AUTOTESTCON 2024
DoD and NDIA Executive Plenary Session
August 27, 2024

ATS Digital Transformation and the NDIA DE Project Dicscuss Overview

Mr. Patrick Curry - Moderator
US Army Test Measurement and Diagnostic Equipment

- Panel of Government Service representatives from the DoD's ATS technology programs and National Defense Industrial Association's Automatic Test Digital Engineering / Digital Transformation Project Committee representatives.
- The eight-member panel are involved with Digital Engineering transformation in their organization and association with the NDIA DE project.
- The NDIA ATC representatives will summarize the project results addressing Digital Transformation and its relationship to ATS.
- The Government Panel members will provide insights from their perspective on their organization and their interest with DE/DT with respect to the DoD ATS.
- The session will include a Q&A after each of the NDIA Project review and the Government Panel review.

Panel Members

Industry

Ion Neag (Reston Software)
Darcy Smith (Keysight)
Jim Orlet (Boeing)
Tim Stanley (CACI)

Government

Steve Butcher (Army)
Mike Malesich (Navy)
Kevin Simpson (Air Force)
Josselyn Webb (Marine)

Panel Discussions

- Discuss the NDIA System Engineering Automatic Test Committee Project on Digital Engineering and Digital Transformation Project
  - Reminder of the Project Goals – Tim Stanley
  - Update on the Standards - Dr. Ion Neag
  - Update on the Processes/Tools and Project Gaps – Darcy Smith
  - Cybersecurity and ATS – Jim Orlet
  - The ATS/ATE Life Cycle and Digital Transformation – Tim Stanley
  - Conclusions, Recommendations and answering “The 4 Questions” – Tim Stanley

- Government Panel Discussion

  Insights and Interest to DoD ATS
  - Steve Butcher, USA Test Measurement and Diagnostic Equipment
  - Michael Malesich, USN Automatic Test Equipment
  - Kevin Simpson, USAF Automatic Test Systems Division
  - Josselyn Webb, USMC Marine Maintenance Command

NDIA System Engineering
Automatic Test Committee
2023 Joint Industry and DoD Project
Digital Engineering and Digital Transformation

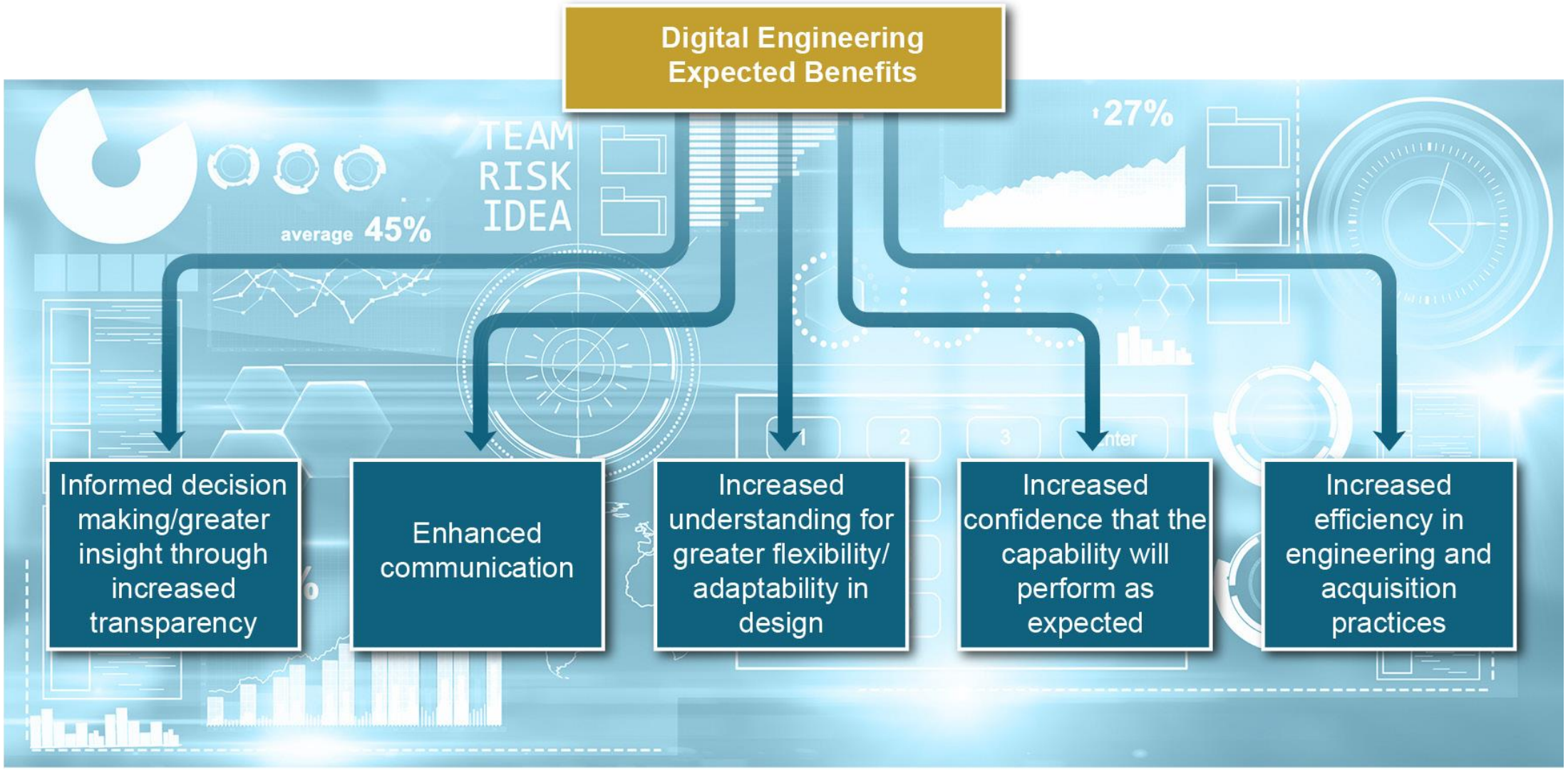
Problem Statement

Driving force behind project was presentation at 2022 ATC Plenary Session

- The DoD and the ATE industry needs faster and less expensive methods to develop, deploy, and sustain automated test solutions. What is industry's ability to delivery digital models (or simulation for its items) (Q1)?
- The DoD Digital Acquisition mandate is pressuring government acquisition organizations to emplace processes that deliver digitally acquired digital products. What is the ability of industry to collaborate in a digital environment (Q2)?
- The industry lacks definition of the digital acquisition process as it relates to ATE and Digital Engineering / Transformation.
- What is the current state of industry to support an ATS Digital Product Model and Acquisition (Q3)?
- What are the insights Industry may provide to support our DoD ATS partners with their Digital Engineering and Acquisition needs (Q4)?

Deliver a document for DoD reference that provides insights into the ATS/ATE Defense Industry's capabilities and potential improvements to support Digital Acquisition and the necessary execution of Digital Engineering and Digital Transformation.

Digital Engineering Expected Benefits



Source: U. S DoD, Digital Engineering Strategy, June 2018

DoD Automated Test Systems (ATS) Goals

- Reduce ATS total ownership cost by minimizing the proliferation of unique test systems and standardizing on designated ATS families.
- Reducing ATS logistics footprint enhancing warfighter's ability to rapidly deploy support in the modern conflict scenarios
- Improving quality of diagnostics and fault isolation reducing time to test, repair and return to service failed systems.
- Creating ATS interoperability/transportability within and across Services.

Note: DoD Automated Test System Executive Directorate Office, 7 Mar 2023; USAF Management Board Chair, Mr. Scot McClain

Project Mission and Goal

- Mission: Provide NDIA with a paper/presentation on where test industry is on this subject

  Provide recommendations to the government on how the ATE industry can support Digital Engineering and Digital Transformation, specifically the process, approaches, models, tools, and standards by which the automated test equipment and test programs are developed, acquired, and maintained through Digital Acquisition.

- Goal: Indicate the state of tools and processes within the Automated Test Industry and the Standards used by this industry, along with expectations from government on Digital Engineering, Digital Transformation, and the Digital Acquisition process.

Help the government understand/gauge industry's response to a digital acquisition using available tools and the standards by which to convey the digital product.

Some Definitions for Common Ground with Project

- Digital Engineering

  Using Under Secretary of Defense for Research and Engineering (https://ac.cto.mil/digital_engineering):

  "Digital engineering is an integrated digital approach using authoritative sources of system data and models as a continuum throughout the development and life of a system. Digital engineering updates traditional systems engineering practices to take advantage of computational technology, modeling, analytics, and data sciences."

- Digital Transformation (varied inputs, all themes from DoD strategy for a fully digital environment and acquisition process)

  Digital transformation is the adoption of digital technology by an organization to digitize non-digital products, services or operations.

- Digital Acquisition (in alignment with adoption of Digital Transformation and providing digitized products)

  Process of using digitally described products, that includes detailed digital models of the products for procurement, sustainment, and management of the product life cycle.

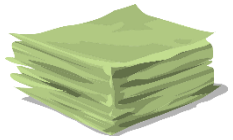
- Model Based System Engineering (MBSE): INCOSE defines MBSE as the formalized application of modeling to support system requirements, design, analysis, verification and validation of activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases.

Digital Engineering Across UUT Life Cycle

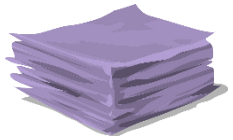
Design | Validation | Production | Sustainment

Current focus

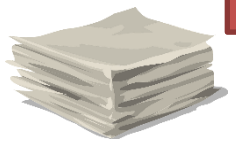
UUT Requirements



DV Test Requirements

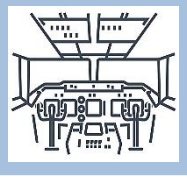


Production Test Requirements

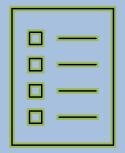


Sustainment Test Requirements

Digital Thread



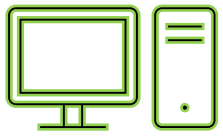
UUT Model



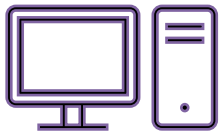
DV Test Requirements Model

Production Test Requirements Model

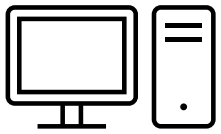
Sustainment Test Requirements Model



DV Tester Model



Production ATS Model



Sustainment ATS Model

"Model" = a digital representation of a physical object (ex. System, subsystem, component)

Standards Update
Dr. Ion Neag
Reston Sofware

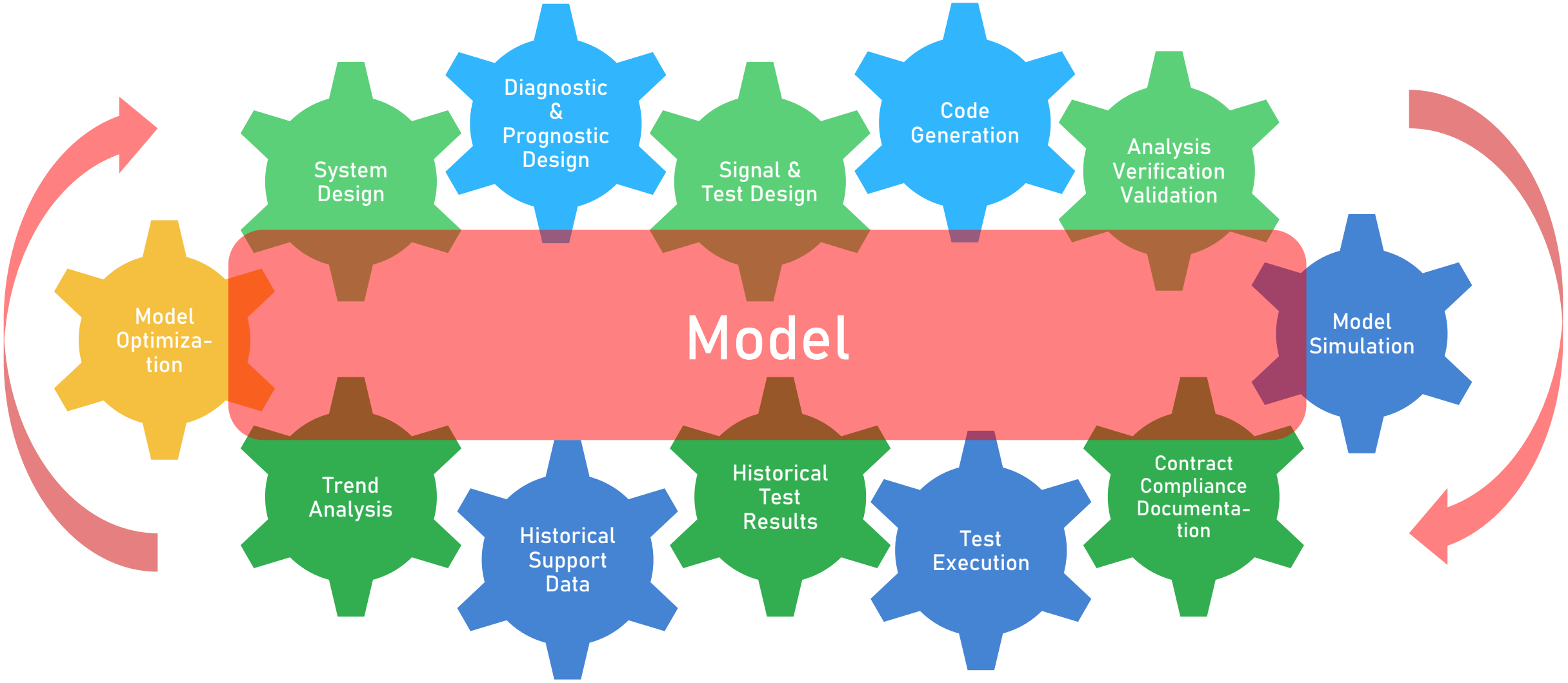
Standards and Tools in Digital Engineering and Digital Transformation

Adoption of standards - essential element of Digital Engineering / Digital Transformation

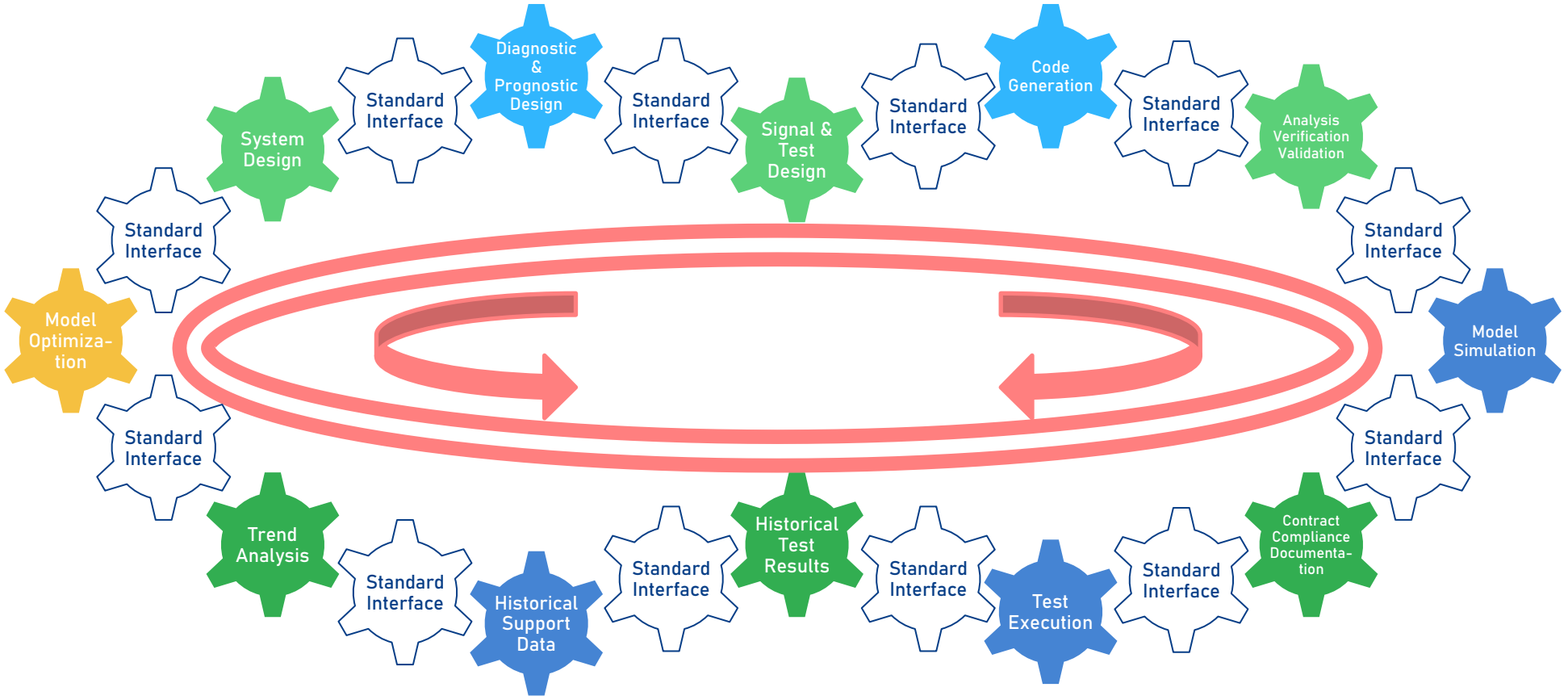
Gaps related to standards & standard-enabled tools

Ongoing and future standardization work to address the gaps

Digital Engineering for ATS



Standards-Based Digital Thread

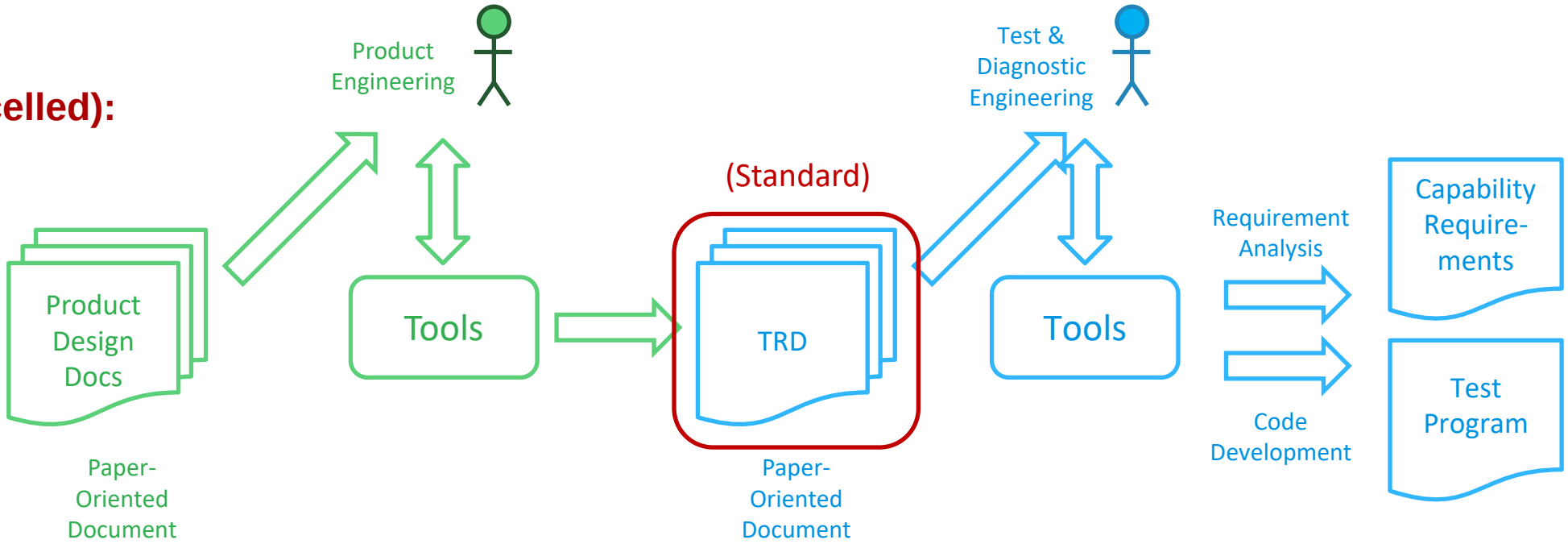


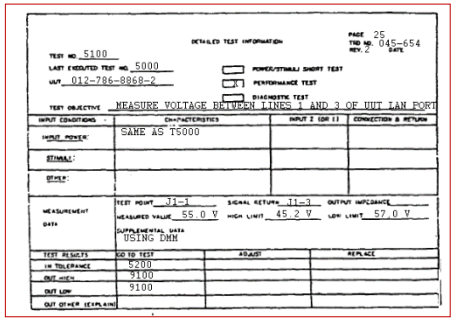
Why Standards?

Transitioning from paper-oriented data…

TRD Standards (cancelled):

- Mil-Std-1345B
- Mil-Std-1519



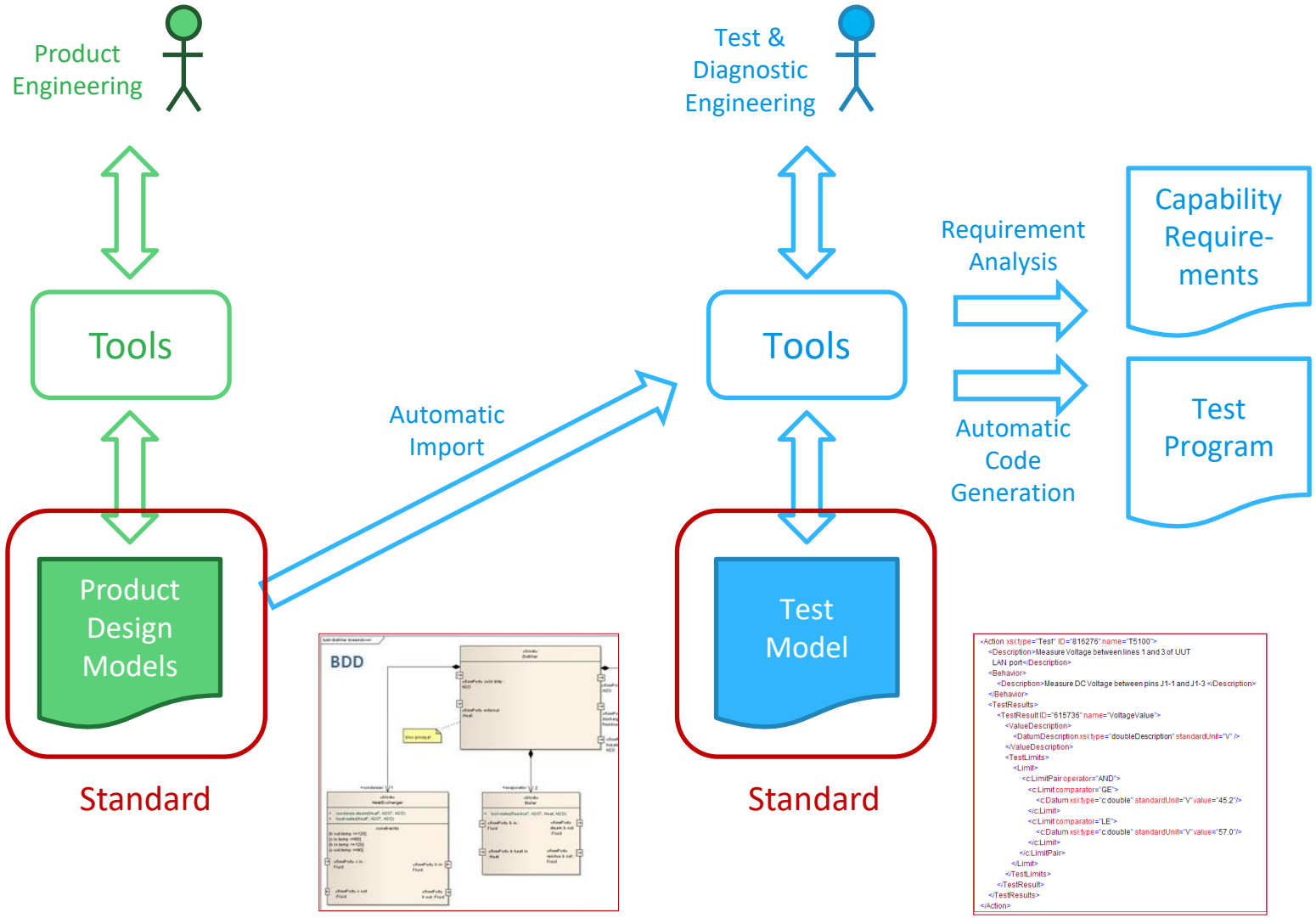


Why Standards?

… to digital models:

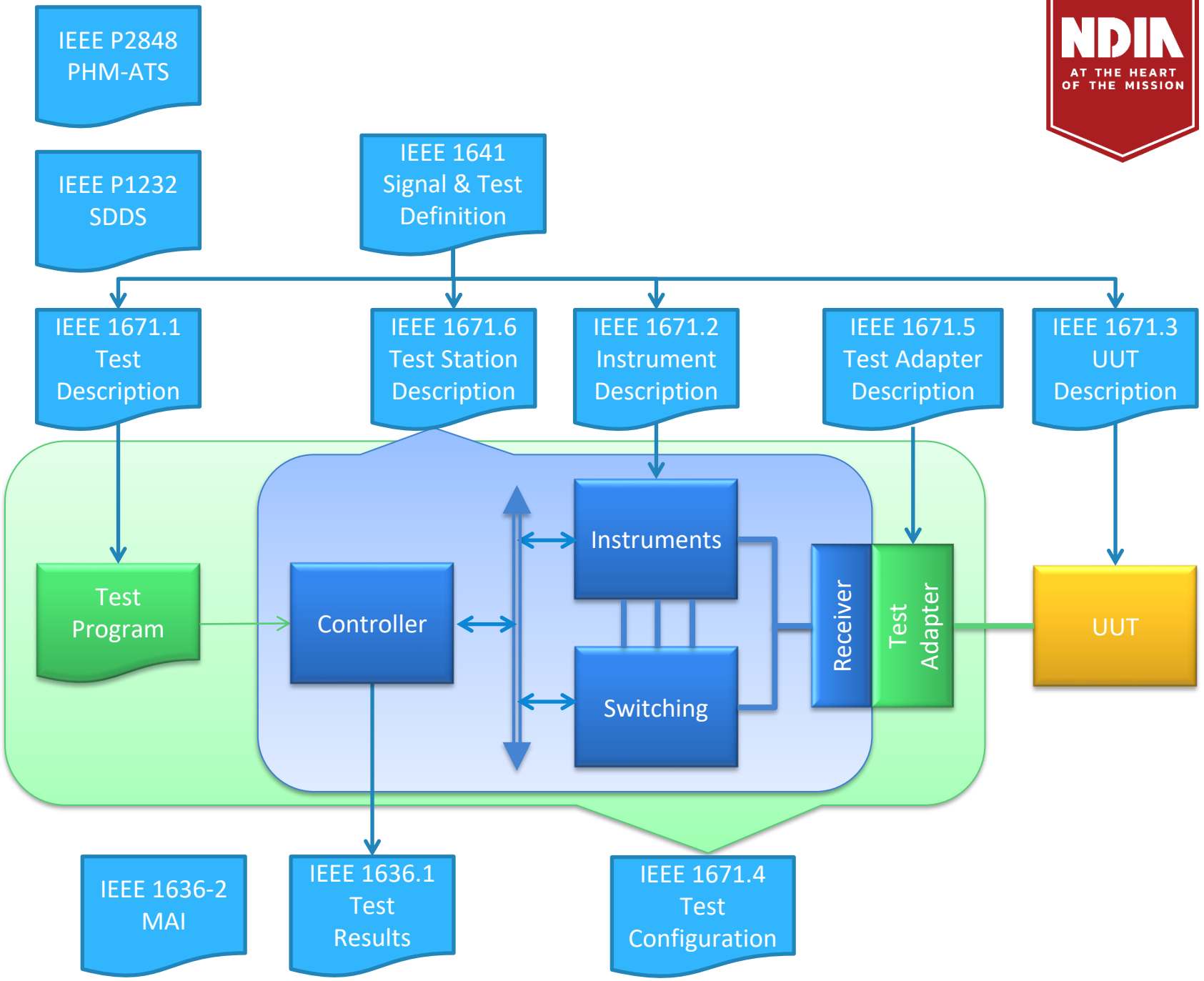
Model data standardization

- Critical for tool **interoperability** (commercial and government-owned tools)
- Obsolete tools can be **replaced**
- Model data can be easily **shared** between government and industry and across services
- Model data can be **maintained** for the lifetime of the product



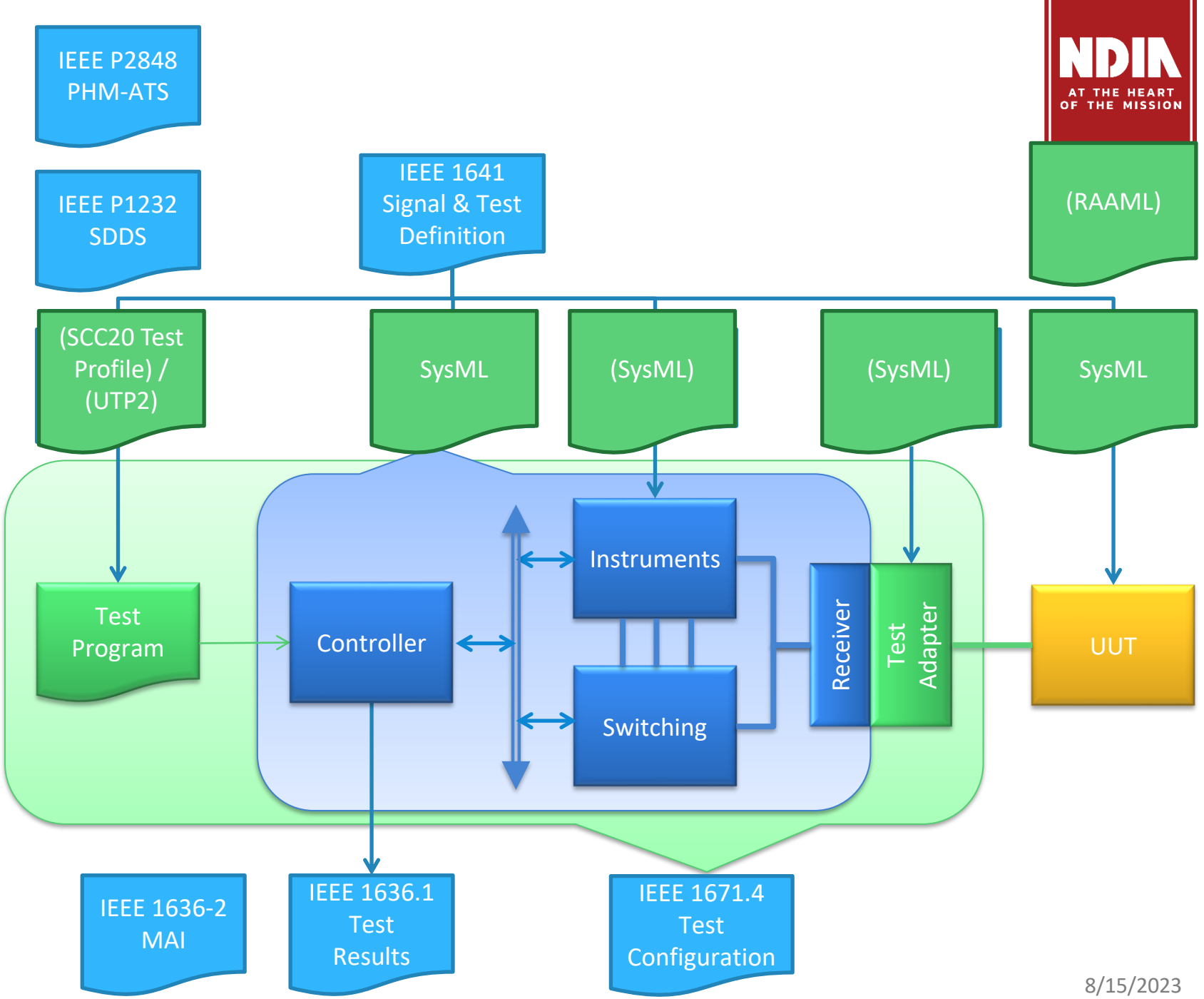
IEEE Standards

- **IEEE 1671 ATML**: Automatic Test Markup language
- **IEEE 1636 SIMICA**: Software Interface for Maintenance Information Collection and Analysis
- **IEEE 1641**: Signal & Test Definition
- **IEEE P1232 SDDS**: System Diagnostic Data and Services (formerly AI-ESTATE) – in development,
- **IEEE P2848 PHM-ATS**: Prognostics and Health Management in Automatic Test Systems – in development

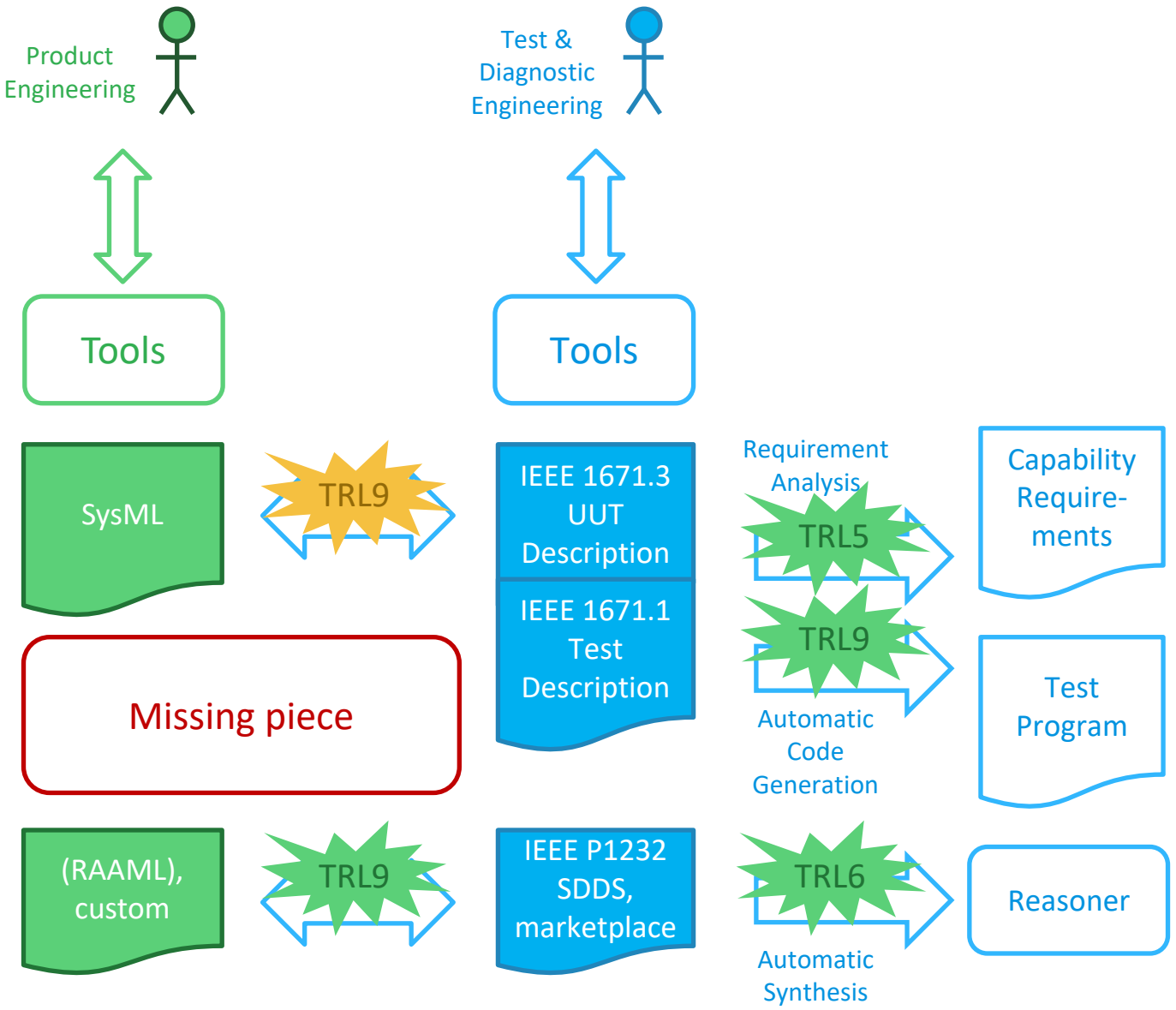


SysML Standards

- **SysML**: Systems Modeling Language
- **RAAML**: Risk Analysis and Assessment Modeling Language
  - FMEA profile
  - FTA Profile
- **UTP2**: UML Testing Profile ver. 2
- **SCC20 Test Profile**: in work, IEEE SCC20 study group



Why SysML and ATML?



Product design domain

- Established modeling languages
- Established tools

ATS domain

- Specialized model features, ex. signals
- Specialized tools
- ATML Workflows exist
- Some SysML - ATML workflows exist

DoD Pre-acquisition Process, Identified Gaps

1. Unified Modeling Tools: There is a notable lack of **unified modeling tools** for the DoD's generation of test-specific information, hindering the efficient development of detailed and **standardized** test requirements.

2. Common Standards and Style Guides: The absence of common style guides, particularly for ATML and SysML, for conveying test-specific information across DoD sustainment programs creates inconsistencies in requirements communication.

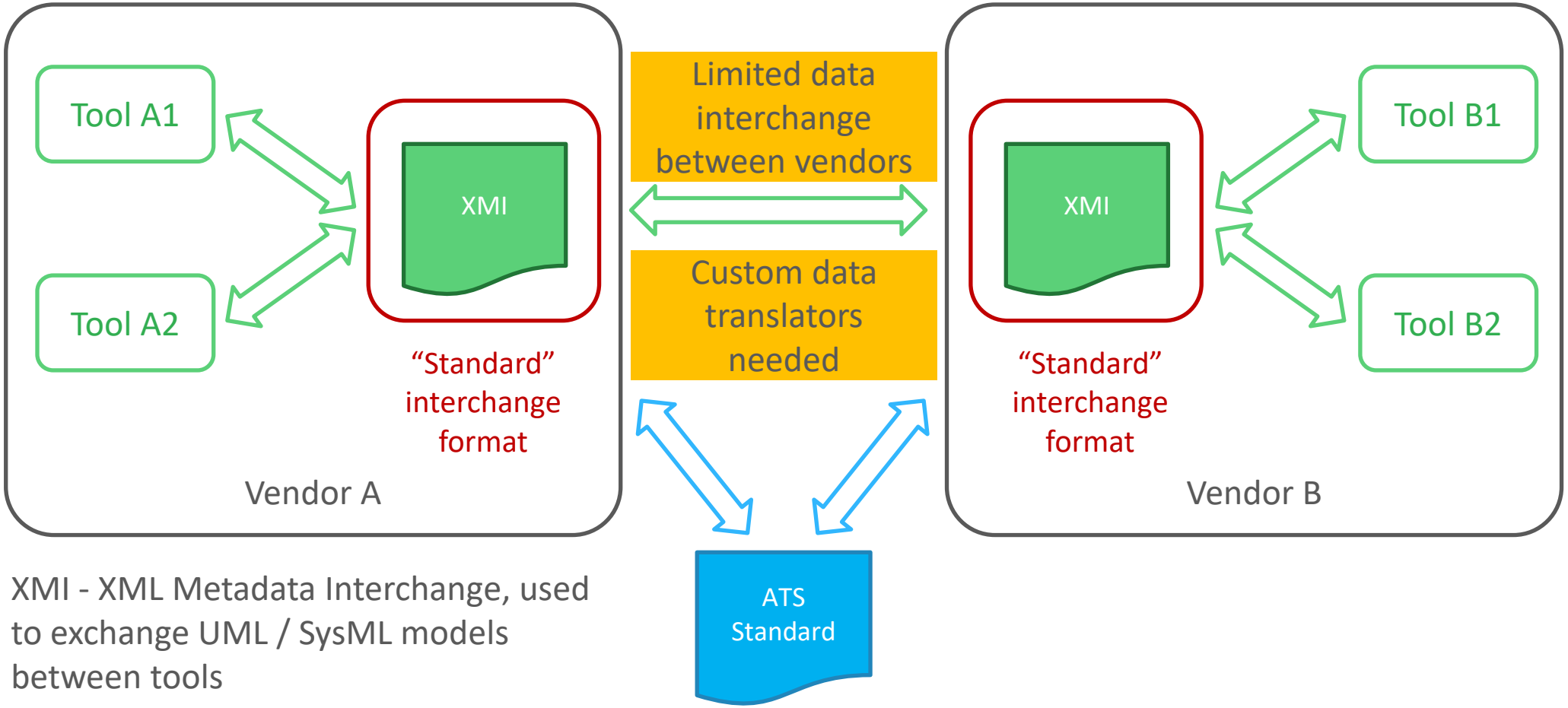
3. Tools for Pre-acquisition Analysis: There is a deficiency in common tools across DoD Services to support pre-acquisition requirements analysis, leading to potential misalignments in understanding and articulating test capabilities.

4. Communication of Test-Capability Requirements: The lack of common style guides for communicating test-capability requirements to the industry as part of an RFP complicates the procurement process.

5. Funding for Existing ATE Models: There is insufficient funding dedicated to creating models of existing ATE, limiting the ability to accurately represent and communicate existing capabilities and requirements.

Unified Tools…

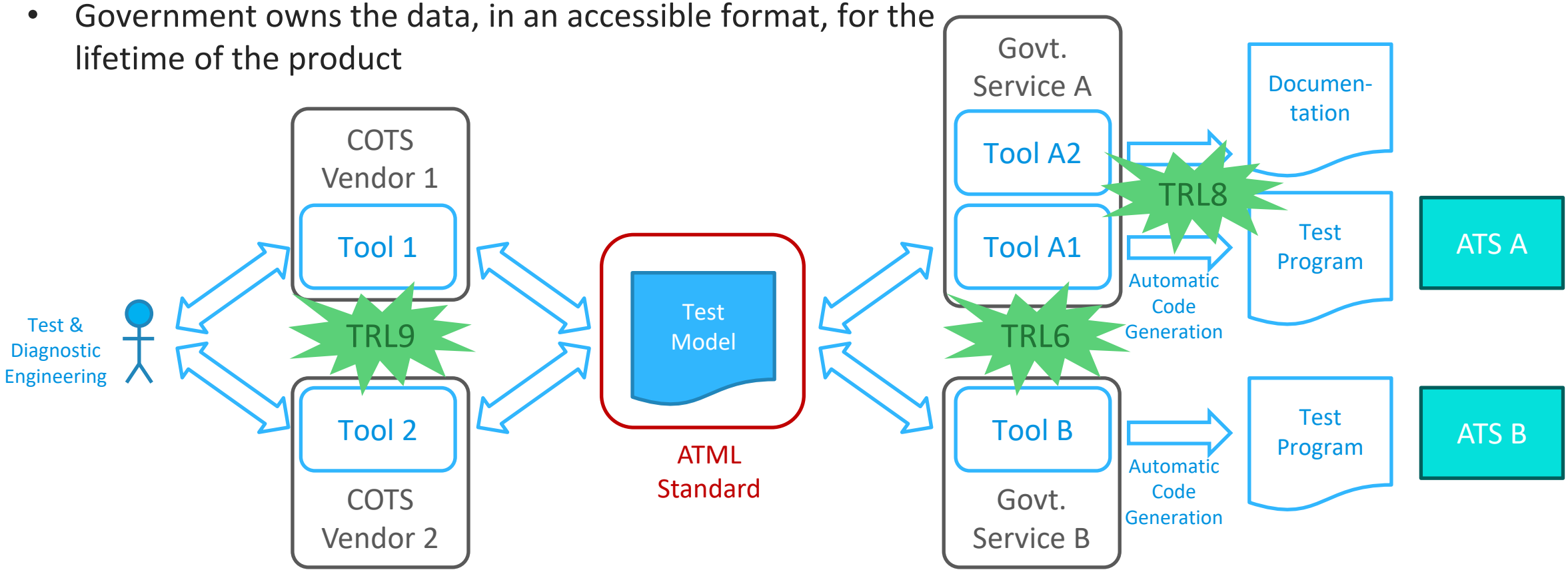
- SysML tools are not interoperable
- Users are forced to adopt single-vendor solutions
- Tool developers must develop vendor-specific translators



XMI - XML Metadata Interchange, used to exchange UML / SysML models between tools

vs. Unified Standards

- Government specifies the standards
- Marketplace selects COTS vendors
- Data can be reused across services
- Data can be repurposed for multiple use cases
- Government owns the data, in an accessible format, for the lifetime of the product



This is possible. It is what we must aim for!

DoD Pre-acquisition Process, Identified Gaps

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Ongoing Standards Development Activities

IEEE P2848
PHM-ATS

- New standard **IEEE P2848** "Prognostics and Health Management in Automatic Test Systems "
  - Extends existing ATML and SIMICA standard elements to support prognostics of UUTs on ATE and prognostics of ATE components
  - Will include user information and examples

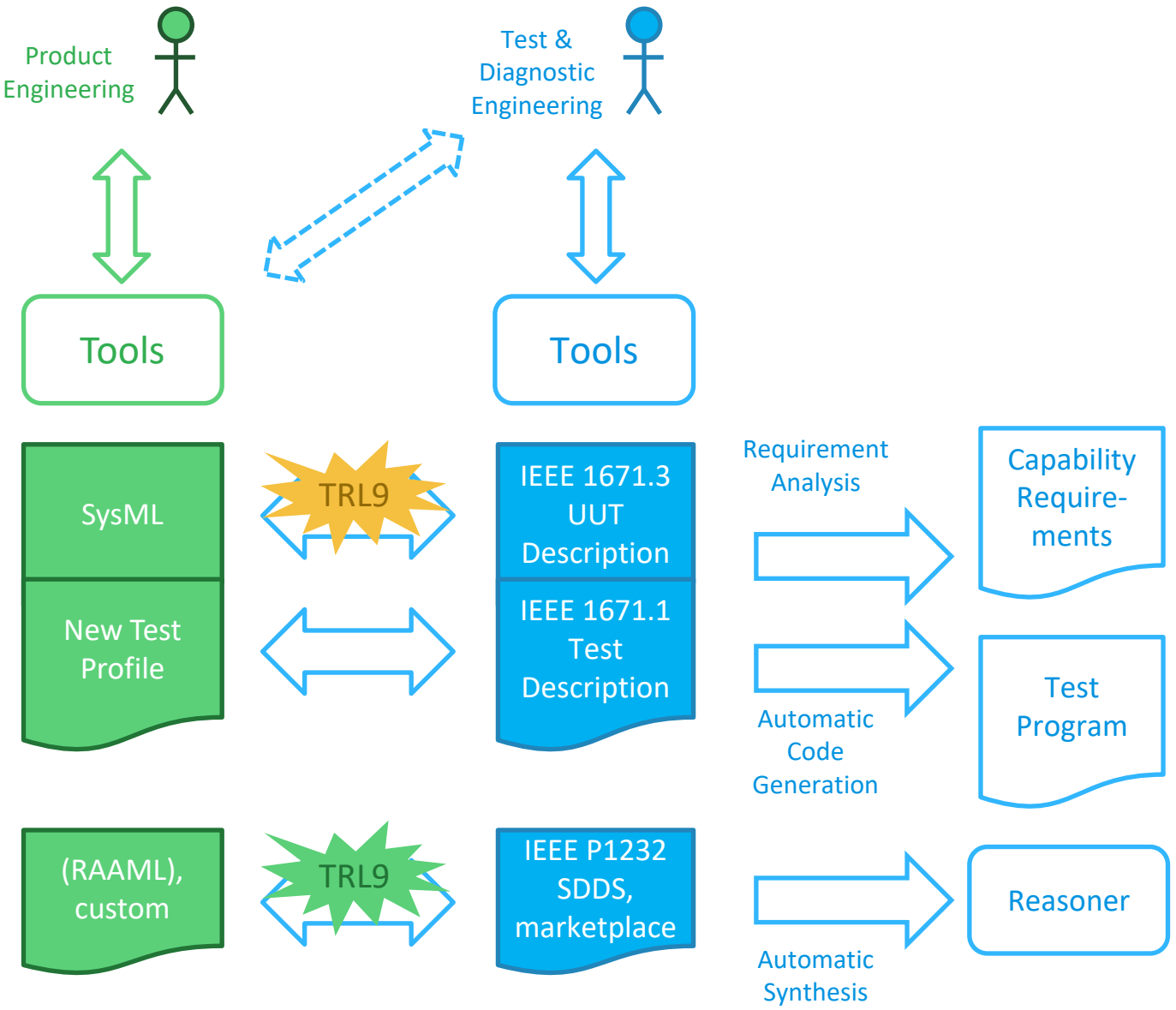
IEEE P1671
ATML

- Revision of **IEEE 1671** ATML
  - Combines all former component standards into a single standard and a single schema set
  - Corrections and additions as needed; non-breaking changes only
  - Unified user information and examples

IEEE P1232
SDDS

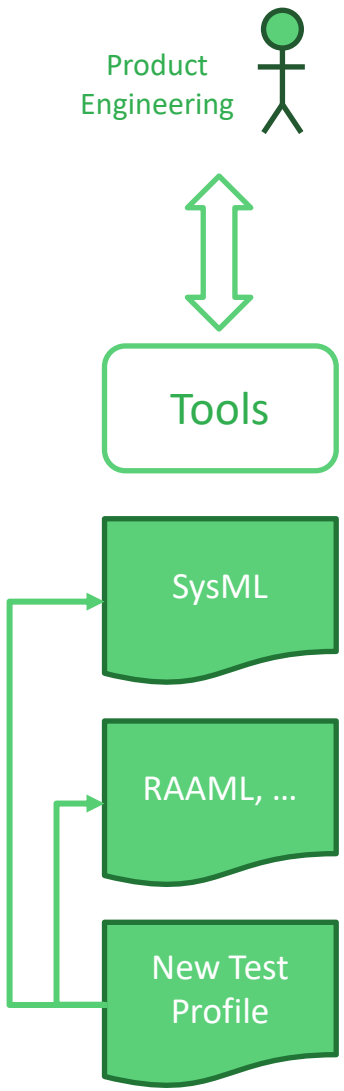
- Revision of **IEEE 1232** (formerly AI-ESTATE)
  - Identical scope; renamed to "System Diagnostic Data and Services (SDDS)"
  - Will explore expansion of the models and services in support of PHM
  - Modeling language will change to XML; redesign will ensure interoperability with the ATML and SIMICA standards

Proposed New Standards Development Activities



- Study Group for "ATML-compatible representation in SysML of test requirements information for electronic systems"
  - Product topology and reliability data from SysML are being successfully translated and imported into diagnostic models
  - There is interest within industry and government in implementing a similar capability for product test data.

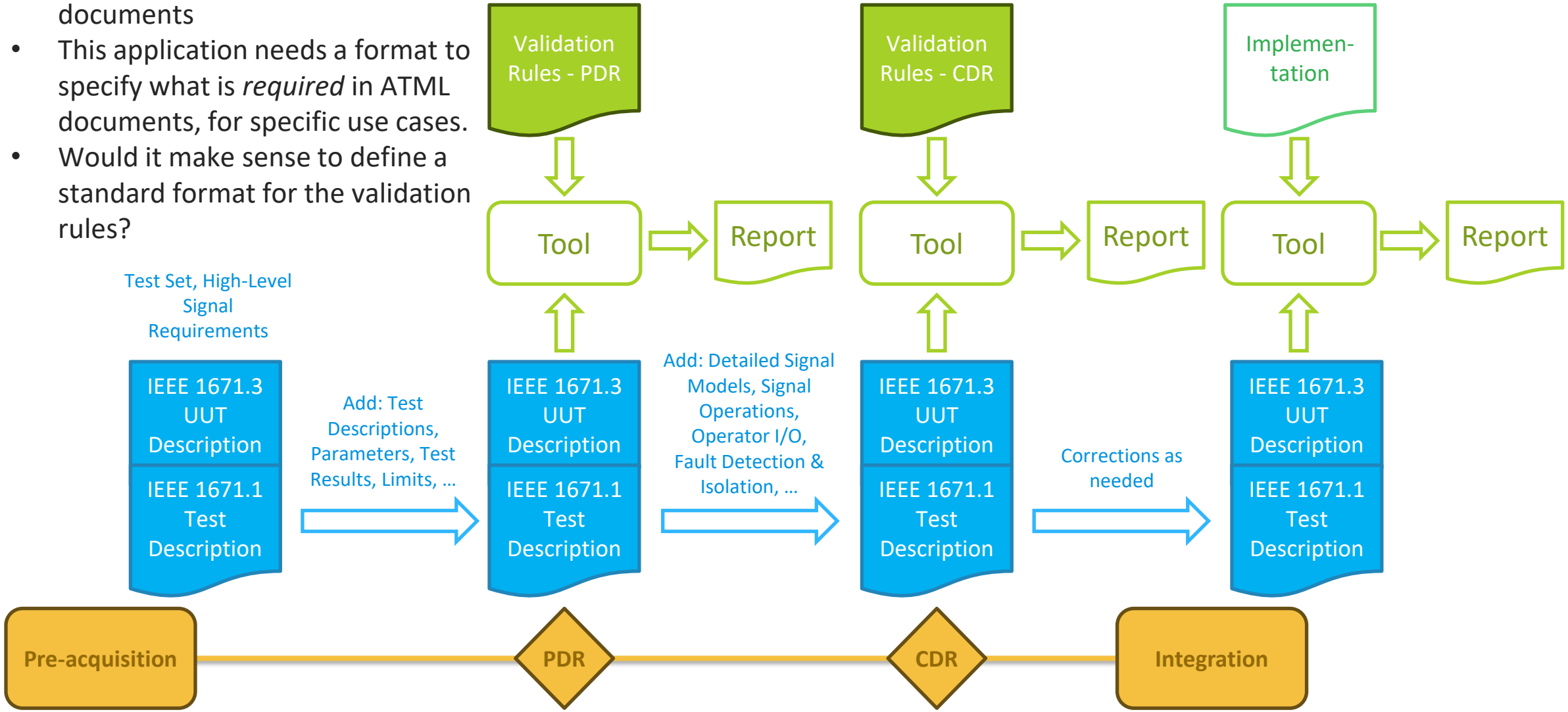
Proposed New Development Activities…



- Objective: Specify a standard format for describing in SysML test information specific to hardware systems
  - Prevent modeling style variations that complicate the translation of product topology data
  - Capture relationships between test data and UUT design data that are commonly described in SysML models (components, ports, states, failure modes, …)
- Benefits
  - Capture test requirements **directly** from the product designers, within the design environments they **already use**
  - Use UUT design data that are **already described** in SysML models
  - Map test requirements to product requirements, if **already described** in SysML

Other Areas for Standardization

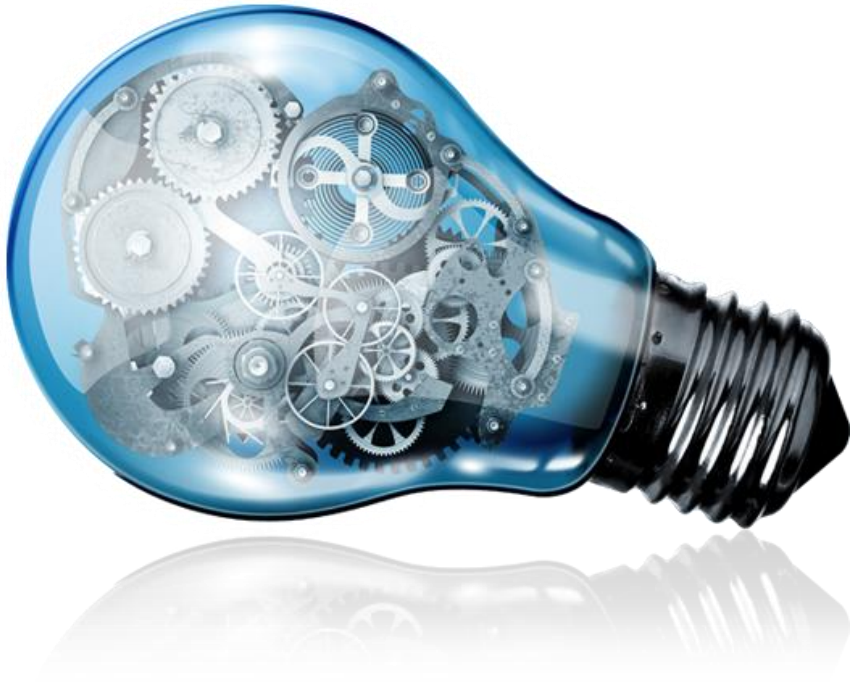
- The existing standards specify what is *allowed* in ATML documents
- This application needs a format to specify what is *required* in ATML documents, for specific use cases.
- Would it make sense to define a standard format for the validation rules?



Other Areas for Standardization

Have any ideas?

- Bring it up in Q&A
- Submit a proposal to IEEE SCC20
- Join standards development activities: https://sagroups.ieee.org/scc20/



Processes & Tools Update

Darcy Smith
Keysight

DoD Pre-Acquisition Vision

(translated from PMA260 2019 Autotestcon Presentation)

Requirements Collection

1

Create/collect UUT test requirements

UUT/ATE Definition

2

Analyze test capabilities vs requirements (UUT vs ATE)

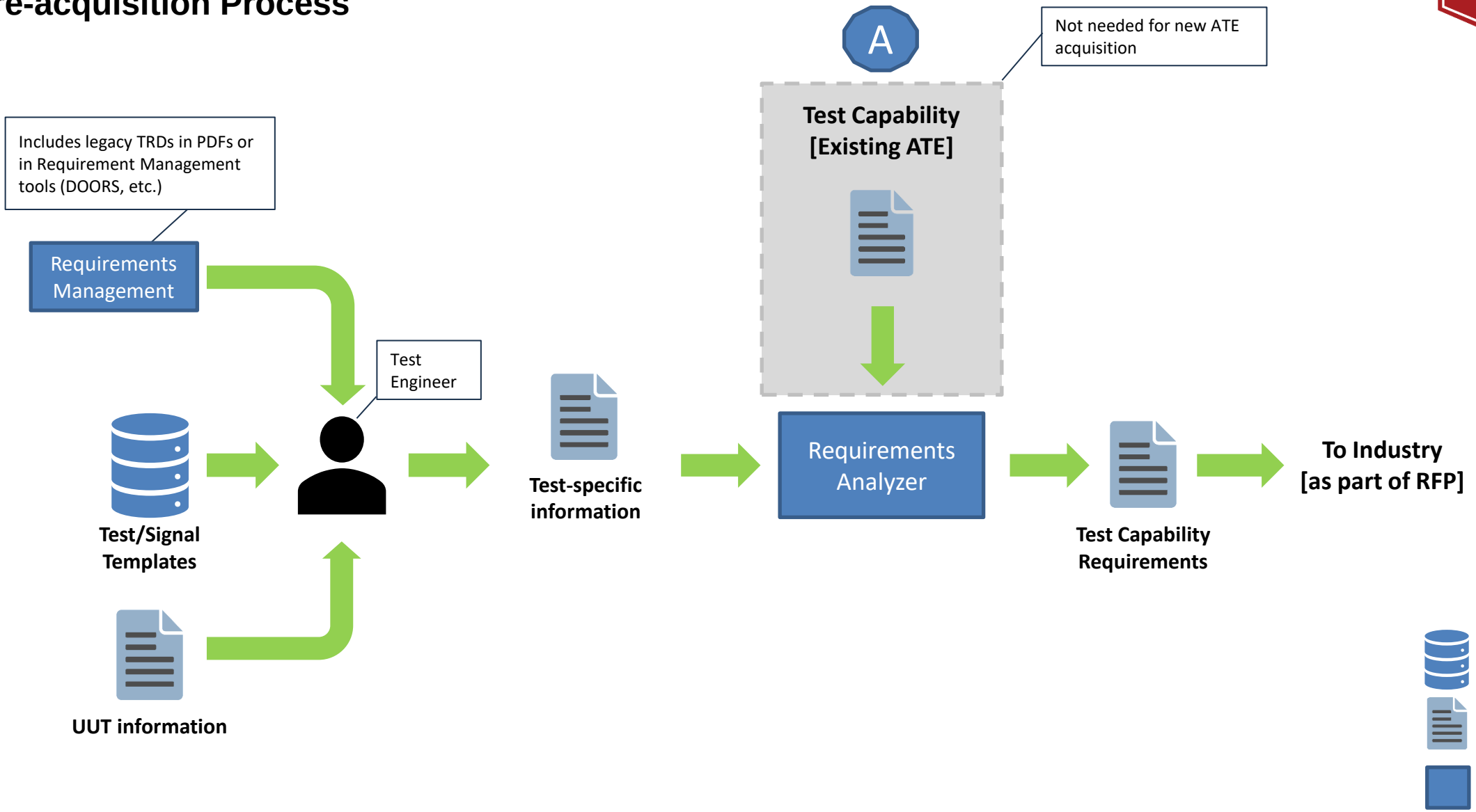
RFP Development

3

Develop RFP using analysis results

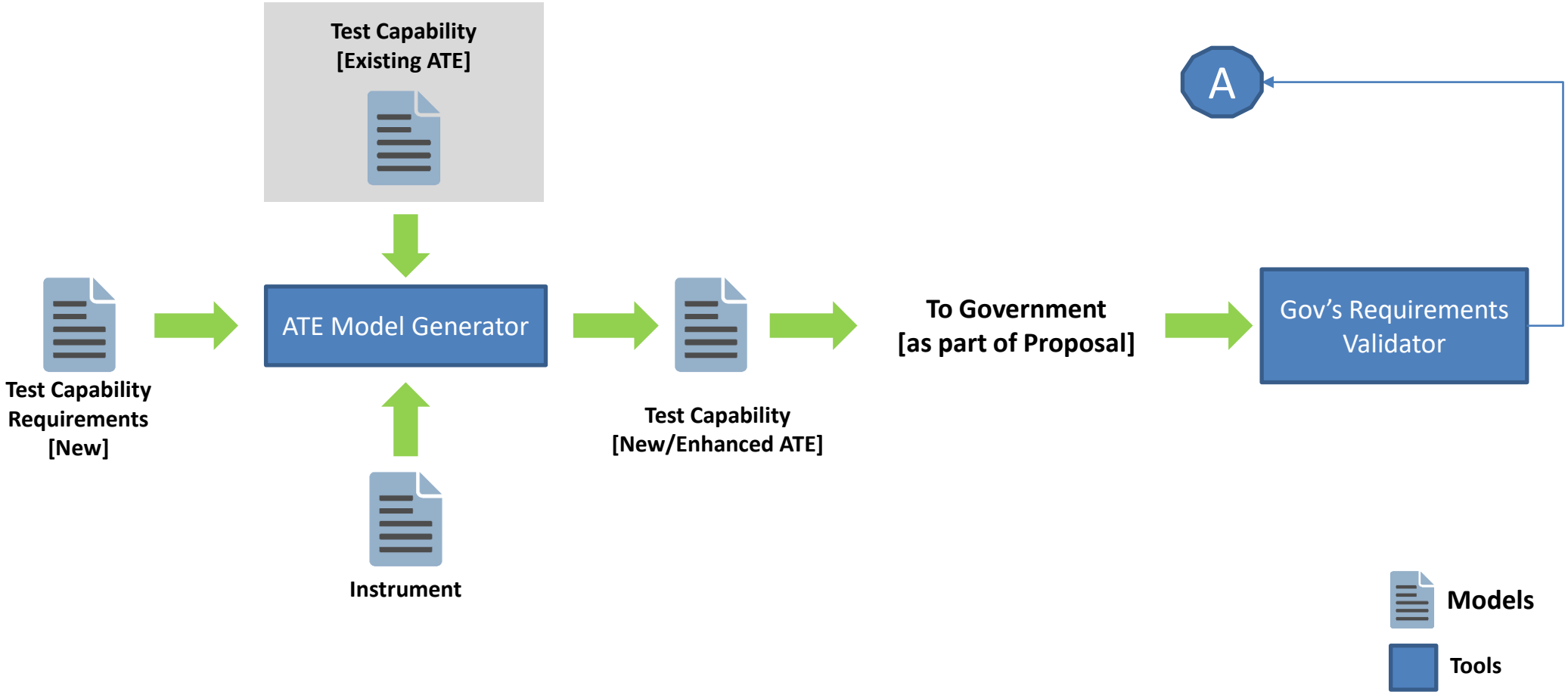
Digital Acquisition Workflow

DoD Pre-acquisition Process



Digital Acquisition Workflow

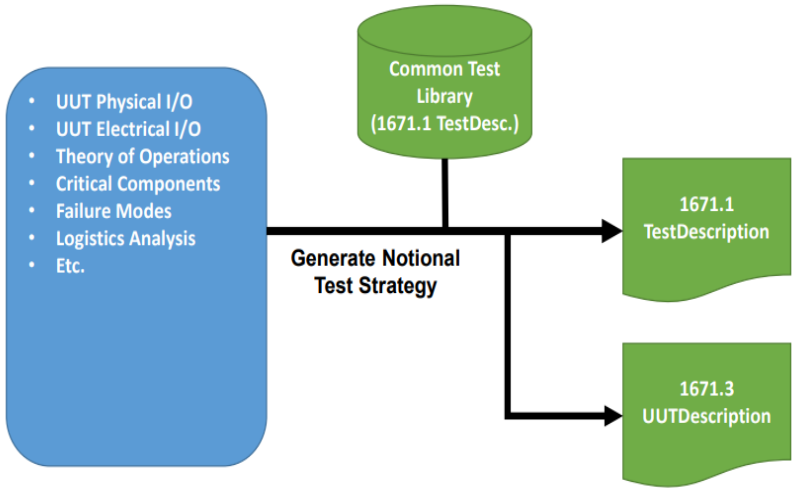
Industry Response to RFPs (Proposal Generation)



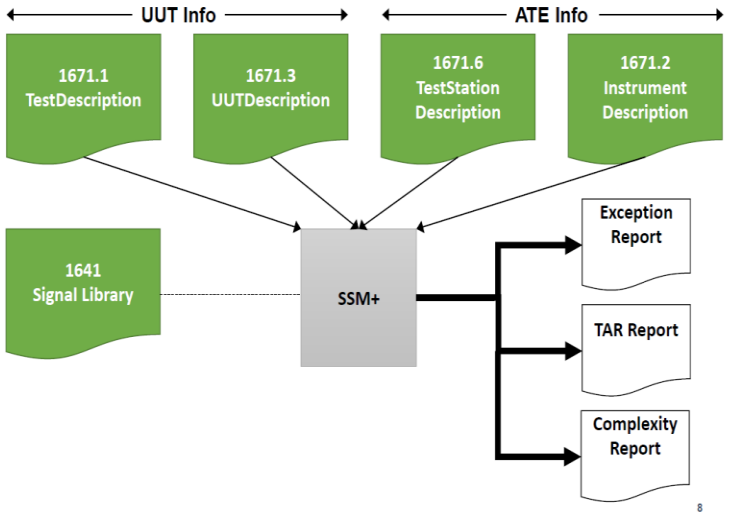
Modeling Standards

- **Modeling standards considered thus far**
  - SysML: Used by DoD & primes for UUT modeling
  - ATML: Used widely for test-specific modeling
- **Standards groups not yet reviewed**
  - IEEE Systems Council: Committees are resource for system engineering documents or guidelines
  - Digital Twin Consortium Part of OMG (Object Management Group): Industry & Government craft interoperable technology standards

Requirements Analysis (Pre-Acquisition)



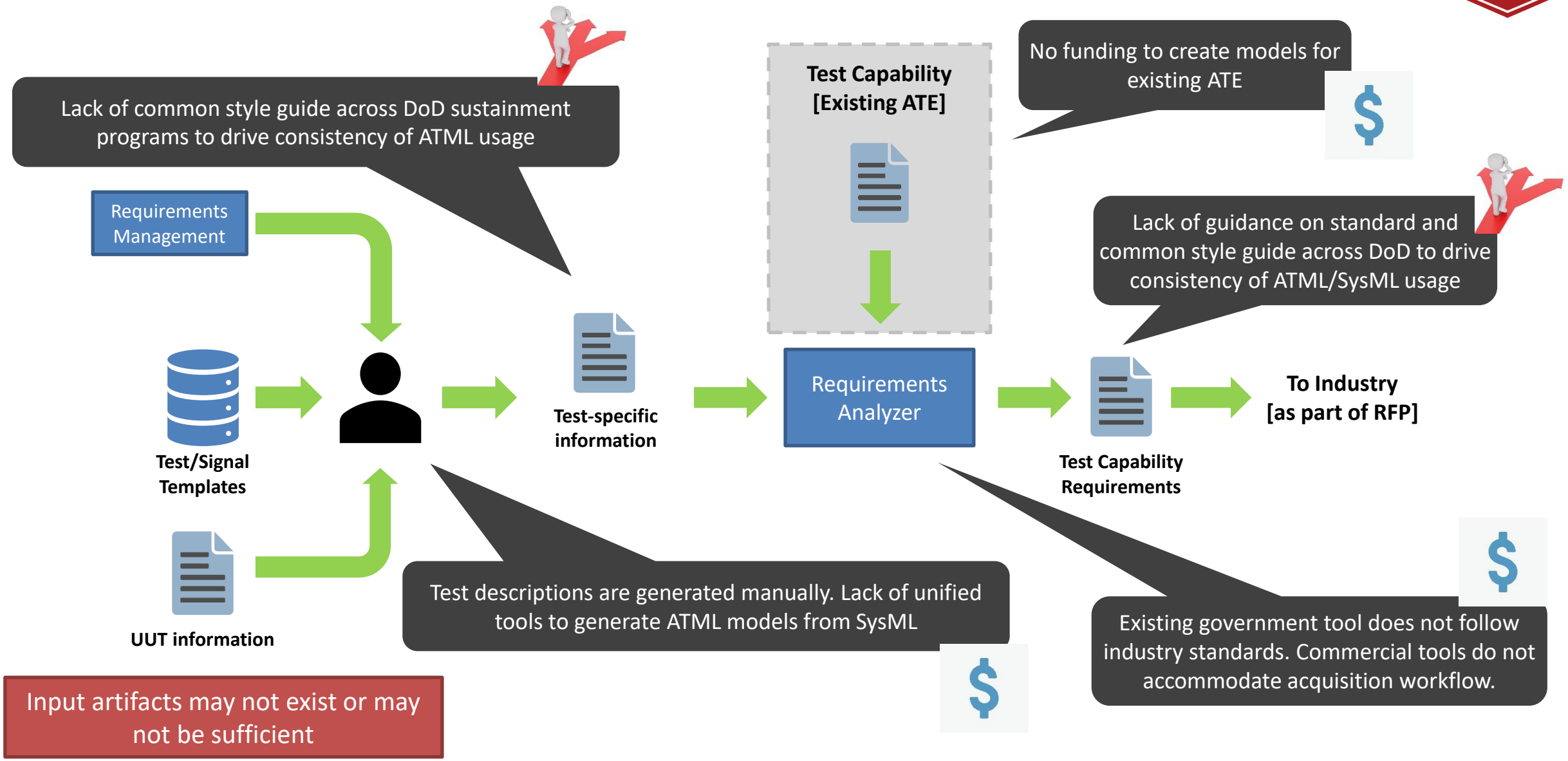
UUT/ATE Compatibility (Pre-Acquisition)



WHERE ARE THE GAPS?

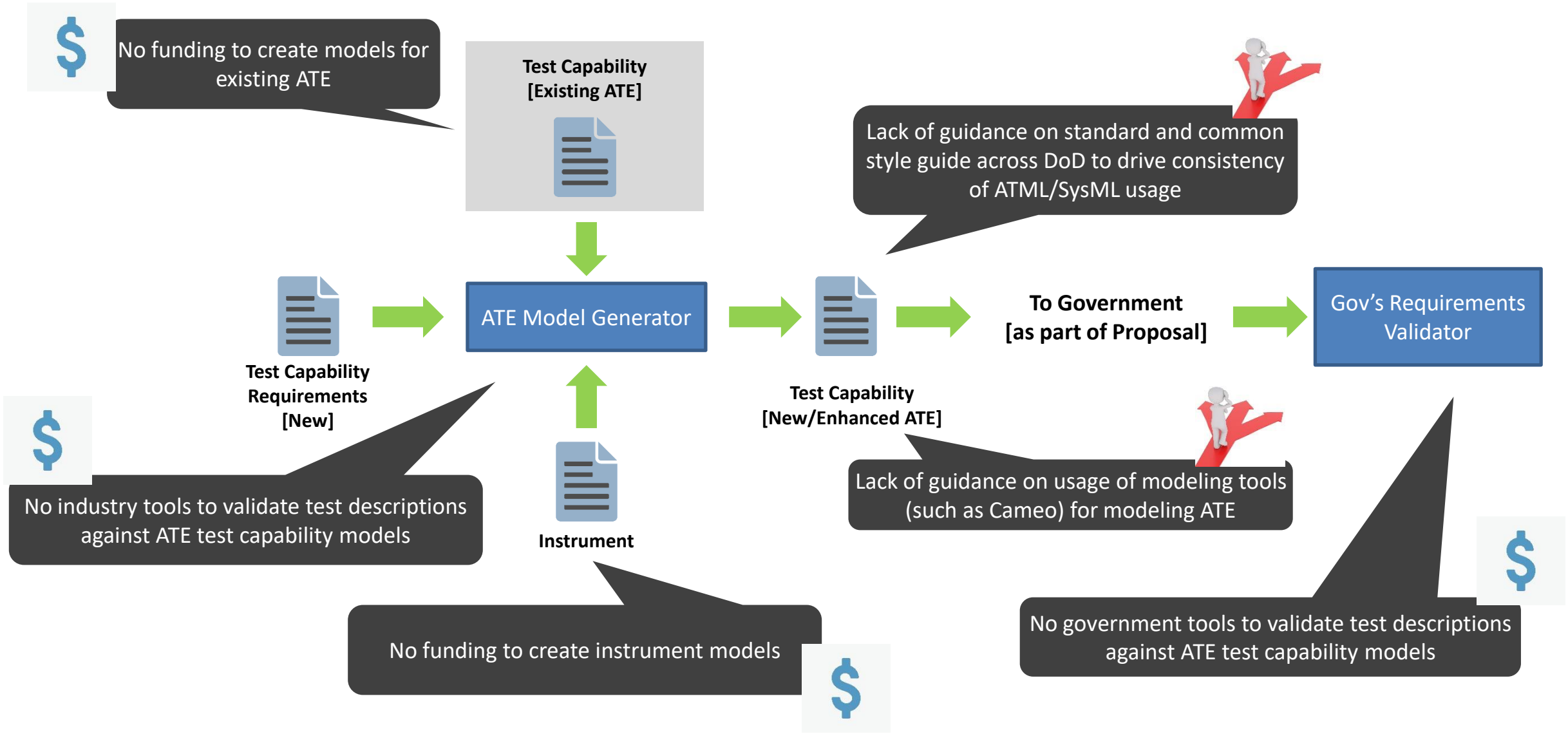
Digital Acquisition Workflow – Gaps

DoD Pre-acquisition Process



Digital Acquisition Workflow – Gaps

Industry Response to RFPs (Proposal Generation)



SUMMARY & RECOMMENDATIONS

Summary & Recommendations

- **Develop common style guide for ATML/SysML usage across DoD (sustainment) programs**
- **Supply guidance on preferred tools (such as Cameo or other) for modeling ATE & instruments**
- **Provide Government Furnished Information or funding projects to deliver for industry's use:**
  - ATE system models & instrument models
  - Digital engineering environment able to accommodate multiple data formats as defined by the digital acquisition workflow
  - Industry tools to analyze and validate test requirements models against ATE test capability models

Cyber and the Digital ATS
Jim Orlet
Boeing

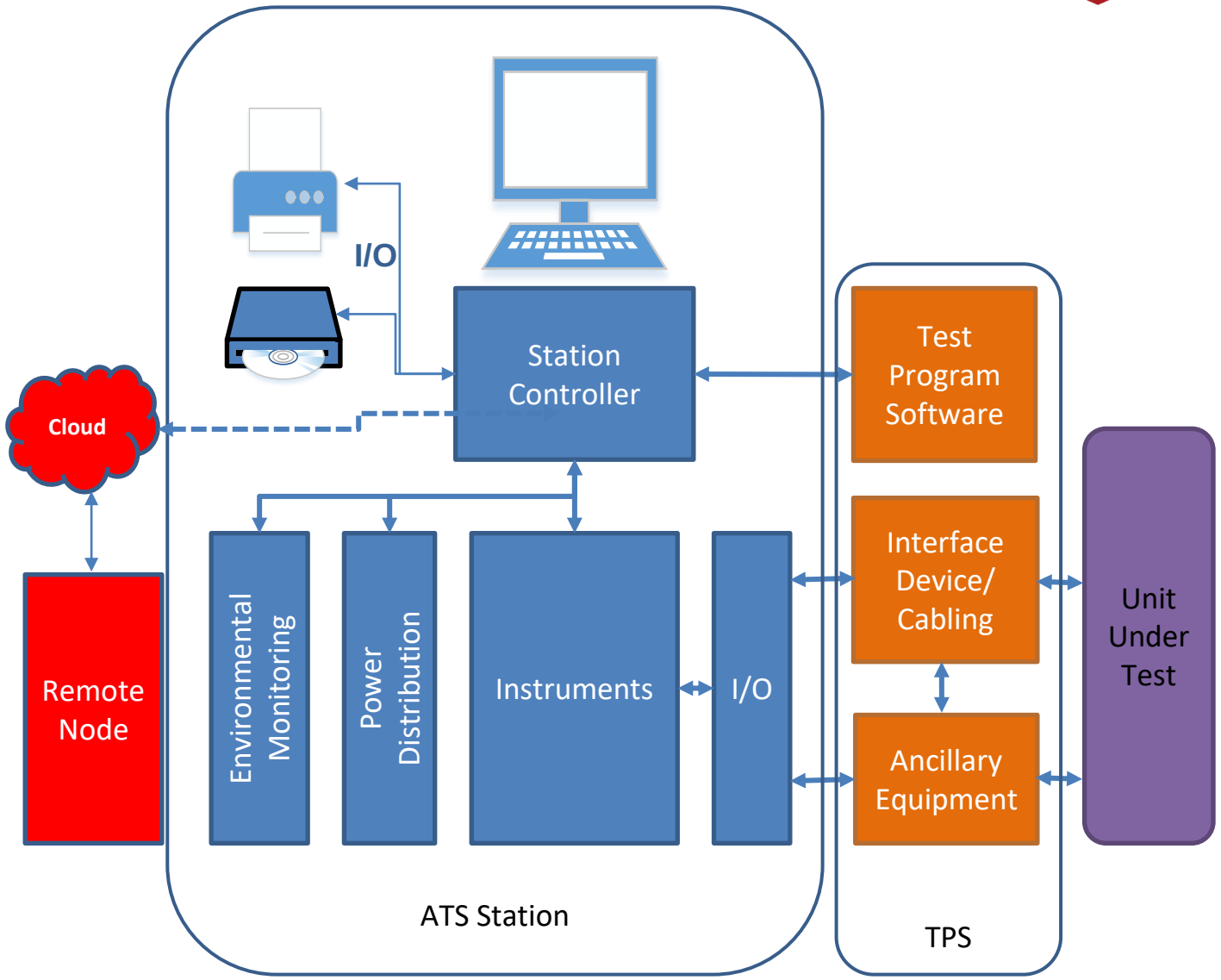
NDIA DE/DT Project Security Overview

Jim Orlet Boeing Senior Technical Fellow

August 2024

Cyber Security for ATS Approach

- **ATS internal instrument architecture and control**
  - Instrument control requires a
- **ATS Connection to Enterprise network infrastructure**
  - Separate the Test hardware from the network
  - Secure the data for transmittal



Risk Management Framework (RMF)

- **Overview**
  - The NIST Risk Management Framework (RMF) provides a flexible, holistic, and repeatable 7-step process to manage security and privacy risk and links to a suite of NIST standards and guidelines to support implementation of risk management programs to meet the requirements of the Federal Information Security Modernization Act (FISMA).

NIST 800-53
Security and Privacy Controls for Info Systems and Orgs

Category	QTY (Enhancements)
Access Control – AC	25 (131)
Awareness and Training – AT	6 (14)
Audit and Accountability – AU	16 (56)
Assessment, Authorization, and Monitoring – CA	9 (25)
Configuration Management – CM	14 (56)
Contingency Planning – CP	13 (49)
Identification and Authentication – IA	12 (95)
Incident Response - IR	9 (41)
Maintenance – MA	7 (28)
Media Protection – MP	8 (20)

Category	QTY (Enhancement)
Physical and Environmental Protection– PE	23 (51)
Planning – PL	11 (11)
Program Management – PM	32 (37)
Personnel Security – PS	8 (17)
Personally Identifiable information Processing and Transparency - PT	8 (21)
Risk Assessment – RA	10 (22)
System and Services Acquisition – SA	23 (106)
System and Communications Protection – SC	51 (139)
System and Information Integrity – SI	23 (101)
Supply Chain Risk Management - SR	12 (27)
Total	320 (1047)

Approx 320 Controls have Low, Moderate, and High Levels of control

NIST 1800

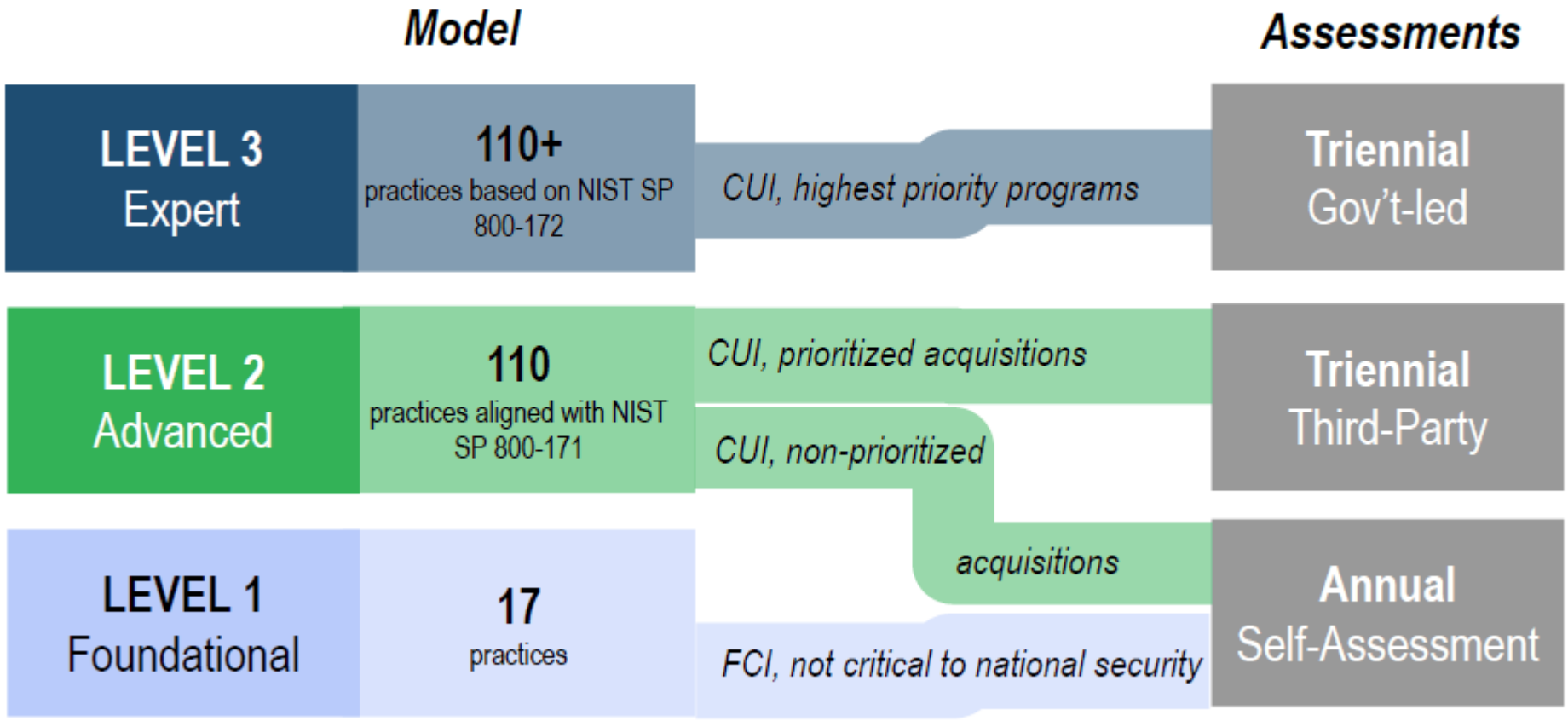
NIST 1800 series documents present practical, usable, cybersecurity solutions to the cybersecurity community

Number	Title	Status	Release Date
1800-40	Automation of the NIST Cryptographic Module Validation Program	Draft	6/7/2023
1800-39	Implementing Data Classification Practices	Draft	4/25/2023
1800-38	Migration to Post-Quantum Cryptography: Preparation for Considering the Implementation and Adoption of Quantum Safe Cryptography	Draft	4/24/2023
1800-37	Addressing Visibility Challenges with TLS 1.3	Draft	5/12/2023
1800-36	Trusted Internet of Things (IoT) Device Network-Layer Onboarding and Lifecycle Management: Enhancing Internet Protocol-Based IoT Device and Network Security	Draft	5/3/2023
1800-35	Implementing a Zero Trust Architecture	Draft	7/19/2023
1800-34	Validating the Integrity of Computing Devices	Final	12/9/2022
1800-33	5G Cybersecurity	Draft	4/25/2022
1800-32	Securing Distributed Energy Resources: An Example of Industrial Internet of Things Cybersecurity	Final	2/2/2022
1800-31	Improving Enterprise Patching for General IT Systems: Utilizing Existing Tools and Performing Processes in Better Ways	Final	4/6/2022
1800-30	Securing Telehealth Remote Patient Monitoring Ecosystem	Final	2/22/2022
1800-27	Securing Property Management Systems	Final	3/30/2021
1800-26	Data Integrity: Detecting and Responding to Ransomware and Other Destructive Events	Final	12/8/2020
1800-25	Data Integrity: Identifying and Protecting Assets Against Ransomware and Other Destructive Events	Final	12/8/2020
1800-24	Securing Picture Archiving and Communication System (PACS): Cybersecurity for the Healthcare Sector	Final	12/21/2020

List of NIST 1800

Number	Title	Status	Release Date
1800-23	Energy Sector Asset Management: For Electric Utilities, Oil & Gas Industry	Final	5/20/2020
1800-22	Mobile Device Security: Bring Your Own Device (BYOD)	Draft	11/29/2022
1800-21	Mobile Device Security: Corporate-Owned Personally-Enabled (COPE)	Final	9/15/2020
1800-19	Trusted Cloud: Security Practice Guide for VMware Hybrid Cloud Infrastructure as a Service (IaaS) Environments	Final	4/20/2022
1800-17	Multifactor Authentication for E-Commerce: Risk-Based, FIDO Universal Second Factor Implementations for Purchasers	Final	7/30/2019
1800-16	Securing Web Transactions: TLS Server Certificate Management	Final	6/16/2020
1800-15	Securing Small-Business and Home Internet of Things (IoT) Devices: Mitigating Network-Based Attacks Using Manufacturer Usage Description (MUD)	Final	5/26/2021
1800-14	Protecting the Integrity of Internet Routing: Border Gateway Protocol (BGP) Route Origin Validation	Final	6/28/2019
1800-13	Mobile Application Single Sign-On: Improving Authentication for Public Safety First Responders	Final	8/25/2021
1800-12	Derived Personal Identity Verification (PIV) Credentials	Final	8/27/2019
1800-11	Data Integrity: Recovering from Ransomware and Other Destructive Events	Final	9/22/2020
1800-10	Protecting Information and System Integrity in Industrial Control System Environments: Cybersecurity for the Manufacturing Sector	Final	3/16/2022
1800-8	Securing Wireless Infusion Pumps in Healthcare Delivery Organizations	Final	8/17/2018
1800-7	Situational Awareness for Electric Utilities	Final	8/7/2019
1800-6	Domain Name System-Based Electronic Mail Security	Final	1/19/2018
1800-5	IT Asset Management	Final	9/7/2018
1800-4	Mobile Device Security: Cloud and Hybrid Builds	Final	2/21/2019
1800-2	Identity and Access Management for Electric Utilities	Final	7/13/2018
1800-1	Securing Electronic Health Records on Mobile Devices	Final	7/27/2018

CMMC 2.0 Mapping



Additional Resources

- **RMF introductory course**
  - https://csrc.nist.gov/Projects/risk-management/rmf-courses

Life Cycle Support and Logistics

LCS

- **Obsolescence and DMSMS Management**
  - More questions than answers with the Digital Transformation migration
  - DMSMS and Obsolescence management is critical to sustaining long term readiness and operational capability
  - Only through Test Stand/TPS/UUT repository tracking for state conditions of the data can Digital Health and Maintenance migrate
    - Still need many of the basic concepts in prognostics with a “single source of truth” for the data to begin the digital data transformation
      - Remaining Useful Life
      - Condition Monitoring
      - Failure Modes and Effects Analysis
      - Degradation Modeling
      - Predictive Maintenance
      - Health Management

Digital Engineering and networking of Test Sets for data collection, analysis, dissemination and proactive maintenance has cyber/networking access impeding productive migration.

Technology Insertion for LCS

- **Technology migration typically impeded by both tight configuration management and TPS backward compatibility.**
- **Model Based System Engineering and Digital Engineering are poised to transform Automated Test Systems and the Logistic Support for platform testable items.**
  - Supporting CM/DM with “ASOT” and ability to have digital repository of test information as well as GFI on platform items (i.e., TRDs, TOs, models, etc.)
  - Test Stand models will allow management of instrumentation and upgrades
  - Automation of test stand code from digital information is possible
  - Streamlined workflows
  - Dependency still on enterprise management of LCS for facilitating rapid adaptation and continuous improvement in the ATS lifecycle.

Desired State

- Ensuring LCS is included in the acquisition of new ATS/ATE
- Demand CBM+ and advanced prognostic tools to be available in the ATS/ATE as a growth capability.
- Include the enterprise operational technology and cybersecurity needs into the acquisition packages.
- Begin small to validate the digital test stand's ability to track, report and support the advanced prognostic tools needed to leverage real-time data and analytics to predict maintenance, reliability and availability of both ATS and Platform items.

SUMMARY & RECOMMENDATIONS

State of the Industry

- **Integration of Digital Engineering and Digital Transformation**
  - Defense sector increasingly recognizing DE/DT importance
  - Increase DE/DT principles across the ATS/ATE lifecycle
  - Identified efficiencies driving transformation in acquisition of ATS/ATE
- **Addressing the Challenges and Gaps**
  - Lack of unified modeling tools and workflows
  - Use of the existing standards with common practices and adopting available tools
- **Cybersecurity**
  - Interconnecting ATS on digital floor/backbone identified need
  - Protection of assets and vulnerabilities to platforms continue to drive silo approach
- **Life Cycle Support and Logistics**
  - Intertwined with Cybersecurity
  - Long term sustainment and insights of ATS/ATE demand greater asset access to address continuous maintenance and larger data insights into both test stands, test assets and unit under test

Industry faces significant challenges in partnering with DoD for standardized practices, adequate funding, collaborative test stand networking to migrate data, and the variation in digital maturity across the services.

Suggestions

- **Funding Support**
  - Both industry and DoD have to invest in digital tools, workflows, training and development of digital twins and models for future ATS assets
- **Collaboration and Communications**
  - Sharing best practices across DoD services (obvious, yet…..)
- **Future-Proofing the Defense ATS/ATE Industry**
  - Investments must be made
  - DoD acquisition must drive requirements through acquisition
- **Pilot Projects and Case Studies**
  - Again, funding, collaboration, and requirements driving the transformation can be accomplished with pilot projects and shared results

Answering the "4 Questions" (finally)

- **What is the current capability of the industry to deliver digital models (and/or for simulation) for ATS?**
  - Industry's current capabilities to deliver models for Automated Test Systems is varied and not easily quantified due to the lack of common style guides, and sufficient government interaction and funding on request from the industry to deliver the models.
  - Currently, SysML and ATML are primarily the standards with a unified style guide absent across the services.
  - Models must be specified within the context of the desired outcomes and associated workflows.
- **What is the industry's current capacity for collaboration within a digital environment?**
  - *I*ndustry's ability to collaborate within a digital environment is sufficient to provide responses to government request with sufficient controlled repository access and safekeeping of proprietary information associated with the tools and workflows that may generate the models of their equipment, systems, and instrumentation.
  - Lack of standardization could lead to an unstable environment if variances in what is required for the models and associated tools and workflows are not leverageable.
- **Is the industry poised to meet solicitations that mandate Digital Acquisition?**
  - Industry is poised to meet solicitation that mandate Digital Acquisition.
  - Noted again, lack of standardization could lead to an unstable environment if variances in what is required for the models and associated tools and workflows are not leverageable across solicitations.

The last of the “4 Questions”

- **How can the US Government best leverage Digital Engineering in future acquisitions to maximize benefits for both the DoD and industry stakeholders?**
  - Some of the most repetitive themes of comments across the industry has been for the Government to fund a cross industry pilot project that would drive responsiveness to these questions and attempt to close the gaps in the acquisition process. The benefits, referencing the 2018 Digital Engineering Strategy themes and as stated near the beginning of the is paper –

> ***“The progression to Digital Engineering is envisioned to empower a paradigmatic shift from the conventional waterfall-based design-build-test methodology to a more dynamic continuous integration model-analyze-build-test approach. This shift is anticipated to enable DoD programs to extensively prototype, experiment, and validate decisions and solutions within a virtual environment, prior to their actual deployment in operational settings. Such a transformation not only promises to streamline development processes but also to significantly enhance the adaptability and effectiveness of solutions delivered to the warfighter.”***

Q & A for the NDIA DE DT Project

AUTOTESTCON 2024
DoD and NDIA Executive Plenary Government Session
August 27, 2024

Panel Members

Government Panel Discussion - Insights and Interest to DoD ATS

- Steve Butcher, USA Test Measurement and Diagnostic Equipment
- Michael Malesich, USN Automatic Test Equipment
- Kevin Simpson, USAF Automatic Test Systems Division
- Josselyn Webb, USMC Marine Maintenance Command

NDIA ATC Digital Transformation Panel

Plenary Session

Army ATS Initiatives in the Transition to Digital Engineering (DE)

The Answer is…

Johnny Carson Show

Carnac The Magnificent

- **$70 Billion**

And The Question Is …

FLRAA

What's the Value of Digital Engineering to the Competitors on the FLRAA Program?

FLRAA: Future Long-Range Assault Aircraft

GAO Protest Criteria, Losing FLRAA Proposal

GAO Report, FLRAA Protest, 6 Apr 23

- **Non-Compliance with Modular Open Systems Architecture (MOSA) Requirements**

Facts About The FLRAA Protest

GAO Report, FLRAA Protest, 6 Apr 23

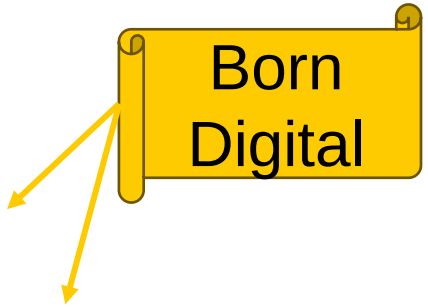
- **The Incumbent Team's Bid (the Losing Bid) was Actually The Low Price**
- **The Incumbent had a 40-year History of Producing the Blackhawk Aircraft**

What's the Digital Engineering Lesson-Learned?

- **To Summarize the GAO Report –**
  - An Insufficiently Granular Modeling Effort That The Government Said Compromised MOSA and Army Objectives for Open Systems Architecture.
  - In Other Words, the Modeling Effort Did Not Drill Down Below the System Level, When the Government was Asking for Sub-System and Component Level Architectural Detail.

Army Digital Engineering 'Pathfinder' Programs

Under Secretary of the Army Directive 2024-03 (Army Digital Engineering), 21 May 2024



1. **FLRAA**
2. **XM-30 (Formerly OMFV**)**
3. **Integrated Fires Mission Command (IFMC)**
4. **Joint Targeting Integrated Command and Control Suite (JTIC2S)**
5. **M113 APC**
6. **PEO Aviation Log Data Analysis Lab**

** OMFV: Optionally Manned Fighting Vehicle

Army ATS Digital Engineering Initiatives

- **Jennifer Swanson, DASA - Data, Engineering & Software:**
  - "We want to build those digital threads from requirements all the way to sustainment".*
- **PD TMDE Sponsored SBIR project A244-034, "AI-Enhanced TPS Development and Sustainment"**
  - MBSE /DE is Complementary Technology, Leveraged by AI
  - **Phase I** Proposal Evaluation closes 28 Aug 24
    - Multiple Bids, up to 4 Contract Awards, 6 Months Period of Performance
  - **Follow-on Phase II** for prototype development
    - Up to 2 contracts, 2-years Period of Performance
- **Working with Other Services on the DOD ATS Management Board**
  - Navy & USMC Representatives Assisting the SBIR Proposal Evaluations
  - Complementary Efforts with the DOD AMB Framework IPT (Chair: Mike Malesich, Navy)

Defense News, "US Army Moves Out on Digital Engineering Strategy", 19 Jun 24

Army ATS Digital Engineering Initiatives

- **Off-Platform Automatic Test Systems (OPATS)**
  - Opportunities in the next NGATS Buy (FY 25-26) to insert DE requirements into the contract:
    - Digital Twin Requirement for the NGATS ATE
      - Hardware & Software
      - System, Sub-System and Component Architecture
    - Model Libraries for the NGATS Instruments
  - Make These Models Available to All TPS Developers
- **Publish Revision to AR and PAM 750-43 to Include Digital Engineering Requirements**
  - PAM 750-43 to have examples and illustrations of ATE Digital Twin, Instrument Model Libraries and a Digital Thread.

Army Digital Engineering Policies and Directives

- Under Secretary of the Army Directive 2024-03 (Army Digital Engineering), 21 May 2024
- ASA (ALT) Policy Memorandum (Policy for the Implementation of Digital Engineering Throughout the ASA (ALT) Enterprise, 11 Apr 22
- Army Digital Transformation Strategy, 12 Oct 21
- 2021 Army Modernization Strategy

Questions?

NAVAIR's Relation to Digital Engineering

27 August 2024

Presented to: AutoTestCon 2024
Presented by: Mike Malesich

DoD ATS Organization

- DoD ATS Management Board (AMB) promotes goals of interoperability, reduced footprint, and reduced lifecycle costs which are all addressed by the DoD ATS Framework IPT
  - Members are Senior ATS leads from each Service
- The DoD ATS Framework IPT created to define an open systems framework for ATS so that future DoD ATS meet the goals of the ATS Executive Directorate
  - Focuses on identifying commercial interface specifications that satisfy the elements in the Framework
  - Assists in the development of formal specifications within industry standards organizations
  - Delivers standards, demonstrations, and tools

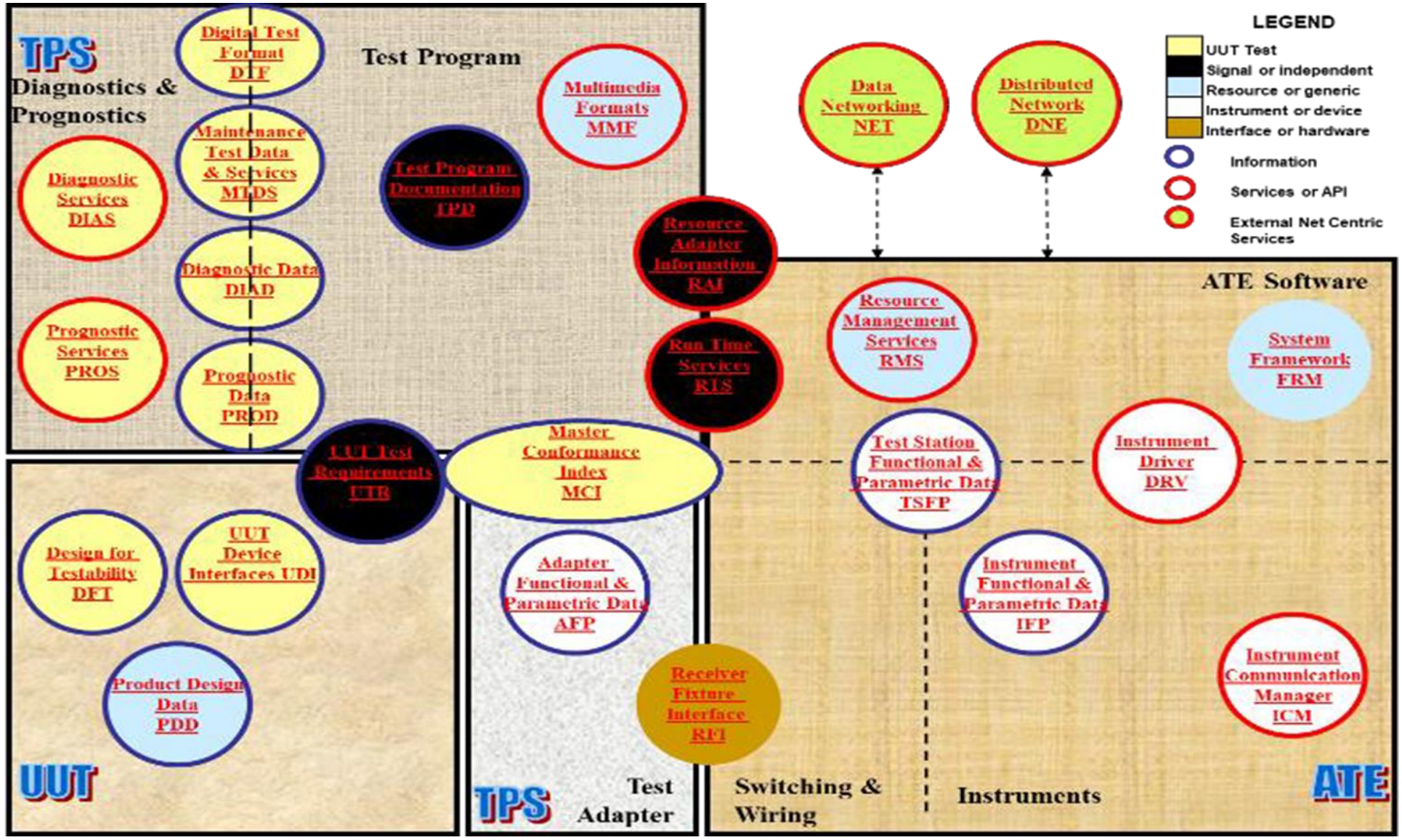
ATS Framework

- ATS Framework IPT leads test and diagnostics standards development and demonstrations needed to promote an Open Architecture ATS, and to advance state of the art concepts and technologies in ATS (e.g. Digital Thread, Condition Based Maintenance, Prognostics)

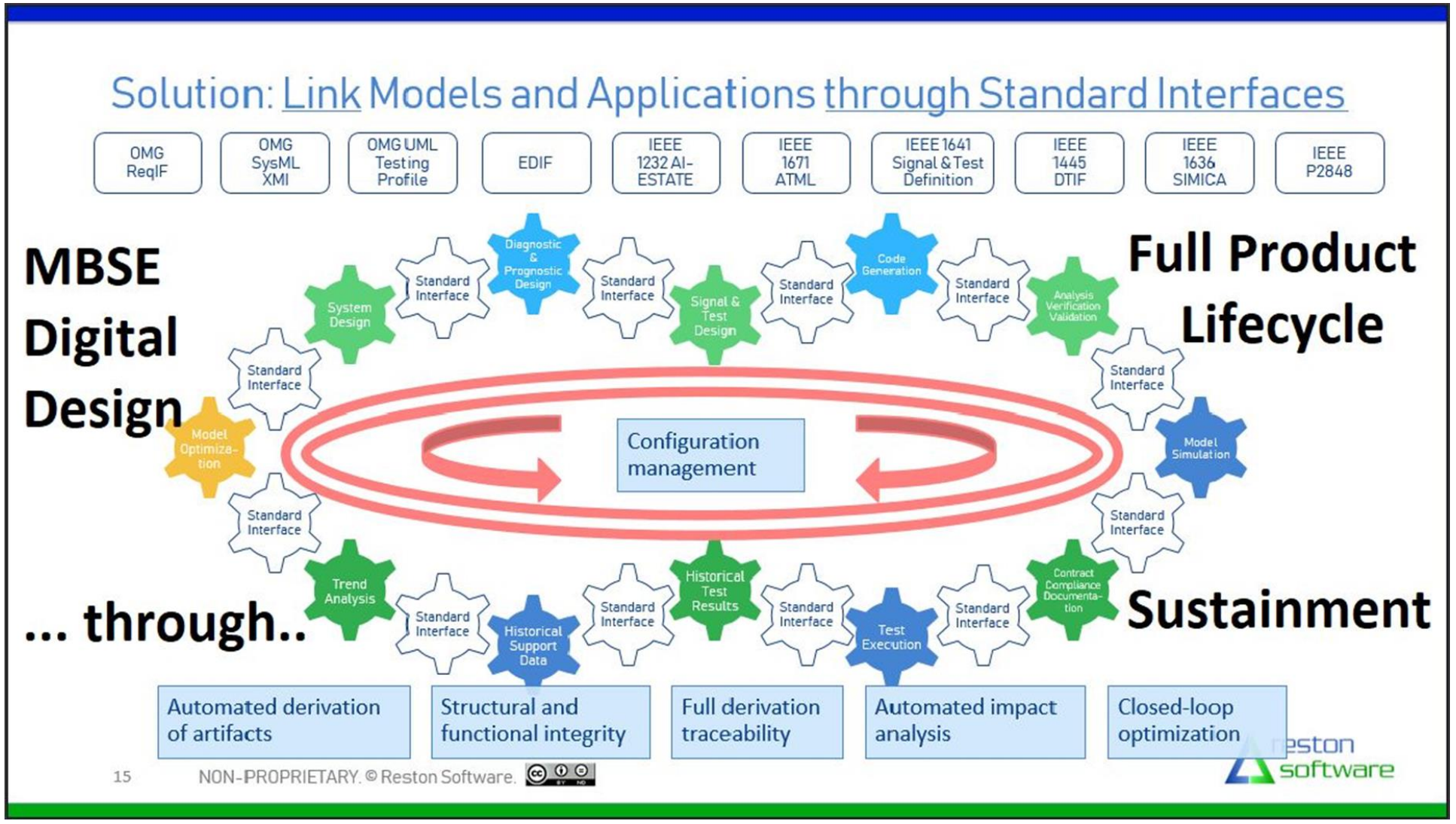
- Efforts and projects to advance the 13 goals of the ATS Framework IPT, including: faster technology insertion, improve TPS interoperability, use model-based programming techniques, modernize test programming environment, define a TPS performance specification, capture design to test data, use weapon system to test data, use knowledge based TPSs

- ATS Framework currently identifies 25 Key Interface Elements
  - Working with industry standards bodies to develop and mature standards that satisfy the elements
  - Currently focused on the standards that support PHM and TPS acquisition

ATS Framework



Integration of Standards in Support of Digital Engineering



Integration of Standards in Support of Digital Engineering

Lifecycle Processes	Process Interfaces/Framework Elements and Standards
System Design	DFT; IEEE 1149.1, 1149.4, 1149.5, 1149.6, MIL-STD-2165, MIL-HDBK-1814 FRM; OSA-CBM, IEEE 1856 PDD; IEEE 1671.3, SysML, EDIF, VHDL, etc. PROD/PROS; SAE JA6268, IEEE 1858 and P1856.1 UDI; SysML, EDIF, VHDL, IEEE 1641 UTR; IEEE 1671.1, 1641
Diagnostic & Prognostic Design	DFT; MIL-HDBK-1814; DIAD/DIAS; IEEE 1232 FRM; OSA-CBM, IEEE 1856, SAE JA6268 PROD/PROS; IEEE P2848
Signal & Test Design	AFP; IEEE 1671.5 DFP; IEEE 1149.1, 1149.4, 1149.6 DTF; IEEE 1445 IFP; IEEE 1671.2 MCI; IEEE 1671.4 RAI; IEEE 1641 Annex K RMS; IEEE 1641 RTS; IEEE 1671 Annex D TPD; ISO 32000 (PDF), ISO/IEC 29500 (Office Open XML), etc. TSFP; IEEE 1671.6 UDI; IEEE 1641 UTR; IEEE 1671.1, 1641
Code Generation	AFP; IEEE 1671.5 DIAD; IEEE 1232 DTF; IEEE 1445 IFP; IEEE 1671.2 PROD; IEEE P2848 RFI; IEEE P1693 RMS; IEEE 1641 RTS; IEEE 1671 Annex D TSFP; IEEE 1671.6 UDI; IEEE 1641 UTR; IEEE 1671.1, 1641
Analysis Verification Validation	AFP; IEEE 1671.5, 1671.2, 1671.6 DFT; (TBD: DFT functions such as BIT can be subject to Verification & Validation) DIAD; IEEE 1232 DTF; IEEE 1445 PROD; IEEE P2848 RAI; IEEE 1641 Annex K RFI; IEEE P1693 RMS; IEEE 1641 TPD; ISO 32000 (PDF), ISO/IEC 29500 (Office Open XML), etc. UDI; IEEE 1641 UTR; IEEE 1671.1, 1641
Model Simulation	
Contract Compliance Documentation	AFP; IEEE 1671.5, 1671.2, 1671.6 DFT; MIL-STD-2165, MIL-HDBK-1814 DIAD; IEEE 1232 DTF; IEEE 1445 MCI; IEEE 1671.4 PROD; IEEE P2848 TPD; ISO 32000 (PDF), ISO/IEC 29500 (Office Open XML), etc. UDI; IEEE 1641 UTR; IEEE 1671.1, 1641
Test Execution	DIAD/DIAS; IEEE 1232 DRV; IVI-3.1, 3.2, 3.3, 3.4, 3.14 FRM; VPP-2, IEEE 1671, IVI-3.5 ICM; VPP 4.3 MTDS; IEEE 1636, 1636.1 PROD/PROS; IEEE P2848 RTS; IEEE 1671 Annex D
Historical Test Results	DIAD; IEEE 1232 MTDS; IEEE 1636, 1636.1, 1636.2 PROD; IEEE P2848
Historical Support Data	MTDS; IEEE 1636, 1636.2
Trend Analysis	DIAD; IEEE 1232 MTDS; IEEE 1636, 1636.1, 1636.2 PDD; IEEE 1671.3, SysML, EDIF, VHDL, etc. UTR; IEEE 1671.1, 1641
Model Optimization	DFT; (TBD DFT features are a target of optimization, in conjunction with PDD. For example, adding test points to split ambiguity groups) DIAD; IEEE 1232 DTF; IEEE 1445 PDD; IEEE 1671.3, SysML, EDIF, VHDL, etc. UTR; IEEE 1671.1, 1641

NAVAIR Policy & Use of Digital Engineering

- DoDI 5000.97, Digital Engineering, December 21, 2023
  - Digital Engineering Body of Knowledge (https://de-bok.org/)
  - Systems Engineering Body of Knowledge (https://sebokwiki.org/)
- NAVAIR Systems Engineering Transformation (SET)
  - Use of Model Based Systems Engineering for acquisition
- Common Aviation Support Equipment
  - Uses, applies and takes advantage of enterprise digital toolsets
  - Guides for use
    - Platform or Program relevant data
    - Products' return on investment (ROI)
    - Departmental or project ROI's
- Fleet need steer solutions
  - Reduce total lifecycle costs
  - Shorten procurement cycles
  - Reduce overall risk
  - Improve safety posture

ATS Digital Engineering

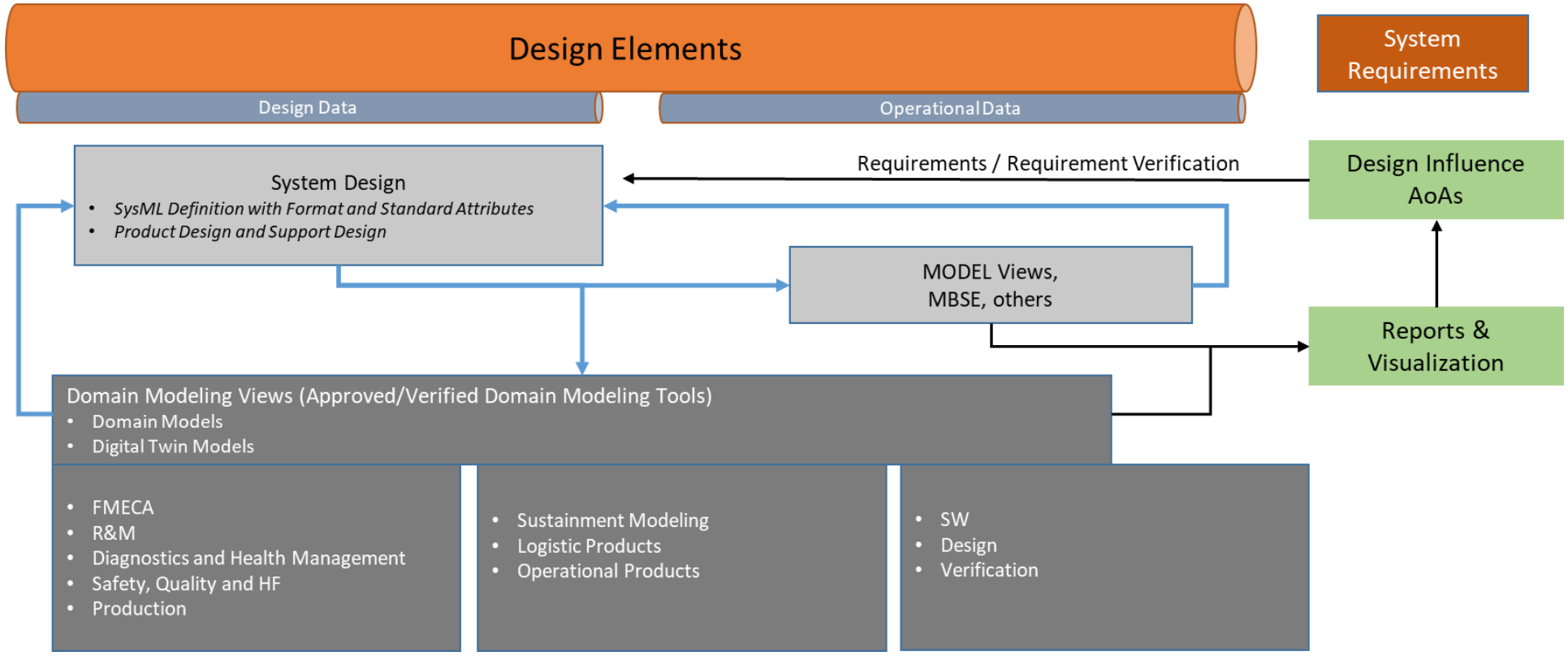
- Model Based Engineering (MBE)
  - Three-dimensional computer aided drafting (3D CAD)
  - Finite Element Analyses (FEA)
  - Electronic Design Automation
- Model Based Systems Engineering (MBSE)
  - Unified Modeling Language (UML)
  - Systems Modeling Language (SysML)
  - Automatic Test Markup Language (ATML)
- Model Based Product Support (MSPS)
  - Aviation Product Lifecycle Management
  - Integrated Systems Engineering Environment
  - Integrated Test & Evaluation Management
- Development, Security, & Operations (DevSecOps)
- Artificial Intelligence (AI) & Machine Learning (ML)
  - Data collection
  - Large Language Models (LLM)

Ontology for Digital Acquisition

- Ontology focus is ‘stakeholder product area design element definitions and alignment’ (‘human to human’, ‘machine to machine’ or ‘model to model’)
  - Several examples are failure mode definition throughout the product lifecycle, test definition, and simple part nomenclature/definition

- The ontology will be foundational to our success with the digital acquisition effort and to improving degrader responses

Model Linkage within Lifecycle



Ontology feeds System Design for stakeholder interfaces and sustainment product design element requirements

Condition Based Maintenance / PHM

- Engineering and Manufacturing Development SOW for Integrated Health Management System (IHMS)
- IHMS Description and Data Architecture DID
- Enterprise Lifecycle Digital Thread

Industry Partner Support for Digital Engineering

- Providing foundation & test bed to allow Digital Engineering throughout the ATS community
  - SBIRs/STTRs
  - NAVAIR S&T projects
  - ATS / TPS modeling as part of an MBSE environment
  - Working with industry (e.g. NDIA)
- Technology areas/applications supported via S&T projects
  - Advanced diagnostics
  - Prognostics and Health Management
  - Data collection and analysis
  - SMART TPS
  - Incorporation of smart avionics
  - ATE instrument management
  - Model Based Systems Engineering / Digital Thread / Digital Twin

AUTOTESTCON Executive Plenary Session

27 August 2024

Kevin D. Simpson, NH-04, DAF
Chief Engineer, Automatic Test Systems Division
AFPEO Agile Combat Support

Roadmap

- **Introduction**
- **Macro guidance from Air Force leadership down to the micro implementation at ATS Program Office**

USAF Policy

- **Dr. William Roper, Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics**
  - There is no spoon (Oct 2020) and Bending the spoon (Jan 2021)
    - Introduction of Digital Acquisition concepts
- **Gen Duke Z. Richardson, Commander, Air Force Materiel Command**
  - Digital Materiel Management: An Accelerated Future State (June 2023)
    - "There is no time for antiquated serial processes, inadequate teaming, or lifecycle and functional stovepipes."
    - "The common threads uniting the entire materiel ecosystem are models, data, and infrastructure."

ATS Implementation

- **Lea T. Kirkwood, Air Force PEO for Agile Combat Support**
  - Agile Combat Support Directorate Strategic Plan (Jan 2023)
    - Enable digital enterprise solutions and materiel management
- **ATS beginning to execute digital transformation strategies**
    - Modular Open Systems Approach (MOSA)
      - Strategy for designing an adaptable system and reducing vendor lock
    - Government Reference Architectures (GRA)
      - Guide solutions to use common, open standards
    - SysML models
      - Part of the Model-based Technical Data Package (MTDP)
    - NDIA DE project
      - Sharing information with Industry

ATS Implementation, cont.

- **ATS digital transformation strategies (continued)**
  - Digital Tech Data
    - 3-D, Model-based sources of truth
    - Interactive and interconnected maintenance manuals
  - Data and Analytics
    - Collecting and standardizing data to support CBM+/PHM
  - Cloud-Based, Integrated Development Environments
    - Software development in the cloud for faster deployment
    - Integrated Environments for real-time collaborative development and reviews
  - Rapid Acquisition/Technology Insertion
    - Use of Small Businesses and Research Institutions to solve problems rapidly

References

- **DoD Instruction 5000.97 - Digital Engineering**

- **AF Digital Transformation SharePoint (CAC Required):** https://usaf.dps.mil/teams/afmcde/SitePages/Home.aspx

- **Digital Transformation Office, Department of the Air Force:** https://dafdto.com/

- **AFMC white paper on Digital Materiel Management:** https://www.afmc.af.mil/News/Article-Display/Article/3423259/afmc-releases-white-paper-on-digital-materiel-management/


AGILE COMBAT SUPPORT
DIRECTORATE

Presenter: Josselyn Webb
Date: August 26, 2024
Version:

MARINE DEPOT MAINTENANCE COMMAND
NDIA ATC Digital Transformation Panel

Mission Statement

ESCT Provides world-class depot-level electronics repair and test, software engineering and development, Calibration of test equipment, engineering, and development support for Automatic Test Equipment (ATE) and oversees the MDMC Radiation Safety Program. We are a service orientated organization with a highly trained and dedicated workforce striving to meet customer requirements within a framework of cost, quality, and schedule to meet the ultimate support goal of ensuring the Warfighter wins battles with superiorly maintained equipment.

- The ESCT Software Engineering Group is a diverse team including:
  - Software Engineers
  - Cyber Security Engineers
  - Testing and Verification Engineers
  - Configuration Management Support

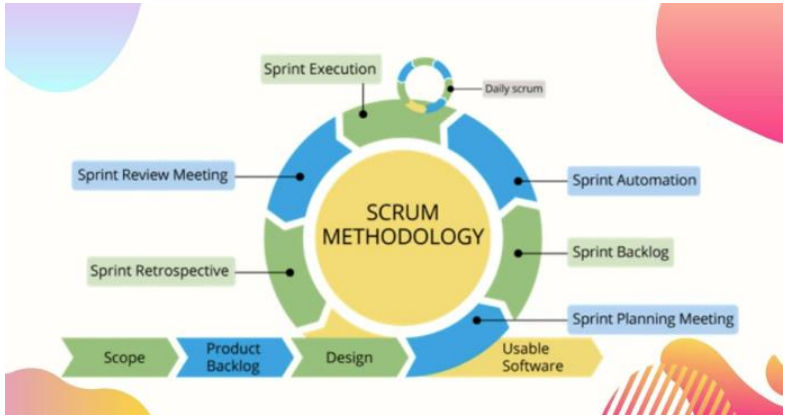
What we do

- Software support for Ground Weapon Systems Marine Corps
  - Automatic Test Equipment
  - Application Program Sets (Test Programs)
- Cyber Security Support
  - Provide ATO support
- Our Program Office supports Systems Command in the acquisition process by reviewing CDRLs and source code add
- Our Program Office supports Systems Command by providing inputs for the ECP process

- DoD Digital Engineering Strategy Goals
  - Formalize the development, integration, and use of models to inform enterprise and program decision making
    - HAL project simulation of instruments
  - Provide an enduring, authoritative source of truth
    - Source code repository
  - Incorporate technological innovation to improve engineering practice
    - Utilization of available tools
  - Establish a supporting infrastructure and environments to perform activities, collaborate and communicate across stakeholders
    - Agile
  - Transform the culture and workforce to adopt and support digital engineering across the lifecycle

Digital Engineering- Where we are

- Tools
  - Git/GitHub
  - Jira
  - Visual Studio
- Agile Project Management
- Training



- Use a source code repository (Authoritative Source of Truth)
- Flexibility of User Interfaces
  - GitHub web
  - GitHub Desktop
  - Command Line Interface (CLI)
  - Visual Studio
- Documentation repository
- Code Reviews
- Issues
- Build on commit (Continuous Integration)

- Sprint tracking
  - Burn down charts
  - Sprint progress
  - Alerts for issues that may need attention
- Backlog Support
  - One stop shop for Stakeholders to view and prioritize
- Scrum Board
  - Visual representation of the current sprint
- Flexibility
  - Track various projects in one place
- Integrated with Git/GitHub
  - Incorporate branch checkouts
  - Naming conventions

Digital Engineering -Future

- Continue to mature our processes
- Continue developing a culture of transparency
- Training
- Visual studio integrated with GitHub Enterprise
- Dev Sec Ops
  - Early Detection of Vulnerabilities
  - Automated Security Testing
  - Faster Remediation
  - Improved Calaboration
  - Compliance and Audit Readiness
  - Enhanced Visibility

Digital Engineering -Conclusion

- Challenges
- Defining where we want to go
- Modernization
- Changing the security culture

Questions?

Logistics COMMAND

Q & A for the NDIA Gov Panel and DE Project Panel

Hyper-Linked Charts

Why the M113 APC?

Under Secretary of the Army Directive 2024-03 (Army Digital Engineering), 21 May 2024

- **The M113 has been Around like Forever, but…**
- **The M113 Has Digital Twins that can be Applicable to Other Ground Vehicle Programs**

Army Objectives for MOSA

GAO Report, FLRAA Protest, 6 Apr 23, pg 13

- The agency explains that "MOSA establishes consistent business objectives and technical practices across weapon systems utilizing an open system approach to make components more easily removable, upgradeable, and interoperable." AR, Tab 3, Combined Factor Declarations at 19-20. In other words, a MOSA allows various parts of the system to be added, removed, modified, replaced, or sustained by different parts of the military and their suppliers without significantly impacting the rest of the system. This approach provides numerous cost, schedule, and performance benefits; as explained in the RFP, "[b]y utilizing [MOSA], the FLRAA system expects improved lifecycle affordability, increased readiness, enhanced capabilities, reduced schedule pressure, and reduced supply chain risk."

Insufficient Architecture Model Detail

GAO Report, FLRAA Protest, 6 Apr 23, pg 17

- In evaluating Sikorsky's FPR, the agency assessed four significant weaknesses, 11 weaknesses, and assigned a rating of unacceptable for both the architecture approach and functional architecture elements
- The SSEB found that Sikorsky "did not provide allocation of functions below the system level of the logical architecture representing an incomplete functional decomposition, allocation, and traceability of system functions,"

DOD ATS Management Board (AMB)