International Council on Systems Engineering
A better world through a systems approach

Welcome to the INCOSE Webinar Series

Wednesday, 31 July 2024 – Webinar 175

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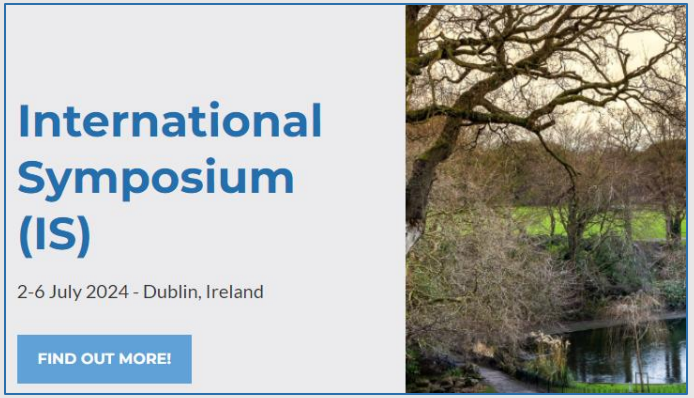
INCOSE Webinar 175:

Model-Based Acquisition for Defense Programs

Presented by Andrew Bonica

About the INCOSE Webinar Series

- Piloted in 2008
- A virtual offering aimed to provide relevant technical information and topics on systems engineering, on a regular basis and on an easy to access platform
- Held once a month (normally on the 3rd Wednesday)
- https://www.incose.org/events



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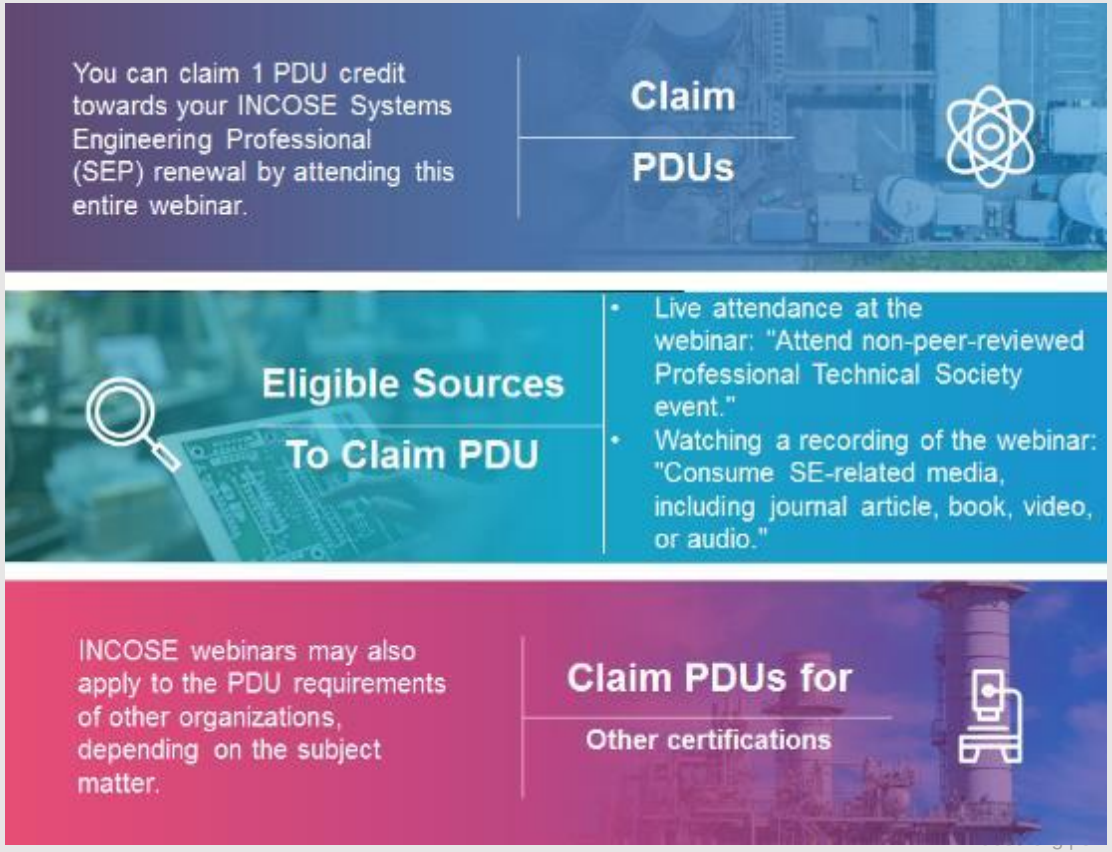
More information can be found on [Renewing Certification (incose.org)]

*PDU – Professional Development Unit



Webinar Cadence

- **Welcome** (2-5 minutes)
- **Presentation** (40-45 minutes)
- Please use Q&A feature via Zoom to enter your questions
- **Q&A Session** (10 minutes)
- Questions will be selected and asked by the Host
- **Brief Closing** (2-5 minutes)

This Webinar is being recorded.

The full recording and slide deck will be made available to all INCOSE members and CAB Associates within 10-12 business days from original air date in the Professional Development Portal (PDP).

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Model-Based Acquisition for Defense Programs

Andrew Bonica, CSEP
DS Government Solutions

incose.org

“Delivering a more lethal force requires the ability to evolve faster and be more adaptable than our adversaries.”

— Dr. Kathleen H. Hicks
Deputy Secretary of Defense
February 4, 2022

Image from @DepSecDef on X.com

UNITED STATES MARINE CORPS VETERAN

UC San Diego EXTENSION

Instructor

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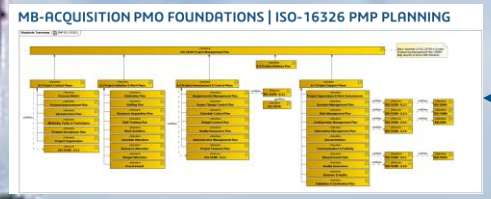
3D V+R

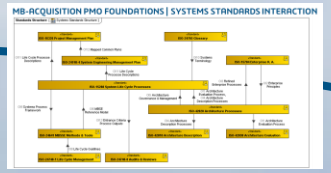
3DEXPERIENCE®

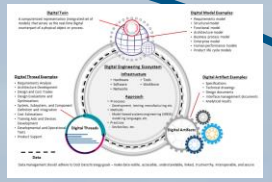
Naval Information Warfare Center PACIFIC

INCOSE San Diego

Business Outcomes Management is about *Planning* ***Business Changes***







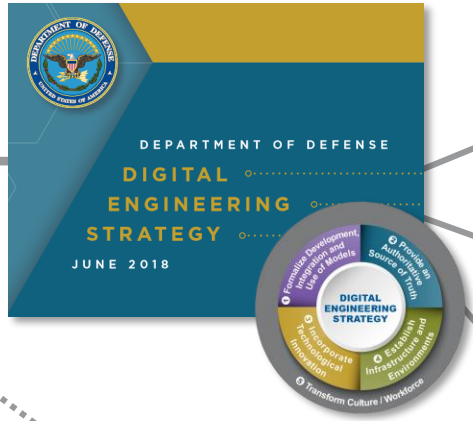
How

"An incomplete bridge carries no traffic"

This is why we think in terms of Harmonic Mean

Why

DoD Digital Engineering Transformation



INCOSE

INCOSE Model-Based Capabilities Matrix

Images and content sourced from:. https://ac.cto.mil/digital_engineering/ ; https://media.defense.gov/2019/Jul/12/2002156622/-1/-1/1/DOD-DIGITAL-MODERNIZATION-STRATEGY-2019.PDF ; https://api.army.mil/e2/c/downloads/2021/10/20/3b64248b/army-digital-transformation-strategy.pdf ; https://www.nationalacademies.org ; https://www.nasa.gov/digital-transformation ; https://www.nga.mil/about/strategy.html ; https://www.dhs.gov ; https://www.incose.org/docs/default-source/default-document-library/leading-mbse-transformation_v5.pdf?sfvrsn=48e59bc6_0

What is Model-Based Acquisition?

"Model-Based Acquisition is the technical approach to acquisition that uses models and other digital artifacts as the primary means of information exchange, rather than document-based information exchange."

Why Model-Based Acquisition?

IMPROVE COMMUNICATION

- Overcome natural language limits
- Common semantics reduce technical assertions ambiguity
- Expose design thinking to the entire team in one place
- Improved collaboration across Acquirer, OEM, & Supply Chain, & across acquisitions
- Improved Configuration Management/Configuration Control within and across acquisition improving deliberate reuse

ENABLE ARCHITECTURE ANALYSES

- Models support formalizing Trade Study & Analysis of Alternatives
- Conduct execution-time behavioral model assessments
- Perform parametric performance and constraint compliance assessments
- Traceability enables robust change impact analysis
- Lifecycle Cost and Affordability
- Mission Effectiveness, Safety, & Lethality

IMPROVE ENGINEERING QUALITY

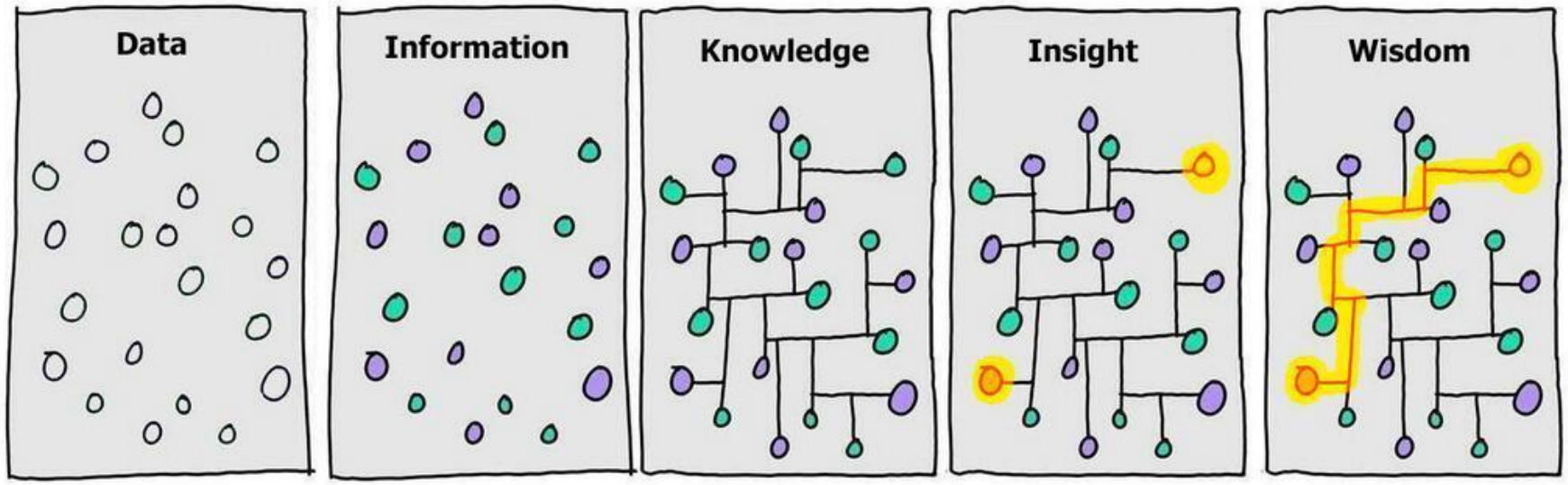
- Early identification of architecture & requirements issues
- Enhanced system design consistency and completeness
- Improved traceability across architectural layers, domains, & aspects
- Reduces risk of errors during integration and testing
- Increased Resilience
- Affords Contract, Program Management, System, Design Discipline, and Specialty Engineering digitally enabled SETRs on Live Data

INCREASE PRODUCTIVITY

- Faster time from inception to operational deployment
- Improved interaction across a multi-discipline team
- Singular definition of technical assertions within model
- Reuse of existing models to support design and technology evolution
- Auto-generation of consistent Architecture descriptions
- Early and on-going architecture & requirements validation

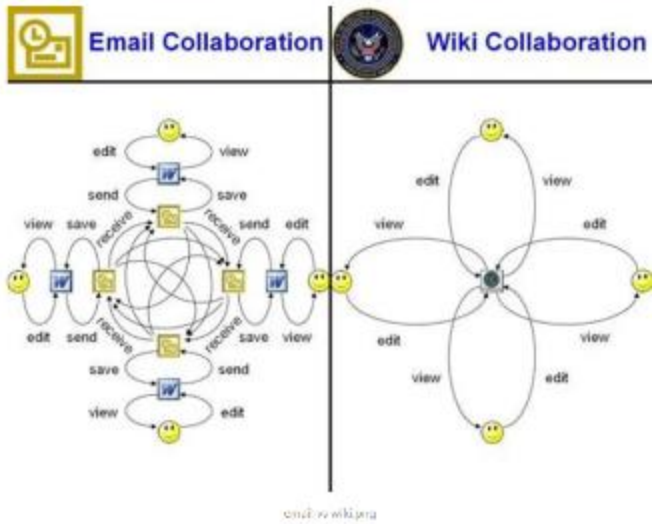
DIGITAL "X" – MODEL-BASED "X"

Requires a Model-Based Enterprise Paradigm Shift

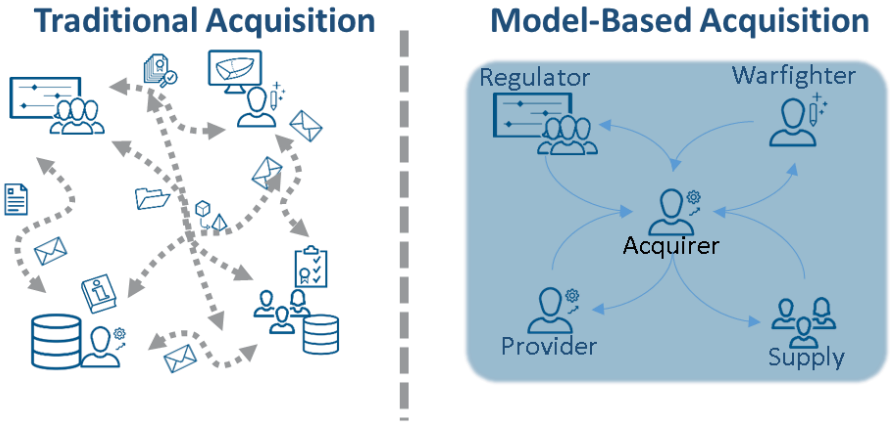


Communications and Collaboration Effectiveness

Intelligence Community

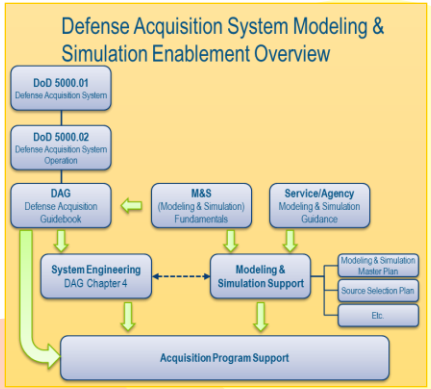


Acquisition Community



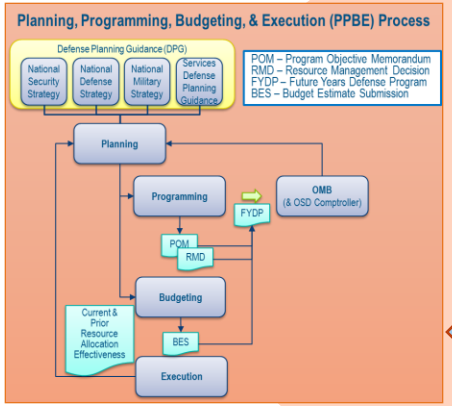
Highlights some key aspects, the left-hand-side undermines trust and has opaque elements. The right-hand-side reduces uncertainty an enhances collaboration transparency

“Big A” Model-Based Acquisition



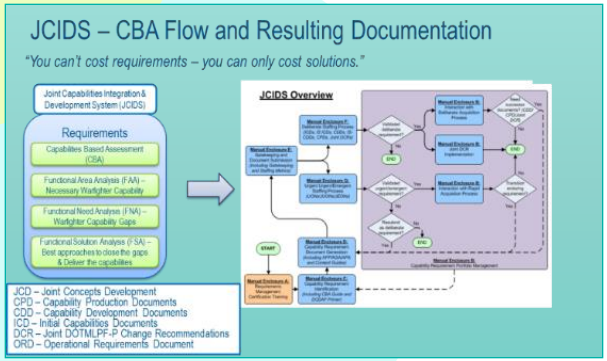
Models

- Cost/Budgeting
- Programming/ Phasing
- Execution
- Models (System, Context, etc.) that support all lifecycle phases
- Risk to Acquisition



Models

- Cost/Budgeting
- Programming/Phasing
- Execution
- Risk to National Interests

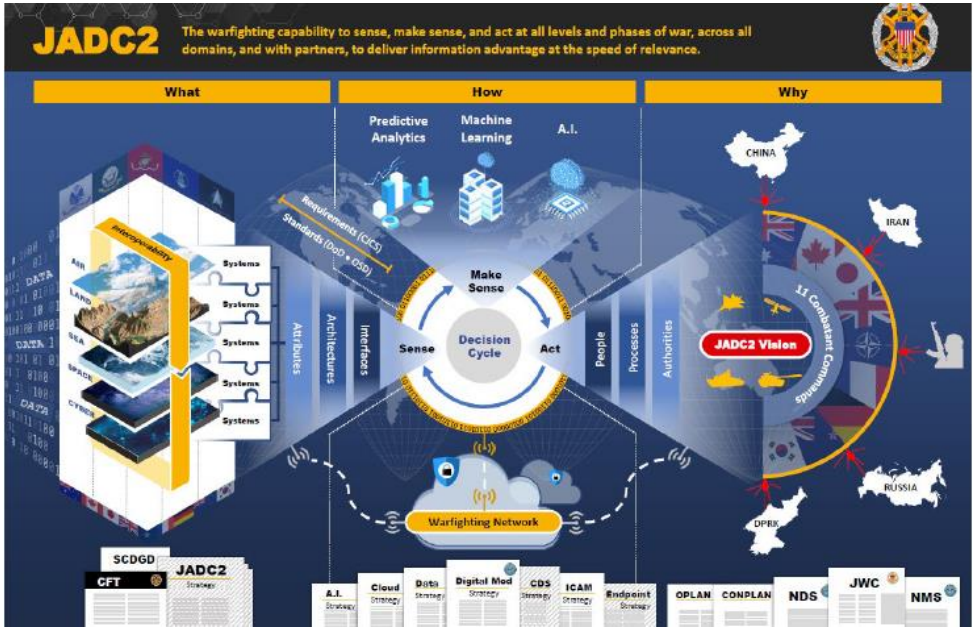


Models

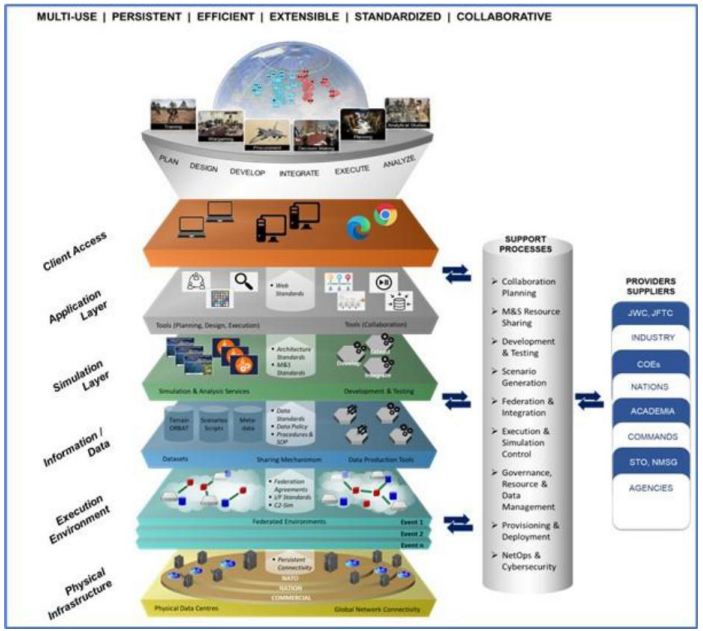
- Capability Portfolio
- System Engineering,
- Semantic architecture,
- Technology design and implementation
- Risk to Capability Gaps
- Game Theoretic
- Human-Involved
- War Game
- Ground Truth

Major Shifts in Systems and Approaches

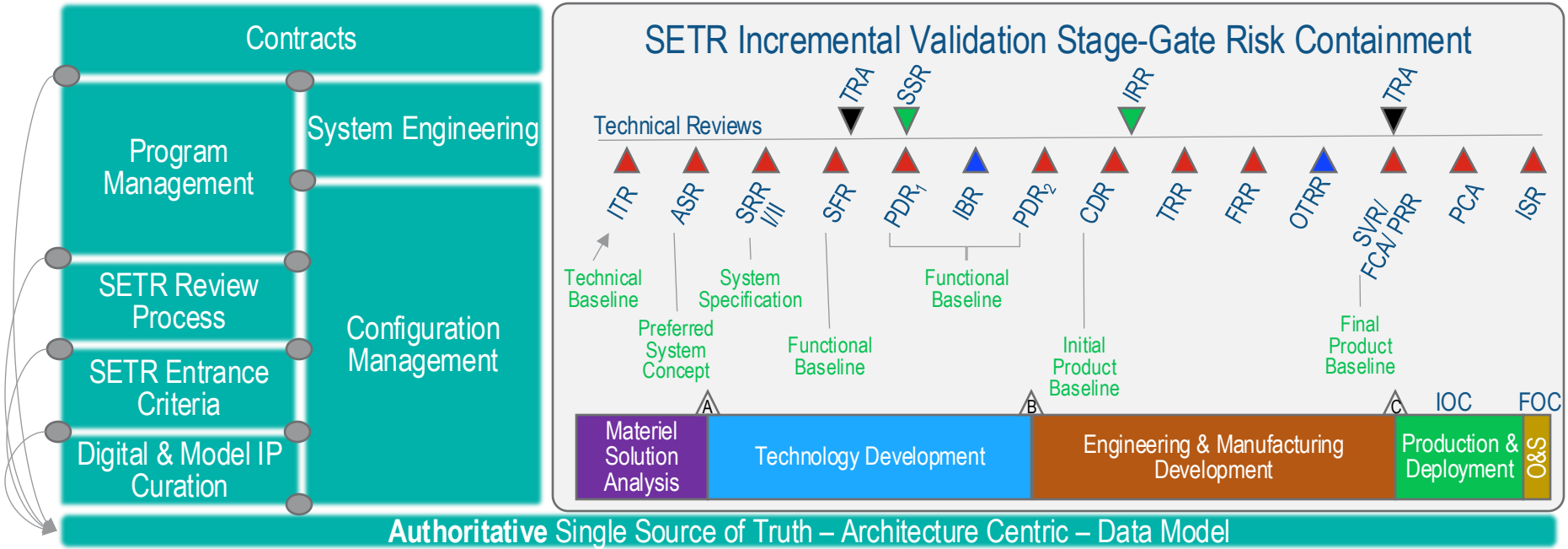
United States & Partners Joint All-Domain Command & Control



NATO Next Generation M&S CONOPS



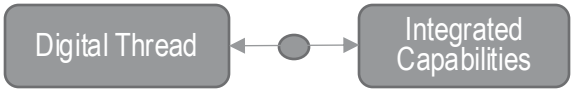
Digitally Integrated, Model-Based Acquisition



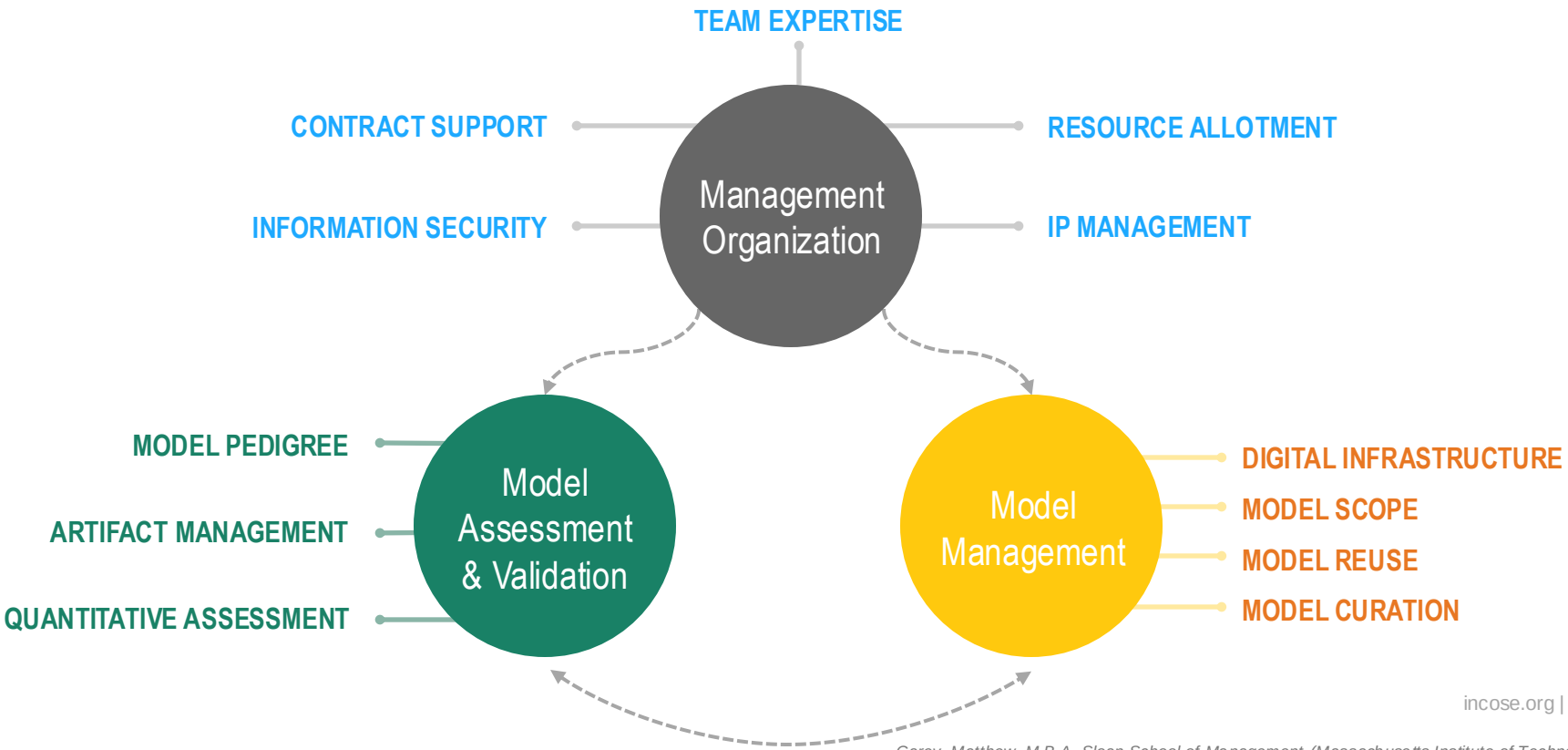
ASR – Alternative System Review
CDR – Critical Design Review
FCA – Functional Configuration Audit
FOC – Full Operational Capability
FRR – Flight Readiness Review
IBR – Integrated Baseline Review
IRR – Integration Readiness Review

IOC – Initial Operational Capability
ISR – In-Service Review
ITR – Initial Technical Review
OTRR – Operational Test Readiness Review
PCA – Physical Configuration Audit
PDR – Preliminary Design Review
PRR – Production Readiness Review

SFR - System Functional Review
SRR – System Requirements Review
SSR – Software Specification Review
SVR – System Verification Review
TRA – Technology Readiness Assessment
TRR – Test Readiness Review

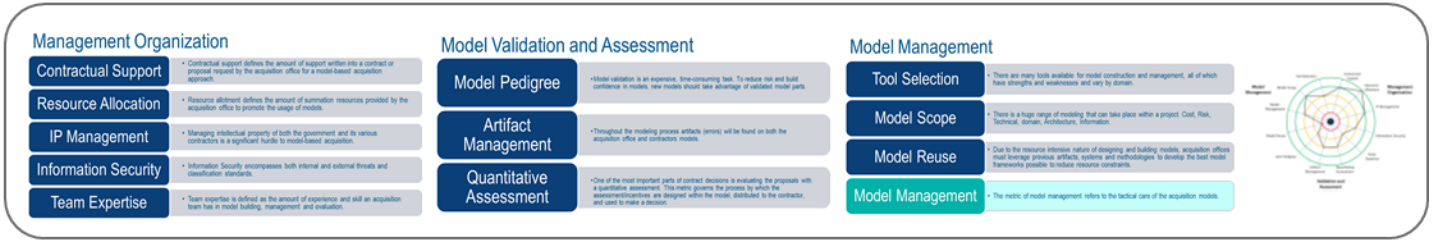


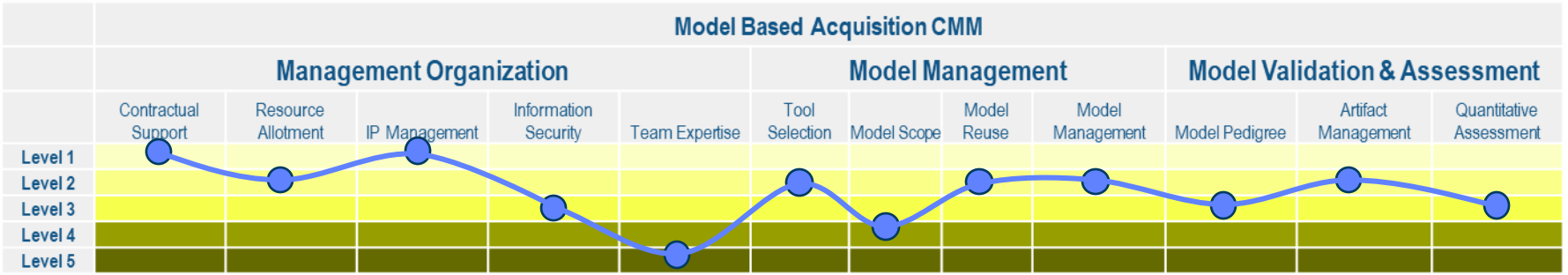
Model-Based Acquisition Principles



Carey, Matthew, M.B.A. Sloan School of Management (Massachusetts Institute of Technology, 2017)
URI: http://hdl.handle.net/1721.1/111881

Model-Based Acquisition Capability Maturity Model





Carey, Matthew, M.B.A. Sloan School of Management (Massachusetts Institute of Technology, 2017)
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MB-A Maturity Principle Compliance

Traditional Acquisition

Traditional Acquisition

Using Pictures and Requirements the Acquirer:

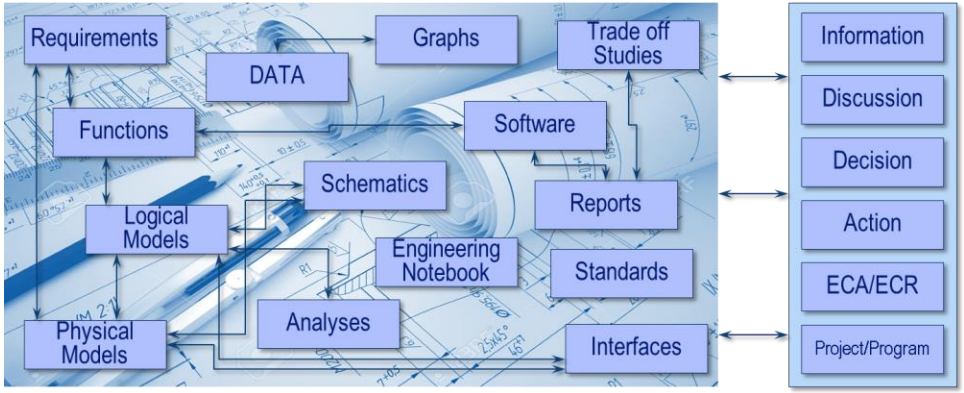
- Specifies Problem Space (CONOPs) in an Operational Requirements Document (ORD)
- Characterizes the Solution In an Initial Capability Document
- Communicates w Provider through Requirements that are supposed to align with Acquisition Strategy
- Evaluates MB Proposals for alignment with program requirement—little or no cross-acquisition reuse
- Manage Acquisition through Documents.

Using Models the Provider:

- Provides Document-Based Solution Response
- Conduct traditional months-long PowerPoint-Based SETRs on Static Data that has fractured source of truth from Proposed Baseline

Acquirer & Supplier:

- Use fragmented tool-based Acquisition, Agreement, Project Enabling, Technical Management, and Technical Operational Processes
- Without Complexity tackling mechanisms very likely produce outcomes that if successful are difficult or impossible to duplicate.



OPTEMPO & Adversary Warfighting Challenges have quickly outstripped the ability to deliver acquisition success commensurate with the timeframes determined by emerging threats of our adversaries. Traditional Acquisition Methods are NP-Hard Problems; i.e. not enough time and resources to be successful,

Model-Based Acquisition

Model-Based Acquisition

Using Models the Acquirer:

- Specifies Problem Space (CONOPs)
- Characterizes the Solution
- Communicates w Provider through GFI reference/Objective architectures that comply with Acquisition Strategy
- Evaluates MB Proposals for alignment with MBAcq. Strategy
- Digitally Manages Acquisition

Using Models the Provider:

- Provides Solution Response
- Conforms to the Acquire MB Reference/Objective Architecture
- Provider responses to acquirer's Model-Based RFx with Conformant Models.
- Conduct Digitally-Enabled MB e-SETRs on Live Data from established Proposed Baseline

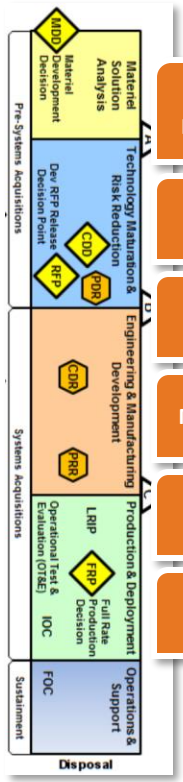
Using Digitally Enabled MB the Acquirer & Supplier:

- Streamline & Enhance the Acquisition, Agreement, Project Enabling, Technical Management, and Technical Operational Processes, associated Analyses, and Simulations including Manufacturing and Regulatory aspects.
- Affords Deliberate Coordinated Cross-Acquisition Reuse

Model-Based Acquisition is digitally-enabled and is both a warfighter & business imperative for acquisition success

MBA Simplified →

State of Defense Acquisitions Process



- Constant Data Conversion and Recreation Between Stakeholders
- Elusive Program Data Baseline
- System Knowledge Pushed to the Right
- Manual and Slow Decision Making
- Siloed Collaboration
- Late Error Identification

What does MBA change?

- Digital Models Exchanged Across Stakeholders in Digital Environment
- Authoritative Source of Truth Data Baseline
- Data and Model Reuse
- Model-Based Design Reviews
- Change Impact Analyses with End-to-End Traceability
- Integrated Collaboration
- MBSE to Manage System Complexity

Model-Based Acquisition

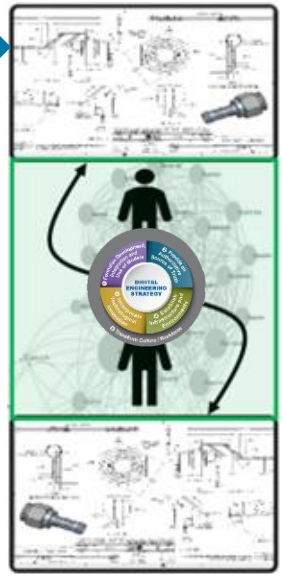
DoD "To Be" | Seamless Digital Ecosystem Exchanges

ACQUIRER

ACQUIRER/SUPERIOR

1. Acquirer Creates Digital Artifacts in Software
2. Software Enables Digital Viewpoints
3. Acquirer Grants Access to Digital Views
   and/or
4. Acquirer Exchanges of Synchronizes Digital Artifacts

OE



OE

PROVIDER/SUBORDINATE

1. Provider Creates Digital Artifacts in Software
2. Software Enables Digital Viewpoints
3. Provider Grants Access to Digital Views
   and/or
4. Provider Exchanges of Synchronizes Digital Artifacts

PROVIDER

Operational **E**xchange pattern replicated many times in the end-to-end acquisition value network scenario involving the Acquirer, Provider/OEM, Supplier, Regulator, Operator/Maintainer-Sustainer and Warfighter.

Improving Outcomes with Model-Based Acquisition

Gain in Efficiency

Reduce cost
with early systems thinking and integrated approach

Reduce risk
with advanced simulation and data reliability

Increase project performance
by avoiding rework, conversion and enabling collaboration

Gain in Accuracy

Design errors detected **earlier**

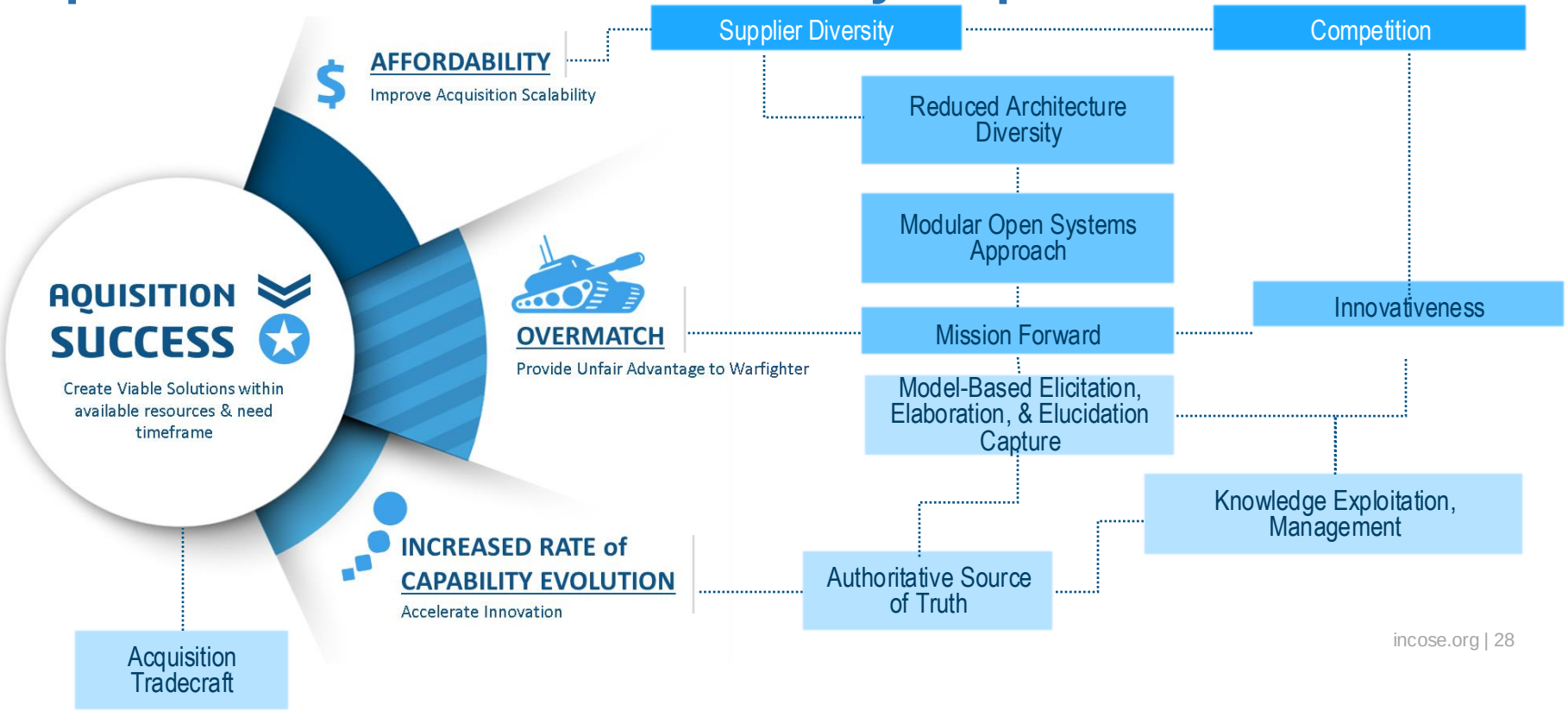
Increase % of **reuse** instead of re-design with model-based enterprise

Improved Quality
by automated solution exploration and defect avoidance

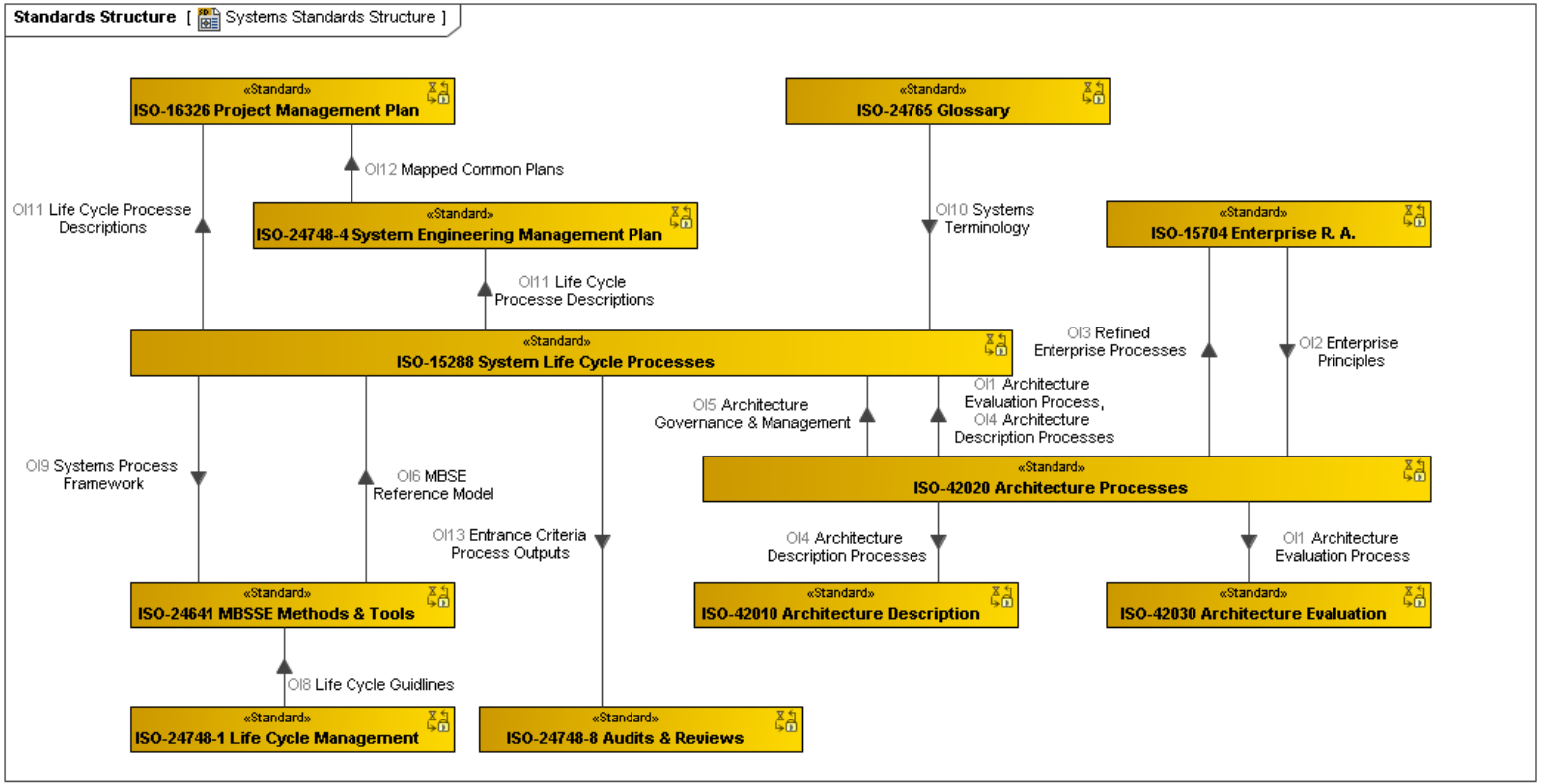
Innovation

Enhanced system **integration** capabilities through innovation

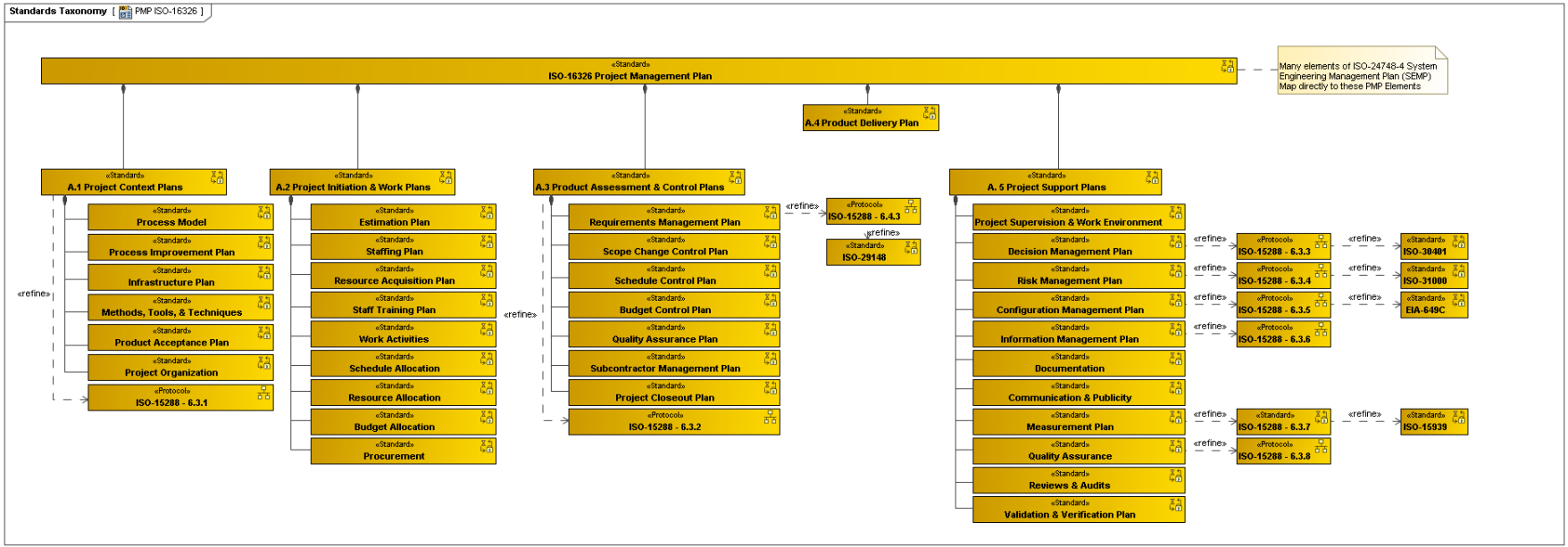
Fighting and Winning in a Complex World
Operational Success is Afforded by Acquisition Success



MBAcq PMO Foundations | Systems Standards Interaction

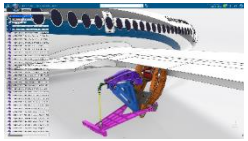
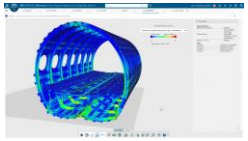


MBAcq PMO Foundations | ISO-16326 PMP Planning



End-to-End | Model-Based Acquisition

Mission Needs — Proposal — Concept — System Design — Configuration Baseline — V&V — Digital Manufacturing — Production Readiness — Certification & Delivery — End of Life

AS NEEDED	AS SPECIFIED	AS DESIGNED	AS PLANNED	AS BUILT	AS CERTIFIED	AS MAINTAINED
						
CONCEPTUAL STUDIES	PRELIMINARY DESIGN & JOINT DEFINITION	DETAILED DESIGN	MANUFACTURING & ASSEMBLY		GROUND & FLIGHT TESTS	IN-SERVICES OPERATORS & SUPPORT

Authoritative Source of Truth

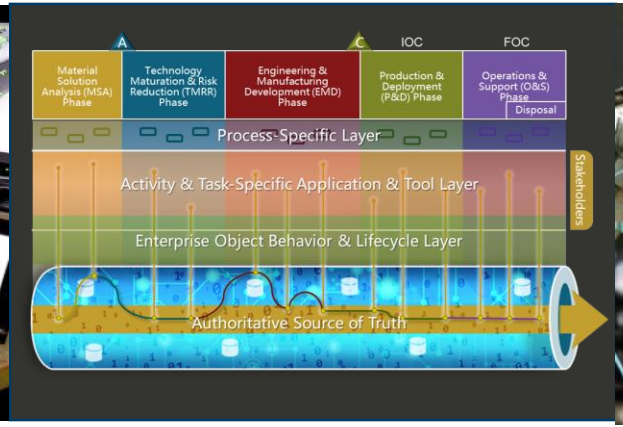
People and Organization — Program & Contract Management — Configuration and Change Management — Validation and Verification — Business Intelligence — Knowledge and Know-how Capitalization

Model-Based Acquisition

DIGITAL CONTINUITY

PRODUCT

OPERATIONS



WARFIGHTER

INTEROPERABLE

FRICTIONLESS

CONNECTED


Thank you

Q&A Session

Please submit your questions in the Zoom's Q&A feature.

Quick Reminders

- All the previous webinars are now located in the Professional Development Portal (PDP).
- Attending a Webinar does count as 1 PDU credit towards your SEP renewal

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