

Mission engineering focuses on understanding how systems contribute to mission outcomes within complex operational environments. Through mission thread analysis, mission engineers examine how capabilities interact within operational scenarios, identifying dependencies and capability gaps (Dahmann & Parasidis, 2024; DoW, 2023). Mission engineering provides a valuable framework for aligning acquisition decisions with operational objectives through capability trade analysis (Paulo & Beery, 2019).

However, practical implementation within acquisition processes requires structured mechanisms for capturing stakeholder insights and integrating readiness assessments across multiple domains. Without such mechanisms, mission engineering insights may remain disconnected from everyday acquisition decision processes.

Conceptual Model: The Integrated Digital Maturity Pathway

Building on these foundations, this research introduces the Integrated Digital Maturity Pathway (IDMP) as a framework integrating user perspectives, maturity assessments, and digital analytics into a unified decision-support approach. The framework incorporates three primary components: (1) structured user stories as the mechanism for capturing acquisition stakeholder perspectives; (2) maturity pathways organizing insights into developmental stages reflecting increasing readiness across technological, manufacturing, integration, and organizational dimensions; and (3) AI-enabled analysis leveraging data analytics to enhance user story interpretation and readiness indicator assessment.

Research Methodology

This ongoing study employs the IDMP framework to elicit and analyze operational user stories within a defense acquisition context. The research is funded R&E through SERC and is being conducted through the Center for Mission Engineering (CME) at Old Dominion University.

User stories are being developed through structured stakeholder engagement and are defined using a standardized format capturing role, capability need, and mission outcome. Each user story is further annotated with contextual attributes, including stakeholder perspective (e.g., contractor, government), triggering conditions (e.g., milestone-driven events), and environmental constraints such as technical data rights and security considerations.

The user stories are decomposed using a four-element analytical structure consisting of Current State, Issues/Frictions, Capabilities Needed, and Objectives. This structure enables systematic identification of gaps between existing conditions and desired outcomes.

To support deeper analysis, the study incorporates a prototype AI-enabled tool which operationalizes the IDMP framework by transforming structured user story inputs into maturity-level assessments and readiness insights. A human-in-the-loop validation process is used to review and refine AI-generated outputs.

Workshop Method

The primary qualitative data sources are a series of SERC-funded stakeholder engagement sessions involving participants from government and industry. The research team has conducted two kick-off meetings and two structured workshops to date, with one additional



workshop, an IDMP AI/ML prototype demonstration session, and a stakeholder survey remaining in the research plan.

Workshops are designed as structured elicitation sessions in which participants articulate challenges when implementing acquisition transformation initiatives. Facilitated discussions guide participants through prompts related to mission alignment, portfolio management, readiness assessment, and digital transformation. The primary purpose is to surface operational user stories capturing stakeholder perspectives on practical acquisition challenges rather than policy interpretation alone.

User Story Development

Narratives from workshops are structured using the standardized format: “As a [role], I need [capability], so that [mission outcome].” This format provides a concise mechanism for capturing the relationship between stakeholder roles, required capabilities, and mission outcomes (Cohn, 2004). Once documented, user stories are organized into thematic categories—portfolio decision-making, mission alignment, readiness assessment, digital data availability, workforce capability, and industrial base capacity and mapped to IDMP maturity levels.

Survey

A supplementary survey instrument will expand the dataset by capturing additional perspectives on readiness barriers, decision bottlenecks, workforce needs, and digital transformation gaps. Survey results will be analyzed alongside workshop data to validate emerging themes and reinforce the operational insights captured through user story development.

AI and Machine Learning Component

An exploratory AI/ML component examines how advanced analytics can enhance user story interpretation. Techniques include pattern recognition to identify recurring themes, story clustering to group similar narratives by shared characteristics, and readiness classification mapping user stories to IDMP maturity levels. The primary purpose is to improve the clarity, consistency, and scalability of user story analysis while maintaining a human-in-the-loop approach ensuring machine-generated insights are validated by subject-matter experts (Lavin et al., 2022).

Results and Findings

The following preliminary findings are based on data collected through the first two workshops and two kick-off sessions. Additional data collection through the remaining workshop, prototype demonstration, and stakeholder survey will further validate and extend these results.

Operational User Story Examples

Two operational user stories selected by stakeholders during workshop engagement illustrate the IDMP framework’s analytical structure. These stories were refined through iterative dialogue with government and industry participants. Notably, neither user story explicitly references mission engineering. However, as the analysis demonstrates, both are deeply embedded in mission engineering concerns reflecting the reality that practitioners experience mission engineering challenges through the lens of their operational roles rather than formal mission engineering terminology.

- **Operational User Story 1 (Design and Prototyping).** As a contractor engineer supporting a government acquisition program, I want AI-assisted 3D model design disclosure capabilities that allow me to securely share controlled model releases with my acquisition



customer, so that the customer can review the design, interact with the model where appropriate, and provide feedback earlier in the development cycle with less latency than traditional stove-piped IT systems or paper-based design exchanges.

- **Operational User Story 2 (Secure Design Disclosure).** As a design engineer working in an EMD or low-rate production environment, I want to rapidly design lightweight parts and generate high-fidelity prototypes using validated CAD models and digital twin data, so that I can conduct fit checks, manufacturing assessments, and readiness demonstrations earlier and with greater confidence in the design and production feasibility.

Implied Mission Engineering Themes

Although neither user story invokes mission engineering by name, both articulate challenges central to the mission engineering enterprise. The DoW's Mission Engineering Guide defines mission engineering as "an interdisciplinary process encompassing the entire technical effort to analyze, design, and integrate current and emerging operational needs and capabilities to achieve desired mission outcomes" (DoW, 2023). Four implied mission engineering themes emerge from the analysis.

- **Theme 1: Mission Thread Readiness and System-of-Systems Verification.** User Story 1 centers on early fit checks, manufacturing assessments, and readiness demonstrations activities that directly support mission thread analysis. In mission engineering, a mission thread traces the end-to-end chain of systems, functions, and interfaces required to execute an operational mission (DoW, 2023; Dahmann & Parasidis, 2024). A component that fails a fit check or proves infeasible for production introduces a gap in the mission engineering thread, potentially degrading the broader system-of-systems capability. Digital twin validation, in this context, functions as mission architecture modeling at the component level verifying that a designed element will perform its intended function within the operational SoS.
- **Theme 2: Mission-Centric Data Continuity and Interoperability.** User Story 2 addresses data fragmentation across the acquisition enterprise. The contractor's need for secure, AI-assisted design disclosure reflects a mission engineering imperative: maintaining the integrity of authoritative engineering data as it moves between stakeholders who must collectively assess how a design element fits within a mission architecture. The "stove-piped IT systems" described in the user story represent breakdowns in what mission engineering requires continuous, traceable data flows across organizational boundaries (SERC, 2023). IRLs assess interface maturity between system elements (Sausser et al., 2009), and User Story 2 describes a friction point at precisely this contractor–government interface.
- **Theme 3: Accelerated Mission Capability Delivery.** Both user stories emphasize earlier engagement and reduced latency values aligned with the 2025 Acquisition Transformation Strategy's mandate to field technology at a rate that outpaces adversaries (DoW, 2025a). User Story 1 pursues this through high-fidelity prototyping enabling earlier readiness demonstrations; User Story 2 through interactive digital review capabilities replacing sequential, document-based exchanges. Both seek to shorten the timeline between engineering decisions and demonstrated mission capability.
- **Theme 4: Cross-Domain Readiness Integration.** User Story 1 operates at the intersection of TRL and MRL validating both design integrity and production feasibility simultaneously. This cross-domain assessment is precisely what mission engineering requires: understanding how readiness in one domain affects readiness in others and, ultimately, mission outcomes (Sausser et al., 2009; See, 2021). User Story 2 introduces IRL by addressing the maturity of the contractor–government interface for exchanging



controlled technical data. The embedded data rights considerations further illustrate how non-technical readiness factors legal, contractual, and security intersect with engineering readiness to shape mission outcomes.

IDMP-Structured Analysis with Mission Engineering Mapping

Table 1 presents the IDMP-structured decomposition of both user stories, extended to include the implied mission engineering themes identified above.

Table 1. IDMP-Structured Operational User Story Analysis

Element	User Story 1: Design and Prototyping	User Story 2: Secure Design Disclosure
Perspective	Contractor / Design Engineer	Contractor Engineer (Prime ↔ Government Interface)
Trigger	Need for early validation during EMD / LRIP phases	Milestone-driven design review and data exchange requirements
Current State	Sequential prototyping, limited digital twin integration, delayed manufacturability insights	Fragmented data-sharing environments, reliance on static artifacts, limited real-time collaboration
Issues / Frictions	Late discovery of design/manufacturing issues; extended iteration cycles; limited confidence in early-stage designs	Data rights ambiguity; security constraints; latency in feedback loops; restricted model accessibility
Capabilities Needed	Integrated CAD–digital twin ecosystem; rapid prototyping; model validation pipelines; early manufacturability assessment	AI-assisted model segmentation and access control; secure model-sharing environments; interactive digital review capabilities
Objectives	Accelerate readiness demonstrations; reduce rework; improve design confidence; compress timelines	Enable early stakeholder engagement; reduce acquisition cycle latency; ensure secure and compliant data exchange
Constraints	Model validation requirements; tooling limitations; production constraints	Data rights frameworks (Unlimited, GPR, Limited, Restricted); classification and cybersecurity requirements
Incentives	Reduced cost and schedule risk; improved production readiness	Faster decision-making; improved collaboration; reduced program risk
Implied ME Themes	Mission thread readiness (component validation supports SoS integrity); cross-domain readiness (TRL–MRL intersection); accelerated mission capability delivery	Mission-centric data continuity (secure data flows across organizational boundaries); integration readiness (IRL at contractor–government interface); accelerated mission capability delivery



The analysis incorporates contextual considerations including technical data rights frameworks, formal design reviews as controlled mechanisms for model disclosure, and emerging practices such as interactive digital twin-based design review under applicable cybersecurity and classification requirements.

Cross-Cutting Themes

Synthesizing the mission engineering analysis alongside broader workshop data, three dominant themes emerge:

- **Decision Latency.** Participants described delays caused by the absence of integrated readiness data. Both user stories reflect this: User Story 1 through extended iteration cycles from sequential prototyping, User Story 2 through feedback latency from stove-piped exchange processes.
- **Data Fragmentation.** Relevant data regarding technology maturity, manufacturing capability, integration readiness, and workforce capacity exist within multiple independent systems. User Story 2 directly articulates this challenge fragmented data-sharing environments prevent real-time collaboration across the contractor–government boundary.
- **Mission Traceability Gaps.** Acquisition frameworks emphasize program-level metrics—cost, schedule, and technical performance without clearly linking them to mission outcomes. The mission engineering analysis reveals that both user stories, though framed as engineering workflow improvements, ultimately serve the mission engineering objective of connecting system-level performance to mission-level outcomes.

IDMP Model Refinement

The themes and mission engineering analysis provided input for refining the IDMP model into five maturity levels:

1. **Initial:** Acquisition activities are program-centric with independent readiness assessments and reactive, manual decision-making.
2. **Managed:** Structured processes emerge for capturing readiness indicators and coordinating across portfolio programs, though analytical tools remain limited.
3. **Defined:** Formal mechanisms integrate readiness data across technical domains and link assessments to mission objectives, with improved visibility into capability dependencies.
4. **Quantitatively Managed:** Digital tools and data analytics support quantitative evaluation of readiness indicators, enabling trend analysis, systemic gap identification, and scenario-based evaluations.
5. **Optimized:** A fully integrated digital acquisition environment where readiness indicators, mission engineering analysis, and portfolio decision frameworks operate within a unified analytical ecosystem, supported by AI-enabled predictive analysis and continuous improvement.

Both user stories correspond to challenges at the Managed-to-Defined transition User Story 1 through readiness assessments lacking integration across the design–manufacturing boundary, User Story 2 through structured but fragmented data exchange processes. This convergence suggests organizations are actively seeking mechanisms to integrate readiness data and improve mission traceability.



AI-Enabled Analysis

Clustering analysis reveals distinct user story categories associated with portfolio governance, readiness assessment, digital data integration, and mission engineering support. AI tools have identified capability gaps where stakeholders consistently expressed unmet needs related to readiness visibility, mission traceability, and decision-support tools. Notably, the AI-enabled analysis surfaced the implicit mission engineering themes in both user stories themes not immediately apparent from practitioner-framed narratives but visible through pattern recognition across the broader workshop data corpus.

Decision Support Outputs

The framework produces three key decision-support capabilities: (1) portfolio prioritization through mapping user stories and readiness indicators across capability portfolios; (2) mission alignment by linking readiness indicators to mission engineering analyses; and (3) risk trade analysis integrating readiness indicators across technical, manufacturing, integration, and workforce domains.

IDMP User Story Canvas: A Practitioner-Ready Digital Tool

To operationalize the IDMP framework for practitioner use, the research team developed the IDMP User Story Canvas: an interactive web-based application providing acquisition stakeholders with a structured digital environment for creating, analyzing, and validating user stories within the IDMP maturity framework.

A prototype application was developed using a prompt-driven architecture to demonstrate the operationalization of the IDMP framework. The prototype ingests structured user story data, including contextual attributes such as perspective and triggers, and applies AI-assisted processing to generate higher-order maturity level inferences.

The system functions as a translation layer, converting narrative user inputs into structured readiness outputs aligned with acquisition and mission engineering constructs. Outputs include inferred maturity levels, capability gaps, and decision-support insights.

Importantly, the prototype incorporates a human-in-the-loop (HITL) validation step to ensure that AI-generated recommendations remain contextually accurate and aligned with domain expertise. This approach supports a hybrid analytical model that combines computational efficiency with expert judgment.

The application implements the IDMP framework through several integrated components:

User Story Capture. Figure 1 depicts the tool supports both mission-level user stories (“As a [enterprise/organization], I want [outcome], so that [value]”) and operational-level user stories (“As a [role], I want [action], so that [result]”). Users select a perspective (Government or Industry), a story trigger (e.g., Risk Threshold, Audit Finding, Mission Gap), and a target maturity level (L1 Initial through L5 Optimizing), along with constraints and incentives that contextualize the operational environment.



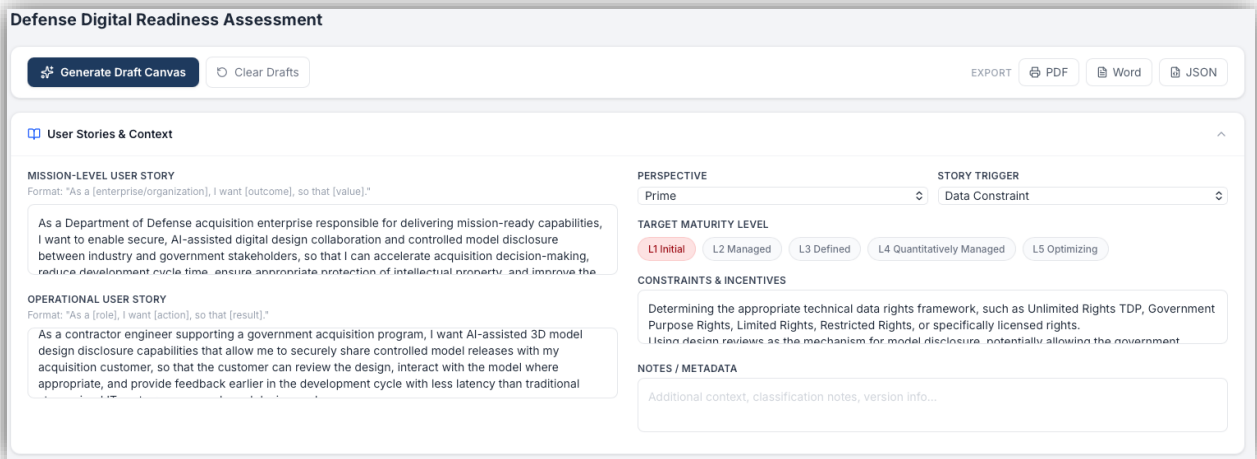


Figure 1. IDMP Tool User Story Capture

Readiness Canvas. Figure 2 (below) depicts the core analytical component is a six-dimension by four-element matrix (24 cells) that structures readiness assessment across: Capability (what can we do today?), Evidence (what evidence exists?), AI Role (what AI is currently used?), Human Role (how are humans deciding and overseeing?), Risk (what risks are exposed?), and Time (how long do decisions take?). For each dimension, four elements are assessed: Current State, Issues, Capabilities, and Objectives. This structured canvas directly operationalizes the multi-dimensional readiness assessment central to the IDMP framework.

DIMENSION	Current State	Issues	Capabilities	Objectives
Capability	What can we actually do today? Current capability posture is reactive and undocumented from a prime contractor integration and delivery perspective. The Department of Defens...	Where does capability fail, break, or not scale? Capability gaps exist where fragmented and ad hoc processes prevent consistent execution of to enable secure. Cross...	What tools, processes, skills, or resources enable execution? Existing enablers include inconsistent, individually dependent tools and process assets. The contractor engineer supporting a government acquisition progra...	What capability must be strengthened or matured? Target capability maturity requires advancing from the current fragmented and ad hoc state to a posture that fully supports to enable secure. The contractor...
Evidence	What evidence exists today? Evidence availability is reactive and undocumented. Current artifacts, metrics, and data records are fragmented and ad hoc, limiting the confidence of...	Where is evidence weak, missing, outdated, or unreliable? Evidence gaps are most pronounced where data is fragmented and ad hoc or missing. Audit trails for key decisions lack sufficient...	What evidence pipelines, measures, or artifacts are available? Available evidence pipelines include inconsistent, individually dependent data collection mechanisms. Some measures and artifacts are in place but covera...	What evidence quality or traceability must improve? Improve evidence quality and traceability to directly support to enable secure. The contractor engineer supporting a government acquisition program must...
AI Role	What AI is currently being used, if any? AI utilization is currently reactive and undocumented from a prime contractor integration and delivery perspective. Limited AI tools are deployed and their...	Where does AI mislead, underperform, or lack trust? AI limitations include fragmented and ad hoc model governance and inconsistent trust frameworks. constrained by data quality or...	What AI functions reliably augment analysis or decisions? Functional AI capabilities include inconsistent, individually dependent analytical tools and decision-support mechanisms. Where deployed, AI reliably...	How should AI support evolve to improve readiness and decision quality? AI support should evolve to deliver inconsistent, individually dependent augmentation aligned with to enable secure. The contractor engineer supporting a...
Human Role	How are humans currently compensating, deciding, or overseeing? Human decision-making is reactive and undocumented from a prime contractor integration and delivery perspective. The contractor engineer...	Where is human authority unclear, overloaded, or inconsistent? Human authority boundaries are fragmented and ad hoc and roles may be ambiguous or overloaded. constrained by data quality or...	What human expertise, review processes, or decision roles are formalized? Formalized human expertise includes inconsistent, individually dependent review processes and established decision roles. The contractor engineer...	What human roles need clarification, support, or strengthening? Clarify and strengthen human roles to ensure to enable secure is achieved with accountability. The contractor engineer supporting a government acquisition progra...
Risk	What risks are currently exposed? Current risk exposure is reactive and undocumented from a prime contractor integration and delivery perspective. Known risks associated with to enable...	Where are risks unmanaged, underestimated, or poorly tracked? Unmanaged or underestimated risks exist where fragmented and ad hoc processes fail to capture emerging threats. constrained by...	What controls, mitigations, or oversight mechanisms are in place? Risk management mechanisms include inconsistent, individually dependent controls and oversight structures. Existing mitigations address known hazar...	What risks should be reduced, monitored, or anticipated earlier? Advance risk management to enable proactive identification and earlier intervention for to enable secure. Establish inconsistent, individually dependent...
Time	How long does response, action, or decision-making currently take? Decision and response cycle times are reactive and undocumented from a prime contractor integration and delivery perspective. Current timelines to execut...	Where do delays create harm, rework, or lost opportunity? Time delays create harm or lost opportunity where fragmented and ad hoc coordination and approval chains extend cycle times...	What currently shortens cycle time or improves responsiveness? Existing mechanisms that shorten cycle time include inconsistent, individually dependent workflows and decision support tools. Where applied, these reduce...	How should response time, decision speed, or implementation pace improve? Improve decision speed and implementation pace to support to enable secure within required timelines. The contractor engineer supporting a government...

Figure 2. Readiness Canvas for User Story # 1 for Level 1 Maturity

Summary Outputs. Figure 3 depicts the operational features that include decisions, training recommendations, and implementation plans based on completed canvas data. It supports export to PDF, Word, and JSON formats for integration with existing acquisition documentation workflows.



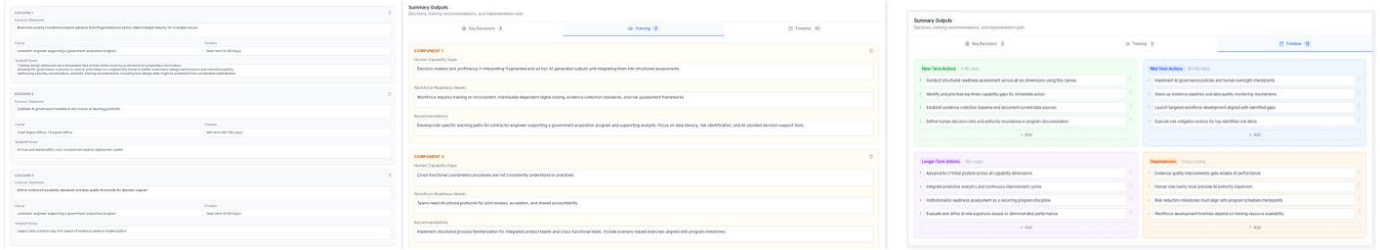


Figure 3. Operational Features—Decisions, Training, and Timeline

This digital tool represents a key contribution of the research by translating the conceptual IDMP framework into a practitioner-ready instrument that acquisition professionals can use in portfolio reviews, strategy sessions, and workforce development activities.

Six Dimensions of the Readiness Canvas

The IDMP Readiness Canvas organizes assessment across six dimensions, each addressing a critical facet of acquisition readiness. Together with four assessment elements (Current State, Issues, Capabilities, and Objectives), these dimensions form a 24-cell assessment matrix that provides comprehensive readiness coverage:

- **Capability (“Can we do it?”)**. This dimension assesses the organization’s current ability to execute acquisition activities. It examines what can be done today, where capability fails or does not scale, what tools and processes enable execution, and what capabilities must be strengthened or matured. Capability assessment directly supports PAE portfolio evaluations by providing structured visibility into executable capacity across programs.
- **Evidence (“What proof exists?”)**. This dimension evaluates the quality, availability, and traceability of evidence supporting acquisition decisions. It examines what evidence exists today, where evidence is weak or unreliable, what evidence pipelines and measures are available, and what evidence quality must improve. Evidence assessment supports the Acquisition Transformation Strategy’s emphasis on data-driven decision-making by ensuring that readiness claims are substantiated by verifiable data.
- **AI Role (“How does AI help?”)**. This dimension captures the current and planned use of artificial intelligence within acquisition processes. It assesses what AI is currently being used, where AI misleads or lacks trust, what AI functions reliably augment decisions, and how AI support should evolve. This dimension is particularly relevant as the Acquisition Transformation Strategy emphasizes using AI to reduce administrative burden and accelerate decision-making (DoW, 2025a).
- **Human Role (“Where must humans decide?”)**. This dimension examines how human judgment, authority, and oversight operate within acquisition environments. It evaluates how humans currently compensate and decide, where human authority is unclear or overloaded, what human expertise and review processes are formalized, and what human roles need clarification or strengthening. This dimension ensures that AI-augmented processes maintain appropriate human-in-the-loop governance, consistent with responsible AI principles in defense decision-support contexts (Hare et al., 2022; Preece et al., 2020).
- **Risk (“What could go wrong?”)**. This dimension assesses the risk landscape across acquisition portfolios. It examines what risks are currently exposed, where risks are unmanaged or underestimated, what controls and mitigations are in place, and what risks should be anticipated earlier. The risk dimension incorporates considerations



aligned with the DoW Risk Management Framework (DoWI 8510.01) and Joint Risk Analysis standards, providing structured risk visibility for portfolio-level decision-making.

- Time (“How fast?”)**. This dimension evaluates the temporal aspects of acquisition decision-making and execution. It assesses how long response and decision-making currently take, where delays create harm or lost opportunity, what currently shortens cycle time, and how response time should improve. Time assessment directly supports the Acquisition Transformation Strategy’s emphasis on speed, addressing the critical need to deliver capabilities at the pace required by modern operational environments (DoW, 2025a).

Each cell in the 24-cell matrix includes a guiding question that varies by the selected maturity level (L1 through L5), an AI-generated draft response drawn from evidence sources, a human-validated response, a confidence score, source references with provenance tracking, identified gaps, and a validation status progressing from draft to validated. This per-cell structure ensures that every assessment is traceable, evidence-based, and subject to human oversight.

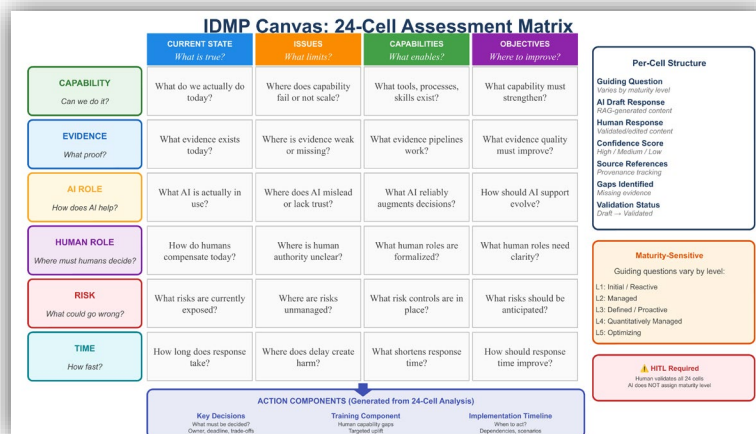


Figure 4. IDMP Canvas: 24-Cell Assessment Matrix

The canvas also generates three action components from the completed 24-cell analysis: Key Decisions (what must be decided, including owners, deadlines, and trade-offs), a Training Component (identifying human capability gaps and targeted uplift needs), and an Implementation Timeline (establishing when to act, with dependencies and scenarios).

AI Processing Pipeline: From Context to Evidence

The IDMP User Story Canvas is supported by a multi-stage AI processing pipeline that transforms user-created inputs into structured, evidence-based readiness assessments. The pipeline architecture reflects the research team’s approach to integrating retrieval-augmented generation (RAG), orchestrated multi-actor processing, and continuous learning within a human-in-the-loop framework.

Input Layer: Context Header. The pipeline begins with human-created inputs captured through the canvas interface. These inputs include the mission-level and operational-level user stories, the selected perspective (Government, Prime Contractor, Vendor, Test/Evaluation, or Sustainment), the story trigger (Milestone, Risk Threshold, AI Anomaly, or Data Constraint), and the target maturity level. Together, these inputs define the problem context and scope the subsequent AI analysis.



Context Processing. The input layer feeds into a context processing stage that performs query reframing and context binding. This stage takes the user story, trigger, and maturity level as inputs and produces structured context and dimension-specific queries as outputs. Context processing ensures that downstream retrieval and analysis are precisely scoped to the user’s operational environment and maturity target.

Multiple RAG Models. Structured queries are processed through multiple RAG models that retrieve relevant content from authoritative data sources. These sources include the DoW Digital Engineering Strategy, the DoWI 5000 Series, the Risk Management Framework (RMF), the Mission Engineering Guide v2.0, and industry benchmarks. Each source is indexed using FAISS (Facebook AI Similarity Search) vector stores to enable efficient semantic retrieval. The RAG models contextualize user stories by aligning them with prior cases, benchmarks, and established readiness guidance, producing evidence bundles that ground subsequent analysis in authoritative documentation.

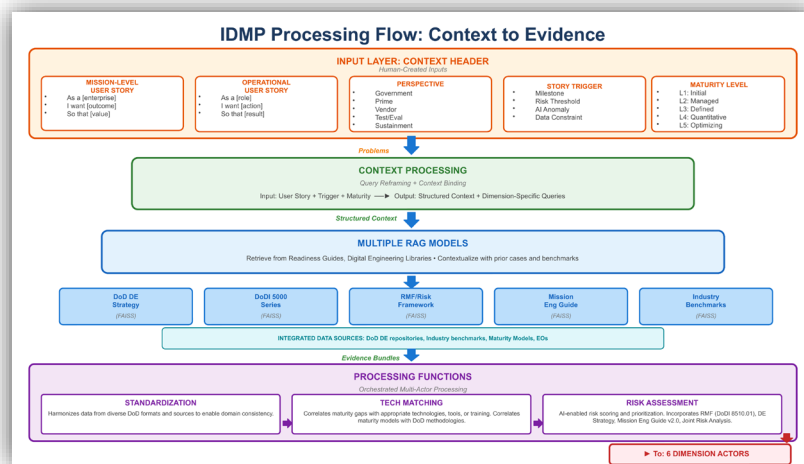


Figure 5. IDMP Processing Flow: Context to Evidence

Orchestrated Processing Functions. Evidence bundles pass through three specialized processing functions operating as orchestrated multi-actor processors:

- **Standardization** harmonizes data from diverse DoW formats and sources to enable domain consistency, ensuring that readiness indicators from different programs and organizations can be meaningfully compared.
- **Tech Matching** correlates maturity gaps with appropriate technologies, tools, or training, and aligns maturity models with DoW methodologies to identify pathways for capability improvement.
- **Risk Assessment** performs AI-enabled risk scoring and prioritization, incorporating the RMF (DoWI 8510.01), Digital Engineering Strategy, Mission Engineering Guide v2.0, and Joint Risk Analysis standards to provide contextualized risk evaluation.

Six Dimension Actors. Processing function outputs are distributed to six specialized dimension actors, one for each readiness dimension (Capability, Evidence, AI Role, Human Role, Risk, and Time). Each actor generates draft responses for the four assessment elements within its dimension, producing the initial content for the 24-cell canvas matrix.

Output Layer: Decision Support and Adaptive Insights. The pipeline produces a comprehensive set of decision-support outputs including digital maturity insights, intelligent recommendations, predictive analytics and scenario forecasts, knowledge graph and reasoning



summaries, risk intelligence dashboards, technology alignment maps, IDMP Canvas updates, and HITL feedback channels. These outputs are designed to provide acquisition professionals with actionable, evidence-based decision support that integrates multiple analytical perspectives.

Continuous Learning and Feedback Loop. The architecture incorporates a continuous learning mechanism that feeds outcomes back into the system. This includes HITL validation results, model retraining and optimization data, user story evolution tracking, knowledge graph expansion, decision outcome tracking, and governance and oversight updates. This feedback loop ensures that the system improves over time as more user stories are processed and validated, creating an increasingly robust knowledge base for acquisition decision support.

Discussion

The preliminary findings suggest that the IDMP framework addresses a meaningful gap in current acquisition decision-support capabilities. By combining structured user stories with integrated maturity assessments and AI-enabled analysis, the framework provides a mechanism for translating policy intent into operational practice.

Several aspects of the results merit further discussion:

- **Integration of Readiness Domains.** The IDMP framework's ability to synthesize readiness indicators across multiple domains—technology, manufacturing, integration, workforce, and organizational addresses a persistent limitation of existing readiness models. By structuring assessment within a unified maturity pathway, the framework provides portfolio leaders with a more comprehensive view of capability readiness than any single readiness model can provide independently (Sausser et al., 2009; See, 2021).
- **User Stories as Decision Artifacts.** The research demonstrates that user stories can function as more than requirements documentation. When structured within the IDMP framework and enriched through AI-enabled analysis, user stories become analytical artifacts that inform maturity assessment, capability gap analysis, and portfolio prioritization. This extends the traditional application of user stories beyond agile software development into complex defense acquisition environments (Sporse et al., 2025).
- **AI-Enhanced Analysis with Human Oversight.** The AI/ML component's ability to identify patterns, cluster related stories, and assess readiness conditions demonstrates the potential for machine-assisted analysis in acquisition decision-making. Importantly, the human-in-the-loop approach ensures that AI-generated insights are validated by subject-matter experts, maintaining the trust and accountability necessary for high-stakes defense decisions (Hare et al., 2022; Preece et al., 2020).
- **Practitioner Readiness.** The IDMP User Story Canvas translates the conceptual framework into a practical tool that acquisition professionals can use within existing workflows. The structured 24-cell assessment matrix provides a repeatable methodology for readiness evaluation, while the AI processing pipeline automates analytical steps that would otherwise require significant manual effort.
- **AI-Enabled Analysis.** AI-enabled analysis has improved the consistency of readiness classification and the identification of cross-cutting themes across stakeholder groups. The combination of clustering, pattern recognition, and maturity scoring demonstrates the potential for AI to augment, but not replace, expert judgment in acquisition decision-support.



Limitations and Future Research

As this research is ongoing with data collection continuing through September 2026, several preliminary limitations should be acknowledged.

The sample of workshop and survey participants, while diverse, does not represent the full breadth of the defense acquisition enterprise. Workshop scope is constrained to the specific acquisition transformation topics addressed in facilitated sessions and may not capture all relevant dimensions of stakeholder experience. The AI-enabled analysis is currently exploratory, and further validation is needed to assess the reliability and generalizability of AI-generated readiness classifications across broader acquisition contexts.

Future research should expand the stakeholder base to include small to medium businesses, additional acquisition organizations and operational commands, refine the IDMP maturity levels through broader empirical validation, and evaluate the framework's effectiveness in supporting actual portfolio-level acquisition decisions. The integration of additional AI capabilities including predictive analytics and natural language processing for automated user story quality assessment represents a promising direction for enhancing the framework's analytical power.

Conclusion

This ongoing research demonstrates that the IDMP framework provides a mechanism for operationalizing acquisition transformation through structured user stories, integrated maturity assessment, and AI-enabled analysis. The framework addresses a persistent gap between policy objectives and practical decision-support capabilities by providing acquisition leaders with a repeatable methodology for assessing readiness across multiple domains.

Key contributions include: a validated approach for developing and analyzing acquisition user stories that capture operational perspectives on transformation challenges; an integrated maturity model that synthesizes readiness indicators across technology, manufacturing, integration, workforce, and organizational dimensions; evidence that AI-enabled analysis can enhance the consistency and depth of user story interpretation; and a practitioner-ready digital tool the IDMP User Story Canvas that translates the conceptual framework into an operational instrument.

With additional workshops, an AI/ML prototype demonstration, and a stakeholder survey planned for the remainder of the performance period, the research team anticipates further refinement and validation of these preliminary findings.

As the DoW continues to implement its acquisition transformation strategy, frameworks such as the IDMP provide a structured approach for ensuring that reform objectives are translated into measurable readiness improvements and actionable decision support. By centering the acquisition process on stakeholder perspectives and integrating multiple readiness dimensions within a unified analytical framework, the IDMP framework contributes to ongoing efforts to accelerate the delivery of capabilities that support national defense objectives.

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